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SCHOOL OF GRADUATE STUDIES

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COMPUTER-AIDED INFORMATION SUPPORT SYSTEM FOR THE MANAGEMENT OF FORESTRY IN ZAMBIA

A Thesis submitted in partial fulfilment of the requirements for the degree of

Master of Science in Information Science.

by

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Computer-Aided Information Support System for the Management of Forestry in Zambia

by

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To

my beloved wife Mary

and

children Kabwe, Chilambwe and Natasha

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ABSTRACT

This study is aimed at designing a computer-based information support system for the management of forestry in Zambia. For this purpose, a survey was conducted to ascertain the information flow structure in the industry and the information seeking pattern of the various categories of forestry personnel. In addition, the study was directed at examining the current practices relating to collection, processing, storage, dissemination, and retrieval of pertinent information in this national economic sector.

The forestry sector is an important sector in the economy of Zambia. But due to some historical developments, the sector has been given a superficial attention on the national economic priorities. However, for the purpose of developing the forestry sector, several institutions have been established under the auspices of the Forest Department to conduct research in forestry and to produce forestry personnel. The major forestry research institutions include; (1) the Division of Forest Research, (2) the Division of Forest Products Research, (3) the Bee-Keeping Division, the Zambia Forest College, and several research stations scattered around the country. This study was, therefore, undertaken to gain an understanding on how information is coordinated among the forestry institutions.

The findings of this study show that the existing manual operated information system in the forestry sector is inadequate to respond to the information needs of the forestry information users. The majority of information users indicated that the current information facilities could not meet their requirements, especially when the information needed was not available at the local information unit. For this reason, the computer-based information support system for the management of forestry in Zambia has been proposed. The proposed information system is to have an information retrieval system with a central database located at the Forests and Timber Research Library in Kitwe. The central database will be fed by the various information units of the forestry information network. Two types of prototype databases using Micro

CDS/ISIS have been designed. The first one is an integrated database comprising bibliographic records, and profiles of experts, forestry institutions, information systems, and the profiles of research projects. The other one is a set of specialized databases comprising two databases of FOVEG and TSPE. These databases are intended to provide information on the types of forest vegetation found in Zambia, names for tree species, location of specific tree species, and their description. To facilitate the search of these databases, the ISIS Pascal interface has been used to write an application program for the user interface that would allow both the IS staff and the end-users to interact with the system in a friendly way. Finally, a measure for implementing the prototype system, and for its further improvements, are suggested.

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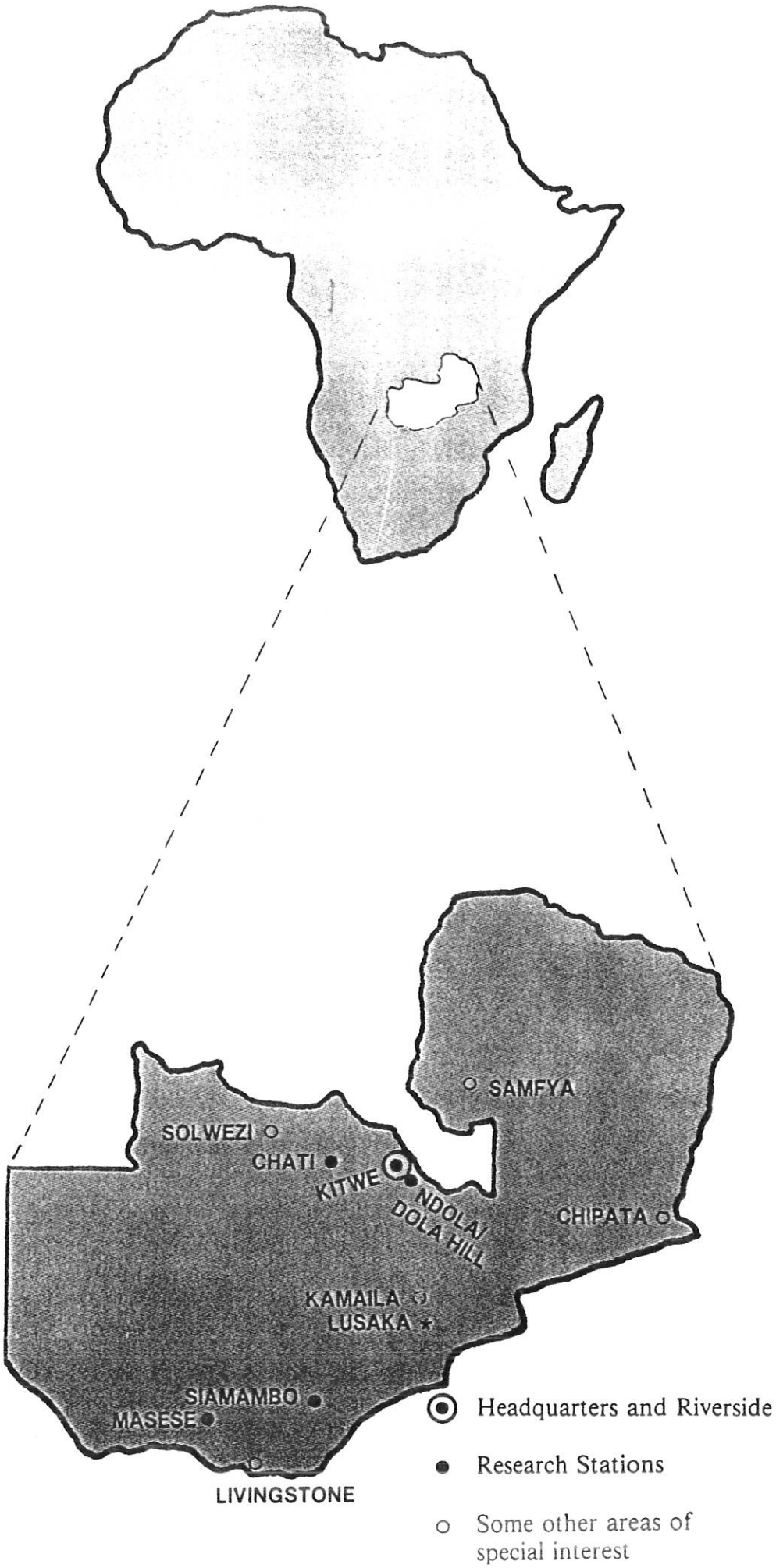

Kirjapaino Oy Maakunta Joensuu Finland 1987

ABBREVIATIONS

ARINET	Academic and Research Institutions Network
BPP	Bits per Pixel
CAIDC	Committee for the Automation of information and Documentation Centres.
CBU	Copperbelt university (Zambia)
CDS/ISIS	Computerized Documentation Systems/Integrated Set of Information Systems
DBMS	Database Management System
DDC	Dewey Decimal Classification Scheme
DP	Dot pitch
DPI	Dots per Inch
FINNIDA	Finnish Development Agency
FST	Field Select table
FTP	File Transfer Program
GDP	Gross Domestic Product
GIS	Geographic Information System
IA + C	Information Analysis and Consolidation
IDE	Integrated Development Environment
IS	Information System
INDECO	Industrial Development Corporation
MIS	Management Information System

NCSR	National Council for Scientific Research
PADIS	Pan African Documentation Information System
PC	Personal Computer
PPM	Pages per Minute
PTC	Posts and Telecommunications Corporation
RFP	Request for Proposal
SDI	Selective Dissemination of Information
SISA	School of Information Studies for Africa
UNECA	United Nations Economic Commission for Africa
UNZA	University of Zambia
USIS	United States Information Service
VDU	Video Display Unit
ZAFFICO	Zambia Forests and Forestry Industry Corporation
ZLA	Zambia Library Association
ZLS	Zambia Library Service

CHAPTER 1

INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

For any planning and decision making process to be meaningful and effective at all levels of decision making framework, the availability of relevant, precise, and timely information and information processing tools including the continuous contacts and sharing of information, experiences, and practices among individuals and institutions knowledgeable in the areas of immediate concern are among the essential inputs. Without these elements, the major decisions on any course of action regarding projects to be undertaken and the research areas to be explored would be ad hoc, misplaced, and inadequate to address the perceived or identified problems. The decision process is also likely to be extremely slow to be concluded.

In the modern decision making and planning process, accurate, reliable and timely information is essential. In order to meet this requirement, the application of computer systems in the storage, access, retrieval and circulation of real time information, is providing a complete departure from the restricted, time consuming and costly manual information systems. The traditional manual record maintenance and file management practices have the inherent shortcomings which have proved inefficient in responding

to providing real time information for effective decision making and planning. These shortcomings include the rigid procedures in file manipulation, problems relating to storage space expansion and space allocation. Loss of records, file misplacement and the difficulties encountered in the access to particular records in the files constitute some of the problems attributed to the manual information processing and service systems. These types of information management systems are often confined to particular organizations, institutions or business enterprises. The access to the information maintained in these organizations often requires seeking administrative authorization.

In addition to administrative procedures required to gain access to information available in widely dispersed geographic areas, the process usually involves expenses on communication, using either telephone facilities or being physically available at the place where the required information is located. Other expenses may include the postage, Xeroxing of documents carrying the information sought, and problems caused by difficulties in manipulating information contained in the files in order to obtain only the particular piece of information required for a given purpose.

The rapid expansion and widespread application of computer systems have made it possible for individuals, organizations or business enterprises to work together in a useful and continuous manner, irrespective of their geographical separation. Computer systems incorporate facilities for easier file management, record storage and space management, file manipulation for extracting only the pertinent and relevant

information required for a particular purpose, and they involve less time for information search and retrieval. In addition, computers are providing unique sets of functions and interactions on the local, regional, national, and international scale because of the rapid expansion and improvements in computer networks and global telecommunications services. It is on the basis of these benefits which can be derived from the application of information technology, that the reorganization or reorientation of information systems in the forestry sector in Zambia should be implemented for the purpose of taking advantage and drawing on the benefits of accessing various distributed information bases, and essentially to improve on the sectoral information processing, handling and dissemination of information to users within and outside the forestry sector.

The survey of existing information services in the forestry sector in Zambia was aimed at discovering the nature of the operations and services of the information facilities. The study was undertaken with a view to establishing a concrete foundation on which to base decisions and plans that may be pursued to reorient the management of information systems to cope with, and to meet the information requirements of all categories of information users within and outside the forestry sector.

The data analyzed in this thesis is, therefore, intended to be used in the process of introducing information management changes or modifications to the existing information facilities at both the micro sectoral level as well as facilitating linkages at national and international levels. Recommendations arising from the analysis are

intended to provide a basis on which to construct effective and efficient information access procedures and processes in order to facilitate information sharing using the modern information technology (IT). The approach to establishing mechanisms for effective access to relevant, accurate, precise and timely information is envisaged in the cooperative strategies and decisions to share available information resources within the institutions comprising the forestry sector and other institutions at national level and beyond.

The survey is primarily an analysis of the information facilities, resources and capabilities available in the forestry sector aimed at gaining a clear insight on the current practices, procedures and institutional culture with a view to proposing and recommending ways and techniques that can be employed to reorganize or reorient the information systems for effective information management and dissemination.

1.2 OBJECTIVES OF THE STUDY

1.2.1 General Objectives

This study is aimed at taking stock of information facilities, capacities and resources at institutional, regional and national levels in the forestry sector in Zambia. The general objective of this study is, therefore, to investigate the existing information systems in the forestry and related sectors in Zambia, and to find out how the available resources and resource capacities can be enhanced and/or reoriented to develop an

effective and efficient information service system based on the application of information technology (IT) at the micro institutional level with linkages at the national and subsequently at international levels.

1.2.2 Specific Objectives

For the purpose of achieving the general objective of this study, the following specific objectives are identified:

-- Conducting a survey of the extent to which the existing information processing, handling, utilization and dissemination techniques and capacity exists in the forestry sector in Zambia; and how computer-based information facilities can be applied to facilitate the development of a coordinated information network system among all the components of the forestry industry;

-- Identifying the information system structures in the industry regarding information coordination and distribution, information sources, information products, and information services as they are provided to meet users' specific information needs;

-- Ascertaining information seeking patterns of the various categories of forestry researchers, decision makers, and other information users for the purpose of

designing information service systems that are capable of meeting their specific information needs;

-- Designing and developing prototype referral databases, such as, profile databases of institutions in the forestry and related sectors, information systems, experts in forests and forestry profession, research projects; and also bibliographic databases in forestry for reference service.

-- Designing a specialized database of the profiles of core concepts going with the study of forests and forestry.

1.3 JUSTIFICATION FOR THE STUDY

The literature survey conducted at various information institutions reveals very little about the information management and information services provided in the forestry sector. The Zambian case is illustrative of this kind of a dearth in literature on information services in forestry. Much emphasis has been given, and documentation has been done in the agricultural and industrial sectors. This trend can be attributed to the development strategies the government adopted in the post independence period. Kaniki (1989) has attempted to comprehensively document information services and information use in the agricultural sector in Zambia.

Documentation on the state of information generation, distribution and use in the forestry sector is represented by seminar papers prepared by Chimbelu (1985) and Hatembo (1985). In these presentations, it is revealed that large amount of research information is generated, but the major problem lies in the availability of mechanisms to make such information available for use by end users.

Since 1964, when Zambia attained her political independence, it was recognized that investment in agriculture and natural resources would play a large role in the development of the national economy. The initial steps to transform the economic base were defined in the first Transitional Development Plan issued immediately after independence in 1965 (Zambia. Office of the President. Central Planning Office 1965). This plan provided the basis on which attention for national development would be broadened to include agriculture, natural resources, and forestry as important sectors to contribute to the national development process. This Plan outlined the government's policy intentions to develop forestry industry and to move away from the heavy dependence on imported forestry products. Details on policy regarding the development of the forestry sector is discussed in Chapter Five.

Given the understanding that the forestry sector is an integral part of the total national economy, then it calls for the development of a strong information component, or support that would make the overall forestry management viable and essentially capable of contributing effectively to the development of the national economy. For the purpose of harnessing, maintaining, controlling, and managing a sustainable forestry

development, useful information is required at various levels of the sector. The required information structure in the sector should, therefore, be concerned with the tasks of effective processing and disseminating reliable, pertinent and timely information on forestry resources, location of the forestry institutional components, the amount of information being acquired and processed, the current demand, and the supply and use of information.

Forestry management also involves research in the properties of Zambian timbers, searching for new product uses, and improving the marketing of both indigenous and plantation produce. On a larger scale, this involves the balancing of forestry activities with related activities in the related sectors of the economy, such as the environmental sector activities which stress activities for curbing deforestation and environmental degradation, including land and water development.

In order to address these issues adequately for sustainable development, a sound information structure must be developed to coordinate information sharing in interconnected sectors. In this context, an efficient information system must be established to service the various categories of the target user groups within the forestry sector.

1.4 SCOPE AND LIMITATIONS OF THE STUDY

1.4.1 Scope

Data collection for the study was conducted between August 1, and September 30, 1994. The following is a list of the major institutions engaged in studies and research in forests and forestry, and therefore were selected for the study:

-- Mwekera College of Forestry, Kitwe

-- Division of Forestry Products Research, Kitwe

-- Division of Forest Research, Kitwe

-- National Council for Scientific Research, Kitwe

-- Mount Makulu Central Research Station, Lusaka

-- Zambia Forests and Forestry Industries Corporation, Kitwe.

Among the institutions selected, Mount Makulu Central Research Station and Zambia Forests and Forestry Industries Corporation did not provide the required data within the specified time and therefore, the present study was narrowed down to the following four institutions:

1. Mwekera College of Forestry, Kitwe
2. Division of Forestry Products Research, Kitwe
3. Division of Forest Research, Kitwe
4. National Council for Scientific Research, Kitwe

1.4.2 Limitations

Based on the time limit, geographic dispersion of forestry divisions, and the problems encountered in data collection discussed in Section 1.6.3, the survey was limited to the operating information centres in the four institutions mentioned above. The response rate to the administered questionnaires, among these institutions selected for study, was low. This made it difficult for me to compile a representative list of experts in the forestry sector. In addition, some of the returned questionnaires were not completed in full.

1.5 APPLICATION OF RESULTS

The nature of the findings of the research will dictate the decision to make recommendations to the Ministry of Environment and Natural Resources on how the entire sector can benefit from utilizing an efficient information system for effective information dissemination and utilization through the linkage of all the components of the forestry industry.

In addition, results emanating from this research project may well activate/cultivate interest in the forestry industry on a larger scale, and may open up more grounds for private investment. If properly utilized, the findings of the project would help to create an environment for the establishment of private forest products processing enterprises

as a departure from the present situation where only very few government owned mills particularly Zambezi Saw-mills Ltd. are the major processing plants in Zambia.

Proposals and recommendations arrived at in this thesis are intended for use by the decision makers in the government at ministry and department levels, decision makers in the forestry institutions, organizations and forestry business enterprises, as well as to be the basis and guideline for initiating the design, development and implementation of the computer-based information systems in the forestry sector in Zambia.

1.6 METHODOLOGY

1.6.1 Data Collection

Data for this study was primarily collected through the administration of a structured questionnaire and interviews with selected people in the identified institutions. The field work was conducted between August 1, and September 30, 1994. The selected institutions were visited for the purpose of completing questionnaires and conducting interviews. In addition to information obtained through questionnaires and interviews, useful information was collected from observing the processes and procedures followed in the information services.

Additional data was collected using secondary sources of information. These included various reports of the selected institutions, published material as well as unpublished literature.

1.6.2 Data Processing and Analysis Methods

Analysis of survey data for the purpose of coming out with an optimal information service system that would adequately service the forestry sector as a whole was carried out as thoroughly as practicable.

1.6.3 Problems Encountered During Field work.

Some of the problems encountered during the course of administering questionnaires and conducting interviews are highlighted here:

1.6.3.1 Bureaucratic Procedures

One of the major problems encountered was that of the failure to meet relevant officers at their work places for interview purposes. In order to obtain appointments to meet most of the interviewees, the process involved lengthy bureaucratic procedures which required seeking permission or clearance from the department heads and setting appointment time with the earmarked people. As a result, much of the time was

unproductively spent in trying to meet the bureaucratic requirements and getting to interviewees and those intended to complete questionnaires.

For the questionnaire administration, most of the targeted officers were not available for the purpose of filling in the questionnaires. Although attempts were made to request for appointments in good time, only few individuals honoured their appointments while others were not available for one reason or another. This pattern was common among almost all the institutions selected for study. Meanwhile, some of the respondents indicated that they would send the filled in questionnaires to the researcher's address. Unfortunately I did not receive any of these.

1.6.3.2 Confidentiality

Access to a large part of information requested in the questionnaire and interview schedule was not supplied because of its confidentiality. It was indicated that only authorized officers were allowed access to certain type of information. This development involved getting the authorized officers in order to complete the questionnaires.

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1.6.3.3 Non-availability of Data

Certain information which was sought was simply not available on record in some institutions. Details of project funding, budget allocations and the duration of projects were in most cases not available.

In almost all the institutions studied, there was hardly any recorded data on annual expenses, on research materials and on the details of the sources of research funds. The research budget did not specify separate categories for recurrent and capital expenditures. Budgetary breakdowns included records on transport, maintenance and stationary. It was difficult to come across separate budget items for research materials and research funds.

These are some of the problems faced during the field work. Some of the problems essentially indicate the explicit unorganized state of the information management system prevailing in the various research institutions in the country. The poor maintenance of records and in some cases the non-existence of certain relevant data in the selected institutions suggest that there is an urgent need to systematically organize the data bases in these institutions.

The method of literature survey was used to collect relevant pieces of information from different documentary sources. But, for the purpose of using those pieces of

information in relevant chapters, the technique of "Information Analysis and Consolidation" (IA+C) was used.

1.6.4 Facilities and Tools for System Development

It may be noted here that, for the purpose of developing the prototype information support system, the following facilities and tools have been used:

1. The network facility available at the School of Information Studies for Africa;

2. The Micro CDS/ISIS software for the creation of the databases;

3. The ABNCD (Abebe et al 1992) integrated database approach; and

4. CDS/ISIS Pascal for developing the interface.

CHAPTER 2

MANAGEMENT OF THE FOREST ENVIRONMENT IN ZAMBIA

2.1 INTRODUCTION

Generally, people take for granted the benefits that trees offer. Trees provide shade, prevent soil erosion, ensure adequate water supply, enrich the soil, and act as homes for many wild creatures.

Historically, human societies have been deeply involved with forests and the resources that forests provide. For a long time, man has used the forest as a place of safety; and also as a source of fuel, clothing, and materials for shelter. Man has primarily used forest products and resources in house building activities. House building has evolved from the use of pole frame structures to the use of logs and timber for house construction. Also the forest has always offered wood, and medicines for human use. In addition to these uses, forests have been the source of nuts, berries, fruits, bulbs and roots, as well as of fish and game animals (Sharpe *et al* 1986).

The term "***forest***" originated in the idea of an area where the common people might not go. ***Silva forestis*** meant woods lying outside those areas for common use, or wooded areas reserved to protect the beasts of the forest and their habitat (Sharpe *et al* 1986, 6).

As human societies developed, human beings evolved techniques on how to treat and use forest resources, and applied their ingenuity to the use of forest products to make life easier. Sharpe (1986) and his colleagues have documented the importance of forest cover in relation to the preservation of water and ground moisture. They have explained that without the covering of forest, watersheds would cease to produce a regulated flow of clear water; and navigable channels may become silted in. This means that wherever forests exist, they serve in this way to keep ground water levels stable. Thus, forest cover contributes to the maintenance of water cycle.

This chapter considers the general pattern of the evolution of the utilization of forests and forest products by man; and that of management of forests for the purpose of deriving more benefits from forest resources. The economic aspects of forestry, and investment in forest industries, both by the state and the private entrepreneurs, are also discussed.

2.2 FOREST RESOURCES

Nowadays, wood substitutes have been discovered; and they are extensively used in industry, and other domestic applications. But, wood itself is indispensable in some situations. Besides paper, wood treated in various ways provides many commodities for use by man. While wood substitutes have been discovered and used in industry and domestic applications, still today, some parts of the world, and Zambia in particular, continue to depend on wood for fuel, shelter, and shifting cultivation.

Considering today's use of forest products, it can be believed that these products had been equally important for domestic and other uses in earlier times. Historical accounts of different societies have indicated the use of forest for fortification and concealment. But, the role that timbers play in construction activities, furniture making, and industrial use, is clearly apparent. The ability of forest cover in holding soil in place, reducing soil erosion, enriching the soil, and in preserving ground water have rendered other benefits to the mankind.

The considerations of the important uses of forest resources, and the benefits that forest covers offer, have prompted many governments today, to be seriously concerned about the adverse effects of deforestation leading to the scarcity of timbers. This concern in turn, has widely prompted the implementation of the projects of replanting trees of economic significance. In addition, they are now taking special care in supporting continuous research on all kinds of forest resource. The historical evolution in the use of timber has actually made many national governments to identify certain forests as being of strategic significance.

2.2.1 Land and Its People

Formerly Northern Rhodesia, the Republic of Zambia came into being as an independent state within the Commonwealth of nations on October 24, 1964. The country has a total land area of 752,614 sq. km; and, it is divided into local divisions

of nine provinces. Entirely landlocked, Zambia has common boundaries with Tanzania, Malawi, Zimbabwe, Botswana, Namibia, Zaire, Angola and Mozambique.

The large part of Zambian land consists of a high plateau. The general elevation varies from 3,500 feet to 4,500 feet above the sea level. Occasionally, mountains rise to 7,000 feet. The plateau is deeply entrenched by the Zambezi River and its tributaries; the Kafue, spanning the Copperbelt, Central and the Western regions, the Luangwa, in the East, and in the north, by the Luapula River (Zambia 1970).

Zambia is within the tropics. But, the country has cooler mean temperatures than many parts of tropical Africa; because of the general height of the plateau. There are three distinct seasons: (1) a cool dry season which extends from May to August, with the temperature varying from 15.6°C to 26.7°C; (2) a hot dry season from September to November; and (3) a hot rainy season from December to April, during which temperature varies from 26.7°C to 32.2°C. The annual rainfall is 50 inches or more in the north; and between 20 and 30 inches in the south of Lusaka (Zambia 1970).

The total Zambian population in December 1990 was estimated to be 8,119,000. Most of the country is sparsely populated, especially in rural areas. The 1991 estimates put the Zambian population density at 29 persons per square mile; but its growth rate has been a staggering 3.5% (World almanac... 1993).

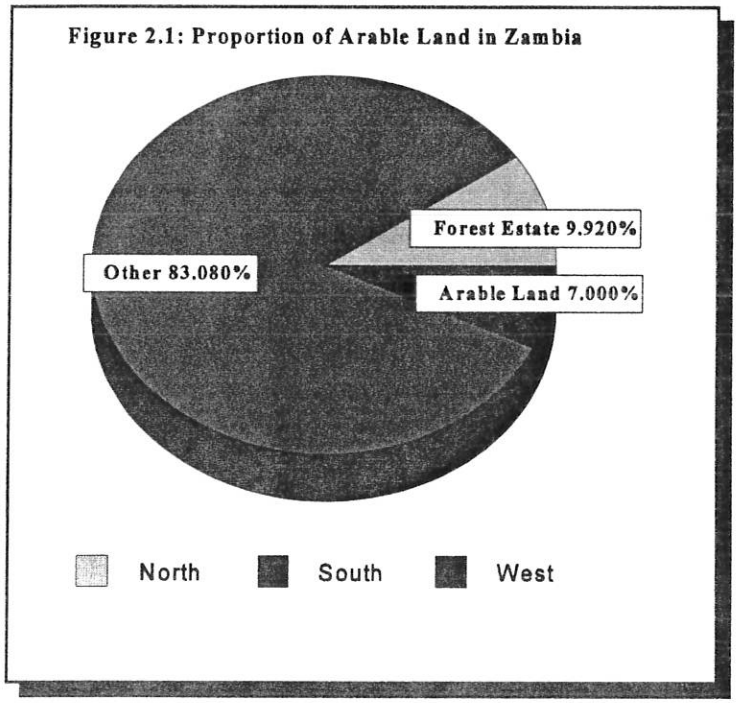
2.2.1.1 Main Types of Vegetation in Zambia

There are many different, but inter-related factors which determine where and how trees grow. In Zambia, the most important of these factors are the amount of rainfall, the length of the dry season, the range of temperature, the slope of the land, and the activity of man. Storrs (1979) reports that the natural conditions over a very long period of time, have caused the vegetation types, which are found in Zambia today. But it is the activity of man, which has brought about the most dramatic changes.

The Zambian vegetation can conveniently be divided into four main groups: (1) closed forests, (2) open forests or woodlands, (3) anthill vegetation, and (4) grasslands. Often, the destruction of closed forests, especially by fire, leads to the formation of woodlands. In turn, the destruction of woodland vegetation would result in open grasslands. Details of vegetation classification in Zambia are presented in AppendixA.

Out of the total land area of Zambia, about 7% is arable land (figure 2.1). The remaining land area is either forest land unsuitable for agricultural prospects, or inhabited. Despite this problem in the quality of the large part of the land, agriculture and forest resources have been identified to be by far the largest source of subsistence, employment, and income generation. The larger population is still living in the rural agrarian areas; and their livelihood is still dependent on subsistence farming, and forest resources.

Given the availability of vast unexploited land, the Government has recognized the agricultural and forestry activities as socially and economically productive fields for investment with a view to uplifting the standards of living of the rural population. The other recognized sectors for government investment are the mining, manufacturing and industrial sectors.



Having recognized the potential benefits that can be derived from forests, the Zambian government has been interested in assisting the small private entrepreneurs to go into forestry business for the purpose of contributing to the nation's commercial timber harvest. But till now, the government has not put in place the mechanisms of allotting forest lands for private forestry businesses. By and large, the information on this aspect is not readily available to private entrepreneurs or individuals who may be interested in forest industries.

Under the Second National Development Plan, the Government of Zambia, as a matter of policy, gave top priority to the agricultural and rural development. But in spite of this emphasis of investment in agriculture and rural development, a shortfall was reported in this area at the end of the Second National Development Plan period, in 1971. The plan failed to reduce the disparity between urban and rural incomes. Meanwhile, the country registered a rapid movement of persons from the rural areas to the towns during the same period (Standard Bank 1971, 11).

As a result of the rural-urban migration, Zambia is comparatively one of the highly urbanized countries in Africa. Urban growth has continued to expand as more people continued to migrate from the countryside to the growing industrial towns in search of employment. This trend has continued for some time; and now the government is really concerned about this development; and it is trying to put in place certain mechanisms to reverse the situation.

2.3 ECONOMIC AND SOCIAL USE OF FOREST PRODUCTS

In general terms, the management of forests and forest resources, relates to decision making, planning, and management activities for the purpose of deriving as much output-value as possible from forests. This calls for taking note of the changes in the economic environment, that may influence forest management. In determining the output-value of forests, forest managers are equipped with basic economic concepts; and they use these to identify or establish efficient, and profitable management

programs. For the purpose of identifying changes in the economic environment of forests, the forest manager needs to have adequate information on changing economic trends in taxes, interest rates, regulatory activities, and in the general level of economic activity on the forest manager's management programs.

These activities require ready access to precise data on many aspects of the focus of the program. This involves also an understanding of some of the basic economic concepts; and of various activities involved in forestry, that are able to help the forest manager to understand why forests are managed in the way they are, and why management approach must change in response to changing economic circumstances.

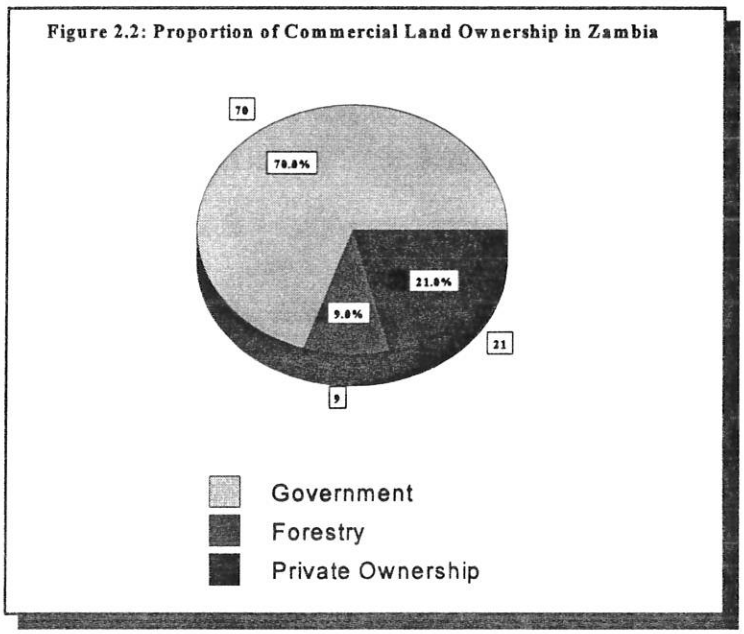
As an investment sector, forestry is different from many other sectors because of unusually long gestation periods involved. Kula (1988) comments that because of the long gestation periods involved, the growth of forests distributes income between generations; and that these long gestation periods make it obvious that more than one generation will be involved in any venture.

When trees are planted, it is known that the bulk of the benefits would be captured by future generations. Conversely, when trees are felled, it means that benefits are being reaped from projects which were established in the past. For this reason, forestry necessitates estimating timber productivity and value a long time ahead. This renders current forest projects to be problematic for establishing their economic viability and

benefits. This is because, the nature of future demand and utilization of forest products, may not easily be predicted.

In Zambia, the large portion of commercial timber lands, are owned by the government, followed by wood-using industries; and the scattered small tracts of timber land, are owned by private individuals (See figure 2.2).

Figure 2.2: Proportion of Commercial Land Ownership in Zambia



Out of the non-government owned land, the larger part of the timber land, is held by businesses as investments. This is because forestry business often does not provide much income in the short-term; and such businesses demand long-term investments, and require substantial capital resources. However, the rewards of managing timber lands for a number of decades can be substantial.

For Zambia, the year 1969 saw a continued expansion of the Forest Department's activities in most fields with continued emphasis on investment in plantations. With the completion of the district-by-district survey of Zambia's forest resources, the Division of Working Plans and Surveys turned its attention to management planning, and to establishing soil survey units for surveying and selecting plantation areas.

In the same year, the Government increased industrial plantation in the Western Province to a further 5,900 acres, of which 3,800 acres were planted with **tropical pines,** and the remainder with **eucalyptus** (Zambia... 1970, 26). In addition, considerable areas were cleared and prepared for future tree plantings.

Under the U.N.D.P./F.A.O. project, the forest industries' feasibility study, market studies, and demand/supply projections were made; and the resident experts commenced advisory and training programs in mechanized forest work, and in timber technology and work study. The Zambia Forest College continued to train and produce Foresters, and Forest Rangers.

2.4 ECONOMICS OF FORESTRY

There are trends and cycles in economic activity that significantly influence the practice of forestry. The general level of economic activity influences the demand for all goods and services; and there are special economic circumstances, that influence particular forest products, and services.

In relation to forestry economics, foresters are concerned with the relationship between the volume of timber being harvested, and the volume of timber being added to the timber inventory by growth. In terms of forestry management, when tree removals exceed net growth, it means that timber is being used more rapidly than it is being replaced resulting in the decline in timber inventory. Such a decline can mean even less growth in the future; and the eventual inability of timberlands to supply industry with harvest at the required levels. Consequently, this in turn, can cause unemployment in timber industries; and this can lead to economic dislocation for communities, significantly dependent on the wood processing industry.

Commercial timberlands are defined as the forests that are capable of producing at least 20 cubic feet of industrial wood per year (Sharpe *et al* 1987). For Zambia, about two-thirds of the land area is occupied by forests; and nearly one-third of these forests is classified as commercial timberlands. It can be noted, that not all Zambian commercial timberlands actually provide harvests of timber. Some timberlands are too far from mills; or are too poorly stocked with commercial timber to make harvest profitable. Also, some private land owners are simply opposed to cutting trees in their areas.

2.4.1 Timber Demand

The demand for commercial timber is a derived demand emanating from the demand for housing, furniture, containers, and paper. Often, housing is a basic consideration.

With the increase of the number of dwelling units built each year, the demand for timber increases. However, the growth of the housing industry is dependent on such factors as the rate of household formation, urban growth, and interest rates on home mortgages.

The timber industry in Northern Rhodesia consisted of one major sawmill, which was also a substantial exporter of timber. This was the Zambezi Sawmills, established in 1948 as a government owned enterprise, to process and do business in timber. A small number of smaller privately owned sawmills existed; but their main concern was to supply timber to the mines, and constructional joinery (Zambia 1969).

The timber that comes from the Zambian forests, is used as raw material of great importance in forest product industries, building industries and mining industries. The consumption of wood for local industrial purposes has steadily been increasing since 1965, when large construction projects were being implemented, and mining prospecting expanded. The wood harvested each year is used to manufacture lumber and millwork, railway sleepers, plywood and veneer, furniture and containers, and a variety of paper products.

Large supplies of indigenous timber come from most of the provinces in Zambia; and the largest supply comes from North-Western Province. However, the forests are not always well located from the point of view of the local market. The **teak forests** in Western Province (Barotse), for example, are located far away from the population

concentration in the upper Zambezi valley. In 1972, the accessible supplies of Barotse teak became exhausted; and for this reason, Zambezi Sawmills had to cease operations in the area (INDECO 1972, 34). Indigenous supplies have, therefore, been supplemented in all provinces by the establishment of regional and local supply plantations (Zambia 1966).

2.5 FOREST MANAGEMENT AND PROTECTION OF FOREST RESOURCES

The administration of forestlands is a complex business made up of many different kinds of activities. One aspect of forest management is planning to achieve greater economic effectiveness. The Society of American Foresters (1958) defines forest management as "*the application of business methods and technical forestry principles to the operation of a forest property.*" In this context, the task of forest management is to develop, organize, and maintain a forest business for the benefit of a nation. Like any business venture, forestry can be integrated in the national economy as a major economic sector.

Forest management is essentially the core or the mainline of forestry. The forest manager is usually concerned with anything that affects the operation of the area in his charge. Also, he needs to have an intimate understanding of silviculture; the long-range viewpoint of the planner; the skills of an administrator; and the alertness, flexibility, and all round resourcefulness of a successful businessman (The Society of American Foresters 1958).

For the purpose of forest planning, the forester is most likely to utilize economic concepts and methods. This includes the job of administration which involves considering changes in the ongoing programs that may improve the productivity of the property.

2.5.1 Management of Natural Forests for Wood Production

The management of natural forests of indigenous species, is the alternative to plantation management; and it generally provides less wood per hectare. Therefore, the number of hectares necessary to produce a given output level is greater. Regardless of differences in plantation management, and regardless of the continuing advantages of exotic plantation in several important emerging forest producing regions, Sedjo and Lyon (1990) point out that approximately one-half of all timber production worldwide originates from natural stands. Furthermore, they project that the relative importance of natural stand production will not change in the near foreseeable future.

Tropical forest production, to date, largely can be explained by the frontier theory of resource use (Barnett and Morse 1963). The theory provides that where there is an abundance of a resource, the price of the resource may be too low to justify management costs. Only as the resource is depleted and its price rises, will management efficiencies develop and incentives be created to reduce waste in production. This explains, in part, why there has been little effort until recently to develop more efficient schemes for exploiting tropical forests.

In relation to the preservation of tropical forests, Anderson, Roselle and Katelman (1992) argue that developed countries should ban tropical timber imports in order to halt non-sustainable timber harvesting. Conversely, Vincent (1990) argues that import restrictions could actually hasten the conversion of forest lands, as they would reduce the return to timber production, and remove the economic incentive to keep lands under forest cover.

2.5.2 Managing Forests for Many Purposes

Forest lands are managed for a multiplicity of purposes, with usually one use for a given area. Such lands can often be managed for several uses, sometimes on the same area, and sometimes with different dominant uses assigned to separate areas. Frequently, timber production dominates on a particular area. But the management of the whole forest is directed at achieving the net optimum benefit. This means that the aim of management is to keep forest lands productive, protecting them from damage, and ensuring that optimal yields are achieved to satisfy market demands.

Forest managers are required to initiate and change management programs in response to changes in costs, prices, and public concerns. The general economy together with the social concerns of the day, play a role in controlling how forests are managed, for what products and services, and for what identified target user. For this purpose, the forest manager needs to have adequate information at his command on all the economic aspects of forestry in order to make sound decisions. In this, way land use planning

becomes a process of reaching decisions about how forests should be managed. The first decision to be made in this direction is how to allocate land to various uses. Also, decisions should be made on how best to adapt parts of the forest to timber growing, recreation, and wilderness, or game habitat.

It should be noted that assignment of parts of the forest for a particular use should not necessarily preclude other uses. Often, timber stands provide game habitat during some stages of their development; and many parts of most forest areas provide multiple uses. Use allocation, then, is one important kind of decision that forest managers must make. The forest manager does this by considering the information available on both the natural characteristics and capabilities of each part of the property, and the kinds of output or uses that are identified to be in greatest demand.

The economic principle of the best or highest use indicates that the use that provides the greatest value of output, and meets the most urgent need should be chosen. This way the forest is sub-divided into areas, compartments, allotments, game habitats, and other units, each devoted primarily to the production of a particular output. Production becomes the physical or tangible process of combining certain necessary elements or inputs so that they result in a desired output.

Often, natural forests provide some timber, forage, wildlife, water, recreation, and other outputs. But management actions, however, can augment or increase these outputs. Timber stands can be protected from fire and pest losses. Managed timber

areas or plantations can be fertilized, thinned, and pruned to obtain trees of greater volume and value, and they can also be replanted after harvest with genetically improved seedlings.

Similarly, the treatment of range allotments to obtain a greater production of forage, and the installation of fencing and water reserves to control and distribute animal use, can significantly increase forage output and utilization.

As forests are being economically utilized, they conform to the law of diminishing returns. Sharpe and others (1968) explain that this is an invariable rule that indicates that for each production unit, some increase in output is available for only a small additional cost or effort, but that the point is soon reached at which additional output is available only at an increasingly large cost. This means that additional quantities of output can be obtained by intensifying management programs, while taking into account cost implications. It is reasonable to add to output as long as the value of the additional output exceeds cost.

The procedure of looking at successive increments in output, determining their cost and value, and finding the last increment where the value of added output exceeds the added cost, is called marginal analysis in economic terms (Sharpe 1968). It is through marginal analysis that foresters determine the most appropriate intensity of management for each production unit.

In addition to supplying raw materials directly for industrial use, Zambian forests might conceivably be used as environments for the establishment of beeswax and honey industry. However, little attempt has been made to promote this industry on a large scale.

2.5.2.1 Amenity Values of Forests

In addition to industrial use, forests are also important as recreational sites. National parks have been created for this purpose including preservation of wildlife. In many instances, forests are also managed for such amenity values as wilderness, wildlife-viewing opportunities, the preservation of rare or endangered species of animals and plants, scenic beauty and attractiveness, and other intangible benefits. These amenities create real benefits for forest users, but are intangible in the sense that their economic value is unknown. Yet a judgment still must be reached as to how much is appropriate to spend to secure amenity values.

2.5.3 Forest Protection

Forest protection is a critical policy interest for Zambia as much of the forest areas have been depleted of trees. On the global scale, Hyde (1991) reports that the world consumption of wood has increased tremendously, especially the demand for fuel wood, industrial roundwood, and pulpwood which increased in the neighbourhood of 25% in the decade 1975 to 1985. Globally, deforestation occurs at an annual rate

approaching to 0.7%. This exploitation of global and especially tropical forests threatens the earth's long-term climatic pattern, its reserve of genetic resources, and the more immediate life support of dependent local human communities.

In Zambia, the direct causes of much deforestation can be attributed largely to land conversion for agricultural production, charcoal burning, and, to a lesser extent, to timber harvest practices. In addition, some indirect causes of deforestation include policy failure relating to the security of land tenure for indigenous populations, for agricultural developers, and for commercial timber operations.

These problems raise the interest of efficient forest management based on pertinent information. This information can only be provided by a well-organized and efficient forestry information infrastructure.

In Zambia, doubts about the effectiveness of private entrepreneurs to economically manage forest resources, have been given as reason for the public sector to manage forests. As a result, forest management in Zambia has been found to be affected by similar problems experienced by other public sector institutions.

2.6 FOREST PRODUCTION OF WOOD AND OTHER PRODUCTS

Although a wide variety of goods are produced in the forest, wood and wood products remain the primary commercial goods. The major wood products range from fuelwood

and charcoal for domestic consumption, and roundwood products, such as, lumber and panel products, to pulp and paper products for domestic consumption, and for export.

Wood and fiber products have been the outstanding commercial outputs associated with the forest. Forest economists, therefore, have been focusing their attention on determining optimal harvest strategies for these products. Subsequently, as the regeneration of economic plants, and timber management became more important, forest economists expanded their scope of concentration to a full range on production options in their analyses of forest management.

Considering forest productivity in the short-term, it can be established that the available forest land can satisfy the market demand for timber, and other forest products. Within this framework, the question arises as to what part of the forest is to be harvested. When it comes to forest harvesting, focus is placed on cost consideration including unit price of the processed products, and the processing costs. Processing costs include milling costs, transportation costs to the mill, and harvesting costs.

2.7 FORESTRY IN DEVELOPMENT

The understanding of forestry's relationship to development has not been given due consideration in Zambia, as compared to agriculture. This is partly due to the early development policies discussed in Chapter 5 that placed more emphasis on the

agricultural sector, and rural development, with only a non-committal inclination to forestry projects.

The early views considered forestry simply as an activity for a state institution established to engage itself in production of timber for use in the mines, for producing railway sleepers, and for producing softwood for furniture making. This view de-emphasized the other non-commodity and household uses of the forest (Westoby 1962).

Forestry's strong forward and backward linkages to the economy, though recognized; still, they were not used effectively in the process of industrialization. Hischman (1958) explains that forest resources have the capacity to offer an excellent vehicle for countries in developing their own capital bases. Established plantations, and pulp and paper mills did not live up to their initial expectations in Zambia. This development led to the continuation of importing many of the items produced from timber. Furthermore, expanding rural populations, and increasing fuelwood consumption, both in urban and rural areas, continued to deplete forests of the usable trees; and this attracted growing attention.

The contribution of forestry to economic development in Zambia, still remains an unsettled question. Zambia, like many other developing countries, has endeavoured to develop her internal wood processing capacities. But, this has often resulted in economic failure; and in the wastage of resources, because of misplaced policy approach. The World Bank, and other donor agencies have made numerous policy

statements regarding the desirability of environmentally sound forestry activities. These institutions have recently placed emphasis on sustainable land uses, and social efficiency, as the most economically, and financially, satisfying means of addressing these objectives. It, therefore, remains a task for the various states to address these issues in line with their development objectives.

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CHAPTER 3

THE ROLE OF INFORMATION IN NATIONAL DEVELOPMENT

3.1 INTRODUCTION

Generally, information is acknowledged to be one of the essential input required in the process of decision making, planning, research, production, as well as in general enlightenment. This is a critical resource in national economic, social, political, cultural, and technological development processes, without which, attempts for development planning, would be ineffective, futile, and substantially misplaced.

The access to, and use of information, has been cited as actually being a power dividing the world into advanced and least developed nations, rich and poor nations, or developing and developed nations (Chimbelu 1985). According to Bhathal (1979), the world today is divided into those that create science to advance frontiers of knowledge, and those that do not; those that have the know-how, and those that do not.

In the contemporary economic, social, and scientific order, excellence in scientific and technical research is a driving force that enhances, not only the nations' cultural status and prestige, but also sets standards of creativity, truth, honesty, independence of judgment, clarity and logic (United Nations 1971).

Scientific and technical knowledge is, therefore, indispensable for human progress. In order to support the development process and to avoid mistakes in development planning, decision making, and project implementation, it must be ensured that relevant, reliable, accurate and timely information is available and accessed easily at any time.

This chapter discusses the role that information systems play in national development activities, particularly, the role that information professionals can play in the reorientation of decision makers' attitude toward appreciating the essence of having well organized and adequately funded information systems in general, and information services to support the development of the forestry sector in Zambia, in particular.

The areas of focus include the efforts so far made in Zambia to harness this resource, for the purpose of supporting various information needs in the forestry sector; and the kind of information linkages existing at the national level. Activities relating to the organization of information service systems in the forestry sector in Zambia are also discussed.

3.2 INFORMATION IN NATIONAL DEVELOPMENT

Information and education are basic requirements for economic, social, political, technological, and cultural development in every nation. Indeed, the concept of information as a national resource for supporting development planning cannot be

disputed. It is acknowledged to be an essential commodity for informed decision making. Discussions on ways of increasing the utilization of information are a testimony to the recognition by planners and administrators of the indispensability of organized information to all processes essential to development (Likubangwa 1988).

Information is an integral element in all human experience, and a resource of importance to all primary, secondary, and tertiary production systems. As such, information, like all other national resources, needs to be planned and harnessed for use.

Development planning is an information intensive process, which requires a sound information base to support the planning process effectively. The formulation of national development plans, therefore, requires timely, accurate, and reliable data; and information on key parameters of the national economy. These development parameters include information on gross domestic product (GDP), population, natural resources, technology, health indicators, balance of payment, national debt, etc.

Essentially, this is a macro-planning process which involves high risks, and is subject to external influences and interventions. Hence, the trends and developments in the economic, social, political, scientific, and technological environments at national, regional, and international levels, need to be constantly scanned in order to alert planners and decision makers; and to analyze their likely impact on national plans and

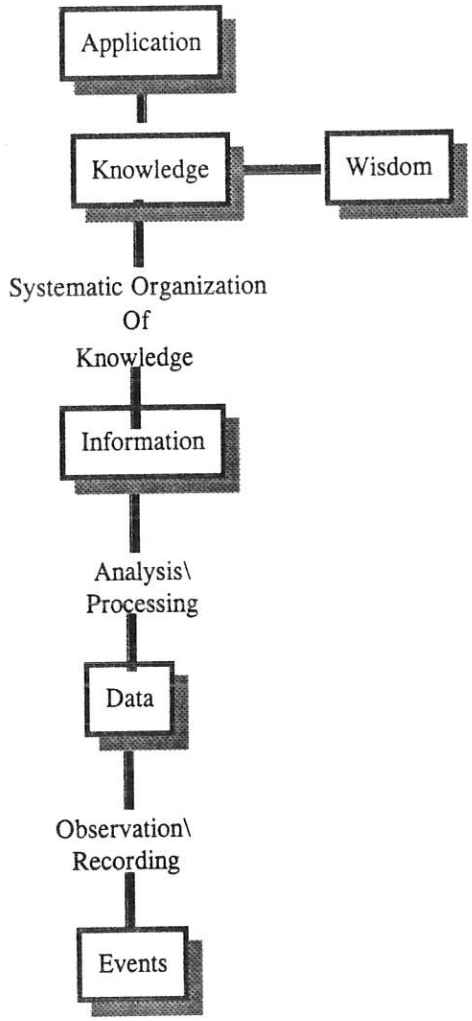
programs. These aspects can effectively be handled by systematically organized information systems capable of securing required information, analyzing it, and presenting it in the format suitable for the immediate requirements.

3.2.1 The Problem of Definition

Different people have ascribed different meanings to the term information. Depending on the context in which the term is used, information has been regarded as a commodity, energy, set of facts, data, and knowledge used by human beings to achieve their objectives. Information professionals tend to agree on the essential components that characterize the concept in relation to data, knowledge and wisdom (Figure 3.1).

Davis and Olson (1985, 6) define information as "data that has been processed into a form that is meaningful to the recipient and is of real perceived value in current or prospective decisions." This means that relevant data have to be collected and processed in a meaningful way that will be used in decision making (Figure 3.2). Schutz (1975), on the other hand, suggests that information can be understood as "the communication of intelligence or knowledge... for the work of documentation and information facilities... is new knowledge disseminated in accordance with the information requirements of the receiver for the fulfilment of his tasks in government, science or technology" (UNECA 1988).

Figure 3.1: Information Processing



In this thesis information is considered to embrace both these meanings as seen in the context of relevant data, signals, facts, views, opinions, ideas, events, and news of value (Lundu 1985) to decision making, planning, and problem solving, in the process of development planning.

Figure 3.1: Information Processing

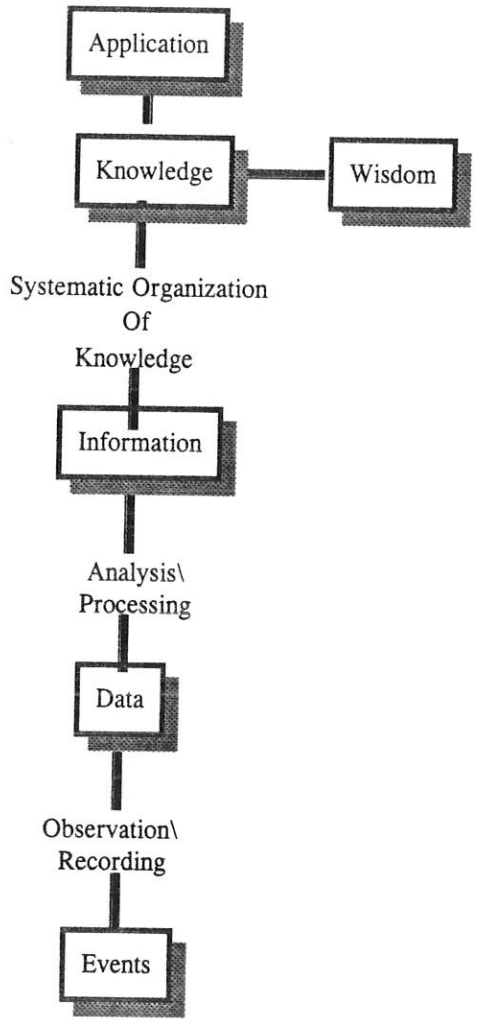


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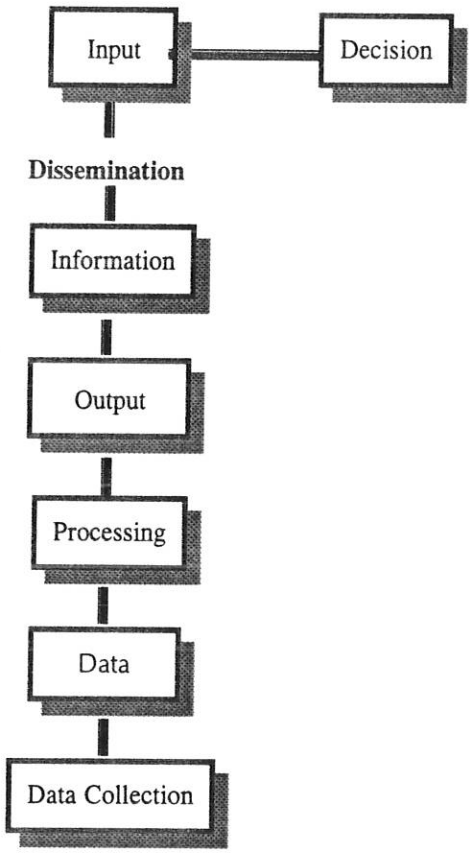
Figure 3.2: Information Processing for Decision making



Source: Lucas, Henry C. 1990. Information systems concepts for management. New York: McGraw-Hill.

Thus, providing man's chances for survival. It should be noted, in this regard, that context, situational factors, and personal understanding of the problem, or set of problems at hand, would dictate the interpretation of information or the type of information that would be required for decision making.

3.2.2 Nature of Information Required for Decision Making

Normally, decisions are made when a problem or a set of problems is identified. A problem exists when the decision maker's ideal situation differs from reality (Lucas 1990). When this situation occurs, the decision maker is required to initiate action or devise a program for the purpose of rectifying the problematic situation, or condition, in order to make the ideal situation a reality. For the purpose of solving a problem, decision makers seek causative information or data in order for them to gain adequate knowledge about the situation before setting in motion curative measures, or developing some program to remedy the situation. Also, decision makers need information on the alternative courses of action or solutions to be applied to the problem area. Use of Information is essential at every stage in the process of making decisions.

Certain kinds of information can be characterized to be more suitable for decision making than others. Also, the time frame in which information has been in existence makes it historical or prescriptive (Lucas 1990). Historical information is based on past decisions, previously encountered problems, or experience. This kind of information can be used to design alternative solutions and to monitor performance in current decision making. Depending upon use, information may be required in summary form or in detail.

Presentation of information in the form that is suitable for each application requires the competence of an information professional. It is often frustrating, on the part of the information user, to be provided with inappropriate information by an information system. Lucas (1990) points to the generation of inappropriate information as a common failing of most computer-based information systems. This failing of computer-based information systems can be attributed to the faulty design of information base whose access may not be flexible enough to respond to data manipulation, suitable for particular information needs. A similar set of data/information can be used for strategic planning, managerial control, and operational control in an organizational setting. But, such information needs to be refined to conform to the decision type, detail and accuracy requirements in a given situation.

Due to modern developments in science and technology, it has become a difficult activity to plan and decide on national development issues today. National planning activities require accurate and current information on the local, regional, and world conditions for the purpose of constructing effective plans for the nation. For this purpose, information on all aspects of development indicators is vital and need to be accurate, reliable and available on demand. It is for this reason that a question arises as to whose responsibility it is to collect and provide the required information necessary for development planning.

3.2.3 Responsibility of Information Service Systems

In order to make this resource easily accessible, information service systems need to play their rightful role in information handling and dissemination; and need to be able to adapt to new environmental changes in terms of the prevailing technology, and the needs of the current and prospective users.

An information system has, as its concern, the generation, collection, processing, transmission, and use of information, within a specified sector of the community supported by organized services. An information system, in this regard, is specifically concerned with the effective and timely transmission of information from its source to its destination.

3.2.4 Information as a National Resource in Zambia

The role of information in socio-economic development activities in Zambia has long been recognized and accepted. It has been acknowledged that the lack of useful and productive information in development sectors often lead to development stagnation or regression. For this reason, the capacity to generate, process, store, transmit and utilize productive information is acknowledged as one of the determining factors in the social and economic development process of the country. All social and economic sectors will function effectively when there is timely, accurate and reliable information to support the needs and operations of the economic sectors.

3.3 INFORMATION SERVICE SYSTEMS

Different information service systems exist in various forms. Whether a system is called a documentation unit, information centre, library, or records unit, such an institution is charged with the task of generating information required to serve, primarily, the organization under which it falls, to help it achieve its objectives. These systems provide information for decision making, planning, management, system operations, and for research and development. Information service systems are designed to offer services for the primary generation of information through research activities, collecting information, recording and processing, analysis and synthesis (consolidation), storage, selection, answering to queries, attending to users, dissemination and communication of information (Debons 1989).

In general, information processing is one component of the activities of organizations. This component of organizational activities has often been taken for granted in many organizations. however, it is now being realized that information is a resource which needs to be managed. In today's complex technological environment, an organization's success is becoming increasingly dependent on its ability to manage information, especially, taking advantage of the opportunities presented by technology.

For the purpose of running an organization efficiently, Lucas (1989) explains that, one way to use information is to help reduce costs in order to follow a strategy of being the

low-cost producer in the industry. In order to achieve this objective, information can be used to run an organization, or deliver a service efficiently.

Information management is an organizational activity, not only confined to traditional libraries, but it is an activity assigned to a variety of information systems created to facilitate information processing and utilization. For this reason, many organizations have realized that information is an entity in itself. It is also acknowledged that information on all aspects of an organization's operations, including information on competing organizations, and on the national and international economic order, is vital for its success.

The task of managing information resources has become more complicated as a result of advances in technology. The manager of an information system and the management of organizations, need to take the responsibility for developing a vision for information processing, and to determine the role of information processing in the organization. This group is required to determine the role and objectives of the information processing in relation to supporting operations, decision making, strategic planning, or the combination of these functions.

In addition to making decisions about the functions and objectives of the information department, the head of the information department should also be concerned with the internal organization of the information services department.

3.3.1 Computer-based Information Systems

Modern organizations are largely interested in using technology strategically for the improvement of operations, and success in their businesses. It is, therefore, essential to design an information system that is capable to use technology to support the provision of a service, while at the same time, will operate to support the strategy of the organization.

In a computer-based information service system, it is important to put much attention on computer operations. This is because organizations using computerized services require a reliable service and good response time of the system. Therefore, the information service system manager should be able to be careful in hardware and software selection and installation. The decision to acquire a computer system should be based on the volume of operations that will be required to be performed by the computer system.

3.4 INFORMATION RESOURCES FOR NATIONAL DEVELOPMENT IN ZAMBIA

Information is not a scarce resource in Zambia. In fact, information is abundant, but the basic problem is that information is scattered in various, and usually, unknown locations. Different sectors of the economy generate large quantities of information, especially emanating from feasibility studies, market research, board meetings, etc.

In addition to the information produced locally, a lot of imported information is available through the media of books, journals, memoranda, films, video tapes, television, and radio transmission.

A large amount of information resources are available which can be tapped for use in the development programs of the country. What is needed is a workable mechanism for making known and for disseminating such information to those who need it, and to ensure that the information is used. One such mechanism is resource sharing.

Table 3.1: Libraries and Information Centres in Zambia

Type of Library	No. of Libs.	Institution
Public Libraries	46	ZLS, USIS, City, Municipalities, Church
Academic Libraries	30	Universities, Technical & Teacher Trng Col
School Libraires	160	Secondary Schools
Special Libraries	52	Specialized Institutions
Total	288	

Source: Chifwepa, V. 1994. Libraries and the freedom of information in Zambia: a Zambian country report.

In Zambia, the existence of various libraries, supported by the central government, city, municipal, and district authorities, research and educational institutions, confirm the fact that information is, indeed, acknowledged to be an important resource without which no proper decisions can be made. Table 3.3 above presents the categories of libraries and information centres in Zambia.

3.4.1 Appreciation of Information in Zambia

The general pattern in Zambia indicates that, there is an apparent misunderstanding of the role of the information services by many people. This state of affairs is a long standing problem which has contributed significantly to the little concern and little support given to information service units, and the low regard and the lack of appreciation of what information professionals can offer. Highly trained information professionals are few in Zambia, and the majority of them are employed by the universities, while government institutions have less trained information manpower on their staff establishments. This aspect has made it very difficult for this group of information workers to convince the government administrators to change their attitude toward information systems.

Many managers of organizations and government administrators fail to understand the reason for continuing to support information systems. They believe that it is a waste of resources to invest in information services, because often immediate returns are not perceived for the money invested. This thinking has contributed to the low regard for the information systems. In such circumstances, it becomes most challenging and frustrating to hold a position of an information manager. The negative attitude toward information service systems by many operating officers is largely due to little knowledge about information processing services. It is disheartening to note that the decision makers, who are expected to be the natural supporters of information and documentation services fail to link the importance and role of information in their

decision making process. They tend to regard information processing activities as uninteresting that they should know less about it. This negative attitude is very difficult to overcome and this situation creates constant problems in information processing (Lucas. 1989, 17).

In addition, the information professionals today are facing other problems relating to the mobilization of financial resources in the face of the general economic decline, soaring book and periodicals prices and the increasing world literature output. These trends are making it very difficult for the professional to satisfy the information needs of his users at the time of declining acquisitions. This is a serious challenge to all professionals in the information sector.

Given this sad environment, professionals need to prepare ground for a permanent coordinated system or network of information services. The starting point should be the formulation of information policies, to secure government commitment to the development of the information sector, and to ensure that the government assumes the responsibility of the general management and financing of information service sector in the country.

3.4.2 Information Resource Sharing

Today the volume of information that is generated is so enormous that it is practically impossible for any one single information system to capture a significant amount of

information generated from events occurring all the time, all over the world. This trend has inspired the thinking on cooperation and resource sharing among institutions at the local, regional, national, and international levels.

This thinking is based on the understanding that local institutions in defined subject areas are better placed to comprehensively collect information resources at the local level, complemented by information generated outside the organization. It is also acknowledged that if functions and operations of these local institutions were to be coordinated, wider coverage of information resources would be achieved; and the sharing of resources would increase user satisfaction.

Also, the volume of information has demanded the establishment of the specialized and general information utilities to complement information services offered by libraries, documentation, and information centres.

Information resource sharing is defined as a mode of operation whereby the functions of one information centre are voluntarily shared in common by a number of other information centres (Encyclopedia of Library and Information Science, Vol. 25 1972). For resource sharing to be feasible, adequate information resources should be available. Also, the institutions involved should be willing to share their resources so that all participating institutions in the venture can benefit.

If they were to be coordinated at the national level, information systems can be able to reflect a comprehensive collection of national literature and information resources representing the overall national bibliographic control. The national coordinated information system can play a significant role in providing access to information required in the national planning process. The national information coordination system can subsequently contribute to the global bibliographic control, and facilitate access, and usage of information available in various institutions.

The above presentation and mode of thinking is yet to be implemented in developing countries. Many developing countries do not even have national libraries and national information policies. This is a situation that requires concerted efforts from various sectors, institutions, and individuals involved in decision making. Information professionals have been strong advocates of cooperative information management and resource sharing. But, in spite of the efforts made by information professionals, certain important links are still missing. To make this situation a reality, the involvement of decision makers at the national level becomes imperative. It is this link, in the system, that is often missing. Decision makers are required to actively participate in the ratification and enforcement of policies regarding the functioning and operations of various information systems in the economy. This group of actors in the process of formulating national information policies should be made to understand the importance of having national information policies in place, and made to appreciate how policies can facilitate the creation of coordinated national information networks that can be of great help in national planning and decision making process systems.

3.5 INFORMATION FOR PROJECT IMPLEMENTATION IN ZAMBIA

A wide variety of development projects has been identified in the developing world that can lead to the improvement of the unfavourable conditions of the social, and economic infrastructures. Projects for upgrading and establishing road network systems, water and sanitation systems, electrification, and rural industries, have been identified to be part of national development.

In Zambia, numerous projects have been proposed with the good intention of improving conditions of the lacking areas, and to raise the living standards of the majority of the rural populations. More often than not, these projects have been suggested and approved by politicians lobbying to upgrade their constituencies. Such approach to project approval has often been taken without regard to other infrastructural factors in the economy. Examples of misplaced projects in Zambia are many. Illustrative of these include the Livingstone Motor Assemblers, Mansa Batteries, and to some extent the textile industry, including the Rural Reconstruction Project of the early 1970s.

A lot of financial resources has been wasted on many misplaced projects in Zambia. The major reason for project failure can be attributed to lack of appreciation of information. Often, major decisions are not supported by information regarding the communications systems in the area, the distance from the source of raw materials, information on the supportive sectors, and information on the nature of the market,

both internal and external. This information is valuable in deciding project feasibility in a given area.

3.5.1 Use of Foreign Expertise in Project Implementation

Reacting to the failure of many economic projects in the country, the government of Zambia has tried to use foreign expertise to implement government projects. This approach has often proved to be a costly undertaking because it involves a great deal of uncertainty about continuity after foreign experts have left.

When foreign experts are contracted to survey and evaluate projects, they need to have an adequate understanding of the environment in which they have to implement projects. This understanding can be gained through the availability of information about local environment relating to economic and social practices, technological, cultural, belief, and value systems of the local populations. Without this information, experts would not be able to adequately evaluate, implement, or recommend suitable solutions that would help to improve the local situation. Recommendations on many projects in this situation would be based on projects that have succeeded elsewhere. Lack of information and understanding of the local environment has been one of the major factors in project failure in Zambia.

Project proposals need to be evaluated on the basis of background information which will guide the process, progress, and success of the implementation of the project. In

this regard, well organized information systems are needed to provide the required information. Information systems which should be able to provide certain types of information need to be identified as a first step, then information on related projects which have been undertaken before should be available for the purpose of project feasibility analysis, and information on people who have been involved in previous projects should be available for the purpose of consultation.

In order to have easy access to such types of information, information systems operating in the sector of interest should be able to maintain databases on various aspects of project interest. The ideal situation is for these information units to maintain integrated databases which should be able to facilitate presentation of required data and information from the same database.

3.6 INFORMATION UTILIZATION IN THE FORESTRY SECTOR IN ZAMBIA

Self sufficiency in forest products or wood calls for improvement in forestry productivity. This requirement entails information support services that are capable of enhancing management and operation practices. Information on forestry technology, methods and techniques, as well as research-in-progress, at national and global levels, can help researchers and planners to keep abreast of current developments, to apply research results, and to minimize wastage of resources and time caused by unnecessary duplication of efforts. Such information can be obtained through conferences and

conference proceedings, Science and Technology journals, research reports, abstracts and indexes, various databases and on-line services.

In Zambia, the Forest Department is charged with the responsibility of developing the forest industry in the country. The Department has the jurisdiction over the Divisions of Forest Research and Forest Products Research and several outlying research stations and areas of interest to the forestry sector. Its responsibility is to give countrywide coverage of their fields of activity (Forest Department 1987) and to support information collection, distribution and usage in the forestry sector.

Both the research divisions and the Zambia Forest College are serviced by a small library and information service unit based in Kitwe. During data collection for this study, it was found that the library is supposed to service all forestry institutions in the country.

3.7 INFORMATION PROFESSIONALS

Although managers can be blamed or criticized for apathy and disinterest in information services operations, a number of problems can be blamed on the information service professionals themselves.

TABLE 3.2: The Challenges of contemporary Information Service System

1. Supporting the organization's strategy
2. Meeting the demand for computer power and smooth operations.
3. Dealing with aging information systems
4. Reducing the backlog of applications.
5. Supporting end-users
6. Managing information service system personnel to reduce turnover and enhance skills.
7. Developing a vision of the role and contribution of technology to the organization.
8. Defining an overall hardware and software architecture, including microcomputers, mini-computers and communications.
9. Coordinating processing decisions across the organization.

Adapted from: Lucas, Henry C. 1989. **Managing information services**. New York: Macmillan.

Sometimes information professionals fail to understand management and its objectives. The failure to understand the overall objectives of the organization leads to the misplacement of the information services unit functions. As a result, management also fails to understand why they should continue to support services whose contribution to

the success of the organization is not immediately observed. With these problems, it becomes very difficult, if not impossible, to establish a well managed information services system.

3.8 ORGANIZATION OF INFORMATION SYSTEMS

Information services have been organized in a number of different ways to respond to the needs of the overall organization system. Prominent among organization structures of information service systems have been the centralized, decentralized and the combination of the two structures. With the availability of microcomputer systems, the trend has been toward distributed and decentralized coordinated information processing systems.

In decentralized processing, equipment is placed and managed at remote sites. There is no communication among computers, and there may be little coordination (Lucas 1989). Distributed processing, on the other hand, features remotely located equipment, but the various computers are connected for some portion of the day in a network. Distributed processing requires a great deal of coordination. A distributed micro computing system is often characterized by end-user computing. In this way, information services professionals play the role of facilitating the use of computer facilities and supporting end-user computing. In this case, users are allowed and encouraged to become more independent, and capable of handling some of their own computing needs. The cost for this type of information processing structure is

manifested in the need to coordinate, to integrate activities of diverse individuals in order to be sure that the organization maintains control over information processing in the aggregate. Lucas presents three components of the structure of information processing: the location of information, equipment, and the management of processing (Figure 3.4).

TABLE 3.3: Organization Design for Information Services

Real system Type	1	2	3	4	5	6	7	8
Information	Centralized	Decentralized	Centralized	Decentralized	Centralized	Decentralized	Centralized	Decentralized
Equipment	Centralized	Centralized	Centralized	Centralized	Decentralized	Decentralized	Decentralized	Decentralized
Mgt of Inf. System	Centralized	Centralized	Decentralized	Decentralized	Centralized	Centralized	Decentralized	Decentralized

System type:	1	2	3	4	5	6	7
Comment :	Very common e.g. batch sytem	Common E.g. online system	Rare	Usual e.g Online Local computer Depart sites.	Common E.g. Data collection from remote sites	Computer Staff Management coordinate decentralization	Rare

Note: The table illustrates the possible processing patterns when each variable is centralized or decentralized.

Adapted from: Lucas, Henry C. 1989. **Managing information services**. New York: Macmillan.

For the purpose of choosing a suitable information service operating structure, managers of information systems need to have adequate understanding of the objectives or mission of the organization they serve, and a comprehensive understanding of individual user information needs. With this knowledge information system managers will be able to manage uncertainty inherent in the environment and create systems that

will be able to be responsive to the different needs of users. As the organization grows and becomes more complex, information services systems also need to adjust in response to the organization's complexity and changed environment.

To reduce the misunderstanding of the role of an information service system, especially among the group of decision makers in organizations, and to cultivate the appreciation of the role of the information system, managers of information systems need to devote some effort to marketing of information services, and to convince managers and users that the information system deserves their interest and support.

In addition to land, labour and capital, information is a crucial resource in forest management. Information is actually a strategic national resource necessary for national economic, and social development, especially, in a country like Zambia whose economic, social, technological and cultural infrastructure are still weak.

In forest industry information about the type of timber required and the kind of wood products being manufactured is needed for the industry to know the types of trees to plant and harvest.

CHAPTER 4

INFORMATION TECHNOLOGY IN ZAMBIA *

4.1 INTRODUCTION

Developing countries share many concerns regarding the introduction of advanced information technologies. These apprehensions primarily relate to the loss of cultural identity, and the continued dependence on, and being dictated by, external forces. In spite of these fears, developing countries have the desire to meet the basic needs of their people and to decrease the gap between the developed and developing nations.

Commenting on Africa's dependence on the developed world, Zulu (1994) explains that Africa is not only dependent upon developed countries for finance, technology, food, weapons, resources, and markets for raw materials, but also for information. Zulu further explains that "With respect to information, an examination of collections of libraries and other information centres in sub-Saharan Africa, will reveal that over 90% of the book stocks and periodicals are imported." Therefore, third world countries need not have fears in adopting imported IT, but should utilize it to develop their technology base.

* The detailed presentation of the application of information technology in Zambia is provided in an unpublished country report on Information Technology in Zambia, compiled by the author.

With regard to development objectives, application of information technology and the development of indigenous technology capacity have profound implications for the future development of Zambia within the global economy. The acquisition, diffusion and application of information technology, as a tool in development programs, can have a significant facilitating push in development planning of the country, and can be used for the communication and information exchange with other countries. A full exploration of policy implications, and the creation of institutions for the acquisition and use of information technology in Zambia is a prerequisite to effective and efficient information management. These aspects need to be supported by a sustained process of dialogue both at the national and international levels. Strategically planned acquisition of IT, and the building of capacity to manage IT, would significantly facilitate optimal application and utilization of information technology.

In relation to global interrelationships, Michalski (1986) comments that information and communication technologies are set to change dramatically the social and economic fabric of our societies. These technologies are already having far reaching implications on methods of production, employment patterns, and the structures of industry; on the conduct of financial transactions; and on the lifestyles of all the communities, and the entire nation.

It is the intention in this chapter, therefore, to offer a broad review of the implications of information and telecommunications technologies for the Zambian society, the economy, and international relations.

4.2 INFORMATION TECHNOLOGY

Information technology, generally refers to technologies comprising the machinery for producing and disseminating data/information (UNECA 1991). This technology includes the use of computer, telecommunications, and broadcasting as tools for the organization, dissemination and accessing of information (Davies 1985, 248). In common usage, the term "information technology" refers to computer-based technology and telecommunication. But, it includes other applications of technologies. Some of the IT applications include: CD-ROM, computer networks, desktop publishing, expert systems, GIS, interactive video, satellite communications, etc. (Zijp 1974). Therefore, the term information technology is used here to cover all technologies used in the collection, organization, processing, and in the transmission of data/information. For the purpose of managing and transmitting information, some of the equipment that make up these technologies include: printing, reprographic, micrographic, computers, telecommunications, electronic office equipment, video technologies, and software products.

Accordingly, the essence of information technology is the desire to achieve the transfer of data/information from source to its destination, using the fastest means possible.

This requirement, entails the use of appropriate equipment, and adequate development of data communication infrastructures in the country. By way of quick transmission of information, and access to appropriate development information, the use of modern technologies can significantly improve and facilitate planning, monitoring, and delivering of national development programs. Appropriate use of information technologies can also provide logistic support for coordination and distribution of resources and services to widely geographically separated locations.

4.3 TECHNOLOGY TRANSFER

Utilization of Western technology in various sectors of the national economy is not a new phenomenon in Africa. Technology transfer has been going on since the Western multi-national companies started to extend their business enterprises to Africa. Similarly, computer technology was introduced in Africa at the same time as the Western countries began to use it in various processes and its application in Africa has followed similar trends as other productive technologies.

Regarding problems relating to the application of information technology, Zulu (1994) reports that, the problems of computers in Africa centre around their under-utilization, lack of indigenous maintenance capability, and their being of exclusively foreign origin. What Zulu is trying to emphasize is the fact that IT has not yet established roots for indigenous innovation, and the capabilities to modify imported technologies to suit local environmental needs.

During the 1970s, it was commonly assumed in developing nations that the process of economic, social, and technological development was a simple matter that could be initiated and maintained by the transfer of advanced technologies from the developed to the developing countries. Such transfers were assumed, especially of the modern latest technologies, to facilitate a smooth development process. This assumption, in relation to the implementation of the development process, has proved to be increasingly difficult to achieve. Consequently, countries like Zambia, which attempted to mould their development process on this assumption, ended up incurring huge debts and exhausted almost all their financial resources on inappropriate technologies. This situation arose because the transferred technologies were not tuned to the immediate needs of the receiving country and, therefore, brought in certain social and cultural problems resulting in the failure of many development projects.

The introduction of information technologies has often followed the same pattern in many developing countries. Initially, the benefits of advanced information technologies were seen to be a driving force in development strategies, and were assumed to outweigh the costs (Munn 1978, 23). The assumption that, technologies could be transplanted to other cultures without sufficient understanding of the needs of the users, and the lack of foresight regarding the support needs of the information systems themselves, have been the basic problems in technology transfer.

One of the major problems in developing countries is the lack of trained technicians and operators. The lower level education in information technologies provide problems

in the continued maintenance and development of computer systems. Also, the software used with computer systems cannot be developed in the country due to lack of training and experience. This aspect brings in the problem of adapting software to local needs.

It should be understood that the various types of information technologies are tools, and that they are not an end in themselves. Although the Developing countries do have needs for appropriate information, they need to be cautious in adopting various technologies available on the market and need to acquire new technologies which should match the needs or necessities of the given level of development. Access to information is important for the process of development, but the control of these technologies is an essential step in meeting the basic needs of developing countries.

4.4 INFORMATION TECHNOLOGY INFRASTRUCTURE IN ZAMBIA

Applications and development of IT are part of a wider infrastructure which includes communication facilities and electricity supply as infrastructural prerequisites. As support systems for the development of IT, telecommunications and electricity supply have been registering satisfactory development, adequate to support the capabilities in information processing in Zambia. In most urban areas in Zambia, power supply is fairly reliable and stable.

There is also a reasonably comprehensive telecommunications network serving national, regional, and international requirements to a satisfactory degree. Further

enhancements on the existing infrastructure will facilitate advancement in IT in the country.

4.5 APPLICATION OF INFORMATION TECHNOLOGY IN ZAMBIA

Computer applications predicate an area of human endeavour which is profoundly marked by rapid advances in the microelectronic science and technology. The extent to which Zambia could take advantage of the multispectral opportunities inherent in the science and technology of microelectronics is contingent, in a large measure, on the scientific and technological capabilities of the local human resource, required to operate in concert with local needs, to identify, develop, and to implement appropriate research and development (R & D), or R & D support programs. Regarding the application of computers in development objectives, the report on the Workshop on Application of Mini/Micro Computers (1985) provides that the computer lends itself to a functionality that can be responsive to local socio-economic concerns of developing countries, including industrialization.

In the modern global economy, utilization of information technology is, apparently, directly or inextricably linked with economic development. If it is accepted that the development or the growth of the national economy is linked to the effective utilization of information technology, then, the development process in Zambia will, inevitably, depend on sufficient development of the information sector. In order to create a concrete sustainable development strategy, the country needs to develop the ability to

communicate efficiently with local and international markets, so that information flow and information exchange on aspects of the international business, and on the operation of financial markets, will be assured. It is, therefore, observed here that lack of information regarding the crucial economic factors at the global level can be a critical constraint in the development process of the country.

4.5.1 Status of Information Technology in Zambia

Reasons for lagging behind in development for developing countries, and Zambia in particular, apparently can be attributed to non-effective utilization of development information in planning efforts. The current situation is not necessarily due to lack of data on which to base various meaningful socio-economic planning processes, but the problem can be found in the inability of planners to recognize, develop, and to maintain appropriate infrastructures for data gathering processing and utilization.

A review of information infrastructure in Zambia, and the appraisal of the application of information technologies by libraries, information, documentation, data and information analysis and consolidation centres, required to meet information requirements of development planners in Zambia, highlight a number of inadequacies. These shortcomings are primarily due to the lack of appreciation of the role of information in development programs by political and planning officers, and inadvertently, the peripheral role that information professionals have been accorded in the development process.

On the one hand, the lack of appreciation of the importance of information, has, ostensibly, resulted in a number of policy gaps in those areas which are vital to the acquisition and use of modern technology for planning and implementation of socio-economic development objectives. On the other hand, information professionals themselves have been passive and inactive in promoting the use of information products, and in sensitizing the users of information about the role information can play in their role performance. Information professionals, with only a few exceptions, have failed to convince decision makers and planners about the need of having a comprehensive information policy to guide the acquisition and use of information technologies. These observations reflect the place accorded to information service systems and the information professionals in the national priorities.

Zambia, like many other developing countries, has yet to develop the capacity of indigenous technology in computer technology. The country still continues to depend on the technology that is developed in the developed industrialized countries. The major reason for this state of affairs can, substantially, be attributed to the low-level of computer scientists and technologists required to develop, maintain and service hardware configurations and software. As a result, Zambia is one of the markets for the computer systems developed in the developed world. International Computer manufacturers are represented in the country by either the manufacturers' agents or regional offices.

With the availability of numerous vendor representatives in the country, the Zambian market has been flooded with all kinds of computer systems, ranging from the large mainframe to a wide range of powerful microcomputers. The government has not so far defined, or legislated on the national policy to regulate the importation of computer technology, or technology transfer in general. Each individual organization or private enterprise, has the freedom to acquire, and, or to import any type of computer system identified to be suitable for the individual requirements. This trend has resulted in the existence of many computers of different make and different capacity in the country.

It is now that a few Zambians trained in computer technology are appreciating and recognizing the essential role that computer systems can play in production, and, consequently, in the development of the national economy. With this recognition, the trained manpower are now advocating for regulatory measures that can help in the harmonization of computer systems acquired by various institutions and business houses for the purpose of entering into cooperation or sharing of resources, especially the information resource.

4.5.2 Status of IT in Information Management Systems

Since attaining her political independence in 1964, Zambia embarked on a political, social, economic, and scientific and technological development process meant to transform the nation, from structures that had been created by the British colonial government. Government departments were expanded, parastatal organizations,

educational institutions, and private enterprises were encouraged to grow. All this was done to diversify the economic base, from the large dependence on the mining sector, to a broad based economy. The approach was to build the economic, social, and technological infrastructures that had the potential to utilize new technologies for national development.

During this period up to the middle of the 1970s, it was generally assumed that, the acquisition and utilization of modern information technologies would facilitate quick transformation of the nation, and quicken the process of development in order to achieve levels attained by the developed countries. On the basis of this assumption, the Zambian government embarked on the development and the improvement of the communications facilities, research institutions, and encouraging economic utilities to adopt new technologies in their operations. As a result, many organizations started acquiring computer systems even though plans were not made on how to utilize them to support their operations. The need to quickly develop the nation, ushered in the computer acquisition orientation that has resulted in the creation of the basis on which application of computers is increasingly being utilized in the fields of business management, industry and education.

A complete listing of all installed and operational applications in Zambia is a rather difficult task to compose at the moment. However, computers were initially installed in Zambia exclusively to assist and facilitate operations relating to:

i. the preparation of financial records;

ii. the analysis of business trends; and

iii. the tabulation purposes.

Therefore, the most common applications in operation fall in the following categories:

i. Financial Systems;

ii. General Management Information Systems;

iii. Planning and Development Models; and

iv. General Office Automation.

This is a general categorization of applications. Otherwise, the individual level of sophistication of each application would normally vary among different institutions. However, the general pattern for existing applications would fall in either of the application areas listed here. For many installations, the majority of existing applications fall in the financial area. This element indicates that there is still much to be done to integrate the computer in the overall planning and decision making process.

Although computers have been used widely in government and commercial institutions, their use in libraries, documentation, and information centres has been minimal. Today, information professionals in Zambia are very much interested in introducing computer-based services in their operations for the purpose of enhancing information services. Among academic libraries, the University of Zambia has taken the lead in library automation. Already the library is using computers for serials management, and

it is in the process of extending the use of computers to other library functions. The Copperbelt University has also drawn a comprehensive plan for automating all library functions within a short-term. The library has acquired one computer under the FINNIDA assistance, and more computers are expected to be received under the same project.

In general, the majority of automated library services, so far are found in libraries of international organizations. These include the British Council, United States Information Service (USIS), and some special libraries and information systems found in large organizations.

With these humble beginnings in library automation, a number of libraries have indicated to have plans to automate their services given the availability of necessary financial resources. While the priority areas for special libraries revolve around information retrieval, academic and public libraries emphasize house keeping activities, particularly, the book circulation, reference services, and records management.

4.5.3 Participation in International Information Networks

While an inventory of computer density in Zambia cannot easily be composed, and numerous computers are available in the country, it is disheartening to note that many vital institutions in the country operate without any computers, and in some cases, without access to direct telephone lines. This phenomenon makes it very difficult for

the economy to participate in the regional and international networks such as Pan African Development Information System (PADIS), Fidonet or Internet. Fortunately, Zambia, unlike many African countries, is one of the participating nodes on these network systems. The University of Zambia and Zango have been on the Fido network for several years, and the direct Internet connections were established early in 1995. In order to participate and utilize fully the facilities available on the networks, Zambia needs to significantly improve communication network systems to cover a wider area extending to the rural areas of the country, and to connect various computer installations to the networks.

In spite of the existing deficiencies in the basic information technology equipment and manpower, it is imperative that some sectors of the economy in Zambia must be able to participate fully in the international information network systems so that the country can be able to maintain economic competitiveness on the international market, and to remain a part of the international economic, technological and information order.

Developments in telecommunications, has had significant impacts on the speed, frequency, type, and degree of international contacts made between people and institutions. Today, an action taken in one country can have repercussions in other parts of the world in a matter of seconds (Robinson 1986).

Telecommunications in many African countries have been described as deficient. Zambia is not an exception in this predicament. In Zambia urban areas are serviced

with many telecommunication lines although the performance of the facility may not be dependable. Rural areas have not benefited much from this facility as few lines have been allocated to selected rural areas, mainly, the provincial capitals. As rural development has been underscored by the government, telecommunications should adequately be extended to these areas as a facilitator of the development effort, and for easing the communication problems among development sectors.

4.5.3.1 Electronic Mail

Electronic mail system is a facility which uses computer systems and telecommunications for transmission of messages. It is established to take advantage of the computer facilities for faster message or data transmission. The facility is designed to exchange information between computers within the local area of an organization, and in widely geographically separated locations where computers are available. e-Mail uses a modem and a telephone line to transmit data in smaller inexpensive formats (about $^{1}/_{10}$ that of fax). The advantage of using electronic mail is that, information sent on the e-Mail facility is immediately ready for use at the receiving computer. The requirements for e-Mail only include a computer, a modem, communications software, and the ability to type (Rigby 1993).

4.5.3.2 Remote Database Access

On the networks, such as Internet and Fidonet systems, database search requests can be conducted using the e-mail facility. This can be done by sending requests to colleagues who have access to the databases, or through a database search service such as Infoterra. Small search results can be returned by e-mail, while larger ones could be sent on disk by speed post.

The terminal mode can also be used for database search by using the packet switching service for on-line searching if a local X25 account and subscription has been made on an international X25 service in Europe or north America. This a cheaper way of conducting on-line searching. Zambia has the international electronic connection initially installed at the university of Zambia (Table 4.1).

Table 4.1: Internet and Fido Address for Zambia:

Location	Internet Address	Fido Address
Unza	sysop@unza.gn.apc.org	5:761/1
Zango	sysop@zango.gn.apc.org	5:761/2

4.5.3.3 Problems Affecting Communications Systems

Given all these information transfer facilities, problems regarding the implementation of telecommunications in Zambia relate to the following:

i. Conflicting policy signals from government. Often the government institutions issue policy statements regarding developing telecommunications systems throughout the country, but fail to financially support projects when presented with project proposals. For approved projects, the government bureaucratic procedures take too long to implement them.

ii. Indiscriminate and uncoordinated planning. Historically, the development emphasis has been placed on urban areas rather than the rural areas.

iii. Faulty and unreliable services. Huge communications installations have been installed in Zambia, but their performance are erratic due to various operational problems, especially, the lack of trained staff.

iv. Under-utilization of available resources.

v. Lack of manufacturing capability and heavy dependence on imported equipment and maintenance. Almost all equipment is imported and the maintenance of the equipment is usually dependent on foreign expertise.

vi. Deficient logistic machinery relating to manpower, equipment/tools and transportation.

vii. Proliferation of different technologies leading to problems of internetworking the systems and incompatibility of equipment.

4.5.4 National Council for Scientific Research (NCSR)

National Council for Scientific Research was established, in Zambia, in 1967 by the Act of Parliament to advise the government on all matters pertaining to scientific research policy and technological development; and to establish research and development infrastructures in areas of national development priorities, where such facilities do not exist (Bardouille 1984). Activities of the Council include:

i. Formulation of policy on the development of science and technology and its recommendation to government for implementation; and

ii. Coordination and monitoring of activities relating to scientific research and technological development.

Although IT is not explicitly mentioned as part of the Council's responsibilities, there is ample room in its mandate to accommodate information technology as another major area of concern.

4.5.5 Computer Association of Zambia

The Computer Association of Zambia is a national professional association for practitioners, created to provide a common forum for communication of professional views on various aspects of IT among professionals. The Association is also envisaged as a channel for presenting professional issues to the government and other institutions of interest. The primary objective of the Association is to advance professional activities, and to develop and advance the use and application of computer technology in Zambia. Being a non statutory body, the Association has no legislative mandate or power to regulate or control the acquisition and application of IT in Zambia. For this reason, the National Council for Scientific Research can effectively coordinate the acquisition and application of IT in the country.

4.5.6 Manpower Development

At the moment, few individuals are trained in the application of information technologies in Zambia. In order to take advantage of the benefits of information technologies, Zambia should take deliberate measures, as national policy, to increase the development of the manpower base for the development, use and management of

information technologies. Currently the country has inadequate training programs in information technologies, and has a serious shortage of manpower in the area. Practical experience shows that, the library studies program offered at the University of Zambia is still teaching traditional librarianship. The program does not have the teaching of IT component in the curriculum at the moment. At the regional level, programs offered at Addis Ababa University, Ethiopia, and Ibadan University in Nigeria, cannot adequately cope with the demand for skilled manpower at the continental level.

4.6 COMPUTER SCIENCE TRAINING IN ZAMBIA

While it is acknowledged that the most pressing economic and social needs and the problems that Zambia is facing are significantly influenced by the available information, there is a further and perhaps even more important related need. This is the need for trained and professionally competent manpower to compile, collate, classify as well as to analyze the appropriate information that has been generated and collected. The following is the nature of computer science training in Zambia:

4.6.1 On-the-Job Training Programs

This kind of training is normally conducted by the organizations, institutions or companies during normal working hours using special training officers or understudying the trained personnel. The purpose for this kind of training is to develop and improve the skills of candidates who in their daily work carry out duties connected

to computers, such as data processing, but do not have the minimum acceptable requirements for entry into colleges. Candidates who pass through this kind of course are usually assigned tasks and responsibilities to operate the computer systems. Subsequently they are sent for further full-time training in Zambian colleges or the neighbouring countries such as Kenya, Zimbabwe, and Botswana, in order to take diploma level programs.

4.6.2 Middle (Sub-Professional) Level Training

The middle level training is normally conducted at local institutions. The School of Technology at the Copperbelt University, and the Northern Technical College offer diploma courses in Computer Science. On completing their studies, the graduates are awarded diplomas and are expected to manage computer facilities on a daily basis especially carrying out the principal operational functions.

4.6.3 First Degree (Professional) Level Training

The University of Zambia and the Copperbelt University provide undergraduate level computer science training in Zambia. The overriding objective of the computer science training is to ensure that Zambia has a permanent and regular supply of trained staff for industry and government.

At this level, graduates are expected to possess a complete understanding of all branches of computer science activity as well as a special competence in a particular area and should be able to initiate new work and carry out applied research studies as well as provide sound technical advice and guidance. The University of Zambia owns an ICL ME 29 Computer and several microcomputers which are used during teaching and laboratory sessions. The Copperbelt University owns a number of microcomputers located in the computer centre for teaching and laboratory sessions and several microcomputers are available in the Schools and staff offices.

4.6.4 Postgraduate (Specialist) Level Training

In addition to a thorough knowledge and competence in all aspects of computer science, the computer scientist is required to have a specialist expertise in a particular branch of the subject. Such knowledge and skill, ideally, should not be purely theoretical, but should have a clear practical orientation. Zambian computer specialists obtain their training in universities abroad.

Figure 4.1: Manpower Projection in Computer Science Training

Enrolment per year

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Middle level	10	15	20	25	30	46	50	60	75	85	100
Professional	–	–	–	15	25	30	35	45	55	65	75
pecialist	–	-	–	1	1	1	2	3	5	7	10

In 1986 the Department of Mathematics at the University of Zambia compiled the manpower training and projections for the period 1981 to 1991 as shown in table 4.1.

4.7 CONSTRAINTS IN THE APPLICATION OF INFORMATION TECHNOLOGY

As noted in Chapter 3, the application of information technologies in Zambia has been handicapped by a number of political, socio-economic and marketing problems. Problems that hamper the application and utilization of information technology in Zambia include the following:

a. The lack of awareness among policy makers regarding potential strategic opportunities as well as the problem areas associated with information technologies;

b. The lack of understanding of the unique issues associated with planned and controlled introduction of these technologies;

c. The lack of trained manpower in information technologies for operating the available equipment effectively and for developing appropriate software for local applications; and

d. Lack of a comprehensive information technology policy.

The force behind the application of information technologies in Zambia, is a requirement for the country to adopt and implement policies aimed at achieving self-reliance in the information activity relating to the following areas:

i. Computer acquisition and use;

ii. Human resource development for developing the technology, use of the technology, and its maintenance; and

iii. Telecommunications.

4.8 INFORMATION TECHNOLOGY POLICY IN ZAMBIA

As Zambian industries expand and change their traditional methods of production to more efficient utilization of capital and manpower resources, the computer has come to be recognized as an important tool in facilitating this change. It is acknowledged in government and business sectors, that social and economic developments are, significantly, influenced by the available information, and that appropriate quantitative and qualitative data is an essential prerequisite for successful development. There is a fundamental requirement to collect, analyze, and store as much accurate and comprehensive information as possible for application in business and production operations. In this respect, the computer is recognized as a basic tool for analysis, storage and retrieval of information for current use and future reference.

In order to cope with this newly evolving situation, formulation of an overall strategy concerning computers will be most appropriate. The direction of the development of any new technology should be carefully guided so that the unnecessary, and most likely expensive, negative consequences can be avoided. Moreover, the country must also be spared from a reversal which may ensue due to a combination of application failures, and negative impacts caused by the rapid advancement in this non-indigenous technology. For Zambia, the possibility of leap-frogging must be taken into consideration because more choices in technologies, and chances to learn from the failures of more developed countries, are available.

For this reason it is important to take stock of the data about computers in the country, and to start the formulation of the national strategy for this technology.

The development and effective implementation of policies relating to acquisition, use and maintenance of computer hardware and software should seriously be considered on the scale of priorities of the country. These policies should be directed at checking undue proliferation of unsuitable or obsolete hardware configurations entering the country. Additionally, the policies should incorporate the aspect of determining the nature of requirements in such areas as software acquisition, training and hands-on know-how, and outright purchase of technology.

In the process of diffusing and application of information technologies in Zambia, the country can effectively draw on the experiences of other developing countries whose technological base is advanced such as Brazil (Adler 1986), and India (Kumar 1984) in the development of indigenous capacity for the manufacture, use and maintenance of the computer technology within the context of developed economies.

4.9 APPLICATION OF COMPUTERS IN FORESTRY

Computers can be utilized in forestry to help solve research problems, organize administrative data, and analyze managerial options (Sharpe 1986, 320). At one time computers were applied only to computing problems, or were restricted to accounting functions and word processing in large organizations. To the practising foresters, in

general, computers have been available to meet their day-to-day computational needs. Recently, several significant changes have taken place that now extend computer technology to management foresters and others.

The reduction in the cost of computers has greatly increased access to computers by forestry personnel. Another factor has been that the government, forest products companies, and other public forestry agencies, have increased their demands on foresters for information and analysis. This increased demand for information has caused foresters to seek more effective methods to manage information and forests. The other cause of the increased use of computers has been the emphasis on computer science and quantitative courses in forestry school curricula.

4.9.1 Database Management Systems (DBMS)

Often foresters deal with large amounts of data in the form of lists or tables of information, forest observations, field plot records, periodic repetitive reports, inventories and similar information. Database management systems, are available to simplify working with these data. Databases are organized into files containing records, or observations of similar information, and this allows foresters to manage their information base by adding new records to the database, deleting records, updating or changing records, and printing reports from the stored information. Forestry applications include forestry bibliographies, fire-weather data records, reports of forest fires, and timber sales; continuous forest inventories, timber stand and compartment

records; and mailing lists of customers and suppliers; including lists of projects, either completed or in-progress, and information on institutions engaged in forestry business (Sharpe 1986).

A common application of database management in forestry is seen in the control of information on wood volumes received at woodyards. Small computers are used for entering data on suppliers as loaded trucks arrive. The computer system automatically records the volume and value of timber entering the woodyard and updates the inventory. Periodically the system is used to pay suppliers for delivered wood and inform mill operators of changes in inventories.

4.9.2 Management Information System (MIS)

An extension of database management systems is the management information system (MIS). This concept draws together all the information needed for decision making and strategic planning in a single computerized format for use by top-level managers. Such systems have many capabilities, including access to large amounts of data, data analysis, trend projections, simulation, optimization, and the ability to display information in many formats, including graphs, charts, tables and text (Sharpe 1986). Although few comprehensive systems of this type exist at present, information management applications are moving toward this integrated approach. This integration of databases can be achieved by using the CDS/ISIS and MINISIS software packages.

Decision makers in forestry business may use management information systems to improve the effectiveness of their actions.

Often, foresters need to perform specialized forestry computations to support decisions and to meet management needs. In these activities computers are being used by many practitioners to do such analyses more quickly and more accurately (Anderson et al 1981). Some of the jobs in repetitive or complex calculations are forestry investment analysis involving timber sampling, cruising and volume estimation; growth and yield estimation; and appraisals of timberlands.

4.9.3 Geographic Information Systems (GIS)

Computerized systems that manage map information, the geographic information systems (GIS), are used mostly by forestry institutions and organizations with extensive land holdings. Geographic information systems have been used to analyze and solve problems in many resource areas, including wetlands, timberlands, mineral resources, outdoor recreation, water supply, road networks, and transportation planning (Sharpe 1986).

4.9.4 General Business and Professional Applications

All forestry divisions, departments, and offices have management jobs similar to those performed in other businesses. Computers in these units are used for tasks such as

accounting, record keeping, and word processing. Managers benefit by access to more accurate and timely information and by the fact that the information is produced at a lower cost.

When the volume of information to be handled by organizations increased, and the need to process large amounts of data to extract small amounts of information was recognized, computer capabilities were used to manage information. Microcomputers have been the popular equipment used for a number of tasks in the organization, including the following:

-- Preparing documents (word processing);

-- Performing financial analysis (electronic worksheet);

-- Providing personal filing and database systems;

-- Serving as a terminal connected to larger computers;

-- Presenting graphs; and

-- Proving access to external databases.

4.10 EFFECTS OF COMPUTER USE IN FOREST MANAGEMENT

Surjadi and Luhukay (1986) report that, the objective of employing computers and informatics in the country, is to help improve and enhance development efforts. In the forestry and forest related sectors, therefore, computers and informatics are taking an increasingly important role, although almost all production activities in forestry are still being performed manually. In Zambia most of the forest research centres are not

connected to e-mail facilities of any kind. But, taking into consideration the need for effective communication among the research institutions and among the researchers, this facility is absolutely necessary.

Foresters' use of computers to solve problems and manage information has eased the tasks that required substantial computations to be done more quickly, and often, more accurately than before, thus allowing foresters to devote more time to other demanding responsibilities. These responsibilities include managing land, and forest resources. Problems too complex to be handled by manual methods are now analyzed with appropriate computer programs. In many instances this has led to more cost-efficient land management decisions. Computers have also been used to do repetitive, or routine and sometimes tedious tasks, reducing the time devoted to such activities.

Probably the most significant effect of computers on the forestry profession has been the extension of new technology to practitioners and field workers. Computer programs have allowed foresters to access more technical information and analytical methods than ever before. In the field, foresters can now use small computers linked to the central computer system for entering data from the field. Large bibliographic databases, computerized satellite imagery, geographic mapping systems, and other information systems are now available through computers. Computers also allow foresters to use problem-solving mathematical techniques such as linear programming, simulation models, statistical procedures, numerical methods, process control, engineering application and design (CAD), field work, database management systems

(DBMS), and system dynamics. The net effect of applying computers to forestry problems has been to increase the quality of services provided while reducing costs.

4.11 LIMITATIONS OF INFORMATION TECHNOLOGY

Information technology offers enormous opportunities in information handling and the performance of organizational tasks. But IT alone, however, is not enough. IT is only a tool, which if used effectively and complementary to other inputs, can contribute to development. Other inputs are often required in order to realize potential benefits. The complementary input required include:

i. **Organizational change.**

IT alone will not solve the problems of adequate use of information and poor decision making. In order for decision makers to improve decisions, they must have the incentive and the skill to do so. Consequently, there is often a need for organizational change to fundamentally alter the incentive

ii. **Improvement in information management**

Adoption of IT will not automatically improve data management. IT will not, for instance, convert "bad data" into "good data". Data quality needs to be ensured and problems resolved as the standard dictum "garbage in, garbage out" states. Nor will IT solve data management

problems relating to inadequate understanding of users' information needs, obstructed flows of needed information among organizations and information that is provided in inappropriate formats.

iii. **Skills development**

Effective use of IT usually requires training.

Considering the benefits and limitations of IT, it is essential that information systems should be designed to respond to users' information needs and their patterns of information use. This is important because the adoption of IT in many cases, has been "technology driven" rather than "needs driven". This means that acquisition of IT has been dictated by the mere motive of owning the computer equipment, rather than the adoption of IT based on the user requirements for information. If adopters obtain IT without knowing why and how they want to use it, the result can be an expensive venture ending up with the equipment that cannot serve the organization's needs. A common symptom of this problem is the adoption of hardware before the organization has clarified the ways in which they will apply IT. While another symptom can be the adoption of technology that is "**high tech**" and more expensive than necessary.

Ideally, projects that introduce IT need to establish an in-built organizational capability to maintain the technology, to provide incentives for effective use, and to provide budget allocations for current costs, such as maintenance and training.

Using computers to process information has caused many changes in the traditional business operations. In Zambia, the application of IT in information management systems has largely been confined to the special libraries. No computers are presently applied to the management of library operations in the public, and academic libraries. The situation is slowly changing as both the university libraries in the country have embarked on a serious acquisition of computers in spite of various problems involved. Many Zambian organizations now own computer systems of one type or the other. But these systems are not effectively used. One major reason for ineffective use of computers is the inadequate availability of trained personnel at a higher level of Computer Science or related area. Often, individuals who are professionally trained have opted to find work outside the country.

4.12 AUTOMATION OF INFORMATION SERVICES: FUTURE PROSPECTS

There is no doubt that computers are useful tools in information management and user services. Computer-based services provide the advantage of increased speed and flexibility which results in the efficiency of a system. The training given to professionals will indeed play a major role in determining the future of automating information handling in libraries and information centres in Zambia.

CHAPTER 5

FORESTRY AND FOREST POLICY

5.1 TRENDS IN NATIONAL PLANNING FOR FORESTRY

Foresters define ***forestry*** as *the science, the art, and the practice of managing, and using for human benefit, the natural resources that occur on, and in association with forest lands* (Sharpe et al 1986, 19). This is a general definition whose subject matter involves many aspects of natural resource management. Therefore, in its general subject coverage, forestry may include disciplines that deal with air, water, earth, fire, plants, animals, and human beings in relation to forested lands, and the products and services they provide. This framework makes forestry to be an interdisciplinary profession that has a part to play in the studies of meteorology, environment, agriculture, botany, and of the social behaviour of human societies as they interact with nature.

In its wider subject extensions, forestry policy is regarded as a statement of objective guidelines or terms of reference with procedures for achieving the stated goals, taking into account its implications on other related disciplines. Forestry policy defines the mission of the agencies concerned with the development and enhancement of techniques and methods of efficient management of forests.

Forest policy also defines the governing principles, plans, or courses of action in regard to forest resources. These principles or plans are usually decided upon and enforced by the national government or proposed by the agency responsible for the management of forests.

A policy is supposed to represent a definite course, or method adapted and followed by a government institution, or individual whose interest is to develop and manage forest resources. This means that the framework or the nature of policy is supposed to be a guideline in decision making, planning, and functioning of the forestry system for the purpose of enhancing forest productivity, and to increase the forest yield. As a guideline, policy is amenable to change when circumstances under which such a policy was defined, change. Dana (1956) observes that, changing times inevitably result in changing policies, so that policies are in a constant state of flux.

Dana and Fairfax (1980) further observe that, the policy regarding the management of resources, including the forest and range policy, is both a major influence on, and an expression of, the social, economic, and political structure of the country. They draw attention to the fact that ideas regarding the appropriate approach to wild land resources have changed and developed, as the nation has changed and developed. Changes in forest resources exploitation have occurred over a period of time from the period of free uncontrolled forest exploitation to restricted management approach. As a result of uncontrolled forest use, and the consequent depletion of forest resources and damage made to the ecosystem, controlled forest management and reforestation

programs have been instituted. The need to protect forests from further destruction and damage of the ecosystem, has resulted in the articulation of various policies to guide efficient forestry management and regeneration of deforested areas.

5.2 FOREST POLICY: A HISTORIC PERSPECTIVE

To put the differences between policy and law in perspective, Sharpe (1986) notes that, legislative law emanates from the legislature, while administrative law comprises the regulations that an agency formulates to enforce legislative mandates, as well as to embody its own operating regulations. A Policy in forestry is now applied to the interaction between human beings and the natural resources.

5.2.1 Pre-colonial Land Settlements

Prior to the coming and the establishment of the colonial government, the Zambian land was settled by different tribal nations scattered in all the regions of the country. These tribal groupings followed the political and social formations of chiefdomship. Rules and regulations were formulated through the chiefdom structure to govern the social, economic, political, and cultural life of the citizens. During this period, land was vested in the chief as a custodian of land on behalf of the subjects. In order to settle or open up a given land for economic activities in a particular area, an individual had to seek permission and approval from the chief in the area. The chief had the authority and power to allot or to refuse the allotment of land falling under his

jurisdiction. Land was regarded, by and large, as a major asset for tribal groups; and many wars were fought over the control of land.

In spite of these historical events, large tracts of land remained virgin and unexploited. Large areas were unsettled and therefore, forests extended over large areas with only scattered villages. Demarcation of tribal lands was arbitrary; and were usually made on the basis of tribal groups found in the area.

5.2.2 Forest Policy in the Colonial Era

The coming of the colonial administration changed certain settlement patterns for the purpose of facilitating the administration of the colonial government. From the early days of establishing the colonial administration, the colonial government set out to demarcate administrative areas into manageable portions to conform to its administrative capacity. An Administrator General was appointed by the colonial government to develop areas of interest, and to impose and collect hut or head taxes from the citizens.

Land was demarcated into industrial areas, commercial farming blocks, settlement reserves for the indigenous people, and forest reserves. As early as 1928, laws were enacted to regulate the administration and utilization of land. The State Lands and Reserves Ordinances of 1928 provided for the demarcation of land into administrative

regions, settlement reserves, forest reserves, game reserves, industrial land and mining and minerals areas, and commercial farming blocks.

Still during this period, there was no clear policy about the administration and settlement in the local reserves areas. These areas continued to be administered by the chiefs who were now responsible to the Colonial Government Administrator-General. The new administration encouraged the grouping of settlements into larger villages, from the widely dispersed village settlements to more integrated village systems. This type of village settlements was organized and demarcated from the village level, to the district and provincial levels. Each district was assigned a District Commissioner to oversee the district's activities. The District Commissioner was responsible to the Administrator-General who reported to the Colonial Office in London.

Most of the original forest policy initiatives and changes evolved slowly from the impetus of a few people and/or organizations, who/which were concerned with the promotion and the enlargement of public support for changes. This concern arose from the observed rate at which forests were being depleted and wildlife decimated. But the process of formulating any meaningful policy to protect the endangered animal species and fauna, took quite a long time to conclude. Even today, policy changes involving state legislative Acts frequently take long for completion and may require even more time for acceptance and compliance.

5.2.3 Forest Policy in the Post Colonial Period

In post colonial Zambia, the Forest Department, established under the Ministry of Environment and Natural Resources, is the major forestland management agency. Therefore, policies regarding the management and utilization of forest land emanate from this agency. Policies set for it by the National Assembly and the executive branch, together with its own operating regulations, have a strong influence on forest policy on all state lands. This influence extends to private lands as well.

5.2.4 Actors in National Forest Policy Formulation

The actors in national forest policy formulation, both executive and legislative, can be categorized as follows:

1. ***The Bureaucracy***. The bureaucratic system includes the state administration insiders, the appointed agency officials of the executive branches of government and their supporting staffs. The Ministries most concerned in forestry issues are the Ministry of Agriculture, Food and Fisheries, the Ministry of Finance, and, particularly the Ministry of Environment and Natural Resources.

2. ***Society***. This category of actors in forestry issues includes the social force or public involvement in the matters relating to environmental

conservation, such as, the Wildlife Conservation Society, and other clubs concerned with environmental issues.

3. ***Industry***. Industry is characterized as having vested economic interest, as well as, technical expertise in forestry matters.

4. ***The Forestry Profession***. This is concerned with matters of forestry management and research.

These groups reserve the right to advise, or advocate their various points of view, sometimes to one another, but in the end, their proposals are taken to National Assembly, or its separate committees or members. A Bill may originate with the legislative arm of the government or an administrative agency of the executive branch.

The introduction of a bill may proceed either by the administration drafting and introducing a bill or a Member of Parliament requesting and receiving drafting services from an executive agency. The 1994 Lands Draft Bill was introduced and read in the Parliament by the Minister of Environment and Natural Resources. The Bill was then subjected to public scrutiny and debate by publicizing it in the national media, and subsequent discussions by the minister with the general public. The intention was to solicit the public will and consent before the bill was enacted into law. This arrangement was a clear departure from the legislative law enactment without involving the participation of the people. Land issues and forestry have become intensely political

issues in Zambia. This politicization of land issues is manifested by the heated debates which characterized the Lands Bill of 1994.

5.3 ZAMBIA NATIONAL FOREST POLICY

Until 1984, forest policies in Zambia were directly linked to the ruling party's policies. The ruling party dictated how forest areas should be managed in line with the party principles. The party principles emphasized man-centredness which often went against the efficient management of forests. These principles were based on the motivation that man should live where he found it suitable, and to exploit natural resources for his benefit. These policies in Zambia were frequently inferred from Acts of parliament and from the actions of the President, and the cabinet members in interpreting and carrying out the assigned responsibilities in the forest sector. As a result, administrators and experts normally disagreed as to which of these policies was to prevail over the other. Changes in policy definition are, therefore, made to suit the objectives of government in place. The Lands Bill of August 23, 1994 is an illustrative case in the Zambian policy redefinition. This Bill confirms the fact that policies can be changed or influenced by changed perceptions of the decision makers.

Since 1964, the national forest policy was made to direct activities in the forest sector with the following objectives:

-- To place under Government control, and to manage forest areas needed to protect the land against floods, erosion, and desiccation; and to maintain, and protect the flow of rivers;

-- To carry out in each district, forest surveys and to determine the forest resources for each district and the forest areas needed to be managed for land protection and for local and industrial supplies of forest products, and the forest plantations which are needed, so that the forest estate required can be put under Government control;

-- To carry out all necessary research work on ecology, protection, management, and restocking of indigenous forest areas;

-- To place under Government control, land for forest plantations needed to provide forest produce for peoples' homes, farms, and local industries;

-- To spread among the people of the Republic an understanding and value of forests, and to provide training opportunities for people engaged in forest work;

-- To advise and encourage local authorities and private enterprises in the practice of sound forestry; and

-- To integrate the Republic's forests in a wise system of land use and in the development of the Republic's other natural resources.

5.4 LANDS BILL OF AUGUST, 1994

In 1994, a significant change was introduced to change the 1964 land laws. This law has significant implications on forest management in the new political environment.

The Bill repealed Chapter 289 on Land (Conversion of Titles) Act of the Laws of Zambia. The repealed laws include:

1. The Zambia (State lands and reserves) Orders, 1928 to 1964.
2. The Zambia (Trust land) Orders, 1947 to 1964.
3. The Zambia (Gwembe District) Orders, 1959 to 1964.
4. Section two of the Western Province (Land and Miscellaneous Provisions) Act, 1970.

The Bill generated a lot of interest and debate among the members of the public, associations and organizations as to whether the will of the people and considered judgement and action were taken into consideration.

The Minister of Environment and Natural Resources had to explain and validate the contents of the Bill. The Minister was at pains to try and convince the public on the

efficacy and implications of the Bill and its closer relationships to the implied versions of land policies which were in existence prior to drawing up the 1994 Bill.

The 1994 Lands Act set out to document covenants, regulations and rules of procedure concerning land ownership and land alienation. In addition, the Act provides for the recognition and continuation of customary tenure and the conversion of customary tenure into leasehold tenure. It also provides for the establishment of Land Development Fund and Lands Tribunal.

5.4.1 Land Alienation

On land alienation, section 5 of the Lands Bill provides that " In alienating land, the President shall take measures to control settlements and methods of cultivation on land as may be necessary:

(a) for the preservation of natural resources on that land; and

(b) for the proper utilization and preservation of natural resources on that land."

It is inferred from the provisions of the Bill that the President shall not alienate land situated in a district or an area where land is being held under customary tenure without consulting any other person or body whose interest might be affected by the grant, except where the alienation is intended for a public purpose. This section in the Lands Bill defines public purpose to include purposes relating to:

(a) exclusive Government or for the general benefit of the people of Zambia;

(b) for or in connection with sanitary improvements of any kind including reclamations;

(c) for or in connection with the laying out of any new township or the extension or improvement of any existing township;

(d) for or in connection with aviation;

(e) for the construction of any railway authorized by legislation;

(f) for obtaining control over land contiguous to any railway, road, or other public works constructed or intended at any time to be constructed by government;

(g) for obtaining control over land required for or in connection with hydro-electric or other electricity generation and supply purposes;

(h) for or in connection with the preservation, conservation, development or control of forest produce, fauna, soil, water and other natural resources.

5.5 SETTING THE FOREST RESERVES IN ORDER

Immediately after the independence, the Government of the Republic of Zambia made certain moves to reorient the colonial policies to the immediate requirements of the new government. Land reforms that ensued in 1968 redefined the reserves policies and all the land that did not fall under the customary charge were vested in the President for

custodial purposes on behalf of the people of Zambia. Forest Reserves and the Wildlife conservation were assigned to the state wing of natural resources and wildlife conservation departments. Policies for the management of these areas were defined and anyone found contravening the law relating to these areas was liable to a court charge. Forest rangers and foresters have been employed by the state to take charge of these areas which were demarcated not for settlement and conducting any productive exploitation of the forest products.

The Forest Department was given the jurisdiction to oversee the countrywide coverage of field activities of the forest divisions. This jurisdiction extended to enforcement and adherence to defined research policy and forestry priorities.

To receive improved management, the Forestry Department was transferred from the Ministry of Agriculture and Water Development (now the Ministry of Agriculture, Food, and Fisheries), to the Ministry of Environment and Natural resources in 1992. Not only was the setting in order of the national forests progressing, but a crop of technically trained graduates was appearing. These were initially trained at Zambia Forest College (Mwekera). Other graduates in forestry were trained outside the country, in Tanzania, United Kingdom and Canada.

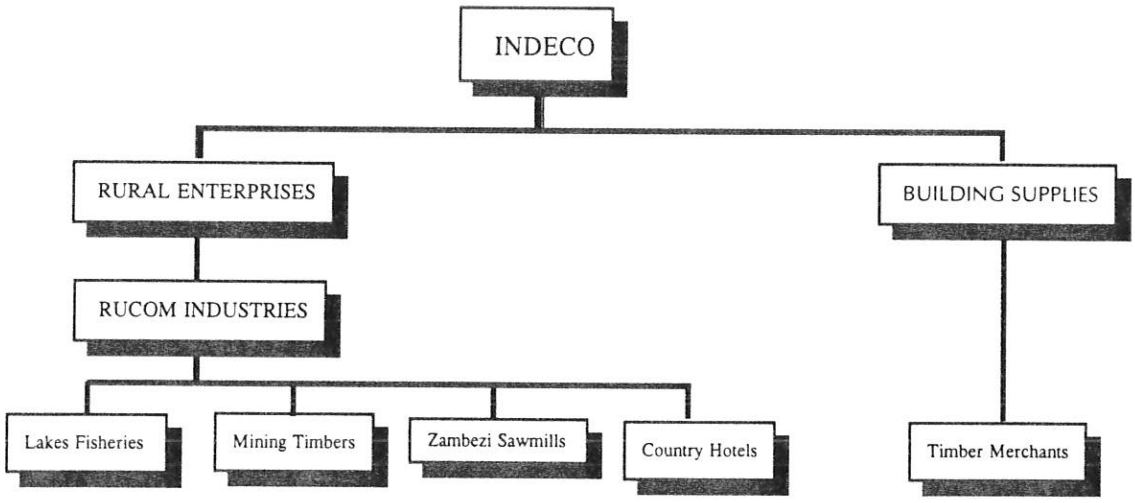
As a policy issue, the Government made it clear in 1970 that more emphasis would be laid on rural development. It was believed at this time that state participation in the nation's economy seemed a form of economic socialism ideally suited to developing

the countryside and meeting the demands of development strategies (Zambia industrial directory 1970, 4). In 1975, privately held land and other enterprises were nationalized. This move made the government to create the Industrial Development Corporation (INDECO) as an institution to oversee or represent the government on the activities of the industrial sector in the country.

5.6. FORMAL RECOGNITION OF RESEARCH

The establishment of the Division of Forest Research in 1956, and the Division of Forest Products Research in 1963, had put the Forest Department emphatically into the business of forest research. Both Research Divisions are based in Kitwe with several

Figure 5.1: INDECO Structure in Rural Industry Development



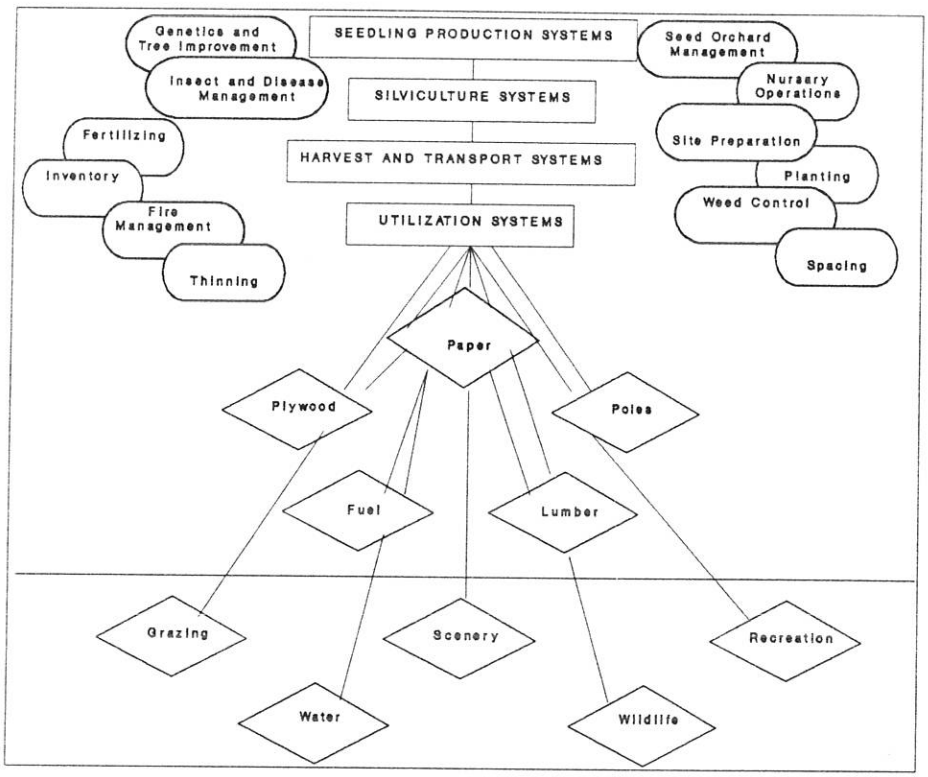
outlying research stations and other areas of special interest in other districts. Research activities are conducted in specific forest production areas shown in figure 5.2. The research activities are distributed in various units established under, and coordinated by the Forest Department.

Although these research agencies in forest products and forestry have been established recently, forestry research in Zambia dates back to the early 1930s when trial plantings of various tree species, as well as the famous Ndola Burning Plots, were established on the Copperbelt (Zambia 1987).

Subsequent to the trial plantings on the Copperbelt, intensive research in forestry began in 1954 when a specialist officer of the Forest Department was appointed. The Forest Research Division, when established in 1956, was charged with the responsibilities of forest conservation and protection, development of silvicultural methods for exotic and indigenous tree species, and the development of suitable regeneration methods for sustained yield from exotic and indigenous forests.

To expand the research activities in forestry, the Division of Forest Products Research was established in 1963. Historically, the Division started off as a component of the Division of Forest Research. The idea of establishing this Division, or research agency, was to develop and promote the use of indigenous hardwoods, mainly **Brachystegia** species and **Baikiaea plurijuga** (Zambezi teak) (Zambia 1987). The research coverage now extends to include exotic plantation species.

Diagram 5.2: Forestry Production Model



At the end of 1987, the forestry divisions employed 15 graduate researchers, 20 diplomate foresters and laboratory technicians, and 150 clerical and general staff.

5.7 MANAGING ENVIRONMENTAL VALUES OF FORESTS

Forestry research has made substantial progress over the past decades in finding ways to minimize the potential impacts of resources management and use of the forest

environment. Research has markedly enhanced the understanding of ecological processes, enabling foresters to predict with much greater certainty, the environmental effects, both positive and negative, of much practices as clearcutting and prescribed burning. As management for all forest resources intensifies, the contributions of research will become increasingly important.

The many benefits of woodlands, parks and green belts within the urban community are being realized. Resource inventory are being made, and ways of taking better care and making better use of existing trees and wooded areas are being studied. Opportunities for making trees an integral and harmonious component of housing developments, industrial complexes, transportation systems, and urban renewal projects are being explored and studied by research workers.

5.8 MANAGEMENT OF THE FORESTRY ENVIRONMENT

Within the scope of forestry protection against damage and destruction, deforestation and desertification, soil erosion and maintenance of water level security, is definitely an important part of forestry. Environmental aspects of forestry and management can include control or modification of practices that contribute to broader problems. Another and more positive aspect, which has been too often overlooked, is the opportunity to manage the forest specifically for the enhancement and greater use of its environmental values.

Rampant deforestation engendered by the traditional methods of cultivation, especially, the shifting cultivation practised in large areas of the northern region of Zambia, coupled with catastrophic uncontrolled fires, contribute markedly to the destruction of forests and other forest values. The overall implication of reckless resource exploitation were and in some places are still not fully understood, but the more readily observable consequences are being sharply condemned. The effects of bad cutting practices, fire and overgrazing on erosion, and stream siltation are evident consequences of these practices and are there for all to see. These are areas that need to be addressed in policy statements, but in practice, are sufficiently contained.

5.9 IMPACT OF FOREST USE ON ENVIRONMENT

Almost any use of the forest can result in undesirable environmental impacts. Road construction, timber harvesting, and type conversion leave their marks on the land as other development activities. The use of chemical pesticides may involve potential for injury to a wide variety of non target organisms including humans.

These procedures, facilities and developments can be planned and managed so as to minimize or avoid most of the unwelcome side effects. Indifferent and poor planning, or faulty administration may also be the cause of environmental problems. Sometimes the full extent and significance of damage are unforeseen. Not frequently, the technology and economic data for improved methods are lacking because there has

been insufficient research on the problems involved. Many mitigating procedures and environmentally safe techniques have been worked out and are now in use.

5.10 MULTIPLE-USE MANAGEMENT

Multiple use of forest lands is a government policy operating on government forests managed by the Forest Department operating under the Ministry of Environment and Natural Resources. It has been the policy of government to grow trees for wood and fibre production as the original, and still it is the major objective of forestry management. However, the intensity of management practices varies with different forest ownership.

CHAPTER 6

SURVEY OF THE EXISTING INFORMATION FACILITIES

6.1 INTRODUCTION

A survey was undertaken with the intention of analyzing the structure of the existing information systems in the forestry and forestry related sectors, with a view to understanding the current state, the future direction of information systems, and the problems faced by the information systems in the Zambian forestry sector. It was intended that on the basis of the information collected, guidelines for the design and development of a computer-based information support system, that could be able to address the identified problems in the existing system, would be formulated. The main findings of the survey are briefly discussed here in relation to the objectives of the study.

6.2 PRESENTATION AND ANALYSIS OF DATA

Data for the study was collected primarily through structured questionnaires. However, additional information was obtained through interviews conducted during visits to the selected institutions. Secondary sources of information, such as, reports of the institutions, were also used; and the collected data was analyzed by using computer facilities available at the School of Information Studies for Africa (SISA).

Two sets of questionnaires were distributed. The first set was meant to solicit information on the application of information technology in information systems in the forestry sector in Zambia. The second set was meant to survey the pattern of information use by researchers and other professional staff.

Out of the six questionnaires distributed for the survey of application of IT, four were initially returned. Later, two extra copies of the questionnaire were sent as reminders to the institutions that did not respond to the first delivery. As a result of the reminder, one institution returned the questionnaire. Altogether, the returned questionnaires represent 83.32% response rate.

In order to collect data on the information requirements of users in the forestry sector, 28 questionnaires were distributed. Out of the distributed questionnaires, 17 were received as usable responses. For this set of questionnaires, therefore, the overall response rate was 60.71%.

The questionnaire survey method was supplemented by personal interviews with 22 representative interviewees from five institutions. Two members of staff from the information centre, two administrators, and four researchers from the Division of Forest Research were interviewed. From the Division of Forest Products Research, one member of the library staff, one member of the administration, and two research fellows were interviewed; two researchers from the National Council for Scientific Research; one administrator, from the Zambia Forests and Forestry Industries

Corporation; and the librarian, the Principal, and five students of forestry at Zambia Forest College were also interviewed.

Questionnaires used for obtaining data for the study are presented in Appendices B1 and B2:

6.2.1 Information Systems Surveyed

All the information systems surveyed are parts of research institutions, except for the Zambia Forests and Forestry Industry Corporation, which is a business enterprise. These information systems fall under the following parent institutions:

-- Division of Forest Research;

-- Division of Forest Products Research;

-- National Council for Scientific Research;

-- Zambia Forests and Forestry Industry Corporation;

-- Mount Makulu Central research Centre; and

-- Zambia Forest College.

All the information service systems indicated that although computer facilities were not currently utilized for information processing/management in the information systems, there existed one type or the other of computer systems in the parent institutions.

6.2.2 Size of Information Resource Collection

The Information Service Unit of the National Council for Scientific Research reported that it had a book stock of 9,258, over 200 periodical titles, and over 5,000 pieces of various reports. The Zambia Forestry and Timber Research library reported that it was having a collection of about 1,000 books, about 120 periodical titles, and various research reports, and publications produced by the Forestry Department. Information resources are indexed by subject, author, and title. The Division of Forest Products Research library estimated the book collection to be not more than 1,000 volumes, and the periodical collection to be less than 100 titles. The Zambia Forests and Forestry Industry Corporation does not maintain a book collection, but subscribes to a few periodical titles of interest. Data on the information resource collections was not obtained from the Mount Makulu Research Station. The Zambia Forest College estimated its book collection to be over 2,000, and its periodical collection about 100 titles.

Table 6.1: SIZE OF INFORMATION RESOURCE COLLECTION

INFORMATION SYSTEM	BOOKS	PERIODIC	RES.REP	M/FORM	A/V	MAPS
Division of Forest Research	c. 1,000	c. 120	Yes	No	No	Yes
Div. of Forest Products Research	< 1,000	< 200	Yes	-	No	Yes
Nat Council for Scientific Research	9,258	c. 200	>5,000	Yes	Yes	Yes
ZAFFICO	Few	Yes	Yes	No	No	Yes
Mt. Makulu Research Centre	Yes	Yes	Yes	Yes	Yes	Yes
Zambia Forest College	< 2,000	c. 100	Yes	Yes	Yes	Yes

Yes - indicates that materials are available, but actual figures are not available.

One information centre reported that it was using Library of Congress Classification Scheme. One uses Dewey Decimal Classification, two use Universal Decimal

Table 6.2: CLASSIFICATION SCHEME USED

INFORMATION SYSTEM	LC	DDC	UDC	COLON	BLISS	OTHER
Division of Forest Research*	--	--	--	--	--	ODC
Div. of Forest Products Research	--	Yes	--	--	--	--
Nat Council for Scientific Research	--	--	Yes	--	--	--
ZAFFICO	--	--	--	--	--	--
Mt. Makulu Research Centre	--	--	Yes	--	--	--
Zambia Forest College	Yes	--	--	--	--	--

Note: ODC - Oxford Decimal Classification Scheme for forestry.

LC - Library of Congress Classification Scheme.

DDC - Dewey Decimal Classification Scheme.

UDC - Universal Decimal Classification Scheme.

*** The Zambia Forestry and Timber Research library is in the process of adopting the Dewey Decimal Classification Scheme.**

Classification, and the Division of Forest Research uses Oxford Decimal Classification Scheme for Forestry for classifying information sources.

6.2.4 Subject Headings/Indexing Used

One information centre uses Library of Congress List of Subject Headings, and two others use Sear's List of Subject Headings. For indexing purposes, two institutions use

OECD Macrothesaurus, and The National Council for Scientific Research uses INIS and SPINES thesauri, in addition to the Macrothesaurus.

Table 6.3: SUBJECT HEADINGS/INDEXING USED

INFORMATION SYSTEM	LCSH	SEAR'S	MACROTHES	OTHER
Division of Forest Research	--	--	--	--
Div. of Forest Products Research	--	Yes	--	--
Nat Council for Scientific Research	--	Yes	Yes	INIS, SPINES
ZAFFICO	--	--	--	--
Mt. Makulu Research Centre	--	--	Yes	--
Zambia Forest College	Yes	--	--	--

INIS and SPINES are thesauri types used for deriving indexing terms in information resource processing.

6.2.5 Software Packages Used

The study established that, the reported available computers were located in the parent institutions, but were not utilized in the information service units. These institutions used the computers, primarily for word processing, financial management, and production of management reports. Other software available in the institutions surveyed are enlisted in Table 6.4.

Table 6.4: SOFTWARE PACKAGES USED

INFORMATION SYSTEM	dBASE	WP	CDS/ISIS	MS/DOS	OTHER
Division of Forest Research	Yes	Yes	--	Yes	SPSS, HG, Lotus
Div. of Forest Products Research	Yes	Yes	--	Yes	SPSS
Nat Council for Scientific Research	Yes	Yes	Yes	Yes	SPSS
ZAFFICO	Yes	WP/Windows	--	Yes	Lotus, MS/DOS
Mt. Makulu Research Centre	--	--	Yes	Yes	--
Zambia Forest College	Yes	Yes	--	Yes	--

CDS/ISIS - Computerized Documentation System/Integrated Set of Information System

HG - Harvard Graphics.

WP - Word Perfect

6.2.6 Types of Service Rendered to Users

Table 6.5 presents the types of service offered by the information centres in the institutions surveyed. Out of the six institutions, only the Zambia Forests and Forestry Industries Corporation reported about the use of computer facilities for information

Table 6.5: SERVICES RENDERED TO USERS

INFORMATION SYSTEM	CURRENT AWARENESS	REFERENCE SERVICES	SDI SERVICES	BIBLIOG RAPHY	ONLINE SEARCH
Division of Forest Research	Yes	Yes	--	--	--
Div. of Forest Products Research	Yes	Yes	--	--	--
Nat Council for Scientific Research	Yes	Yes	Yes	Yes	--
ZAFFICO	Yes	--	--	--	Yes
Mt. Makulu Research Centre	Yes	Yes	Yes	Yes	--
Zambia Forest College	--	Yes	--	Yes	--

management. The use of computers by the Corporation can largely be attributed to the fact that the Corporation is a business-oriented entity and that it requires computer facilities for business record management, such as, the management of financial, stock, personnel, and equipment records. The remaining information centres still use manual systems to manage information resources.

All the information centres surveyed, except for the Zambia Forest College, reported that they offered current awareness services. Except for the ZAFFICO, all others reported that they offered reference services. Two information service units reported that they provided SDI services; and three reported that they compiled bibliographies on request. Only ZAFFICO Data Centre reported that it offered on-line search services.

In addition to providing reference and bibliographic search services, the library at the Zambia Forest College provides material lending services. The National Council for Scientific Research provides cartographic, printing, and audiovisual services also, in addition to the common services.

6.2.7 User Information Requirement Analysis

All respondents surveyed use English as a working language. All reported that they used information services available in their institutions for their various information needs. Seventeen respondents completed and returned the distributed questionnaires.

Fourteen (82.35%) respondents mentioned that the collections maintained in their institutions were not sufficient to satisfy their information needs. The general observation was that the services provided, satisfied their information needs to a certain extent, beyond which they needed other external services.

Two respondents indicated that local resources were actually inadequate to meet their information needs. They commented that in addition to the inadequacy of information resources, the manual procedures involved in retrieving references to information sources were inhibiting; and therefore, they observed that the single computer available in their institution should be used for information retrieval services to improve on the current procedures in information services.

The majority of the respondents indicated that, in addition to local information resources available in their institutions, they often sought complementary information from other information units in the forestry sector itself, public libraries, and special libraries which had a stock of information sources on forestry.

Responding to the question regarding where they used to go regularly for information, if they were not satisfied with the local information services, two respondents reported that they used files in their offices for much of the information they needed. Rarely did they use external sources.

Regarding the average time it took to receive the required information from other information systems, 41.18% of the respondents indicated that it took them between two and three weeks, while 58.82% reported that it took them up to one month or more.

Regarding the activities to which information received was applied, 58.82% of the respondents answered that they needed information for decision making, planning, and in performing their duties; and 41.18% said they needed information for planning and decision making only. As to when their information need was greatest, 58.82% pointed out that they needed information while they were formulating ideas, such as, during planning activities, while evaluating projects, and in the process of decision making. More than twenty nine percent of the respondents indicated that they needed information mostly when they were making decisions; while 41.18% mentioned that they needed information during decision making and planning.

To the question about the important factors to be considered in information services, 82.35% pointed out that the timeliness, pertinence, accuracy, and reliability of information should be the desired qualities of information services. The majority (64.71%) indicated that the ease of access to the information is also essentially desirable. In addition, 64.71% noted that it was important to have information repackaged and presented in a simple and direct form as and when it is required.

As regards the preference of the form of information presentation, 82.35% of the respondents noted that they needed summarized information, reviews of original documents, and abstracts; while 64.71% indicated that they needed critical summaries, descriptive summaries, abstracts; and 41.18% needed full document delivery, full-text database search, CD-ROM media facilities, statistical information, information contained in articles, information contained in files or project reports, and verbal communication. Another 41.18% commented that they require "summarized texts that are not unnecessarily long, but contain useful points or facts", and that "the system need to use computer facilities, and particularly dBASE for database management, would be ideal."

Regarding the hours of working time spent on searching for information, 82.35% reported that they spent between two and three hours, and 17.65% indicated less than two hours. All the respondents reported that they have to spend between two and three hours for reading and evaluating the information received.

Regarding the use of information sources, 82.35% said that on many occasions they received information informally from their colleagues. Only 17.65% reported that they had the opportunity of receiving organized and detailed information formally from the information units. In addition, they said that they received organized information during their course of studies from their teachers.

To the question on the kind of services and facilities they believed could contribute to the improvement of the existing services, all respondents noted that cooperation with other information systems was very essential, and efficient services could be achieved by the use of computer-mediated electronic network communication system in the forestry sector.

All respondents believed that efficiency would be achieved by unconstrained access to information systems' databases, and that the on-line access would facilitate rapid transmission of information, be it text or information reviews.

6.2.8 Information Search Patterns

All respondents indicated that they conducted information search themselves. Only when they faced difficulties in locating what they wanted, did they require the assistance of librarians. More than sixty percent (64.71%) said that they relied heavily on professional colleagues; used research assistants in information gathering; and used the services of librarians. The rest of the respondents reported that they often got important information during their information search as a kind of accidental discovery in the course of browsing publications; and that they gained significantly from correspondences with experts in the field. The same percentage of respondents indicated that they discovered more information by following up references and footnotes from the literature they had consulted.

The survey revealed that 64.71% of the respondents used current awareness newsletters, and bulletins as important sources of information, while 23.53% significantly used research reports for information on the state of research activities in their area.

6.2.9 Problems Encountered in Information Search

With regard to the problems encountered in the process of searching for information, the following general observation was received: "Sometimes information is not easily obtained, may be because the current system (information system) is simply out-dated, or you cannot just find the books containing required data." Another report says "usually the information provided is unsystematic, incomplete, and laborious to retrieve. Sometimes it is so difficult to locate the required information, that one has to give up without any success. There is no central information unit covering all aspects of forestry, only segmented units serve special branches or areas of their specialization".

6.2.10 Financing Information Services

Regarding the idea of charging for information services offered by information units in the Forest Department, 82.35% completely rejected the idea, while 17.65% supported the idea, but with reservations.

6.3 DISCUSSION OF FINDINGS

The six institutions surveyed are the major components of the forestry sector in Zambia. Therefore, we believe that the information gathered, by using both the questionnaire and interview methods, provides ample scope for analyzing information technology application in the forestry sector in Zambia.

6.3.1 Type of Information System

Except for the ZAFFICO Data Centre, all the information systems surveyed are not computer-based. The general report was that parent institutions had one kind or the other of computer systems. The computer systems available in all these institutions are stand-alone machines used for various purposes. Since these computers are not used for library operations, it means that when the information units decide to automate their functions and procedures, they will need to acquire complete computer systems that will be appropriate to information processing and management procedures.

Taking stock of available computer systems in the parent organizations, it may be stated that it will be quite difficult to integrate them in the newly developed system because the machines were not acquired with the intention of applying them to information processing required by the information systems. These machines are also of different memory capacity. However, for certain services, such as current awareness

including SDI, and on-line system interaction services the available machines could be used as terminals of the network system.

6.3.2 System of Classification and Indexing Used

Table 6.3 indicates a kind of disparities in the approach to classifying information sources. Almost all information units surveyed use a different classification scheme. This trend may have adverse effects on information search procedures and, essentially, on the access to information resources when an automated system requires users to conduct their own information search.

For the purpose of providing an efficient service, therefore, all forestry information units participating in the cooperative information resource sharing need to adopt common standards for classification of information, and common standards for description of resources. This approach would facilitate information search procedures and enhance information exchange among the institutions.

6.3.3 Software Packages Available

The available computer equipment in the institutions surveyed use MS DOS and various application software packages. The common application software used is the word processor and dBASE for data base management. Statistical packages and spreadsheets are also available in some institutions.

The need for efficient information management, and the need to achieve a coordinated information management system, require the use of an appropriate common database management software for the purpose of eliminating extra procedures involved in data conversion for the purpose of data exchange. The use of a common database management software package, would also solve problems of adopting commonly agreed upon data entry and retrieval standards, and would contribute to the improvement of information services.

6.3.4 User Access to Information Sources

Table 6.6 presents the approximate volume of information literature available for forestry in Zambia. These collections need to be supplemented by information sources obtained in other institutions, such as, the universities and other specialized collections on forestry. The access to such external collections can be facilitated by the availability of information about such collections in the form of directories of forestry information institutions, specialized forestry collections, faculties in the universities dealing with various subjects on forestry, and profiles of forestry professionals. These can be essential sources of information, as well as reference sources to forestry information available in various organizations. The development of a system that can easily provide this kind of information can lead to the enhancement, to the re-orientation of existing services, and to the improvement of information and document delivery services.

6.3.5 Use of Information Systems' Services

Different user groups in the forestry sector need information for various purposes. Almost all information users noted that the existing information service units in their institutions did not provide sufficient information to meet their information requirements. Majority (82.35%) of the respondents indicated that they needed more information that could be supplied by external sources, but they were not aware of the procedures of gaining access to such external information.

The users who indicated that they frequently sought complementary information from other information units noted that it was difficult for them to know where to find appropriate information. At the same time, when such places were identified, it took time to learn the arrangement of information sources, and the procedures involved in accessing and using the information sources. They noted that if such information could be obtained by using facilities in their institutions, the service could be much improved through the services of the local information unit.

Because of the loss of confidence in their local information service units, some users observed that they depended much on information available on the office files, on information gained from professional journals to which they subscribed individually, and on information received through consulting their professional colleagues.

This trend is an indication that there is a need to develop an information support system capable of providing information on all kinds of sources of information and their location. A large percentage of users surveyed indicated that they needed to have access to pertinent and accurate information as and when they needed it.

The provision of timely information was noted to be one of the most desired feature of an information unit. The general consensus among users was a need for a cooperative approach in information utilization among information service systems, and that the use of computer mediated information network communication system in the sector would be ideal for providing efficient services.

6.3.6 Problems Encountered in Information Search

The majority of the users interviewed blamed the information service systems as being not organized in a manner that could facilitate information search. They noted that the problem might be in the system itself being outdated in relation to the kind of information sought by various users. The major handicap identified for the existing system was the lack of a central information unit that could provide information on all aspects of forestry. The existing system was said to be segmented in structure serving special branches or areas of specialization. This system made it difficult to know what research projects are being carried out in various specialized units and what has already been done.

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6.3.7 Financing Information Services

The general observation was that the governing body of the forestry divisions should be completely responsible for financing information services in the forestry sector. This body must be able to establish institutions or sub-bodies to coordinate information activities and to develop existing services to the standards that would benefit the entire forestry sector and serve interested users who may not be members of the Forest Division.

It is hoped that the outcome of the study will help information managers, primarily, in the forest sector, to develop a sustainable automated information system that will enhance their services.

6.3.8 General Observation

The survey of the information institutions revealed that non of the information systems was computer-based. These institutions operate in isolation of each other. As a consequence, the service to the users is adversely affected. This kind of isolation in providing information services has significantly affected users in their information search.

Users in the forestry sector need information of different kinds. These kinds of information, often cannot be provided by any one information system without the

cooperation of the others. These kinds of information include factual information, bibliographic information, information on projects carried out in the forestry sector and related research institutions, profiles of professionals in forestry, and the profiles of forestry institutions and information systems.

The user-survey gathered that due to the manual procedures involved in information search process, users spent more than two hours to locate the information they required. It was noted that the human intermediary service was inadequate to provide an efficient service. Therefore, it was recognized that a network of the information systems in the forestry sector was an ideal solution to problems relating to isolated and uncoordinated services. In order to address these problems, the network system needs to be computer-based and needs to maintain various databases that are capable of responding to users' information demands.

As a computer-based information network system, the system should be coordinated in such a manner that communication among the various system components is not hampered by human mediated procedures (e.g. seeking permission from the head of the institution for the use of information system). The collection development functions should be coordinated for the purpose of eliminating duplication in information resource acquisition. For efficient information exchange among the forestry information units, common standards in information processing formats should be adopted; and commonly recognized access protocols should be observed. For the purpose of improving information services in the forestry sector and solving the

various identified problems, a network of all information units will be an ideal approach.

The findings of the survey confirm the need for a computer-mediated information network system for the purpose of enhancing system information services and for sharing the available resources in the forestry sector in Zambia.

CHAPTER 7

THE PROPOSED INFORMATION SUPPORT SYSTEM FOR THE MANAGEMENT OF FORESTRY IN ZAMBIA

7.1 INTRODUCTION

On the basis of the analysis of the existing information service system in the forestry sector in Zambia, a computer-based information support system is proposed. The proposed computer-based information management system is intended to operate on the principle of a centralized database which will be required to receive information processed at all the research units in the Forestry Department in Zambia.

The intention to develop a central database system is to achieve an improvement in the operational procedures, and the communication between research units, the library, the Forestry Department Headquarters, the ministries concerned, and suppliers of information resources. For this reason, the system will be required to develop an integrated database for managing bibliographic records, profiles of institutions in the forestry and forestry related sectors, profiles of experts, and records of research projects (both on-going and completed). The system would also be required to create specialized data bases of the core concepts going with the study of forestry.

This approach is envisaged to facilitate maintenance of complete information at a central location which can be accessed by any user without recourse to individual

information units at any one particular time. Services of satellite information service units may be secured when particular information required is not available in the central databases.

7.2 OBJECTIVES OF THE PROPOSED SYSTEM

The general objective of the proposed information support system it to create and to maintain databases capable of meeting user information requirements in forestry. In order to achieve this objective, a central database will be developed at the Forestry and Timber Research Information Centre for the purpose of coordinating the information activities of all the research centres in the Forest Department.

The proposed system will be the heart a nation-wide computer-based network of the information systems in the forestry sector in Zambia. The information units found in the research, academic, and in the administrative sections of the Forest Department, will be required to submit to the central database, records on all the relevant information acquired/generated and processed locally. Each research centre will develop a local area network system for the purpose of coordinating the acquisition and management of information at the local research centre level, while the central database will assume the overall responsibility of coordinating activities of the various local area network systems.

Based on user information requirements, various databases will be created to provide information for planning, decision making, research, teaching, and general management requirements. In order to meet these requirements, referral databases, such as profiles of forestry experts, profiles of research projects, profiles of forestry information systems and forestry institutions; and databases for factual information will be created.

7.3 FUNCTIONS OF THE PROPOSED SYSTEM

The fundamental idea behind developing a computer-based information support system in the forestry sector in Zambia is to achieve the efficient utilization of the system resources by all categories of users. For the purpose of controlling the use of the system, all users will be given "user names" which will serve as an "account" allocation.

Given that the requisite hardware and software are made available, the proposed system will be required to perform the following functions:

Data Input Operations -

Data input operations will be done from system workstations on local area networks, saved on the local system, and subsequently, records will be submitted to the central

database. Data input operations will include the creation of various files on which different types of records will be maintained.

For data entry operations, appropriate on-line data entry worksheets will be provided. By calling appropriate worksheets through a menu driven user interface, the documentalist will be guided through the worksheet by data field labels, complemented by help messages invoked by pressing the "help key", **F1**. After a full record has been entered, the system will be able to save records on the local server automatically. Data editing facility will be provided during record creation and afterwards. Samples of the data entry worksheets are given in Appendices C1 - C7.

Information Storage -

The creation of database records will be done from any workstation on the network and saved on the local area network server. When records are created the system will be able to check the field for data submission to the central server maintained at the Forest and Timber Research Information Centre. If the record is being created for the first time, messages will be displayed on the terminal to remind the person entering data to send the records to the central database. If a record is a duplicate, an appropriate message will be displayed, prompting the documentalist to make appropriate adjustments. If records being created are bibliographic, the documentalist will be prompted to update the field on the number of copies available in the contributing information unit. After records have been created and submitted to the central database,

database. Data input operations will include the creation of various files on which different types of records will be maintained.

For data entry operations, appropriate on-line data entry worksheets will be provided. By calling appropriate worksheets through a menu driven user interface, the documentalist will be guided through the worksheet by data field labels, complemented by help messages invoked by pressing the "help key", **F1**. After a full record has been entered, the system will be able to save records on the local server automatically. Data editing facility will be provided during record creation and afterwards. Samples of the data entry worksheets are given in Appendices C1 - C7.

Information Storage -

The creation of database records will be done from any workstation on the network and saved on the local area network server. When records are created the system will be able to check the field for data submission to the central server maintained at the Forest and Timber Research Information Centre. If the record is being created for the first time, messages will be displayed on the terminal to remind the person entering data to send the records to the central database. If a record is a duplicate, an appropriate message will be displayed, prompting the documentalist to make appropriate adjustments. If records being created are bibliographic, the documentalist will be prompted to update the field on the number of copies available in the contributing information unit. After records have been created and submitted to the central database,

the check field will be updated to indicate the submission of the record to the central server.

Information Retrieval -

For searching and displaying of records from the databases, users will be required to define their search request by entering appropriate options presented in the menus, and following instructions provided on the screen. Information search procedures include the choosing of the database to be searched, entering the search term or a combination of terms, and choosing the appropriate display format. When these procedures have been completed, the system will output hit records according to the display format chosen. For bibliographic records, details will indicate the holding information unit and the number of copies available. If the user needs to have a copy from the holding information unit, the user will be required to submit an inter-library loan request on-line.

For factual information required for quick reference, for decision making and planning, as well as, for studies and research, appropriate databases on tree species, their characteristics, and their location will be created. Another database on the types of forests, their location, and their economic value will be created for use by planners, decision makers, forest administrators, researchers, and any user interested in forestry.

Data/file Transfer -

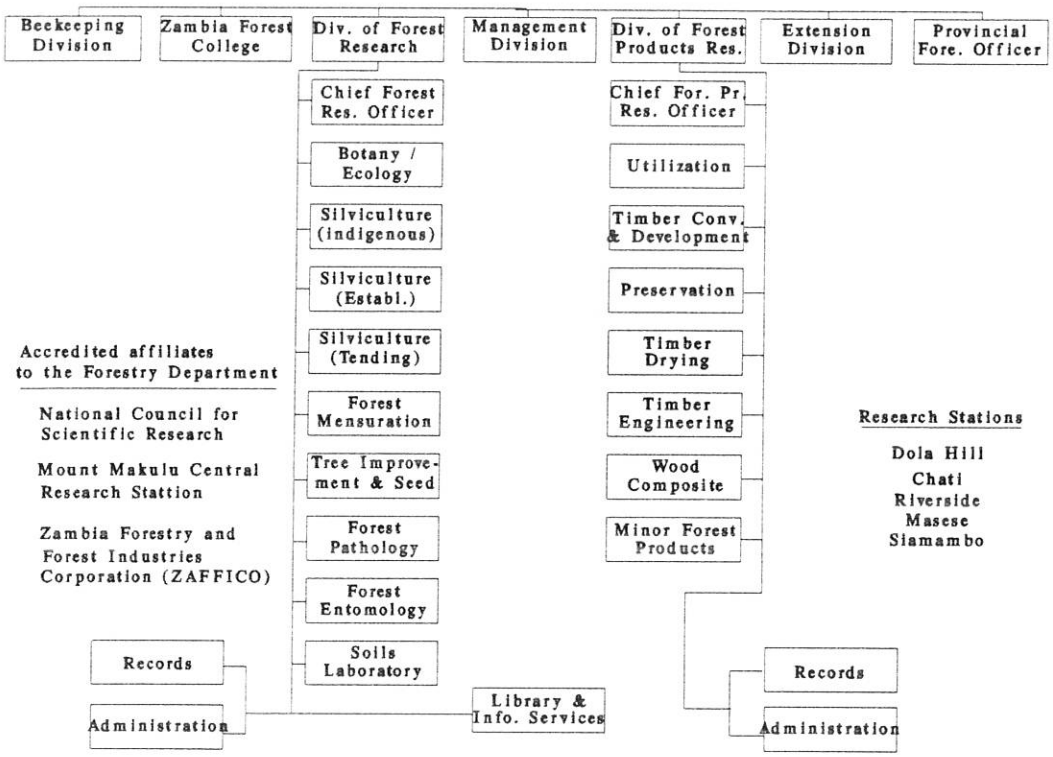
The system will provide the facility to save data retrieved from remote databases on the user system. This is the reason why standardization in hardware and software will be emphasized. The adoption of common standards by the forest research units will not only facilitate data exchange among the research units in the Department, but will also enhance use of the system resources by all users in the forestry sector.

7.4 STRUCTURE OF THE PROPOSED SYSTEM

The design of the proposed information support system is aimed at eliminating the existing constraints in the process of accessing information. The suitable system configuration needed to address some of the identified problems relating to information access, is a distributed processing and centrally managed information network. Based on the existing forestry organization structure (Figure 7.1), the proposed information system structure will take the shape presented in figure 7.2.

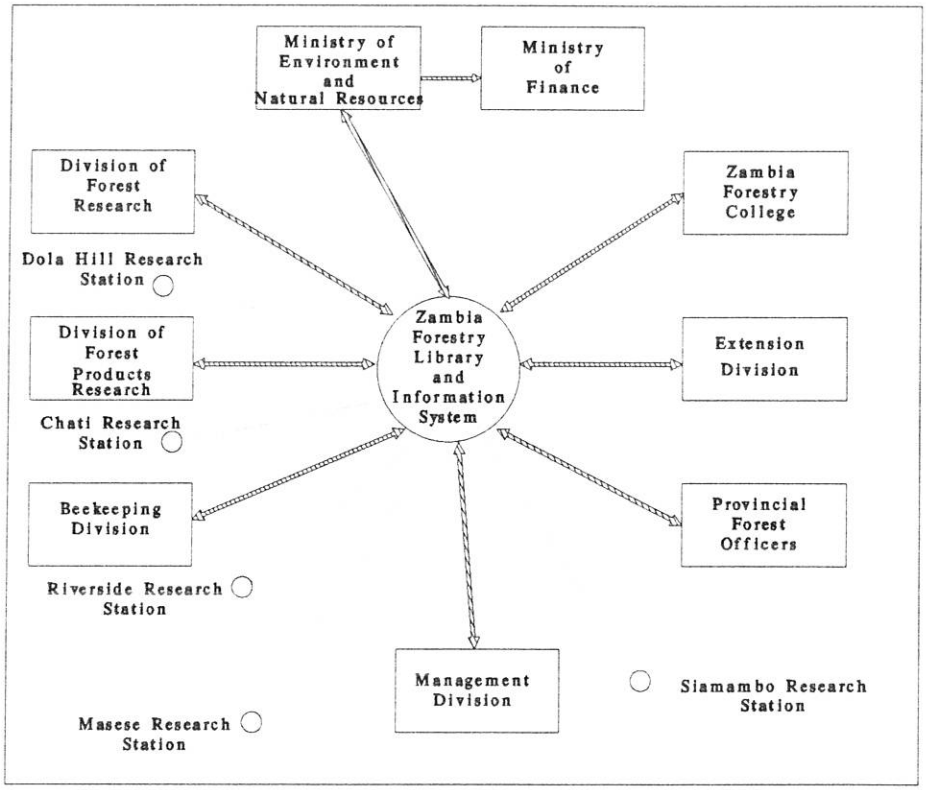
The Zambia Forestry and Timber Research Information System will be the central coordinating centre for the information activities of all the research, academic, and administrative units of the Department.

Figure 7.1: ORGANIZATIONAL STRUCTURE OF THE FORESTRY SYSTEM



A distributed information processing system is recognized here as a requisite system for the forestry research sector in Zambia. It is acknowledged that, the various sections in the Department are the elements that carry out research activities and generate research information. Hence, they are better

Figure 7.2: STRUCTURE OF THE PROPOSED INFORMATION SYSTEM



placed to come up with more realistic requirements of what they want to achieve. Where technical expertise is lacking, in terms of requirements specification, these units can secure the services of the central Forestry Information unit to which they are connected, or they can request for the services of the Systems Manager.

7.4.1 Forestry Systems/Computer Committee

It is recognized here that the Forestry Systems/Computer Committee is the logical body needed to perform the essential functions of coordinating forestry sector computer and networking efforts. In a bid to perform these functions, the Committee requires complete information on the computer and networking facilities necessary for all units of the Department.

7.5 GENERAL SYSTEMS DESIGN

7.5.1 Hardware Requirements

Hardware specification is meant to guide decision making concerning hardware acquisition. A complete specification ensures that no piece of hardware is unintentionally left out. This approach takes into account the tasks that the computer is required to perform, and also, takes into account the equipment that can easily be maintained locally.

Since the popular and common microcomputers on the market in Zambia are IBM and IBM compatibles, it is logical to acquire systems that can run on these machines. These machines can accommodate the running of a network system and CD-ROM facility. It is, therefore, envisaged that the trend of using IBM and its clones is likely to continue

for a long time, since more applications and maintenance support on these products are available in Zambia.

7.5.1.1 Key Factors to be Considered in Selecting Hardware

The key factors needed to be considered in the selection or evaluation of hardware should be efficiency of the equipment capable of accommodating various user requirements. The minimum specification requirements should include the following:

FOR PC/WORKSTATIONS -

-- 386DX-40;

-- 8Mb RAM;

-- 200w power supply;

-- 200Mb(+) IDE Hard Disk (greater than 22ms access time);

-- 1.44, 3.5" floppy drive;

-- SVGA 1Mb video display adapter;

-- 14" SVGA, low radiation colour monitor with swivel box;

-- 101 key enhanced keyboard;

-- Serial 3 button mouse (preferably logitech);

-- Parallel port, 2 x serial ports and 1 x game port;

-- NE 200 compatible 16-bit ethernet card;

-- DOS 6.0(+);

-- Windows 6.0; etc.

FOR PC/NETWORK SERVERS (File Server) -

-- 486DX-66;

-- 16Mb RAM;

-- 230w power supply;

-- 1 x 500Mb IDE Hard Disk (greater than 22ms access time);

-- 1.44, 3.5" and 1 x $5^1/_4$" floppy drives;

-- 1 x SVGA 1Mb video display adapter;

-- 1 x 14" SVGA, low radiation colour monitor with swivel box;

-- 1 x 101 key enhanced keyboard;

-- 1 x Serial 3 button mouse (preferably logitech);

-- 1 x Parallel port, 2 x serial ports and 1 x game port;

-- 1 x NE 200 compatible 16-bit ethernet card;

Novell NetWare version 4.0(+);

-- DOS 6.0(+);

-- Windows 6.0; etc.

-- Public domain FTP/Telnet;

-- Packet drivers for TCP/IP;

-- IDE disk controller; and

Apart from the machine processing power, the following factors for the input, output, storage, and communication devices should be considered:

MONITOR (VDU)

-- physical size of the monitor - 25 x 80 (14" screen size);

-- colour of the monitor - the trend is to acquire colour monitors;

-- text and graphic screen accommodation - select the screens that can display both text and graphics;

-- Number of colours the screen can display - 256 colour display;

-- Screen resolution - 640 X 480 resolution and above;

-- Dot-pitch (DP) - the size of single dots. The smaller the size of dots the better, e.g. 0.26 DP.

-- Refresh cycle - 70Hz and above (the light hits to the screen);

-- SVGA card, etc.

PRINTER

-- Print quality - Draft and letter quality - NLQ;

-- Dots per inch (DPI) - 600 dpi resolution;

-- Pages per minute (PPM);

-- Paper size and type accepted - continuous/non continuous feed; and

-- Type of paper accepted - to include transparencies; and

-- Form feed.

SCANNER

-- Print colour;

-- Pages per minute (PPM);

-- Bits per pixel (BPP) - 24bpp for the colour monitor; and

-- Dots per inch (DPI) - lighter DPI (454dpi) is recommended and 600dpi for the laser printer.

As the system will be developed with a network configuration, appropriate network equipment will be required. An Ethernet card for the microcomputers running on MS-DOS would initially be sufficient to set off the implementation of the local area networks within the research institutions. Local area network workstations at each node will need to be completely configured with ethernet card, and any appropriate database management system software, TCP/IP, E-Mail, File transfer program (FTP), and other requisite utilities. The local area networks will then be configured on a national wide-area network system. At some point, rationalization may call for review of some of the installed computing platforms, therefore, the system should be developed with a flexibility to accommodate additional utilities.

For a research institution network, especially, for the purpose of achieving easier data exchange, it will be ideal to acquire equipment platforms commonly used by other research institutions. The IBM and compatible personal computers with Industrial Standard Association (ISA) bus are quite popular in Zambia, and have become a suitable PC platform for graphics, desktop publishing, and networking. The proposed

system should, therefore, be considered with these facilities in mind. The PCs required for networking the forestry information system in Zambia should be configured as workstations with the minimum specifications given in section 7.5.1.1.

7.5.2 Software Requirements

A research institution with widely spaced units like the Forest Department may require diverse software applications. As the case may be, the use of commercial software should be taken cautiously, because the use of software involves legal implications which demand that purchased software should not be copied and distributed without the consent of the vendor. In order to observe this requirement, the network has to acquire a network licence for pieces of the same software that may be installed separately on each station/node. This means that only a limited number of sites on the network will have a piece of software. Multiple-users could use the same software in accordance with the licensing regulations.

The recommended software to be acquired should support the following applications;

- Word processing;
- Graphics presentation;
- Decision support;
- Database management;
- Text retrieval;
- Library management applications;

-- Spreadsheets;

-- Computer-Aided Design (CAD); etc.

One of the most important aspects to be considered on any platform is the software cost and its availability. With the current development revolving around the use of simulation and CAD packages, with processor intensive graphics requirements, an investment in an appropriate multi-user system running on easy to network database management software, expandable and capable of being integrated with the increasing number of PCs is required. The availability of such facilities would greatly improve the performance of the research fraternity within the entire forestry sector in Zambia.

7.5.3 Network Requirements

The concept of networking has to be taken, not in the concept of computers alone, but in the diverse communication systems and services such as telephone, fax, telex, etc. which can be located anywhere on the network. The design and implementation of a network at Section, Division, and Department levels, should, therefore, be guided by a clearly defined strategy. It is therefore necessary that, implementation of a meaningful networking policy governing the hardware platform, the network protocols, connectivity, network services, and the application of software is carefully planned.

7.6 DATABASES

In order to meet the various information requirements of users, the forestry information system needs to provide two categories of information. These categories relate to the referral and factual information. Referral databases maintain information on bibliographic data, information on the forestry experts, information on forestry research institutions and forestry information systems, and also the information on projects carried out in forestry. Factual data refers to the specific information that is accessed for ready use in planning, decision making, general management and for general knowledge.

For the purpose of providing these types of information, the forestry information system will need to create databases capable of handling these kinds of information. ABNCD (Abebe et al 1992) integrated database structure approach has been adopted to develop the AUGUS integrated database which can accommodate the above mentioned categories of information. This database structure allows the creation of different types of data records in the same database and permits the access of the integrated database using separate data entry worksheets and display formats. Therefore, the use of an integrated database approach by the Forest and Timber Research Information System will help to facilitate efficient information storage and retrieval.

One other database namely FOVEG has been designed by the author to provide information on forestry specialized information. Information that this database will provide include the type of forests found in Zambia, the types of tree species found in the country and their specific locations, and also their description.

Keeping the information requirements of users in view, field select tables (FST) for each database have been created for the purpose of identifying key-terms and search elements that are likely to be used by end users. Detailed features of each database appear in the following subsections.

7.6.1 Specialized database

For the purpose of providing specific and factual information for use in planning, decision making, research, and in forestry study, one specialized database has been created. This is the FOVEG database which has been created to provide information on the types of forest vegetation, description of the vegetation, location of vegetation, the economic value of the vegetation, ownership of the forest area, and its annual contribution to timber production and other forest resources. Figure 7.3 presents an output from the FOVEG database. The database can be searched through several keys defined in the field select table (FST).

Figure 7.3: SAMPLE OUTPUT FOR FORESTS RECORDS - FOVEG DATABASE

ZAMBIA FORESTS

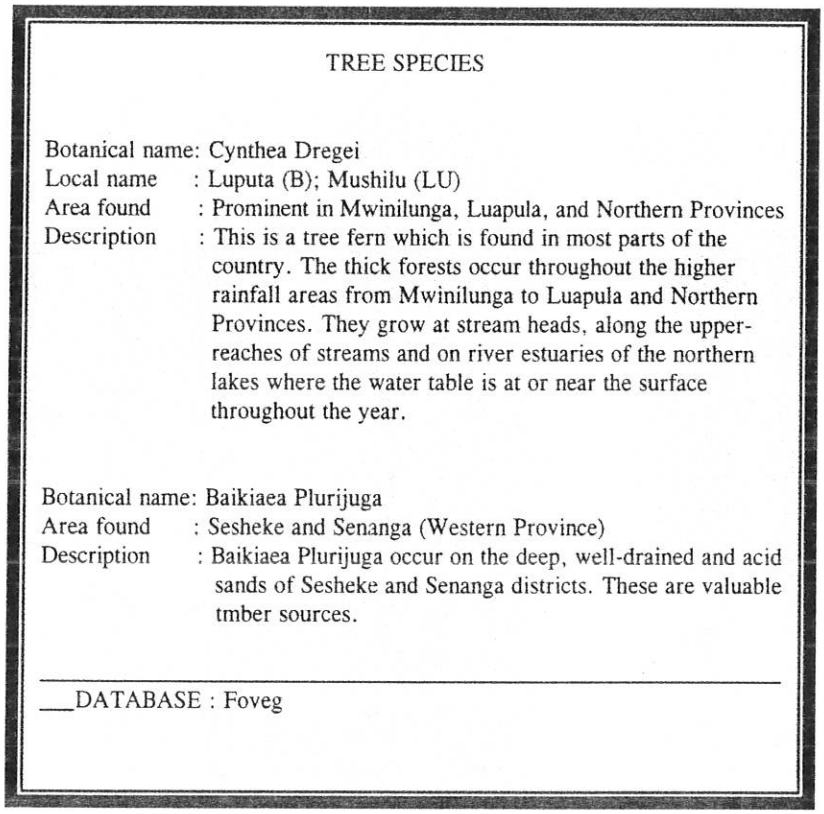
Name of forest : RIPARIAN FOREST
Area found : Northern, Luapula, and Western Provinces
Height : Average 25 metres
Description : This type, which may be refferred to as riparian woodland or gallery forest, is very variable, but at its best is three-storeyed with a closed evergreen canopy at over 20 metres high. The middle storey is open and evergreen. Here orchids and ferns are common. Riparian forest occurs in narrow strips on sides, and on wide "flats" beside rivers and lakes.

Name of forest: MARQUESIA FOREST
Area found : Kawambwa, Luwingu, and Kasama districts
Height : Average 28 metres
Description : This forest is similar to Parinari forest, but with some different species. This type still covers extensive areas in Kawambwa, Luwingu, and Kasama districts.

___DATABASE : Foveg

In addition to the above, the database has been created to provide information on the botanical names of particular tree species and their local names, description of the tree species, and the types of forests in which they are found. Figure 7.4 presents an output from the database using the TSPE display format. The field definition tables for the databases appear in appendices E-1 and E-2.

Figure 7.4: SAMPLE OUTPUT FOR TREE SPECIES - FOVEG DATABASE



TREE SPECIES

Botanical name: Cynthea Dregei
Local name : Luputa (B); Mushilu (LU)
Area found : Prominent in Mwinilunga, Luapula, and Northern Provinces
Description : This is a tree fern which is found in most parts of the country. The thick forests occur throughout the higher rainfall areas from Mwinilunga to Luapula and Northern Provinces. They grow at stream heads, along the upper-reaches of streams and on river estuaries of the northern lakes where the water table is at or near the surface throughout the year.

Botanical name: Baikiaea Plurijuga
Area found : Sesheke and Senanga (Western Province)
Description : Baikiaea Plurijuga occur on the deep, well-drained and acid sands of Sesheke and Senanga districts. These are valuable tmber sources.

___DATABASE : Foveg

7.6.2 Integrated Database

"AUGUS" has been developed as a prototype integrated database for bibliographic records, profiles of experts, profiles of information systems, profiles of forestry institutions, and profiles of research projects.

For the purpose of searching the database, users will be required to define their search parameters, enter the search terms, and to identify the display format. The reason for

selecting appropriate display formats is to retrieve only the field elements relevant to the type of information required.

7.6.2.1 Bibliographic Database Search

For retrieving bibliographic information, users will be able to conduct database search by author, title, subject, or by any keyword that appears in the record. A Sample output appears in figure 7.5.

Figure 7.5: SAMPLE OUTPUT OF A BIBLIOGRAPHIC RECORD

```
                    BIBLIOGRAPHIC RECORDS

Class number  : SD 411 Wil

Author        : Williams, M.R.W.

Title Statmt  : Decision making in forest management.
                2nd ed. Letsworth, Herts: Research
                Studies Press, 1988.

ISBN          : 0-86380-068-8

Price         : $ 49.95

Descriptors   : FORESTS AND FORESTRY;
                FOREST MANAGEMENT; FOREST RESOURCES;
                FORESTRY DECISION MAKING; FORESTRY PLA-
                NNING

Notes         : The book covers techniques used in making
                decisions in the process of managing the
                natural environment, and the techniques
                used for regenerating forest vegetation.
```

7.6.2.2 Profile of Forestry Institutions/Information Systems

In order to retrieve information on the institutions of the forestry sector in Zambia, users will be able to access records by identifying the specific institution by its name, or by checking the units that constitute the Forest Department. Figure 7.6 presents a sample record for institutions.

Figure 7.6: RECORD OF THE PROFILE OF AN INSTITUTION

PROFILE OF INSTITUTIONS

Name of Institution	: Tree Improvement Research Centre
Type of Institution	: Research Centre
Principal Officers	: Chimbelu, E.G.
Parent Organization	: National Council for Scientific Research
Associated Entities	: Division of Forest Research; Division of Forest Products Research; Mount Makulu Central Research Station.
Services Offered	: Research; Library Service.
Objectives	: To carry out research projects leading to prosperity and development of the economy and the nation 2. To study, coordinate and to evaluate scientific and technical research and development efforts on a country-wide basis.
Research Priority	: Tree Improvement
Discipline	: Forestry
Financial Aspects	: Government
Date Established	: 1965

7.6.2.3 Profile of Experts

In order to get information on experts or professionals in forestry, the user will be able to search the database by the name of person whose particulars are required, by the institution of affiliation, or by the subject specialization. Details of the record for persons is presented in figure 7.7.

Figure 7.7: SAMPLE RECORD FROM THE EXPERTS PROFILE

PROFILE OF EXPERTS

Name	: Chilima, Peter
Sex	: Male
Date of Birth	: 23-09-1952
Marital Status	: Married with 3 children
Educational Qual	: BSc(Forestry) Wood Chemistry and Industrial Economics, University of Dar es Salaam, 1978; Diploma(Forestry) Zambia Forest College, 1975.
Affiliation	: Ministry of Environment and Natural Resources.
Address	: P.O. Box 20388, Kitwe, Telephone: 2170 88; Telex: ZA 52051
Nationality	: ZA
Current Work	: Forester
Work experience	: Forester 1975- Forest Department, ZA

7.6.2.4 Profile of Research Projects

Research projects which have been done in forestry is an essential source of information for researchers, planners, and decision makers. This information is required for assessing the research capacity of the sector, for assessing research areas in which adequate research has not been done, and for determining new research projects. In order to access this type of information, users will be able to search the database by the specific project names, by the names of project team members, by the

Figure 7.8: SAMPLE OUTPUT FOR RESEARCH PROJECTS PROFILE

```
                PROFILE OF RESEARCH PROJECTS

Project Title           : Description and uses of Zambian
                          timbers.

principal Officer       : Chileshe, Patrick B.

Performing Institution  : Division of Forest Products Re-
                          search.
Type of Institution     : Research

Address                 : P.O. Box 20388, Kitwe; Telephone
                          217088; Telex: ZA 52051

Language of Project     : English

Location                : Kitwe

Current Project Status  : On-going


Date proposal Approved  : 1994-09-11

Start date of Project   : 1994-12-01

Recommender             : Chief Forests Research officer
```

host institution, or by the sponsoring/funding organization. A sample output from the research projects database is given in figure 7.8 above.

Data entry worksheets for bibliographic records, for the profiles of experts, for the profiles of forestry information systems, for the profiles of forestry institutions, and the profiles of research projects, are provided in Appendices C-1 and C-7.

7.7 USER INTERFACE

Keeping in view of user requirements and the understanding that the majority of the users of the forestry information system are not equipped with adequate skills and the knowledge to operate computer systems, a user interface has been created to assist users in the use of the system. The interface was written in ISIS Pascal programming language to operate in the CDS/ISIS environment.

The user interface was developed because it was found that the CDS/ISIS interface was not user friendly, especially for novice users. Therefore, in view of the end-user requirements, the interface was developed with the following features:

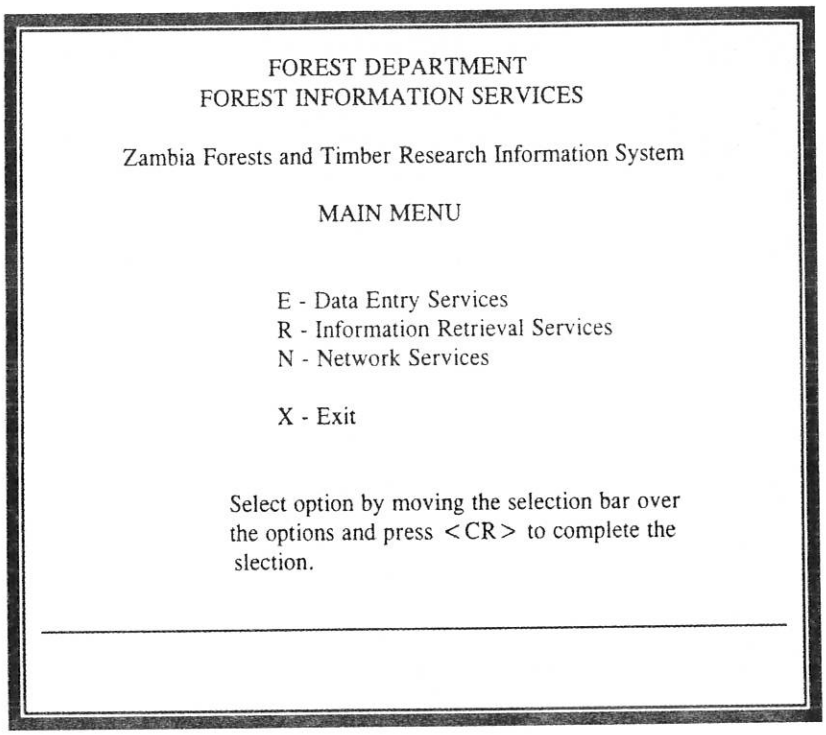
Running the User-Interface Program

On running the user interface program, users will be presented with the identification screen with a caption Forest Department Information System, with instructions on how

to enter into the system operating environment. The first screen will ask for a user password in order to gain access to the system.

After entering the correct user password, a user will be presented with the Main Menu. From the main menu the user will be able to choose the operational environment by entering any of the options provided. Figure 7.6 provides the system operations options given on the main menu.

Figure 7.9: SYSTEM MAIN MENU

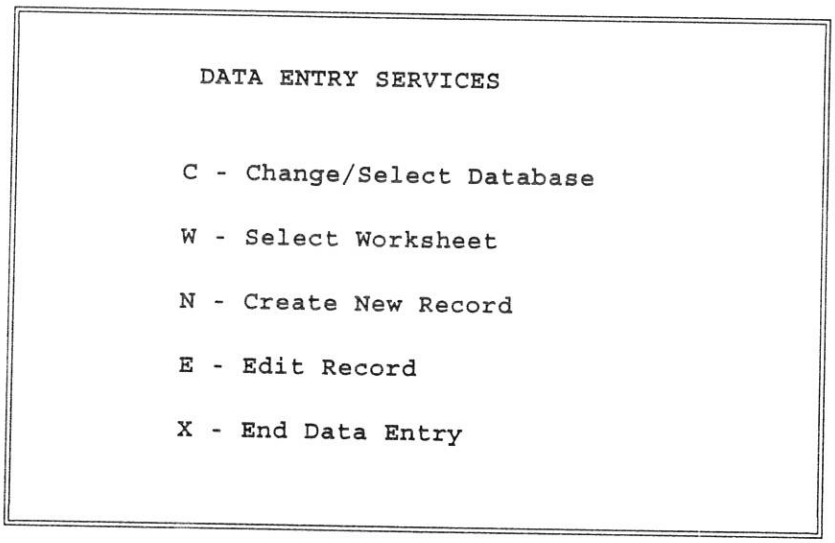


Data Entry Services

On entering the option for data entry services (option E), the system would ask for user identification. This procedure is provided to control entry into the data entry services environment by unauthorized users. Therefore, the use of this option is reserved only for the data processing personnel of the information system.

When the correct ID and password have been entered, the system will display a Data Entry Services Menu. The data entry menu has the following options:

Figure 7.10: DATA ENTRY SERVICES MENU



The data processing person will first need to select the database to work on. To facilitate selection of a database of interest, a pop-up screen, listing all the databases available on the system, is called to the screen by entering the option for database

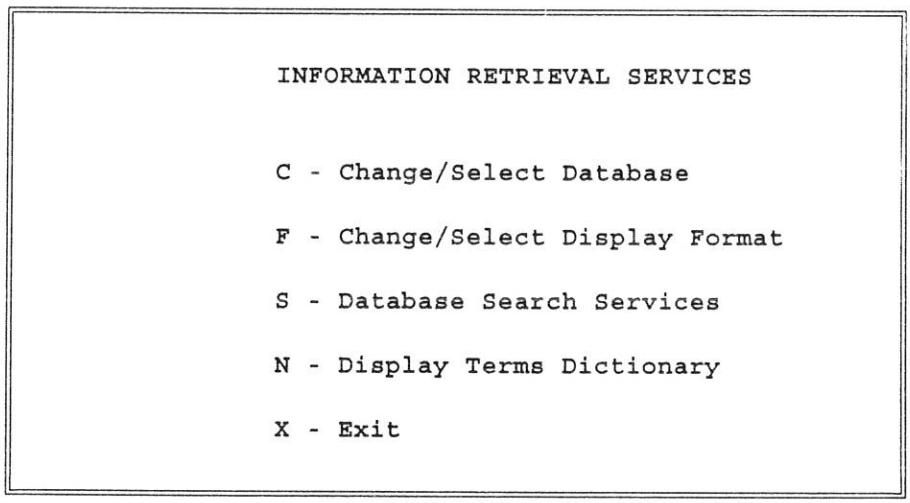
selection. After choosing an appropriate database, the user has to define the worksheet to use for data entry or for editing records. When a worksheet is selected from the worksheet menu, the selected worksheet is displayed on the screen ready for use in data entry operations.

After selecting the database and the appropriate worksheet, user can proceed to work in the database environment by selecting appropriate operations options (i.e. options for creating new record or the option for editing existing records). To come out of the data entry environment, the interface has a provision on the menu to end data entry.

Information retrieval Services

When the option for Information Retrieval Services is selected from the main menu, the user is presented with the information retrieval services menu. The menu has options presented in figure 7.5.

Figure 7.11: INFORMATION RETRIEVAL SERVICES MENU



After selecting the database option, a small window listing all the databases available on the system is called to the screen. Once a database of interest is selected from this list, the name of the chosen database is highlighted at the bottom of the screen. At the same time, the user is prompted to select the corresponding display format to facilitate the search operation. For example, if the database selected is "AUGUS", and the information required is a profile of experts, a message will appear on the screen reading "Select display format...". By pressing the option for display formats, a small window listing all the display formats for each category of records will appear on the screen. In this case, **AUGEX** format, for experts is selected. Then, the user has to type the expression. The system will conduct a search and the output will be displayed on the screen in accordance with the chosen display format.

The user interface facility is essential because it will provide an easy human-machine interaction without worrying about different commands that the system will accept. The facility will be able to guide users on the tasks required to perform on the system. When in doubt over system procedures, the system has a provision for help, that explains operations of the procedures.

7.8 SYSTEM DEMONSTRATION

The proposed system has been developed with a view to facilitating the use, especially, the search and retrieval of information by end-users. Technical staff working in the information system are expected to gain the skills and experience in using the system

for data processing and information retrieval within a short period of time. However, end users will need the interface facility for their different information requirements. End users of the system will be the forest planners, decision makers, administrators, researchers and students, teachers, and any other person interested in the study of forestry. Therefore, keeping in mind the information requirements of the end user, the prototype information search system is presented here to demonstrate how system search procedures would be performed in a real life situation.

Supposing a user wanted to obtain information on the types of forest vegetation found in Zambia, and specifically the location of particular tree species and their description, the user will be required to search for the required information by either using the direct search of the FOVEG database, or by the use of the on-line dictionary. The user would first go into the information retrieval services environment and select the FOVEG database. Selection of the database is done from the Information retrieval Services menu. When the user is in the information retrieval environment, the system would prompt the user to conduct the search by entering search terms from the cursor prompt. For the specific term, such as "RIPARIAN FOREST", the system would conduct the database search and display the output shown in figure 7.3.

7.9 SYSTEM IMPLEMENTATION PLAN - PHASE I

7.9.1 System Implementation Strategy

Before implementing the new system, details of all the available computer systems in the Department need to be made available to the Systems Committee for the purpose of finding ways of integrating them in the proposed information network system. In addition, when specifying requirements for the new system, the designers of the system need to consider the following system performance requirements, in the face of the existing system:

-- tasks to be performed, or modified;

-- volume of transaction to be made on the system;

-- efficiency of the proposed system in view of the tasks to be performed;

-- response time of the system;

-- user friendliness of the new system;

-- cost involved in developing the whole system;

-- maintenance of the system;

-- communication facilities; and

-- software portability.

7.9.2 Choice of the Vendor

Choice of the system vendor needs to be handled cautiously through clearly defined procedures. Initially, the Systems Committee, should be constituted to handle computer systems development and management. The responsibilities of the Committee should include tasks to draw up detailed system specifications based on the study of requirements of the whole forestry system or walk-through. The specifications document will serve to request for vendor system offers, or the Request for Proposal (RFP). The RFP will be distributed to several identified system vendors. On their part, system vendors will use the RFP to develop systems that will meet the requirements of the Forest Department. The response from the vendors will be specifications of the performance of the systems they are able to provide following the RFP specifications.

The Systems Committee will evaluate proposals received from vendors on the basis of the criteria set apriori. Vendors who do not meet the requirements are vetoed at the first evaluation meeting of the Committee, and will be informed accordingly. This is the first phase of the vendor evaluation process. Subsequent meetings of the Committee compare notes on successful proposals and further evaluate these proposals for the purpose of scaling down the list to, at least, two proposals rated high on the criteria rating scale. Between the two competitive vendors the Committee will choose the preferred one on the basis of the given guidelines. This will be the vendor that will be contracted to supply equipment for the system.

Subsidiary consideration for the choice of the vendor may include such things as, guarantees on the hardware, after sales support, and the extras the vendor is able to throw into the package.

7.9.3 Procurement Policy

The Forestry Department needs to establish a policy on hardware and software procurement. The procurement economics provide that when purchases are made in bulk, there is a likelihood for prices to be adjusted downwards, rather than for individual units to undertake purchases of pieces of computer hardware from different dealers/suppliers. Uncoordinated approach to the acquisition of equipment would prove to be expensive. Therefore, hardware procurement for all units of the Department needs to be coordinated through a central facility like a computer centre under the direction of the Systems/Computer Committee. Also, reputable vendors need to be identified before distributing the request for proposal. Essentially, computer purchases need to be carefully planned.

7.9.4 Type Approval

It is not enough to do the complete system specification and to follow proper procurement procedures, the hardware must be tested to establish its performance. This can best be done by

the Systems Committee.

7.10 SYSTEM IMPLEMENTATION PLAN - PHASE II

7.10.1 Department-level Network System

Figure 7.3 shows the basic network configuration for the proposed system. This is based on Ethernet related protocols and an ethernet switch that acts as a bridge or router connecting the ethernet segments.

The initial requirement is to get a working network in place. This approach narrows down the implementation to that of proven technology protocols, and to the use of ethernet and/or Token Ring for the research units' local area networks, and TCP/IP for local area network interconnections, and X25 for wider-area network and international communication.

Ethernet can provide a high performance network with low overhead in cabling and link maintenance. Therefore, the Department will need to take an official stand on the network development with standardized network software protocols. The initial requirement is the availability of PC's equipped with 16-bit cards (ethernet adapters) for 386 microcomputers and above. It must be ensured that PC procured have these cards fitted.

7.10.2 Wide-Area Network Connectivity

Since e-mail is available in Zambia, the Forest Department needs to get connected to a wider area network for communication, message and text transfer, and references. For the purpose of research, the public domain software is initially adequate. This can enable installing multiple copies of the public domain software on the individual section networks, and then have the more reliable software on one or two machines. If users need to use the more reliable software, they can access it across the network.

With a wider area network system, there is going to be a need for standardization within any one type of software. Examples of word processor standardization, can be the limitation to one "text oriented editor" say Word Perfect 6.0, one Windows based editor, Word for Windows 6.0, scientific oriented processor, and PCTeX. The benefits of standardization include the purchase of only a given number of copies of the word processor; while sharing of ideas is made easier since experts will be available all around.

Given the legal implications of the use of software (software pirating), there should be control such that only properly licensed software can be installed on official research department machines. This can only begin to take place if the software packages used can be standardized for the PC hardware and operating system platform.

7.10.3 Connectivity to the Internet

It is recommended that the Department should acquire Internet links and have Internet addresses assigned on a per research unit basis. With this connection the Department will greatly benefit from the use of the Internet facilities and the e-Mail service for the purpose of efficient communication among the researchers within and outside the forestry sector.

There should be adequate connectivity to Internet for efficient information access and message transfer. The UNIX operating system, on an appropriate hardware platform, can offer an easy route for the sections and the Department-wide e-mail and messaging facility with unlimited scope for networking adjustments and services expansion.

7.10.4 File Transfer

File transfer permits the movement of files from one machine to another. Several programs such as Kermit and FTP are available and are commonly used. Also files can be transferred on long distances and across borders.

7.10.5 Access to Software at Remote Sites

With Telnet and FTP, users can work off remote machines at great distances. Users can use software on distant machines and can transfer the results back to their local

machines. This means that there is no massive capital outlay to purchase some of the high-tech end software packages, if an arrangement can be devised with other research institutions that have the software.

The Department needs to purchase workstations, the X25 Gateway computer and dial-in access. There is also the need to set up guidelines and specifications on:

-- computer software;

-- computer hardware; and

-- hardware type approval.

Also there is need for definitive policies on:

-- computer software and software procurement;

-- software licensing;

-- computer hardware procurement;

-- computer hardware maintenance; and

-- Forest Department level network development.

technologies to store large quantity of data, and to process, store disseminate, and retrieve such data, with a high degree of speed and accuracy, makes their use in the information activity very imperative. It is against this background that a re-examination of the information policy and related issues, specially in relation to the application of information technologies should be undertaken.

If such an initiative is taken, a conducive environment will emerge in which a computer-aided information support system pertaining to any sector of national interest would be operative with an assurance of efficiency and effectiveness including that for the forest sector. The proposed system is specially meant for the forest sector. The forest sector in Zambia is of special importance. Because, the forest resources is one of the major contributors to its developing economy. It is well-established that the management of forest resources for the purpose of contributing to the economy of a nation should necessarily be information-intensive. All the successes in this sector in any part of the world confirm this fact. Zambia should necessarily accept this fact, and take all the necessary initiatives to strengthen its information infrastructure which would definitely contribute to the development of all its economic sectors including its forest sector. In an environment enriched with such desirable developments, the proposed computer-aided information support system for the management of forestry in Zambia would be operative with all assurance of contributing substantially to its overall economy. The proposed system has been designed by taking into consideration the factors that have been responsible for the success of several other initiatives, specially those which have been recognized as information-intensive elsewhere.

The proposed system has been specified as a computer-aided information support system for the management of forestry in Zambia. It is a network. The development of this network can be initiated by using the already available micro- and mini-computers in the forestry related organizations and institutions in Zambia. The system would consist of a central unit located in the Forest Department of the government of Zambia. It will be linked up with all the information service units of all the forestry-related organizations and institutions of all levels. These organizations and institutions are located in different parts of the country. Each one of these information service units would function as a "Node" of the network. The information activities of each node would centre round the area of the subject-specialization of its host organization or institution, as the case may be. In regard to the core area of subject specialization, each node is to collect pertinent information and sources of information, process those technically by using specified standards, store those, and create databases corresponding to its information resources to generate information products and services at the local level. Each node would transfer its updated databases to the central unit where those would be edited, tabulated whenever warranted, integrated, and consolidated. Whenever warranted these consolidated databases would be created by merging the databases separately created by the central unit itself. The consolidated databases of the central unit would be readily accessible to each node for generating services at the local level; of course, by avoiding all chances of duplication. When it is operative, the system would enable district ranger offices, no matter how remote they may be located, to be linked with the supervisors, regional foresters, and essentially, with the Chief Conservator of Forests. The system would carry out many

of the applications described in the previous chapter. In addition, the central unit will be able to establish links with various international information systems dealing with forestry information.

With this system, reports and other information needed at each managerial level would easily be aggregated from any level of the organization structure, and would efficiently be distributed to locations where they would be needed using the network system. Information would also be able to flow quickly from top administrators, down through the ranks, using computer-based communications systems.

8.2 RECOMMENDATIONS

The implementation of the proposed system would call for a number of other developments to take place. The following recommendations are being made to make those developments happen.

-- A national **Committee for the Automation of Information and Documentation Centres** (CAIDC) is to be established; and its terms of reference is to include the coordination of the use of computer technology in the forest sector in Zambia.

-- The Committee is to be established under the auspices of the Ministry of Environment and Natural Resources, so that its activities would be able to receive direct attention from the government.

-- The Coordinating Committee (CAIDC) is to be assigned the task of identifying and recommending standards for the collection, processing, and management of information/ data by all the participating institutions for the purpose of smooth and easy information exchange.

-- The Committee is to have the responsibility of establishing regulatory procedures in relation to information technology adoption/acquisition in the forest sector for the purpose of ensuring compatibility in the utilization of hardware and software.

-- The Committee is to be affiliated to the **Zambia Computer Society** for the purpose of facilitating information exchange and consultation with professionals in the field.

-- A mechanism is to be established to attract and retain information professionals in the sector. In order to achieve this objective, conditions of work and service are to be upgraded to a reasonable level.

-- Since most of the scientists and lecturers in the forest sector were trained before computers became popular, a scheme for training them in the use of computers is to be introduced. The education and training of Foresters and Forest Rangers is to incorporate a component of computer appreciation in their curricula.

-- The currently available manpower in the forestry information service units is to be trained in computer applications. The recruitment of new members of the information service staff is to emphasize on attracting persons with computer knowledge and skills. Professionals in computer science, i.e programmers, system analysts, and other data processing professionals are to be attracted to the information service sector.

-- For the purpose of providing efficient and effective information services, interdepartmental and inter-sectoral communication facilities are to be improved. Mechanisms to facilitate easy access to information sources are to be ensured.

-- Bureaucratic procedures, which demand authorization by the Chief Forest Research Officer, are to be eliminated, or suppressed through the establishment of computer information systems protocols which are to be recognized and observed by all participating institutions.

-- Security measures on access to information/data are to be instituted through the use of a log system. This system is to be able to identify and to keep record and track of access and utilization of the system. This mechanism is to be able to provide backward and forward checks and confirmation about system access and information utilization.

-- Since the communication facilities for using the Internet and Fidonet systems are available in Zambia, these facilities are to be extended to the forest sector.

-- For the purpose of research-support in the country, an academic and research institutions network (**ARINET**) is to be established at the national level. This is to be a computer network linking academic and research institutions in the country with international connection facilities.

-- IBM microcomputers and compatibles are to be considered as the first choice for automation of the proposed information network.

It is believed that with an adequate level of professional staffing in the information service institutions, things would improve in the forestry-related research libraries and in other information service units. Most of the items of research information are available in printed forms, such as, research reports, professional journals, in-house magazines/awareness boards, and professional conference/workshop papers. There is a need for systematic documentation - that is, abstracting, indexing and information

analysis and consolidation of these materials. For providing easy access to those items of information and for their dissemination and retrieval, such information service units would definitely need the service of computers to help them perform these tasks efficiently and effectively.

The mechanism for implementing these recommendations may call for further examination with the assistance from existing network systems available at the international level. With a well-organized nationally coordinated information network system, it is believed that development-information will be made available, as and when it is required by planners and decision makers in all the development sectors of the economy. A computer-based information network system will provide the knowledge-based decision support in various decision making environments.

In Zambia, an infrastructure for the application of computers and informatics is already in place. Almost all parts of the country are being served by telecommunication facilities, provided by the Posts and Telecommunications Corporation (PTC). The proposed national computer network system will effectively utilize the digital telephone system which was commissioned by PTC in 1990 for communication purposes.

In the forestry sector in Zambia, the full potential for the application of forest management knowledge and techniques to forestry opportunities and problems, has not yet been fully realized. But, even when needs and possibilities have been obvious, the problem seems to be a lack of awareness, both by planners and by foresters

themselves, of the key role the foresters can play. By training, experience, and outlook, the forester is equipped with a unique set of qualifications that can contribute in an important way to the design and planning of forestry projects if supported by appropriate, efficient and effective information base. With an efficient information support system, benefits of producing good research results, sound decision making and planning in the use of trees, and the protection of the environment can be assured; while, at the same time, costly mistakes can be avoided.

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GLOSSARY

Access controls Controls that limit physical access to computer sites, and that limit electronic access to computer systems only to authorized persons.

Account Same as the "login ID." The word that the user type at the "user ID" prompt. This can be an electronic name, and often is not longer than eight characters.

Address data structure used to identify a unique entity, such as a particular process or network location.

Application software package Predesigned software for specific application, available for purchase and ready for use (possibly with minor modifications) in an appropriate computer information system, used in place of custom- designed software to reduce overall system costs or shorten development time.

Backup file Separately retained duplicate physical copy of a transaction file or historic master file, used for reconstruction and recovery of damaged or destroyed files.

Bit A binary digit, either 0 or 1; the smallest unit of information storage.

Byte Generally, an 8-bit grouping that represents one character or two digits and is operated on as a unit.

Carrying capacity The number of animals an area can adequately support without deteriorating the site.

Clearcutting Removing most or all of the existing stand of trees, thus producing an environment for reproduction that is not influenced by the previous stand.

Commercial forest Forestlands on which trees can be harvested and regenerated with some expectation of a profit.

Database A collection of information that can be sorted and searched in a variety of ways. A comprehensive integrated collection of data organized to avoid duplication of data and permit easy retrieval of information

Default A software function or operation which occurs automatically unless the user specifies something else.

Download The periodic transfer of information files from a central maintenance facility to distributed computer locations.

Ecosystem A network of interactingorganisms and their habitat

Electronic mail Widely used network application where mail messages are transmitted electronically between end users over various types of networks using various network protocols.

Hardware

Forest A community of trees and associated organisms covering a considerable area, utilizing oxygen, water and soil nutrients to attain maturity and reproduce itself.

Forestry The science, the art, and the practice of managing and using for human benefits the natural resources that occur on and in association with forestlands.

Local area network (LAN) A series of computer processors that share files and peripherals.

Mensuration An adaptation of mathematics to the measurement of forested areas, of single trees and logs, of total biomass, and of other units of forest products.

Network A collection of computers and other devices that are able to communicate with each other over some network medium.

Networking Linking of multiple devices through communications lines for distribution of processing and/or the transmission of data

Online Work done on a computer while it is connected to the network.

Output A product, or result, of a dataprocessing.

Policy A predetermined course of action seeking to forward general goals; forest policies are governing principles, plans, or courses of action in regard to forest resources.

Regeneration Replanting of trees after harvest or fire, or reproduction that occurs naturally through seed from standing trees or other mechanisms.

Protocol A set of rules and standards governing data transmission between computers.

Prototype A working system that can be developed quickly and inexpensively; given the necessary software tools, to evaluate processing alternatives and to specify results.

Silviculture The applied science of reproducing and manipulating a forest in order to fulfil stated management objectives.

Stand density A quantitative measure of tree stocking.

Stocking The number of trees in a stand compared with the ideal number for best growth and management

Tree Woody perennial plant, with a single well- defined stem, generally a definite crown; usually 20 feet or more in height at maturity.

APPENDICES

Appendix A: FOREST CLASSIFICATION IN ZAMBIA

A. CLOSED FOREST TYPES

1. Parinari Forest
2. Marquesia Forest
3. Criptosepalum Forest
4. Baikiaea Forest
5. Itigi Forest or Itigi Thicket
6. Montane Forest
7. Swamp Forest
8. Riparian Forest

B. WOODLAND OR OPEN FOREST

1. Miombo Woodland
2. Hill Miombo
3. Kalahari Woodland
4. Mopane Woodland
5. Munga or Savanna Woodland
6. Lake Basin Chipya
7. Kalahari Sand Chipya

C. ANTHILL (TERMITARIA)

D. GRASSLAND

Appendix B1: QUESTIONNAIRE FOR THE APPLICATION OF IT IN INFORMATION SYSTEMS IN ZAMBIA

SURVEY ON THE APPLICATION OF COMPUTER FACILITIES IN THE INFORMATION SYSTEMS OF THE FORESTRY SECTOR IN ZAMBIA

QUESTIONNAIRE

General guidelines :

Please print your answers for the purpose of legibility. Please send the completed questionnaire to the following address before September 25, 1994 :

Augustine Kabwe Mwamba
Copperbelt University Library
P.O. Box 1692
KITWE
ZAMBIA

OR

School of Information Studies for Africa
Addis Ababa University
P.O. Box 1176
Addis Ababa
ETHIOPIA

SECTION A.

GENERAL INFORMATION

1. Name of respondent:.....

2. Sex : Male ☐ Female ☐

3. Age : a. 25 - 30 ☐ 31 - 35 ☐

c. 36 - 40 ☐ d. 40 - ☐

4. Nationality :.....

5. Institution of affiliation :.....

6. Occupation (Position held):.....

7. Name of the information system : .....
.....

8. Type of the information system :

a. Academic Library ☐

b. Documentation centre ☐

c. Information centre ☐

d. Data centre ☐

e. Special library ☐

f. Public library ☐

g. School library ☐

Address : .....
.....
.....
.....
.....

Telephone : .....

Telex :.....Fax :.....

9. Parent organization (If any) : .....
.....

10. Date of establishment :.....

11. Type of documentation activities :

a. Bibliographic ☐ b. Sectoral ☐

c. Multisectoral ☐ d. Numeric ☐

e. Referral ☐

12. Type of services rendered to the users :

a. Current awareness services ☐

b. Reference services ☐

c. Organizational reports ☐

d. Bibliographies ☐

e. Selective dissemination of information (SDI) ☐

f. On-line search services

g. Others (specify) :.....
.....
.....
.....

13. Which category of users are accorded the following services:

a. Current awareness services

i. Top management ☐ ii. Middle management ☐

b. Reference services

c. Organizational reports ☐

d. Bibliographies ☐

e. Selective dissemination of information ☐

f. On-line search services ☐

14. What is the size of the collection of your information system ?

Books a. 100 - 500 ☐ b. 501 - 1000 ☐

c. 1001 - 2000 ☐ d. 2001 - 3000 ☐

e. 3001 - 4000 ☐ f. 4001 - 5000 ☐

g. 5001 - 6000 ☐ h. 6001 - ☐

Periodicals a. 100 - 500 ☐ b. 501 - 1000 ☐

c. 1001 - 2000 ☐ d. 2001 - 3000 ☐

e. 3001 - 4000 ☐ f. 4001 - ☐

Documents	a. 100 - 500	☐	b. 501 - 1000	☐
	c. 1001 - 2000	☐	d. 2001 - 3000	☐
	e. 3001 - 4000	☐	f. 4001 -	☐
Microforms	a. 100 - 500	☐	b. 501 - 1000	☐
	c. 1001 - 2000	☐	d. 2001 - 3000	☐
	e. 3001 - 4000	☐	f. 4001 -	☐
Audiovisual materials	a. 100 - 500	☐	b. 501 - 1000	☐
	c. 1001 - 2000	☐	d. 2001 - 3000	☐
	e. 3001 - 4000	☐	f. 4001 -	☐
Maps	a. 100 - 500	☐	b. 501 - 1000	☐
	c. 1001 - 2000	☐	d. 2001 - 3000	☐
	e. 3001 - 4000	☐	f. 4001 -	☐

Others (Please specify).....
.....
.....
.....
.....
.....

15. Classification system used :

a. Library of Congress ☐

b. Dewey Decimal Classification ☐

c. Universal Decimal Classification ☐

d. Colon Classification ☐

Other(s).....
.....
.....
.....
.....

16. Subject Heading List used :

a. Library of Congress ☐

b. Sear's List ☐

c. Bliss Classification ☐

d. Other (Please specify).....
.....
.....
.....
.....

17. Type of Indexing :

a. Subject ☐ b. Keyword ☐

c. Author ☐ d. Descriptor ☐

e. Title ☐ f. Geographical ☐

g. Other (Please specify).....
.....
.....
.....
.....

18. Thesaurus used (If any) :

a. Macrothesaurus ☐

b. Microthesaurus ☐

c. Classaurus ☐

19. Staff establishment :

a. Number of Librarians/Information Scientists/Documentalists ☐

b. Number of computer/data processing specialists ☐

c. Number of other support staff ☐

16. Subject Heading List used :

a. Library of Congress ☐

b. Sear's List ☐

c. Bliss Classification ☐

d. Other (Please specify).....
.....
.....
.....
.....

17. Type of Indexing :

a. Subject ☐ b. Keyword ☐

c. Author ☐ d. Descriptor ☐

e. Title ☐ f. Geographical ☐

g. Other (Please specify).....
.....
.....
.....
.....

18. Thesaurus used (If any) :

a. Macrothesaurus ☐

b. Microthesaurus ☐

c. Classaurus ☐

19. Staff establishment :

a. Number of Librarians/Information Scientists/Documentalists ☐

b. Number of computer/data processing specialists ☐

c. Number of other support staff ☐

SECTION B.

COMPUTER FACILITIES

20. Does your information system have any computer facilities?

a. Yes ☐ b. No ☐

If the answer is NO go to QUESTION.

21. Where are computer facilities located?

a. in the library/Documentation/ Information Centre ☐

b. within the parent institution ☐

c. share with another institution ☐

22. Description of the available computer facilities :

MAIN FRAME COMPUTERS

a. Make/Model

b. Main memory

c. Operating system

d. Date installed

e. Disk units

f. CD-ROM drive

MINICOMPUTERS

a. Make/Model

b. Main memory

c. Operating system

d. Date installed

e. Disk units

f. CD-ROM drive

MICROCOMPUTERS

a. Make/Model

b. Main memory

c. Operating system

d. Date installed

e. Disk units

f. CD-ROM drive

23. If the available computer facilities used are microcomputers, what type of systems are they?

a. Stand alone microcomputers ☐

b. Network system ☐

24. What kind of services does the information service use computer facilities for :

a. Bibliographic database management

b. Numerical and statistical application

c. Word processing

d. Financial management

e. Other (Please specify).....
.....
.....
.....

25. For bibliographic information management, what software does your information system use?

a. CDS/ISIS

b. MINISIS

c. DBASE

d. STYLIS

e. Other (Please specify.....
.....
.....
.....
.....

26. How does your information system disseminate information to the users?

a. Computer printouts b. Diskettes

c. SDI/Current awareness d. CD-ROM

e. Information Bulletins e. Magnetic tapes

g. Other (Please specify).....
.....
.....

27. What local databases have been created for use in the institution?

a. Database name	b. Number of records in the database	c. Frequency of updating the database
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

28. What external databases does your institution use? (Please indicate/list the databases acquired)

a. Database name	b. Number of records in the database	c. Frequency of updating the database
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

29. Does your institution have any on-line access to remote databases?

a. Yes ☐ b. No ☐

30. If the answer is **Yes**, please list down the remote databases .

a. Database name	b. Host institution
.....	.....
.....	.....
.....	.....
.....	.....

31. If your institution does not have on-line access to remote databases, do you have any plans to have your information system connected to remote databases?

a. Yes ☐ b. No ☐

32. If you have plans to connect your institution to remote databases, when do you intend to do so?

a. Within six months ☐ b. in 1996 ☐

c. in 1997 ☐ d. in 1998 ☐

e. Planned, but no definite date has been set ☐

33. If planned, what type of computer system does your institution intend to introduce?

a. Mainframe ☐ b. Supercomputer ☐

c. Minicomputer ☐ d. Microcomputers ☐

34. For what purposes do you intend to use the computer system?

.....
.....
.....
.....
.....

SECTION C.

AUTOMATED SYSTEM PROBLEMS (For information systems using computers)

34. Have you encountered problems in the use of computers in your institution?

a. Yes ☐ No. ☐

If the answer is **NO** go to question **36**

35. What kind of problems have you encountered in the use of computers?

a. Equipment related problems :

i. Inadequacy of computer hardware

ii. Inadequacy of computer peripherals

iii. Inappropriate software

iv. Lack of software documentation

v. Inadequate computer memory

vi. Slow processing speed

vii. Lack of support from the computer manufacturer

viii. Lack of local maintenance facilities

ix. Unsuitable environmental conditions

x. Other (Please specify.....
.....
.....
.....
.....
.....
.....
.....
.....

b. Personnel related problems :

i. Shortage of trained staff

ii. Lack of available training for staff in software and hardware use

iii. Rapid rate of skilled manpower turnover

iv. Other (Please specify).....
.....
.....
.....
.....

36. How were the staff trained in the use of computers?

a. Trained overseas for short courses
b. Number of staff sent overseas for short courses
c. Trained overseas on long-term courses
d. Number of staff who took long-term courses overseas

e. Number of individuals who trained locally
f. Number staff who trained in groups
g. Number of self-trained staff
h. Other (Please specify).....
.....
.....
.....

37. Are you able to obtain servicing for your computers locally?

a. Yes ☐ No ☐

If you do not get computer servicing locally, what do you do when computers require servicing?

a. Use backup system
b. Mail the whole system abroad
c. Call for experts from abroad
d. Identify faulty parts and send them for replacement
e. Other (Pleas specify).....
.....
.....
.....
.....

38. Do you feel that the work in your information unit has become more efficient since the introduction of computers?

a. Yes ☐ No ☐

39. What do you think could be the reason for not improving work efficiency despite the introduction of computers in your information unit?

a.
b.
c.
d.

40. What do you think could be the reasons for the improvement of the services in your information unit after introducing computer?

a.
b.
c.
d.

THANK YOU VERY MUCH FOR HAVING SPENT YOUR TIME ON COMPLETING THIS QUESTIONNAIRE.

Appendix B2: QUESTIONNAIRE FOR THE USER SURVEY

INFORMATION USER SURVEY IN THE FORESTRY SECTOR IN ZAMBIA

QUESTIONNAIRE IUSQ ☐

GUIDELINES TO THE RESPONDENT

I am a graduate student at the School of information Studies for Africa, Addis Ababa University, Ethiopia conducting information user survey for experts in the forestry sector in Zambia.

The information you will provide in the attached questionnaire is an attempt to learn about user needs with a view to improving the quality of information services provided to you and will be used in the development of prototype databases of profiles of experts in the forestry sector in Zambia. This is part of the preparation of my Masters of Science in Information Science thesis which focuses on the Computer-Aided **Information support systems for the management of forestry in Zambia.**

I would very much appreciate it if you completed the attached questionnaire and returned to the following address before September 15, 1994 :

Augustine K. Mwamba
Copperbelt University Library
P.O. Box 21692
KITWE
ZAMBIA

or send to the following address after the above date:

School of Information Studies for Africa
Addis Ababa University
P.O. Box 1176
Addis Ababa
ETHIOPIA

Augustine K. Mwamba
RESEARCH FELLOW

1.0. **BACKGROUND INFORMATION**

1.1. Surname :..... Forenames:.....

1.2. Sex : Male ☐ Female ☐

1.3. Age :

1.3.1 25 - 30 ☐ 1.3.2 31 - 35 ☐

1.3.3 36 - 40 ☐ 1.3.4 : 40 - ☐

1.4. Nationality :.....

1.5. Institution of affiliation :.....

1.6. Position held :.....

1.7. Permanent Address.....
.....
.....
.....
.....
.....
.....

1.8. Business Address :.....
.....
.....
.....
.....

1.9. Telephone No. :.....

1.10 Telex :..... 1.11 Fax :.....

2.0. **ACADEMIC/PROFESSIONAL QUALIFICATIONS**

2.1. Field of specialization :.....

2.1.2. PhD. ☐

2.1.3. PhD - Year obtained.....

2.1.4. Name and place of the institution :
.....
.....
.....
.....

2.2 Field of specialization :.....

2.2.1. M.Sc./MA - ☐

2.2.2. Year obtained.....

2.2.3. Name and place of the institution :

.....
.....
.....
.....
.....

2.3 Field of specialization :.....

2.3.1. B.Sc./BA - ☐

2.3.2. Year obtained.....

2.3.3. Name and place of the institution :

.....
.....
.....
.....
.....

2.4 Field of specialization :.....

2.4.1. Diploma - ☐

2.4.2. Year obtained.....

2.4.3. Name and place of the institution :

.....
.....
.....
.....
.....

3.0. Theses produce :

3.1. PhD. ☐

3.1.1. Title of the thesis:.....
.....
.....

3.2. M.Sc./MA. ☐

3.2.1. Title of the thesis:.....
.....
.....
.....

3.3. B.Sc./BA. ☐

3.3.1. Title of the thesis:.....
.....

3.4. Other (Please specify):.....
.....
.....
.....

4.0. Professional publications produced :

4.1. Title of the paper:.....

4.2. Journal/Book title:.....

4.3. Vol.:.....No.:..... Year:.....

4.1. Title of the paper:.....

4.2. Journal/Book title:.....

4.3. Vol.:.....No.:..... Year:.....

4.1. Title of the paper:.....

4.2. Journal/Book title:.....

4.3. Vol.:.....No.:..... Year:.....

4.1. Title of the paper:.....

4.2. Journal/Book title:.....

4.3. Vol.:.....No.:..... Year:.....

4.1. Title of the paper:.....

4.2. Journal/Book title:.....

4.3. Vol.:.....No.:..... Year:.....

5.0. Working language(s):.....
.....
.....

6.0. Employment Record :

6.1. Current Employers:.....

6.1.1. Position held:.....

6.1.2. Years of service:.....

6.1.3. Responsibilities attached to your post.....
.....
.....
.....
.....
.....

6.2. Previous employers:.....

6.2.1. Position held:.....

6.2.2. Years of service:.....

6.2.3. Responsibilities attached to your post.....
.....
.....
.....
.....
.....

6.3. Previous employers:.....

6.3.1. Position held:.....

6.3.2. Years of service:.....

6.3.3. Responsibilities attached to your post.....
.....
.....
.....
.....
.....

7.0. Professional/Research activities

7.1. Consultancy work engaged in:.....

7.2. Period for consultancy work: From:.....To:.....

7.3. Research carried out between 1990 and 1994
.....
.....
.....
.....
.....

7.4. Research papers published:
Research title:.....
Period of research: From:.....To:.....
Date of publication (if published):.....
Title of the journal in which research findings were published:.....
Vol.:.....No.:.....Year.:.....

Research title:.....
Period of research: From:.....To:.....
Date of publication (if published):.....
Title of the journal in which research findings were published:.....
Vol.:.....No.:.....Year.:.....

Research title:.....
Period of research: From:.....To:.....
Date of publication (if published):.....
Title of the journal in which research findings were published:.....
Vol.:.....No.:.....Year.:.....

Research title:.....
Period of research: From:.....To:.....
Date of publication (if published):.....
Title of the journal in which research findings were...
published:.....
Vol.:.....No.:.....Year.:.....

7.5. Seminars/Conferences/Workshops attended:

.....
.....
.....
.....
.....

8.0. **USE OF INFORMATION SYSTEMS**

8.1. Do you require information services provided by the information unit in carrying out your duties?

8.1.1 Yes ☐ 8.1.2 No ☐

8.2. If the answer is **YES**, are the available information resources in your local information unit adequate to satisfy your information needs?

Adequate for my needs ☐

To a certain extent they meet my requirements ☐

Inadequate for my needs ☐

Any other comment:.....
.....
.....

8.3. Where do you go regularly to get information?

Local information unit in the work place

Libraries and documentation centers of international organizations

Foreign cultural centers

University libraries

Public libraries

Special libraries

8.4. Which other information systems do you use for your information needs apart from the forestry information unit?

Other information units in the forestry sector ☐

University library ☐

Public libraries ☐

Special libraries related to forestry industry ☐

Other (Please specify):.....
.....
.....
.....

8.5. When you use other information systems, how long on average, does it take to receive the information you require?

Less than one week ☐

Between one and two weeks ☐

Between two and three weeks ☐

One month ☐

More than one month ☐

8.6. For what specific purposes do you require the information you seek from these information units?

Planning ☐

Decision making ☐

Operational activities ☐

8.7. When is your information need greatest?

- At the time of formulating ideas ☐
- During planning ☐
- At the period of project/programme evaluation ☐
- When making decisions ☐
- For my routine work ☐

8.8. What aspects of information do you regard as the most important factor for your information requirements?

- Timely information ☐
- Pertinent and relevant information to the immediate needs ☐
- Reliable information ☐
- Information presented in simple, direct form ☐
- Repackaged information ☐
- Ease of access to the information services and resources ☐

8.9. What type of information do you require for your needs?

- Summarized information ☐
- Full document ☐
- Reviews of original documents ☐
- Critical summary ☐
- Descriptive summary ☐
- Abstracts ☐
- Full text database ☐
- CD-ROM media ☐
- Statistical ☐
- Information contained in articles ☐
- Information contained in books ☐

Information contained in files ☐

Verbal information ☐

8.10. How many hours of your working time do you spend searching for information?

8.10.1 Less than two hours ☐

8.10.2 Between two and three hours ☐

8.10.3 Between three and four hours ☐

8.10.4 Between four and six hours ☐

8.10.5 Over six hours ☐

8.11. How long does it take you to use(read) the information you obtain

8.11.1 Less than two hours ☐

8.11.2 Between two and three hours ☐

8.11.3 Between three and four hours ☐

8.11.4 Between four and six hours ☐

8.11.5 Over six hours ☐

8.12. How do you value the information generated in the forestry sector in relation to your information needs?

Highly valuable

Valuable

Reliable to meet my information requirements

Unreliable

8.13. How often do you use information facilities provided by the forestry sector?

Frequently ☐

Sometimes ☐

Only when I need to find out about something I do not know ☐

When I am working on a project ☐

When I need to make a decision ☐

8.14. Are you involved in the decision making and development planning of the information unit?

8.14.1 Yes ☐ 8.2.2 No ☐

8.15. If **not**, is there a provision for you to influence decisions regarding the development of the information unit?

8.15.1 Yes ☐ 8.3.2 No ☐

If the answer is **Yes**, please specify:.....
.....
.....
.....

8.16. What kind of services and facilities do you believe can contribute to the improvement of the existing information services?

Services that would permit on-line access to its database ☐

Rapid transmission of texts or reviews ☐

More staff ☐

Extension of opening hours ☐

Cooperation with other information systems ☐

computer mediated electronic network communication system in the sector ☐

9.0. **INFORMATION SEARCH HABITS**

9.1. How do you go about searching for the information you require?

Do research myself

Rely heavily on colleagues

Use the services of in-house information specialists

Avail myself to the services of the professionals outside the workplace

Use Research Assistants in information gathering

Use the services of the librarians

Other sources of information (Please specify):.....
.....
.....
.....

10.0. **FINANCING OF INFORMATION**

10.1. Do you support the idea of charging for information services?

Strongly support the idea ☐

Support the idea ☐

Do not support ☐

THANK YOU VERY MUCH FOR HAVING SPENT YOUR TIME ON COMPLETING THIS QUESTIONNAIRE.

Appendix C1: WORKSHEET FOR BIBLIOGRAPHIC RECORDS

Worksheet name: **AUGUM**

FOREST DEPARTMENT

FOREST PRODUCTS AND TIMBER RESEARCH INFORMATION SYSTEM

BIBLIOGRAPHIC DATABASE

Record type _ Date record entered_____

Call number_____

Corporate Author(s)_____

Meeting _____
_____
_____
_____

Title_____

Edition_____

Imprint_____

Date of publ/issue - free form_____

Collation_____

Monographic series_____

ISBN_____ Price_____

Broad subject heading_____
Primary descriptors_____
Secondary descriptors_____
Geographic descriptors_____

Location_____

Notes_____
_____
_____

Language(s) of text __
Documentalist_____

Appendix C2: WORKSHEET FOR PROFILES OF EXPERTS

Worksheet name: **AUGUE**

FOREST DEPARTMENT

FOREST PRODUCTS AND TIMBER RESEARCH INFORMATION SYSTEM

PROFILE OF EXPERTS

Record type _ Date record entered_____

Name of person_____
Sex_____ ate of birth_____ marital status_____
Nationality_____
Affiliation_____
Address_____
_____

Language of competence_____
Specialization_____

Formal educational qualifications _____
Work experience (last)_____
Current work_____
Project titles_____
Recommended by _____
Honours and Awards_____
Membership in associations_____

Documentalist (initials)_____

Appendix C3: WORKSHEET FOR INSTITUTIONS

Worksheet name: **AUGUI**

FOREST DEPARTMENT

FOREST PRODUCTS AND TIMBER RESEARCH INFORMATION SYSTEM

PROFILE OF INSTITUTIONS

Record type _ Date record entered_____
Name of person_____
Former names(s)_____
Type of institution_____
Principal officers_____
Parent organization_____

Address_____
_____
_____

Associated entities_____
objectives_____
Services offered_____
Research priority_____
Geographical area_____
Discipline_____
Financial aspects_____

MFNs of publications_____

Notes_____
_____
_____

Documentalist (initials)_____

Appendix C4: WORKSHEET FOR RESEARCH PROJECTS

Worksheet name: **AUGUP**

FOREST DEPARTMENT

FOREST PRODUCTS AND TIMBER RESEARCH INFORMATION SYSTEM

PROFILE OF RESEARCH PROJECTS

Record type _ Date record entered_____

Project title_____
Principal officers_____
Performing institution_____
Type of institution_____
Other associated institutions_____

Address_____
_____
_____

Project number_____
Contract number_____
Language of project_____

Location_____

Current status_____
Descriptor_____
Geographical area_____

Discipline_____

Financial aspects_____
Resources (equipment)_____
Research priority_____

Committee's decision_____
Date: proposal/approval_____
Date: expect. compl._____

Date: actual compl_____

objectives_____
_____
_____
Recommended by_____
Resource persons type_____
Resource persons_____

Personnel _____

MFNs of publications _____
Abstract/Description _____
_____
_____

Documentalist (initials) _____

Appendix D1: DISPLAY FORMAT FOR BIBLIOGRAPHIC OUTPUT-AUGUB

```
If v999 :'B' then mhl,c25"BIBLIOGRAPHIC
RECORDS"##C5v411##c5"Author      :  "v110(5,20)/c5"Title     :
",v100(5,20) ,x2,v120(5,20), x2,v121
(5,20),x1,v122(5,20)#c8v130#c5"ISBN          :  "v160,c30"Price
    :  "v516#c5"Notes                          :
"v150(5,20)#c5"Descriptors  :
"v320(5,20),c5v300(5,20)/c5v301(5,20)/c5v302,v303(5,20)/fi
```

Appendix D2: DISPLAY FORMAT FOR PROFILES OF EXPERTS OUTPUT-AUGUE

```
If v999 :'E' then mhl, c25"PROFILE OF FORESTRY EXPERTS"##c"Name
of person  :   "v110/c5"Sex        :   "v836/c5"Date of Birth
  :  "v447^b/c5"Marital Status     :   "v835^a,x1,"with "v835
^b"children" /c5"Educational Qualification:    "v831(32,32)|;
|/c5"Affiliation      :   "v112(32,32)/c5"Address     :
"v116^b,"; ","Telephone:  "v116^f,"; ","Telex:  "v116^h,";
","Fax:  "v116^i(32,32)/c5"Language of competence:
"v525,c5"Discipline      :   "v832(32,32)
/c5"Work Experience    :   "v833(32,32)/c5"Current Work      :
"v834(32,32)/c5"Project Title(s)     :  "v200(32,32)
/c5"Recommended by     :   "v850(32,32/c5"Remarks       :
"v150(32,32)/fi
```

Appendix D3: DISPLAY FORMAT FOR INSTITUTION RECORD OUTPUT-AUGUI

```
If v999 :'I' then mhl,c20"PROFILE OF INSTITUTIONS"##C5"Name of
Institution  :   "v111(30,30)/c5'Type of Institution  :   "v960
(30,30)/c5"Former Name(s)    :"v904(30,30)/c5"Principle Officers
:   "v110(30,30)/c5"Parent Organization :   "v112(30,30)/c5"Address
      :   "v116^b(30,30,x2,"Telephone: "v116^f(30,30),x2,"Telex:
"v116 ^h (30,30),x2,"Fax: "v116^i(30,30)/c5"Associated Entities :
"v113 (30,30)|; |/c5"Services Offered    :
"v900(30,30)/c5"Objectives      :   "v625(30,30)/c5"Research
Priority   :   "v965(30,30)/c5"Discipline      :   "v320
(30,30)/c5"Financial Aspects    :  "v700 (30, 30)/c5"Date
Established    :   "v443(30,30)/c5"Location       :   "v410
(30,30)/c5"Working Language   :   "v525(30,30)/c5"Personnel
:   "v570(30,30)/c5"Publications       :  "v899(30,30)
/c5"Documentalist      :   "v430(30,30)/fi
```

Appendix D4: DISPLAY FORMAT FOR RESEARCH PROJECTS RECORD OUTPUT-AUGUP

```
If v999:'P' then mhl,c10,'*** PROFILE OF PROJECTS ***'##/ c2,'TITLE
              : 'v100(25,25)/c2,'PERFORMING INSTITUTION: 'v111
(25, 25 )/c2,'RESEARCHERS          : 'v110 /c2,'SPONSOR
  : 'v700(25,25)/c2,'PROJECTS STATUS       : 'v950/c2,'DURATION
       : 'v441/c2,'TYPE OF RESEARCH     : 'v961/c2,'OBJECTIVES
     : 'v625(25,25) /c2,'DESCRIPTORS          :'v300(25,25)/ c2,
'DESCRIPTION      : 'V310(25,25)/fi
```

Appendix D5: DISPLAY FORMAT FOR INFORMATION SYSTEMS RECORD OUTPUT-AUGIS

```
If v999:'S' then mhl,c4,'*** INFORMATION SYSTEMS ***'##/c2,'NAME OF
SYSTEM       : 'v111/c2,'DATE OF ESTABLISHMENT: 'v443/c2,'HEAD OF
INSTITUTION  : 'v110/c2,'PARENT ORGANIZATION  : 'v112/c2,'ADDRESS
          : 'v116^b,|, |,v116^c,|, |,"Phone "v116^f,",","Telex
"v116^h(24,23),", ","Fax "v116^i(26,25)c2,'DISCIPLINE          :
'v320/c2,'PERSONNEL            : 'v570/c2,'SERVICES OFFERED     :
'v900(24,24)/c2,'DATABASES           : 'v894/c2,'CLASSIFICATION
SYSTEM: 'v896/c2,'SUBJECT HEADING LIST : 'v897/c2,'THESAURUS
   : 'v898/c2,'WORKING LANGUAGE     : 'v525/c2,'GEOG. COVERAGE
: 'v302,", "/fi
```

Appendix D6: DISPLAY FORMAT FOR SPECIALIZED FORESTRY DATA-FOVEG

```
mhl, c20"FORESTRY SPECIALIZED DATABASE"##C2"NAME OF FOREST :
"v10/c2"Area found      : "v80/c2"Height       : "v85/c2"Description
: "v65/
```

Appendix D7: DISPLAY FORMAT FOR TREE SPECIES DATA-TSPE

```
mhl, c30"TREE SPECIES"##c2"Species type    :  "v60/c2"Botanical name
:  "v70/c2"Local name       :  "v75|; |/c2"Area found    :
"v80(2,19) ## c2"Description    : "v65(2,190/
```

Appendix E1: ABNCD FIELD DEFINITION TABLE

?	Tag	Name	Len	Type	Rep	Delimiters/Pattern
_	1	Participating centre code	100	X		
_	2	Participating centre record no	6	N		
_	3	Record status	1	P		A
_	5	Date record entered	10	P		9999-99-99
_	6	Date record changed	10	P		9999-99-99
_	7	Bibliographical level	5	A		
_	8	Bibliographical level - parent	1	A		
_	9	Country of origin of record	2	P		AA
_	10	Record number of parent	6	N		
_	11	Record number(s) of part(s)	6	N	R	
_	12	Record no of other lang ver(s)	6	N	R	
_	20	Language of analysis	18	A		
_	21	Language of text(s)	2	A	R	
_	22	Language(s) of summaries	2	A	R	
_	25	Record heading	50	X		
_	100	Title	500	X		
_	101	Parallel title(s)	500	X	R	
_	102	Translated title - English	500	X		
_	105	Translated title - other	500	X		
_	110	Personal author(s)	80	X	R	ab
_	111	Corporate author(s)	500	X	R	abcdz
_	112	Affiliation	500	X		abcdz
_	113	Other associated inst(s)	500	X	R	abcdez
_	114	Meeting	500	X		abcde
_	115	Trans. name of instn.	200	X		
_	116	Address	300	X	R	abcdefghi
_	120	Edition	25	X		
_	121	Publisher	250	X		abc
_	122	Date of publ/issue - free form	30	X		
_	123	Date of publ/issue - ISO form	10	P		9999-99-99
_	130	Collation (M/C)	200	X		abc
_	131	Part statement	150	X		ab
_	140	Monographic series	200	X	R	abz
_	141	Thesis	200	X		abcd
_	142	Related project(s)	200	X	R	ab
_	150	Notes	700	X		
_	160	ISBN	13	X	R	
_	161	Documnet number	50	X	R	
_	162	Availability	100	X		
_	200	Title of serial	400	X		z
_	201	ISSN	9	P		9999-99-99X
_	202	Title of parent (M/C)	500	X		
_	210	Personal author(s) - parent	80	X	R	ab
_	211	Corporate author(s) - parent	500	X	R	abcdz
_	300	Primary descriptors	200	X		
_	301	Secondary descriptors	400	X		
_	302	Geographic descriptors	200	X		
_	303	Local descriptors	200	X		
_	303	Proposed descriptors	100	X		
_	310	Abstract/Description	1000	X	R	
_	320	Broad subject heading	100	X		
_	400	Processing status	4	X		
_	410	Location	10	X	R	
_	411	Call number	40	X		
_	412	Number of copies	2	N		
_	415	Accession numb.	10	X		
_	420	Type of material	50	X		
_	430	Documentalist (initials)	10	X	R	
_	500	Acquisition type	4	X		
_	509	Order number	25	X		
_	510	Date ordered	10	P		9999-99-99
_	511	Date claimed	10	P		9999-99-99
_	512	Date received	10	P		9999-99-99
_	513	Number of copies ordered	2	N		
_	514	Requester	25	X	R	
_	515	Supplier	200	X		abcdez
_	516	Price	20	X		ab
_	517	Acquisition notes	200	X	R	
_	901	Corporate body	500	X		abcd
_	902	See reference(s)	500	X	R	
_	903	Other language version(s)	500	X	R	

_	904	Former name(s)	500	X		R	
_	905	Later name(s)	500	X		R	
_	908	Reference code	20	X			
_	911	Serial title	400	X			
_	912	ISSN	9	P			9999-999X
_	913	See reference(s)	400	X		R	Z
_	914	See also other lang edition(s)	400	X		R	
_	915	Former name(s)	400	X		R	
_	916	Later name(s)	400	X		R	
_	921	Supplier authority code	4	X			
_	922	Supplier name and address	200	X			abcde
_	997	Authority record notes	200	X			
_	998	Authority record date	10	P			9999-99-99
_	441	Duration	50	X			
_	442	Date:proposal/approval	25	X			ab
_	443	Date:starting	10	X			
_	444	Date:expect. compl.	10	X		R	
_	445	Date:actual compl.	10	X			
_	446	Date:terminated	10	X			
_	447	Date of birth	100	X			
_	830	Nationality	100	X		R	
_	831	Qualifications	100	X		R	abcd
_	832	Specialization	100	X		R	
_	833	Work experience (last)	200	X			abcde
_	834	Current work	200	X			abcde
_	835	Marital status	10	X		R	
_	836	Sex	6	X			
_	850	Recommended by	100	X		R	abcd
_	855	Honours and awards	200	X		R	abc
_	856	Membership in societies	200	X		R	abcd
_	525	Language competence	100	X		R	abc
_	556	Assignments	200	X		R	abcd
_	895	Databases	300	X		R	ndrfa
_	896	Classification system used	100	X		R	
_	897	Subject headings list	100	X		R	
_	898	Thesaurus	100	X		R	
_	899	Periodical publicat.	300	X		R	ij
_	890	Patents taken	200	X		R	abcdefgh
_	900	Services offered	200	X		R	
_	570	Personnel	100	X		R	ab
_	625	Objectives	500	X		R	
_	700	Financial aspects	200	X		R	sacp
_	950	Project status	50	X			
_	952	Training courses	200	X		R	
_	954	Project number	50	X		R	a
_	955	Contract number	50	X		R	
_	957	Resources(equipment...)	200	X		R	
_	960	Type of institution	100	X		R	
_	961	Type of research	100	X		R	
_	965	Research priority	100	X			
_	966	Committee's decision	100	X			
_	999	Record type	1	P			A
_	1000	Name of object	100	X			
_	1001	Local name (Eng.)	100	X		R	
_	1010	Function	300	X		R	
_	1015	Source/Donor (Person)	100	X		R	sfh
_	1016	Source/Donor (Organization)	300	X		R	
_	1017	Vendor	300	X			
_	1018	Price	100	X			cp
_	1020	Provenance	100	X			
_	1021	Archaeological site	500	X			
_	1025	Ethnic group	100	X		R	
_	1028	Date	100	X			
_	1030	Material	300	X		R	
_	1035	Condition	1000	X		R	
_	1040	Dimension (Front)	100	X			hwld
_	1041	Dimension (Back)	100	X			hwld
_	1042	Weight	100	X			
_	1050	Description	1000	X			
_	1055	Fine number	100	X			
_	1056	Photo number	100	X		R	
_	1060	Negative number	100	X		R	
_	1065	Accession number	100	X			
_	1070	Other numbers	100	X		R	
_	1075	Location/storage	100	X			rs
_	1080	Location/exhibit	100	X			rs
_	1085	Classification/Keywords	100	X		R	
_	1090	Treatment	500	X		R	
_	1091	Lab. treatment dates	25	X		R	

_	1100	Exhibitions	300	X	R
_	1105	References	300	X	R
_	1110	Remarks	300		
_	1115	Date of entry	20	X	
_	1120	Date(s) of update	20	X	R

Appendix E2: FOVEG FIELD DEFINITION TABLE

Field Definition Table (FDT) Data Base: FOVEG

?	Tag	Name	Len	Type	Rep	Delimiters/Pattern
_	10	Name of forest	100	X		
_	15	Forest type	100	X		
_	20	Forest ownership	60	X	R	
_	25	Range	100	X		
_	30	Forest products	200	X	R	
_	35	Productivity	100	X	R	
_	40	Number of ranges	5	N		
_	45	Temperature	10	X	R	
_	50	Settlement	30	A		
_	55	Tree species	100	X	R	
_	60	Species name	100	X	R	
_	65	Description	500	X		
_	70	Botanical name	100	X	R	
_	75	Local name	100	X	R	
_	80	Area found	100	X	R	
_	85	Height	10	X	R	
_	90	Year	10	X	R	
_	95	Volume	30	X	R	

Appendix F1: AUGUS DATABASE - FIELD SELECT TABLE

	ID	IT	Data extraction format
-	100	4	v100
-	110	0	(v110/)
-	111	0	mhl,v111^a|%|
-	111	0	mhl,v111^b|%|
-	111	4	(v111^b||,v111^a |%|), v112^||,v112^a|%|, (v113^b| |,v113^a+|%|)
-	111	0	(v111^c/,v111^d/,v111^z/)
-	111	0	v112^c/, v112^d/, v112^z
-	111	0	(v113^c/, v113^d/, v113^z/)
-	112	0	(v112^a/, v112^b/, v112^c/)
-	113	0	v113
-	114	4	v114^a+|%|
-	114	0	(v114^b/, v114^c/, v112^e/)
-	116	0	(v116/)
-	121	0	v121
-	122	0	v122
-	150	0	v150
-	160	0	v160
-	200	0	v200
-	201	0	v201
-	300	2	v300
-	300	3	v300
-	301	2	v300, v301, v302, v303, v304
-	302	0	v302
-	303	0	v303
-	310	4	v310
-	320	0	v320
-	410	0	(v410/)
-	411	0	v411
-	412	0	v412
-	441	0	v441
-	443	0	v443
-	445	0	v445
-	447	0	v447
-	525	0	(v525/)
-	570	0	(v570/)
-	625	0	(v625/)
-	700	0	(v700/)
-	830	0	(v830/)
-	831	0	(v831/)
-	832	0	(v832/)
-	834	0	v834
-	836	0	v836
-	895	0	(v895/)
-	896	0	(v896/)
-	897	0	(v897/)
-	898	0	(v898/)
-	899	0	(v899/)
-	900	0	(v900/)
-	950	0	(v950/)
-	960	0	(v960/)
-	961	0	(v961/)

Appendix F2: FOVEG DATABASE - FIELD SELECT TABLE

Data Base Name: FOVEG FST for Inverted File FST name: FOVEG

- ID	IT	Data extraction format
- 10	0	v10
- 15	0	v15
- 20	4	(v20/)
- 25	0	v25
- 30	4	(v30/)
- 35	4	(v35/)
- 40	0	v40
- 45	4	(v45/)
- 50	4	(v50/)
- 55	4	(v55/)
- 60	4	(v60/)
- 65	0	v65
- 70	4	(v70/)
- 80	4	(v80/)
- 85	0	v85
- 90	4	(v90/)

DECLARATION

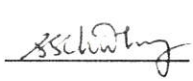
The thesis is my orginal work and has not been presented for a degree in any other university.

(Signed)

Augustine Kabwe Mwamba

May 24, 1995

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



(Signed)

Dr. G. G. Chowdhury

May 24, 1995

(Signed)

Prof. G. Bhattacharyya

May 24, 1995