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SCHOOL OF GRADUATE STUDIES

SCHOOL OF INFORMATION STUDIES FOR AFRICA

STUDIES ON ADVERSE EFFECTS OF AGROCHEMICALS ON THE ENVIRONMENT IN TANZANIA: A COMPUTER-AIDED INFORMATION SUPPORT SYSTEM

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

BY

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Studies on Adverse Effects of Agrochemicals on the Environment in Tanzania: A computer-Aided Inforamtion Support Sytem

by

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School of Information Studies for Africa (SISA)

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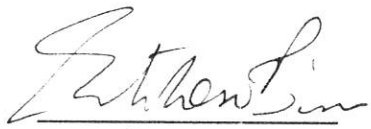
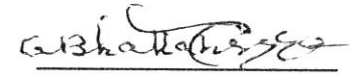
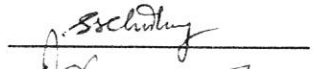
Ato Getachew Birru, Chairman, Examining Board	
Prof. G. Bhattacharyya, Advisor	
Dr. G.G. Chowdhury, Advisor	
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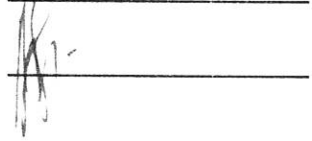
Dr. Taye Tadesse, Internal Examiner	

DECLARATION

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

Blandina Mataba Cheche

May 24, 1995

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

Professor G. Bhattacharyya

May 24, 1995

Dr. G. G. Chowdhury

May 24, 1995

DEDICATION

To my loving and much loved family Antony,

children Sarah, Nice Gloria and Sophy.

ACKNOWLEDGEMENT

I would like to thank all those who have , in one way or the other, assisted me towards the successful completion of this thesis. Since they are many, I cannot mention all of them by name. I just request them to accept this acknowledgement as a gesture of deeply held appreciation.

I would like however to express my special gratitude to my advisors, Professor G. Bhattacharrya and Dr G. Chowdhury for their tireless guidance, contribution and advise throughout this study.

My special thanks are also extended to the Dean of SISA, all the Teaching and Administrative staff at SISA for all the assistance and supervision extended to me during my studies at the School.

The acknowledgement won't be complete if I don't mention my friends in the Tanzanian Community in Addis Ababa for their moral support, encouragement and for taking care of my children whenever I was not available.

Last, but not the least, my gratitude is extended to the immediate members of my family, my husband Antony and my children, Sarah, Gloria Nice and Sophy who had to bear the pains of missing my close attention and care. I have no words which I could use to express my appreciation for the understanding and support they displayed while I was busy with my studies. I just pray that may the Almighty God bless them.

ABSTRACT

The study is an attempt to strengthen the efficiency and effectiveness of the information systems on the protection of the environment against its pollution and degradation due to misuse and abuse of agrochemicals. Its objective is to facilitate the access to timely and correct information for use by decision makers, scientists and researchers, agricultural extension workers as well as by the farmers and others interested in the adverse effects of agrochemicals to the environment.

The study considers the existing information infrastructures within the Tanzanian socio-economic setup, with a view of exploring how the people could have a better access to information on adverse effects of agrochemicals. The inherent weaknesses in the existing agrochemical information infrastructures have been indicated. In order to overcome the apparent weaknesses, it is proposed to establish a computer-based Information Support System on the Effects of Agrochemicals on the Environment in Tanzania (ISSEAET) within the National Environment Management Council (NEMC). The objectives, functions and structure of ISSEAET are elaborated.

The justification for the study is the need to improve on the collection, analysis and dissemination of information on the adverse effects of agrochemicals since the latter are playing a significant role in agriculture. Agrochemicals are credited for increasing farm yields, but they are also associated with numerous hazards to the health of the people and of the environment.

The methodology adopted in the study includes, the use of sets of questionaire for the

collection of data which have been used in the designing of different databases. Questionaires have also been used in ascertaining the information needs of the potential users of ISSEAET. Documentary sources, as well as interviews and on-site visits, also have been used for the collection of data.

The information system being proposed recognizes, however, the need for flexibility in order to accommodate the changes in Information Technology and in the country's political and socio-economic orientation.

ISSEAET is important in the country's desire to establish a computerized National Agrochemical Information Network System. Access to relevant information on how to use agrochemicals while, at the same time, keeping the environment clean is a challenge which ISSEAET intends to meet by the provision of its information products and services.

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LIST OF ABBREVIATIONS

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

DDT - Dichlorodiphenyltrichloroethane

ECA - Economic Commission for Africa (a United Nations Institution)

EFAM - Endemic Familial Arthritis of Malnad

EIS - Environmental Information System

FAO - Food and Agricultural Organization

GDP - Gross Domestic Product

GNP - Gross National Product

ISS - Information Support System

ISSEAET - Information Support System on the Effects of Agrochemicals on the Environment in Tanzania

IT - Information Technology

JET - Journalist Environmental Association of Tanzania

LAN - Local Area Network

MAN - Metropolitan Area Network

NACOLADS - National Council on Libraries, Archives and Documentation Services

NGO - Non-Governmental Organization

NEIS - National Environmental Information System

NEMC - National Environment Management Council

PADIS - Pan African Development and Information System

SISA - System Interface Search Assistance

SUA - Sokoine University of Agriculture

TCMB - Tanzania Cotton Marketing Board

TLSB - Tanzania Library Services Board

TPRI - Tropical Pesticide Research Institute

UC/AID - University of California /United States Urgency for International Development Pest Management and Related Environmental Protection Project.

UNECA - United Nations Economic Commission for Africa

UNEP - United Nations Environment Programme

UNESCO - United Nations Educational, Scientific and Cultural Organization

UNIDO - United Nations Industrial Organization

WAN - Wide Area Network

WHO - World Health Organization

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

The production of food has been a major preoccupation of man throughout history. A number of tools and techniques have been developed in order to increase food supply. In the course of human civilization, man has managed to move from the stage of a hunter and gatherer of wild food to the domestication of animals and the tilling of the soil. In so doing man succeeded in making significant transformation in his own civilization. Man became a farmer, and since then agriculture and animal husbandry have given him a more abundant and secure source of food supply. But continued population growths have surpassed the production capacity of the land. In most cases, particularly in poor and undeveloped economies, population growths appear to outstrip the increase in food production. Since almost all economies of the world started at that stage, man had to meet the challenge of how to make the necessary technological innovations in order to increase the earth's food-producing capacity. It has been argued that following the introduction of agriculture, food production expanded under the influence of six major technological advances: the use of irrigation, the harnessing of draft animals, the exchange of crops between the Old World and the New World, the development of chemical fertilizers and pesticides, advances in genetics, and the invention of the internal combustion engine (Brown and Eckholm 1975, 68).

We don't need to go deeper into the history of fertilizers. But it would be good to point out that the development in this field started with the use of animal manures, bones, wood ashes, wool wastes, guano, fish, chalk, and marl (Collins 1962, 1) before chemical fertilizers were developed in the nineteenth century. Subsequently chemical fertilizers gained their

prominence, particularly in the USA in the 1940s when the Second World War increased the demand for more food (Bull 1982). Since then the use of fertilizers has grown rapidly worldwide due to the desire of farmers in many countries to raise output per acre.

While chemical fertilizers started gaining popularity among the farmers in the 1940s, particularly in the USA, it coincided with the use of pesticides for the control of pests. DDT could be described as the first widely used pesticide. Accelerated use of organic pesticidal compounds like fertilizers occurred during the years after World War II (Rudd 1975, 326)

1.1 PROBLEM AND JUSTIFICATION

1.1.1 Problem Statement

The impact of modern techniques of agricultural production on the environment cannot be underestimated. Various environment-friendly production techniques were traditionally used to increase agricultural productivity while minimizing incidents of insect infestation and the spread of plant diseases. In the contemporary era, the traditional mode of agriculture involving crop rotation and the use of manure has been replaced by modern farming techniques with heavy reliance on synthetic agro-chemicals which have serious adverse effects on local populations and their environment.

A whole range of agrochemical products are increasingly being used either as necessary inputs to maximise agricultural productivity or as means of pest control. But there is no adequate information on their impact on the environment nor are there specific measures taken to increase public awareness on effects of these chemicals on the local populations. While increased use of agro-chemicals has no doubt resulted in an increase in productivity, there is a similar increase in environmental degradation.

The widespread uncontrolled application of fertilizers and different pesticides such as insecticides, herbicides and fungicides leading to undesirable health problems and environmental consequences, has now reached an alarming proportion in the World. It has been, for example, estimated that 305 million kilograms of pesticides enter into the third world and their environment every year. While its impact on the environment is yet to be established, it was estimated in 1990 that 11 million people in Africa are poisoned by pesticides every year with some being fatal.

The problem is of global concern, and a number of countries have already been serious victims of this phenomenon. To demonstrate the magnitude of the problem, it is necessary to quote a few cases which have been observed. According to Bull (1982):

- When DDT was discovered in 1948, it was believed to have been the magic solution to most of the pests. By the 1970s it had been realized that uncontrolled use of DDT was extremely harmful to both the health of man and the environment in general. Some of the diseases that have been associated with DDT include cerebral haemorrhage, and various kinds of cancer.

- Pesticide residues in food is a serious concern. For example, in 1975 it was discovered that pesticide residues in the paddy fields of an area called Malnad were the cause of the disease named Endemic Familial Arthritis of Malnad (EFAM). Additionally, during the Indian Green Revolution, it was found that paddy-fields were increasingly contaminated with pesticides including Parathion and Endrin.

- The use of pesticides could lead to resistance and the destruction of pests' natural enemies thereby leading to the emergence of secondary pests which could be difficult to control. For

example, at the Gezira irrigation scheme in the Sudan, dependence on pesticides has reached very dangerous and expensive proportions to the extent that the number of applications has increased by seven to nine times since chemical pesticides were introduced in the 1940s while production costs have quadrupled in the last 10 years. This development has been caused by pesticide resistance. The problem has been compounded by the arrival on the scene of new pest species like the whitefly in unprecedented numbers. The whitefly excretes a sticky substance which makes it impossible to process the cotton in modern mills. The cotton industry of the Sudan is therefore facing a very serious danger.

- In the Rio Grande Valley of Mexico, cotton production has virtually disappeared; 700,000 acres were abandoned in 1970. The disaster occurred when the tobacco budworm, an important cotton pest, became resistant to a wide range of pesticides.

- The resistance of the diamond-back moth, a pest of cabbages in the Cameroon Highlands of the Malay Peninsula, has developed to a point where different insecticides have to be sprayed many times and in dosages considerably higher than those recommended.

- Occupational and accidental poisoning has also been associated with the use of pesticides. In 1972, for example, the WHO Expert Committee on Insecticides estimated that there were about 500,000 cases of accidental pesticide poisoning annually, and 1% of the cases were estimated to have resulted in death in countries where medical treatment and antidotes are readily available. It is possible that the figure could be higher in the developing countries. It is however acknowledged that despite the lack of accurate and reliable figures, these estimates indicate a serious problem indeed. Further, these estimates do not include any of the chronic

and long-term health effects of pesticides like the cancers, birth defects, sterility and the like which constitute some of the most widely publicized concerns about pesticides especially in the rich countries.

- Pesticides have had adverse effects on the environment through pollution. In Zimbabwe, during 1981, there was considerable public debate concerning the impact of pesticides, especially DDT on the environment. The concern was that some predatory birds and fish populations were threatened with extinction due to river pollution.

- Some pesticides, including chlordane, endrin and heptachlor, still available in some Third World countries are also highly toxic to earthworms which play an important role in circulating and aerating the soil.

- Bees, which play an important role in plant pollination, have also been affected. In some cotton growing areas of Tanzania and Kenya bee keeping is non-existent largely as a result of insecticides.

The impact of agrochemicals on the environment has attracted the attention of many organizations at international, sub-regional or national levels. For, example, in 1972 the UC/AID International Survey on pesticide use cautioned that the dangers of environmental contamination required a rigorous re-examination for the chemical pest control methods currently in vogue in the third world (Bull. 1982. p 74). The UC/AID placed the responsibility on the user of the pesticide insisting that users had the responsibility of using such products in accordance with sensible and recommended standards.

At present pesticides in Third World countries appear to be applied at a relatively small scale, but the trend is to move towards their increased application in the quest for improved and increased yields. This would lead to a dramatic impact on the environment, an eventuality that could affect the livelihoods of the people as it has already started to manifest itself in some countries of the third world. The cases so far enumerated is a clear testimony that the situation cannot continue to be ignored.

The environmental and health problems so far discussed require effective controls especially on the availability and use of fertilizers and pesticides. The hazards they cause to the environment and the people, call for restrictions on their use. Some of the agro-chemicals are banned or severely restricted in countries of manufacture. It is quite unlikely that the exporting countries or the agro-chemical business giants pay much attention to such appeals. It is equally possible that the 1977 United Nations Environment Programme (UNEP) mutual responsibility resolution (Bull. 1982. p 74) was adopted in order to redress such shortcomings. The resolution urges governments to take steps to ensure that potentially harmful chemicals in whatever form or commodity which are unacceptable for domestic purpose in the exporting countries are not permitted to be used without the knowledge and consent of appropriate authority of the recipient country. It is important to underline that users can only exercise these responsibilities if they have access to full, correct, timely and usable information. In many countries of the third world such information is often not available especially to small farmers and farm labourers. The low level of literacy, lack of equipments and services, and a harsh environment make it difficult for users to even follow the rudimentary advise they are given.

From the background so far discussed, there is a need for the creation and maintenance of adequate information databases upon which policy and operational decisions could be based. For many of the developing countries such information databases are weak to say the least.

They are inadequate in terms of meeting the needs of decision making. It is obvious that more informed judgements have a greater chance of achieving the desirable goals. Decision making process is simplified through the development of systematic and comprehensive information systems.

In most developing countries environmental management is given low priority with the attendant consequences of giving little attention to the need to develop information support systems. Tanzania is no exception to this characteristic of developing countries.

1.1.2 Justification.

We have argued under "Problem Statement" that environmental problems caused by the widespread use of agrochemicals have been recognized and that there is a need for all countries to adopt the necessary measures with a view of protecting the people and their environment in general. The 1977 UNEP resolution is a lesson to be borne in mind. It has two essential elements in the fight for keeping the environment clean. Manufacturing/Exporting countries have a responsibility to ensure that:

(1) They stop exporting those agro-chemicals which have already been banned in their own countries;

(2) The highly restricted agro-chemicals are exported only after being clearly labelled including proper usage, transportation, storage and the possible risks they carry. But it is quite clear that such strict measures are seldom observed.

There could be a number of reasons to account for that insensitivity, such as :

(1) The profit motivation of the powerful agro-chemical industry.

(2) Poverty in many of the importing countries compels them to go for affordable

agrochemicals. There are, for example, three major classes of pesticides - organochlorine, organophosphorus and carbamate compounds. Stephen (1987) argued that organochlorine pesticides are the cheapest of all the three classes, but the most persistent in the environment because they are not easily degraded. This could partly explain why chlorinated pesticides (e.g. DDT), although banned, have been in continued use for many years in Tanzania for the control of crop pests.

(3) Ignorance. The majority of the peasants and farm workers are not aware of the environmental and health hazards of many of the agrochemicals. As a result they are not in a position to adequately protect themselves physically let alone put much pressures to the legislators and technicians in order to force them take decisions that would essentially be geared to the protection of their environment.

Environmental problems in many African countries can no longer be ignored. Attention has to be focused on improved land and environmental management. Such an exercise could only be possible with the establishment of strong information support systems which are essential in the policy and decision making process.

Tanzania has established a National Environment Management Council (NEMC), but its information system is still ineffective. Countries like Nigeria and Ghana, have managed to make considerable progress by developing national integrated environmental information systems (The World Bank 1992). Environmental Information Systems (EIS) could play a significant role. It would enable a state to have detailed knowledge of the country's natural resource base with particular importance on the collection and processing of information on:

(1) Land use patterns, including soil and hydrologic conditions, vegetation cover, climate, and the results of human activities, past and present;

(2) Technical, institutional, legal, and economic resources available; and

(3) Information on pollution.

The idea of the study is to establish a network of agrochemical related environmental databases with a view to ensuring data availability and the efficient exchange of information, complete with a retrieval service and a system that would make it possible for a wider dissemination of the information. The EIS would therefore provide a focal point for the exchange of environmental information locally, regionally and internationally.

Tanzania is an example of poor developing country that depends on agriculture for the livelihood of the majority of its people and as a source of much of its foreign exchange earnings. The agricultural sector generates about 60% of the gross domestic product (GDP), and approximately 80% of the population depend directly on agriculture and related sectors such as fisheries for their livelihood. The country is predominantly rural with the peasants constituting about 80% of the estimated population of 26.04 million people. The country has been described as a nation of small peasant farmers as they cultivate almost 90% of the total area under agriculture (Abdallah 1992).

According to the report on Basic Survey for Fertilizer Project (1967), Tanzania had already started to apply considerable amount of fertilizers, insecticides and herbicides mostly imported from developed countries. Most of these agrochemicals are used hazardously by illiterate farmers who cannot read even the instructions on the pesticide containers. The areas that are known for being very productive in agriculture, are the same ones which are mostly affected. These include areas good in the production of either cash crops (like coffee, cotton, tobacco, sisal, pyrethrum) or food crops (maize, wheat, and Irish potatoes). Cash crops demand the application of a lot of fertilizers and pesticides. The same observation is relevant to many of the food crop growing areas; and there has always been much pressure requiring the

government to subsidize the prices of fertilizers and pesticides. The pressure does not only come from the ordinary farmers but it is always given political weight by many Members of the Tanzanian Parliament (i.e. the Legislature). The promotion of the application of modern techniques of agricultural production is being encouraged seriously. Available figures on the supply of fertilizers is a testimony to the government's desire to revolutionize the country's agricultural sector. For example, between 1983 and 1993 imports of fertilizers (sulphate of ammonia) had averaged USD ten million a year with 1991 and 1992 figures shooting up to USD 23.8 million and USD 16.0 million respectively (Mayagila 1993). Quantitatively, the country's consumption of chemical fertilizers (Nitrogen, Phosphate and Potash) has been progressively increasing, from 35,500 metric tonnes in 1980/81 to 38,927 metric tonnes in 1985/86; and by 1991/92 it had reached 51,665 metric tonnes (FAO, 1992).

The Tanzanian case reflects a general trend over most of the countries in the Third World. The Report of the World Bank on Sub-Saharan Africa (1989) observed that Africa's average use of chemical fertilizer was less than 10 kilograms per hectare compared with about 90 kilograms per hectare in China and India. Inspite of the general low level of fertilizer application, the same report argues forcibly that chemical fertilizers will be in demand as farming systems change and new agricultural technologies and crop varieties are introduced. But the report also warns that with the increase in pests and diseases, pre-harvest losses in Africa would be heavy - ranging from 10% to 80% - a problem which could be mitigated by increasing the demand for pest and crop disease control chemicals much of which has undesirable environmental effects.

The World Bank's report brings to light two important elements:

- That poor and developing countries like Tanzania are more susceptible to chemical pollution as are compelled to adopt new agricultural techniques in order to increase

agricultural productivity, a precondition for achieving food self-sufficiency to enable them cope with their ever increasing populations. The population of Tanzania, for example, is increasing at an average rate of 3.3% annually.

- Improving soil fertility in itself would not be enough; solutions have to be found for equally pressing problems of pre-harvest and even post-harvest losses. Widespread use of pesticides could be the solution for the time being. The alternative,biological pest management techniques, is a solution far beyond the capacities (financial and technological) of most of the Third World countries.

Tanzania, however, lacks an efficient information system(s) on the extent of the damage on the environment being caused by the increased application of chemical fertilizers, pesticides and herbicides. As a result, the awareness of environmental implications of their uncontrolled use is inadequate. If such knowledge is scant, control of the environment becomes very difficult let alone enforcing any legislation in force or the International Conventions to which Tanzania is a signatory.

Ignorance on the part of the farmers is so widespread that most of the peasants are not aware of the health and environmental consequences that could be caused by the chemicals being used in their farms. Given that level of ignorance and a rudimentary health service system, it is not possible for most of the peasants to become aware of the symptoms of the diseases that could be caused by the chemicals directly or indirectly.

There was a case in Tanzania, in 1988, whereby 50 tonnes of mixed up pesticides were stored without any covering against rain. Much of the pesticide was carried away by rainwater and washed towards wells and rivers (Southern African Environmental Issues 1993). In a situation like that the government itself needs to be informed. It has to be furnished with up-

todate information on the health and environmental hazards that could be caused by many, if not most, of the chemicals being used in agriculture. That information could be made available through the establishment of an Information system which utilizes modern technology of data collection, processing, retrieval and dissemination.

The absence of an efficient and effective Information System(s) to support the decision making process related to environmental pollution is due to several factors, such as:

(1) The inability to obtain timely and reliable information on the side effects of various insecticides, pesticides and herbicides being used in agriculture.

(2) Limited capacity of national organizations responsible for environmental issues to exchange information, let alone the regions affected by environmental pollution to readily communicate with each other and even with the Centre.

(3) Problems related to the establishment and maintaining a centralized database on various environmental hazards in the country that could be caused by the application of different fertilizers and other agricultural chemicals.

(4) Difficulty in monitoring potential chemical victims.

(5) Difficulty involved in the sensitization of the peasants and other users of fertilizers and related chemicals on the dangers for failure to take the necessary precautions.

(6) Difficulty in providing efficient information regarding the symptoms or signs and effects of chemical hazards.

(7) Difficulty in providing an efficient multi-user service supporting different user groups (medical doctors, farmers, environmentalists, agricultural and veterinary officers and the public at large) to minimize environmental hazards around them, due to the lack of the use of modern information technology particularly the use

of computer technology for the storage and retrieval of required information.

The factors we have so far enumerated cannot be overcome so easily. Yet attempts could be made to meet the challenges through the application of modern information technology in designing and developing an efficient information system enriched with databases which would support the efforts being made towards conserving, developing and ensuring a sustainable utilization of the soil, vegetation, water, life and the environment in general. The system could further provide invaluable information to the government authorities and non-governmental agents involved in the business of importing and distributing agricultural chemicals. The activities of such authorities and agents could be highly facilitated as the information support system would help them in:

(1) Identifying, registering and maintaining the records of hazardous chemicals used or restricted in the country, or internationally.

(2) Keeping records of harmful chemicals being used in different parts of the country.

(3) Keeping the community aware of the harmful effects the chemicals could cause to the land and their health.

(4) Information exchange between and among organizations and countries that produce or import and use those chemicals.

(5) Provide the required information in order to ensure safe application of the chemicals.

Supporting these activities by computerized information system would make the task more efficient both at policy and technical decision making levels. The objective is to design a computer-aided Information system (to be referred to as the Information Support System on

the Effects of Agrochemicals on the Environment in Tanzania (ISSEAET)). The system would specifically deal with the use of agrochemicals and their effect on the environment in Tanzania. ISSEAET is desirable because the adverse effects of fertilizers and pesticides on the Tanzanian environment is no longer a subject of debate, it has already been established.

Information support systems are generally lacking in many countries in Africa. The situation is worse when it comes to environmental information systems. The problem is so serious that the World Bank (1992) observed, "In many countries, whether industrial or developing, environmental data are often incomplete or site-specific, making it difficult to extrapolate the results for the country as a whole. Yet estimates based on such data are routinely made. Although remote-sensing techniques are improving rapidly, providing scientists with more comprehensive pictures of environmental deterioration on regional and global scales, it is still difficult to get a good understanding of environmental degradation at local or project levels without carrying out extensive and expensive baseline studies on the ground".

If an authority as powerful as the World Bank complains of the lack of adequate information on the environment, thereby demanding incurring much expenses in obtaining the necessary data, then the situation should really be very grave. Therefore, it needs to be attended to without further delay. What the World Bank is pointing at is the absence of Environmental Information Systems (EIS) in many of the countries of the world, including Tanzania. This is, therefore, the justification of the proposal: To design a prototype information support system enriched with databases for the retrieval of required information on environmental hazards caused by agrochemicals in the Tanzanian environment.

1.2 OBJECTIVES

1.2.1 General Objective

The general objective of this study is to design a computer-aided information support system for studies on adverse effects of agrochemicals on the environment in Tanzania that would meet the information needs of the users as identified in the earlier section.

1.2.2 Specific Objectives:

The specific objectives of this study, as derived from the general objective, and they are as follows:

(1) To identify the specific information needs of planners, decision makers, researchers, academicians, extension workers, professionals and the general public on the adverse effects of agrochemicals on the environment.

(2) To identify the existing environmental pollution information support facilities in Tanzania and examine the extent of their use with particular reference to environmental pollution caused by chemical fertilizers and pesticides.

(3) To develop databases on various environmental hazards which could be caused by the application of different chemical fertilizers and pesticides.

(4) To design information services and products that can help to accomplish the following:

- link the user's needs and the sources;
- improve efficiency and effectiveness of current activities undertaken;
- permit additional services which would enhance the effectiveness of existing systems.

(5) To design and develop prototype databases on:

- The profiles of institutions, experts, projects, and environmental information systems;
- Pertinent documentary sources of information on environmental pollution, due to use of chemical fertilizers and pesticides; and
- Profiles of specialized databases on chemical fertilizers and pesticides.

1.3 SCOPE AND LIMITATIONS

1.3.1 Scope

Environmental pollution due to the use of agrochemicals, is a very wide subject. A number of different fertilizers and pesticides are used in Tanzania. For example, there are 370 registered pesticide compounds in Tanzania (Tanzania Government Gazette 1986). However, the study is limited to a few widely used fertilizers and pesticides.

The current study also covers the existing environmental infrastructure in the country. Two institutions dealing with agrochemicals, and environmental pollution in Tanzania are covered. These include the National Environment Management Council (NEMC), and Tropical Pesticide Research Institute. The existing information centres in these institutions are discussed. Types of agrochemical information used or available to the users, and difficulties experienced in getting the needed information are also discussed. The study considers in detail the Information Support System on the Effects of Agrochemicals on the Environment in Tanzania (ISSEAET). It recognizes that pollution due to the use of agrochemicals cannot be considered in isolation but only as part of the total agriculture and environment sectors.

1.3.2 Limitations

Due to lack of an already established Environmental Information System adequately enriched with agrochemical information, it was difficult to get reliable data. Most experts in key position didn't want to give the agrochemical data in their possession. During the interview, officials were careful with their answers and were not ready to be quoted. This led the data collection to rely up on secondary sources.

Identification of different agrochemicals was a problem. During the study, it was revealed that one pesticide ingredient may be used to make many pesticide formulations, and the formulations are usually different from each other. For example, insecticides Diazonon and Cypermethrin are each registered under ten different trade names, and by five different companies for each. Each trade name signifies one specific and unique formulation. Each product is registered separately and independently. As a result, it was difficult to identify chemicals under different groups.

Majority of the users of agrochemicals are illiterate local farmers whose comments and needs could not be included in the study.

Finally there was a time limit for the data collection. Two months was not enough to visit most of the institutions dealing with agrochemicals which are located far apart from each other, to collect all the necessary data. As a result, some of the institutions and experts were not visited.

1.4 ORGANIZATION OF THE THESIS

The thesis is organized into six chapters. The first chapter is Introduction. It gives the statement of the problem, justification, and the general and specific objectives. The second chapter, "Methodology" elaborates on the methods employed in data collection, analysis and

organization. The third chapter is on "Background Information about Tanzania". It gives the context in which the proposed Information system will operate. It gives an overview of the country, relating to its location, land, climate, population, language, economy, and the information policies and acts in the country. The fourth chapter gives details of the effects of Agrochemicals on the environment considering the side effects of both fertilizers and pesticides. Further the existing Environmental Information is analyzed. Chapter five gives the details of the proposed Information Support System on the Effects of Agrochemicals on the Environment in Tanzania (ISSEAET), stating its objectives, functions, structure, mandate, database to be maintained, information products and implementation strategies. The last chapter gives recommendations for further survey, study and research.

CHAPTER 2

METHODOLOGY

2.0 INTRODUCTION

The type of study that has been taken up, can be described as a case of "modified" action research. In this particular case, it consists of:

(1) Formulating the general and specific objectives of the envisaged system;

(2) Designing and developing prototype databases of the system as envisaged;

(3) Operating the system to take note of its performance efficiency and effectiveness;

(4) Evaluating its performance efficiency and effectiveness in the light of its objectives;

(5) Introducing a feed-back mechanism through which the results of evaluation, and the lessons learnt during the carrying out of the project could be feedback into the process.

As a result, the process becomes a dynamic one; and it gets modified in the light of experience till it reaches the optimum level of its performance efficiency and effectiveness. In the process, the appropriateness of the methodology (a system of methods) used to carry out the step-by-step major operations of the study, plays the most vital role. Here lies the significance of "Methodology" in relation to a study of this type. (Materu-Behitsa 1994).

The general objective of this study is to design and develop a computer-aided prototype information support system for studies on adverse effects of agrochemicals on the Environment in Tanzania. "Agrochemicals" primarily include the chemical fertilizers and pesticides used for agricultural products. It was realized from the very beginning that the validity of the conclusions to be derived out of such a study would be directly a function of

the extent, precision, reliability, and validity of the data collected for this purpose. All the necessary steps were taken to ensure these qualities of collected data. But, both time and resources available for this purpose, were limited. So, there is no claim for the absolute comprehension of collected data. But all attempts were made to ensure the adequacy of collected data.

2.1 SAMPLING

For a study of the type as mentioned earlier, in many cases, populations of various categories of entity are to be taken into consideration. Depending upon the size of the population in a particular category, need arises to apply an appropriate sampling technique to satisfy the condition of validity of data collection in terms of the size of the sample. In the case of this study also, need arose to take into consideration the populations of several categories of entity in Tanzania. They are as follows:

(1) The population of users of information on agrochemicals, specially those who are primarily concerned with the adverse effects on the environment due to the use of chemical fertilizers and pesticides, covering the categories of users, such as, decision makers, planners, researchers, administrators, teachers, extension workers, and students;

(2) The population of recognized experts in the specific subject who are usually consulted and referred to for advice in relation to the use of chemical fertilizers and pesticides;

(3) The population of organization and institution which are in any way connected with the use of chemical fertilizers and pesticides;

(4) The population of projects which are in any way related to the use of chemical

fertilizers and pesticides; and

(5) The population of information centres (of any type) which are in any way concerned with information on chemical fertilizers and pesticides.

Each and every category of these populations is confined within the geographical boundary of Tanzania. As a result, the number of identified entities constituting each of the category was found to be limited. So, the use of any appropriate sampling technique was not warranted. All attempts were made to cover the totality of identified entities in each category of population. But, because of some unavoidable circumstances and difficulties, it was not possible to cover the totality of identified entities in each category of population.

2.2 DATA COLLECTION

For the purpose of collecting data for this study the following methods were adopted:

(1) The questionnaire method;

(2) The interview method;

(3) The observation method; and

(4) The method of literature survey.

The following sections are devoted to explain as to how each of these methods was carried out.

2.2.1 Questionnaire Method

The questionnaire method was used for the following purpose:

(1) To ascertain the information needs of the users of information on the use of chemical fertilizers and pesticides in Tanzania; and

(2) To ascertain the pertinent facts about the experts, organizations and institutions, information centres, and projects relating to the use of chemical fertilizers and pesticides in Tanzania for the purpose of preparing profiles for each of these entities in each category to design the databases.

It may be noted here that for the same purposes, one or more appropriate other methods also were used, to the extent necessary, for getting the collected facts confirmed, and also to supplement the already collected information.

Five different sets of questionnaire (Appendix 1(b-f) were designed for five different categories of entities, namely, the users, the experts, the organizations and institutions, the information centres, and the projects. The questionnaires were made available to the appropriate respondents giving sufficient time to fill them. Appointments were fixed with the respondents to collect personally the filled-in questionnaires, according to their respective convenience. Wherever necessary, the respondent was informed that the researcher would like to utilize the opportunity of personal meeting for conducting a short interview; and in the case of an information centre, an observation study. Most of the respondents readily agreed to the proposal. But on several occasions, the personal meeting with the respondents did not materialize at the pre-fixed time because of some inconvenience on the part of the respondent. Besides, in several cases it was found that the questionnaire was not filled-in and the researcher had to get it filled in by herself during the personal meeting with the respondent.

2.2.2 Interview Method

The use of the questionnaire method for collecting data, itself suggests the use of an appropriate additional method, if it is feasible and economically viable, to ensure better

reliability and validity of collected data. Among the additional methods, the interview method is a better supplement for this purpose.

It provides an opportunity for cross-checking the data furnished by respondents in the filled-in questionnaires, and also for seeking further clarification on those wherever warranted. For this study, it was envisaged from the very beginning that the need would arise for seeking clarification in relation to ascertaining the information needs of the users; and also in ascertaining the validity of facts about the information centres. In addition, there was the need for collecting some important item of additional information relevant for carrying out the study, specially for the justification of the proposed computer-aided information support system. For all these reasons, the research-design included the use of the interview method for data collection. To facilitate this operation, appointments were fixed with selected respondents prior to the collection of filled-in questionnaires by explaining the need for the personal meeting.

The important items of additional information that were needed for this study, as mentioned earlier, were the following:

(1) The general views of the identified users of information about the role of information in creating environmental awareness; and in protecting the environment from the adverse effects of the use of chemical fertilizers and pesticides.

(2) The specific views of the identified users of information about the proposed computer-aided information support system specially in terms of its essentiality and feasibility in Tanzania.

(3) The information about the organisations and institutions in Tanzania, (in addition to those already identified), which are responsible for collecting data on the pollution of the environmental in general; and in particular, the data on

adverse effects of using chemical fertilizers and pesticides.

(4) The information about the researches on adverse effects of chemical fertilizers and pesticides in Tanzania.

(5) The information about the production, import, and use of chemical fertilizers and pesticides in Tanzania.

For the purpose of conducting the interviews, an appropriate interview-schedule and interview guideline was designed and used (Appendix 1g). Interviews were conducted among the identified users of information on the use of chemical fertilizers and pesticides. They included primarily a group of selected persons from among the decision makers, planners, administrators, and researchers primarily concerned with chemical fertilizers and pesticides in Tanzania. In addition, the officers in charge of the identified information centres also were interviewed. The group of persons interviewed, was selected from the following organizations and institutions:

(1) The Ministry of Agriculture and Livestock Development, Tanzania;

(2) The Ministry of Natural Resources, Tourism, and Environment, Tanzania. (3) The National Environment Management Council, Tanzania;

(4) The Tropical Pesticide Research Institute (TPRI), Arusha;

(5) The Sokoine University of Agriculture (SUA), Morogoro;

(6) The Ukiriguru Agricultural Training and Research Centre, Mwanza;

(7) The University of Dareesalaam Library, Daresalaam.

2.2.3 Observation Method

The observation method was used primarily for the purpose of being familiar with the professional activities of the identified information centres which were in some way concerned

with the information on chemical fertilizers and pesticides. After being familiar with their respective objectives, functions, and structures, special attention was paid in carrying out an observational study of their respective professional information collection and processing activities along with their associated techniques and tools; and of the information products and services generated and rendered by those centres, respectively. The knowledge acquired by carrying out the observational study proved to be extremely helpful in designing the proposed computer-aided information support system. For the purpose of carrying out the observational study, appointments were fixed with the professionals in charge of those information centres; and the visits to the centres were made on the dates fixed for the purpose. The information professionals in those centres were quite cooperative to help the researcher carry out the observational study. It was carried out in the information centres of the organizations and institutions listed in section 2.2.2.

2.3 LITERATURE SURVEY

This particular study centres round and a very specific area of knowledge. The first component of this area of knowledge is the knowledge about " Agrochemicals". In the context of generalized basic discipline of "Agriculture", "Agrochemicals" for this study comprehends primarily the chemical fertilizers and pesticides. The study is concerned only with their use for agricultural production. Chemical fertilizers are used to enhance soil-fertility; and chemical pesticides are used for preventing and curing the damages, injuries, and diseases caused by pests to agricultural crops. Chemical fertilizers are of various kinds; and they are used for various specific purposes. So also is the case with pesticides. As far as the pests are concerned, their varieties are numerous. Again, the concern of this study, is not only the use of the fertilizers and pesticides, but it is extended to the adverse effects due to their extensive use;

and these effects on the environment, as a whole. Again, the environment consists of several elements. This study is specifically concerned with all the elements of the environment of Tanzania. So, the geographical boundary of Tanzania is a very specific restricting factor for both the use of chemical fertilizers and pesticides, as well as for their adverse effects on the environment. Schematically, this area of knowledge can be specified as follows:

Agriculture

. Soil

..Fertility of-

... Enhancement of-

....(By using) chemical fertilizers

.....Varieties of-

.crops

..Damages and diseases of-

...(caused by) Pests

....Varieties of-

.....Prevention/cure of-

.....(By using) chemical pesticides

.....Varieties of-

The second component of this area of knowledge is the Information Support System (ISS). This is a very specific area within the discipline "Information Science". ISS is a typical production system. Its products are information products and services. The primary concern of this study is to design an ISS for studies in the area as specified in the earlier section. The

ISS for this study is not a manually operated system. But it is a computer operated ISS. This factor adds a new dimension to this area of knowledge; and it calls for integrating appropriate knowledge of applied computer science. Knowledge of ISS, as a production system; comprehends knowledge of its environment, specially of the organizations and institutions to which it is going to be a subsystem. In these, the knowledge about the users of information specially about their information needs forms the foundation of all decisions about the characteristic features of the proposed ISS. In addition it comprehends knowledge about the following:

(1) The infrastructure of the ISS;

(2) The input of the ISS that is, its professional manpower, sources of information (documentary, institutional, and human), machines and equipment (computer hardware and software); and money;

(3) The throughput (process) of ISS, that is, the professional techniques and tools for collection development, and information processing, storage, dissemination, and retrieval; including the extensive use of the computer facilities for all these professional purposes;

(4) The output of ISS that is, the information products and services to be generated by ISS to meet the information needs of the users by using its computer facilities;

(5) The marketing subsystem of ISS, that is, the mechanism to pursue its users to accept the products and services of the ISS, and continue to use it in the future; and

(6) The feedback subsystem of the ISS that is the mechanism to receive the reactions of its users in relation to its products and services.

For designing the proposed computer-aided ISS, it was essential to acquire updated knowledge of all the facet, as outlined in the earlier sections. The effective means available

for this purpose was to carry out an extensive " Literature survey". The documentary sources of information consulted and used for this purpose are listed in the " Bibliography" linking the sources to their respective references in the text. Still, some of the specialized categories of sources of information which proved to be of great importance for this study are listed below:

- A Report of a Study Conducted by the Journalist Environmental Association of Tanzania (JET 1994).
- Annual Ministerial Reports and Budget Speeches from the Ministries of Agriculture and Livestock Development, and Natural Resources, Tourism and Environment.
- Reports from international organisations like the World Bank, United Nations, Food and Agricultural Organization (FAO).

The following two individual publications served as sources of very specific information about pesticides:

- Bull, David. 1982. A growing Problem: Pesticides and the Third World. Oxfarm.
- Ak'habuhaya, J., and Lodenius, M., 1988. Pesticides in Tanzania. Publication of the Department of environmental conservation at University of Helsinki. No.10.Helsinki.

The method of literature survey was used to collect relevant pieces of information from different documentary sources. But, for the purpose using those pieces of information in relevant chapters, the technique of "Information Analysis and consolidation" (IA+C) was used.

2.4 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 (SISA);

(2) The micro CDS/ISIS software for the creation of the databases;

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

(4) SISA interface (Molla 1993)

CHAPTER 3

BACKGROUND INFORMATION ABOUT TANZANIA

3.0 THE COUNTRY

The United Republic of Tanzania (hereafter referred to only as Tanzania) was formed in 1964 when two sovereign states of Tanganyika and Zanzibar united to form the Republic. Tanzania lies on the east coast of Africa between longitudes 29 degree east and 41 degree east and latitudes 1 degree south and 12 degree south. The country shares borders with Kenya and Uganda to the north; Burundi, Rwanda and Zaire to the west; and Malawi, Mozambique and Zambia to the south. To the east of the country lies the Indian Ocean.

3.1 LAND

The country has a total area of 945,000 square kilometres. It has three main zones: (1) The islands of Zanzibar, Mafia and the coastal zone with 804 km of Indian Ocean coastline; (2) the highland plateau which rises about 1000m above sea level, and it consists largely of deciduous forests, savannah grass and dry scrubland; and (3) The lake basin which is renowned for its three major lakes (Lake Victoria, Lake Tanganyika and Lake Nyasa). Lake Victoria lies to the north west of the country and its waters are shared between Tanzania, Kenya and Uganda. Lake Tanganyika is on the west of the country within the western drift of the great rift valley. Its waters are shared between four countries, Tanzania, Burundi, Zambia and Zaire. While lake Nyasa is in the south west of the country within the eastern drift of the great rift valley, its waters are shared among three countries: Tanzania, Malawi and Mozambique. Apart from the great lakes, Tanzania is also a land of Kilimanjaro, the snow capped mountain near its northern border with Kenya. The Kilimanjaro is the highest

mountain in Africa rising to 5,895m. Other volcanic mountains include Meru (4567m), situated about 100km west of Kilimanjaro; and Mount Rungwe (2,963m) situated in the south west of the country.

There are many rivers in the country; the main ones draining into the Indian ocean; and others drain into the three major lakes mentioned above.

3.2 CLIMATE

Tanzania enjoys varied climatic conditions. The coastal areas are hot and humid. As one moves inland, the climate changes into a moderate tropical one, with average temperature of about 26 degree centigrade. There is relatively little variation between the hottest month (usually February) and the coldest (July and August).

Rainfall is also varied. The south-eastern slopes of the great volcanic mountains are considered to be the wettest areas with an annual average rainfall of over 1250 mm. The central areas usually receive under 1250 mm of rain; while the coastal area has an average rainfall between 500 and 1000 mm. Although the rainfall is variable from one year to the next, more than one fifth of the country receive over 750 mm. a year.

3.3 POPULATION

In 1990, it was estimated that Tanzania had a population of 26.04 million people. The average annual population increase is 3.3%, considered to be one of the highest in Africa. It is estimated that by the year 2000 the population will reach 36.03 million (UNIDO 1992). The majority of the economically active Tanzanians live in rural areas; while 19% of the estimated population live in towns (Table No.1 and 2).

TABLE 1

ECONOMICALLY ACTIVE POPULATION BY SEX

(FIGURES IN '000s)

Population	1981	1985
Both sexes	9292	10272
Males	4680	5247
Females	4612	5025

Source: ECA 1987 Survey of Economic and Social Conditions in Africa, 1985 - 1986.

3.5 LANGUAGE

Tanzania is a multiethnic and multiracial country. There are approximately 120 different ethnic groups, each with its own dialect and culture. But none could claim to account for more than one tenth of the population. There are also small communities of Asians, Arabs and Europeans, but they constitute less than 0.3 per cent of the total population. It is believed that the unifying force of Kiswahili as a National language, as well as good policies pursued since independence, have been instrumental for the promotion of national unity and in defusing the problem of ethnicity which appears to be serious in many African countries.

TABLE 2

ECONOMICALLY ACTIVE POPULATION: SECTORAL DISTRIBUTION

(PERCENT)

Population Sector	Males		Females	
	1981	1985	1981	1985
Agriculture	78.8	76.5	91.6	90.3
Industry	7.4	7.5	1.6	1.2
Services	13.8	16.1	6.9	8.6

Source : ECA 1987. Survey of Economic and Social Conditions in Africa, 1985- 1986

Kiswahili as a national language is universally spoken. English is used both as a medium of instruction at secondary and higher levels of education and as commercial language with foreigners.

3.5 EDUCATION

From the 16th century to date, the education system in Tanzania has gone through a series of changes due to administrative and political changes that have taken place. The indigenous education was first influenced by Arab and Christian missionaries; and then by the Germans, the British; and finally, after the independence of the country in 1961, by the Arusha Declaration in 1967 introducing a major reform: Education for Self Reliance (ESR). These influences, even today, can be traced in the education policy formulation and implementation.

Education and training in Tanzania is undertaken by all ministries; but the main ones for

general formal and non-formal education, is undertaken by the ministries of Education and Culture, Technology and Higher Education, and the Prime ministers Office (Department of Regional Administration and local Government). The other ministries are involved in sector-specific professional education and training. In addition, formal and non-formal education is provided by communities, non-government organisations (NGOs) and individuals under the coordination of the central government ministries.

There are three channels constituting the education and training system. These include the formal, vocational and professional, and non-formal channels. The formal education system is predominantly academic, ranging from pre-primary to university level. It takes 18 years with the structure being 2-7-4-2-3+. Pre primary education takes two years at the age of 5-6 years. The seven year primary education cycle that follows is compulsory in enrolment and attendance. At the end of this cycle, pupils can go for secondary education, or they may go for vocational training.

Secondary school education is subdivided into ordinary level (Form 1-4) and Advanced Level (Form 5-6). Students who complete ordinary level secondary education can go for the next stages of advanced level secondary education, or for vocational training, or for professional training. Those who complete advanced level secondary education, may join the tertiary and higher levels of education and training.

Tertiary and higher levels of education and training provide education and training in specific skills and professions. Tertiary institutions operate under various ministries, and public and private organisations. They have their own management and administrative structures, and legal stati. The course duration in these institutions is usually between two and three years. University education and training is at the apex of the system; and it offers degrees as symbols of academic and/ or professional achievements.

3.7 HEALTH

Health services in Tanzania are provided by the government, parastatal organisations, voluntary agencies and private institutions. The voluntary agencies provide about 30-40% of health services; and most of their health institutions are located in rural areas. Private institutions play an important role, especially in urban areas, by providing mostly curative services. Sometimes they provide preventive and promotive service also. Traditional healers and Traditional Birth Attendants (TBA) also provide considerable health care in Tanzania.

Health services in Tanzania are provided through a number of complementary institutions. These institutions include the rural dispensaries, health centres, district/regional hospitals and referred to consultant hospitals. The rural dispensaries are staffed by a rural medical aid (RMA) with one or two helpers. The major function of the rural dispensary is to offer curative and preventive services. It also performs the screening of more complicated cases for referring those to health centres. The Health Centres give priority to preventive measures and hygiene. Besides, health centres are extremely used for treatment of common diseases. Above the health centres, there are the district hospitals. It is to the district hospitals where all the difficult and serious cases are referred to. Generally there is one district hospital per administrative district. The regional hospitals are in most cases, similar to the district hospitals; but they are larger, and have more facilities. Besides, they are well staffed. At the top of the system are the sophisticated consultant hospitals. At present, Tanzania has five such consultant hospitals that serve the whole country.

Tanzania, like many other developing countries, has her mission to provide health services to all of her people by the year 2000. The Government of Tanzania through the Ministry of Health evolved a long term plan (1980 - 2000) with the objectives of raising the average life expectancy at birth to 55% - 60% by the year 2000 by reducing the infant

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mortality rate to 50/1000. In addition, it aims to provide Public Health Centres to every village so as to enable every village govern its own health services. It is hoped that by the year 2000 each village should have at least two village health workers. Other objectives of the (1980 - 2000) plan is to develop an appropriate Health Information System (HIS) in the country.

3.7 GOVERNMENT

As previously stated, the United Republic of Tanzania was formed in 1964 by the union of Tanganyika and Zanzibar. In 1965, after a National referendum, Tanzania was officially declared as a one party state whereby TANU (Tanganyika African National Union) was the only legal party on Tanzania mainland (ie. the former Tanganyika); whereas AFRO-SHIRAZ party was the only legal party in Zanzibar. This state of affairs continued up to 1977 when it was decided to merge the two parties; and to form one party under the name CHAMA CHA MAPINDUZI (CCM). In 1990, the political landscape of Tanzania started to change by the introduction of a constitutionally granted multiparty system. The first multiparty election to choose the president, vice president and members of the legislature is expected to take place in October, 1995. Since independence, Tanzania has maintained a tradition of regular general elections after every five years.

Administratively the country is divided into regions, districts, divisions, wards and villages/streets. The country has a parliamentary system of government but with an executive President who is elected every five years. In 1984, the constitution was amended to limit the eligibility of the President to a maximum of two consecutive terms of five years each.

3.8 THE ECONOMY

According to the World Bank, the economy of Tanzania has been declining in recent years. The decline has been estimated to be 1.6% per year from 1980 to 1989. The Gross National Product (GNP) in 1986/87 was estimated to be 120 USD per capita (World Bank 1990). Tanzania's economy, like most developing country's, is agriculture-based with some contribution from the industrial sector.

3.8.1 Agricultural Sector

Tanzania's agriculture is primarily based on peasants' small scale holdings. The agricultural sector generates about 60% of its gross domestic product (GDP), (UNIDO 1992). Approximately 80% of the population depends directly on agriculture and related activities like fisheries.

The main form of agriculture is crop husbandry, accounting for 80% of agricultural production. Animal husbandry accounts for further 15%; fisheries for about 5%; and forestry for less than 1%.

Only 5.5% of Tanzania's land area is arable for permanent crops. Some 90% of that area is under small farm holders, most of whom live in 8200 villages that were formed in the 1970s. They contribute over 75% of agricultural earnings, and produce more than 80% of cereals. The average small holding is under two hectares. The soil is generally tilled by traditional methods. Mechanization and the use of commercial fertilizers are increasing particularly on the larger holdings (UNIDO 1992).

The overall performance of agricultural sector has been inadequate. For example, in the post 1970/71 period, food production registered a low growth rate of 2.9 percent which was below the population growth of 3.3 percent annually. In addition, Tanzania changed from a

1970/71 position of a net exporter to a net importer. In terms of foreign exchange generation, the real value of Tanzania's agricultural exports in 1980 was less than 60% of the 1977 peak (Ministry of Agriculture 1982).

There are a number of reasons to account for the dismal performance of the agricultural sector even though it is considered to be the "backbone" of the Tanzanian economy. A number of reasons have been cited by the Ministry of Agriculture (1982); and they are as follows:

(1) Policy problems (e.g. The nationalization of some of the private, commercial estates/farms, the mobilization of peasants into villages where collective production was encouraged, and establishment of state and parastatal farms);

(2) Unpredictable weather conditions;

(3) Lack of appropriate technical packages due to inadequate research;

(4) Inadequate and untimely supply of inputs;

(5) Disorganised marketing system;

(6) Large post-harvest losses due to inadequate storage facilities at all levels;

(7) Unattractive producer prices; and

(8) Poor pest and disease control methods.

Apart from the above, the central government's budgetary allocation to this important sector has been falling over the years. For example, in 1981/82 the allocation was roughly halved compared to what was given in the year 1976/77. This is shown in Table 3.

TABLE 3

BUDGETARY ALLOCATION FOR MINISTRY OF AGRICULTURE 1976/77 TO 1980/81 IN (TSHS'000,000)

Budget allocation	76/77	77/78	78/79	79/80	80/81	81/82
Agriculture (a)	500	420	580	530	590	523
All ministries(b)	3397	4086	5885	6864	6307	5883
Percentage a/b	14.7	10.2	9.8	7.7	9.3	8.9

SOURCE: MINISTRY OF AGRICULTURE: BUDGET SPEECH 1982/83.

Agriculture shall continue to play a significant role in Tanzania's economy. The agricultural sector has therefore to be transformed qualitatively to be able to meet the challenges of feeding the population which continues to increase at a very high rate. It should generate enough surplus for export as well as for industrial use. But Tanzania's agriculture is based on small scale family holdings, averaging 2 hectares. Intensive farming would therefore be the most logical way to make the land produce more. The need for using improved seeds, fertilizers and pesticides to sustain and increase production of both food and cash crops has been felt for a long time in the history of Tanzania. In 1973/74 and 1974/75, the government went to the extent of embarking on free distribution of fertilizers and other agricultural inputs (Ministry of Agriculture 1982). The government has therefore been taking deliberate measures to mobilize the population in adopting modern farming techniques for improved and better yields. Table 4 shows the amount of various fertilizers distributed in the country between 1973 and 1982.

The use of fertilizers has become popular among the peasants, especially among the producers of cash crops like cotton, coffee, tobacco, pyrethrum, tea, cashewnuts and sisal.

Even producers of staple food have started using fertilizers for better yields. By 1992, the requirement reached the level of 272,600 tons (Ministry of Agriculture 1992).

Insect pests can cause significant crop losses and they are often a major threat to agriculture in Tanzania. Estimated losses of potential crop yield in different continents can be seen in Table 5 .

TABLE 4

AMOUNT OF VARIOUS FERTILIZERS DISTRIBUTED IN THE COUNTRY SINCE 1973 (IN TONS).

YEAR	AMOUNT
1973	6,370
1974	82,570
1975	93,565
1976	70,357
1977	84,817
1978	82,274
1979	93,704
1980	108,091
1981	96,570
1982	81,910

SOURCE: MINISTRY OF AGRICULTURE: BUDGET SPEECH 1982/83.

TABLE 5
REGIONAL CROP LOSSES (%) CAUSED BY PESTS

	Losses caused by			
Region	Insects	Diseases	Weeds	Total
Europe	5	13	7	25
North and Central America	9	11	8	28
South America	10	15	8	33
Africa	13	13	16	42
Asia	21	11	11	43

Source: Akhabuhaya 1988. Pesticides in Tanzania.

According to Akhabuhaya (1988) in Tanzania the stem borer (Busseola fusca) can reduce maize and sorghum yields by 10-20%. Losses due to the army worm spodoptera exempta in Tanzania in the 1978/80 season were estimated to about 14,900 tons of maize. The sugarcane Whitwgrub (Cochliotis melolonthoides) has reduced potential sugarcane yields of 110-195 tons of plant per hectare to less than 24 tons of tons in Tanzania. Cassava mealybug (Phenacoccus manihoti) causes losses ranging from 30 to 80% of total cassava yield.

Great losses are caused also to post-harvest crops by stored products pests. There are estimations that these losses may be even 30% (Ak'habuhaya 1988). The use of pesticides is being encouraged by the government. The amount of pesticides used in the country is shown in table 6.

TABLE 6
PESTICIDES USED, 1991-1993 (In '000's)

	1991/92		1992/93	
	Liquids (Lts)	Dusts (Tons)	Liquids (Lts)	Dusts (Tons)
Insecticides	5,473.6	222.2	6,526.651	351.35
Herbicides	2,831.3	4,393.033	11,220.12	4,393.050
Fungicides	2,491.6	5. 2	1,968.39	4.04

SOURCE: MINISTRY OF AGRICULTURE: BUDGET SPEECH 1992/93.

Starting from the mid 1980s, there has been a policy change. The country has slowly and consistently shed off the socialist command economic policies; and it has adopted the liberal and flexible free-market economic policies. The changes have started to bear some fruits even

though the performance of the agricultural sector is still below in relation to the country's available resources. In the 1991/92 farming season, there were mixed results. The production of food grains registered a deficit of 327,000 tons; the production of cash crops was relatively better and encouraging. For example, cotton increased from 2777,000 bales in 1990/91 to 5000,270 bales in 1991/92; and during the same period, cashewnuts increased from 28,000 tons to 42,425 tons and tea from 15,889 tons to 19,700 tons. There was however no change in the production of coffee, and it remained 49,000 tons during the same period. (Abdallah 1992). Given the correct policy orientations and the government's mobilization of the peasants for adopting modern agricultural techniques, including among others the use of fertilizers and pesticides, the performance of the agricultural sector could improve dramatically

3.8.2 The Manufacturing sector

The manufacturing sector is very small, generating about 8% of Gross Domestic Products (GDP). More than two thirds of its output comes from the major consumer goods industries like food, beverages, tobacco, textiles, garments and shoes (UNIDO 1992).

Economic experts argue that Tanzania's economic performance and growth have not been commensurate with the country's economic potential. The mineral sector, for example, is virtually lying idle contributing less than 1% to GNP despite the availability of substantial deposits of iron ore (85 million metric tons of proven reserves per annum), coal (324 million tons), gold reef (0.8 tons), diamond (2.5 million tons), nickel (40.5 million tons), and soda ash (1.0 million tons) (UNIDO 1992).

3.9 INFORMATION POLICIES AND ACTS IN TANZANIA: AN OVERVIEW

Most of the information systems existing in Tanzania today have been established by acts of parliaments. Among the most conspicuous of these is the Tanzania Library Services Board (TLSB) Act 1975.

This act gave TLSB the responsibilities, to establish, equip, manage, control, and to coordinate all types of libraries in the United Republic of Tanzania. The act did not only give the Board the responsibility of controlling and coordinating the libraries, but also entrusted with the documentation services, training of librarians, promotion and development of indigenous literature and other allied functions in relation to libraries and documentation centres.In 1976, the Act establishing the Tanzania Industrial Studies and Consulting Organization (TISCO) empowered this organization "to coordinate research in industry carried out within the United Republic and establish a system of Documentation in respect to information relating to industrial research or studies furnished to or otherwise acquired by the organization" (section 5(f)).

In another development, an act, passed in 1979 in order to establish the Tanzania Industrial Research and Development Organization, empowered this organization "to establish and operate a system of documentation and dissemination of information on any aspect of applied research carried out by or on behalf of the organization"(section 4(f)).

In 1985, Tanzania Library Services Board, in collaboration with UNESCO organized a Conference on Resource Sharing in Southern and Central Africa Region in Dar es salaam. The Conference drew together for discussions, senior library and information personnel from Southern and Central Africa. The theme of the conference was resource-sharing. However, the issue of formulation of information policy arose again during a workshop on Training of Library, Documentation and Archives personnel, held in Dar es salaam, in 1988. The

workshop recommended to the government, among other things, the need for a national information policy to facilitate the coordination of libraries, archives and documentation centres. The Workshop further recommended the need to find ways of serving the information users more effectively.

In February 1989, a National Seminar on the Establishment of a National Information and Documentation Network in Tanzania was held in Dar es salaam. Participants were drawn from Tanzanian libraries, archives, documentation centres, mass media and computer experts. Other Tanzanian participants included officials from the Ministry of Education, Finance and Planning, Economic Affairs, The Treasury, Ministry of Labour and Manpower Development, The National Commission for Science and Technology and the Central Bank. External participants came from Kenya, Uganda, Somalia, Zimbabwe, United Kingdom, Jamaica and UNECA-PADIS. The key resource person came from Jamaica's National Council on Libraries, Archives and Documentation Services (NACOLADS). The objectives of the seminar were:

(1) To assist in the formulation of a National Information Policy embracing archives, libraries and documentation centres;

(2) To help in the setting up and improvement of the National Information System;

(3) To make preparation for the establishment of the National Information and Documentation Network in Tanzania;

(4) To impress upon administrators and financiers on importance of information in decision making and planning process;

(5) To assist in determining types and kinds of personnel training needs required by information, library and archives professions in Tanzania; and

(6) To attempt to bring together archives, libraries and documentation centres so as to ensure efficient resource-sharing of information in the country.

The Jamaican experience of NACOLADS was considered as a suitable example, applicable to the Tanzanian situation. However one conspicuous gap in the proceedings of this seminar was the absence of a paper on information policy. Although a number of papers mentioned about the need for an information policy, none of them tackled on the exact methodology for formulation of a national policy.

In 1991, Sekimang'a conducted a study of the existing information infrastructure in Tanzania, and a National Information Policy on information systems and services in Tanzania was proposed (Sekimang'a 1992). Later, in 1993, the task force to review the National Science and Technology Policy of 1985 was formed by the Ministry of Science, Technology and Higher Education. The report emphasised on the use and establishment of information infrastructure in the country, but it did not discuss the issue in detail. At the moment, the proposed Information policy by Sekimang'a, in 1992, is the most comprehensive and authoritative document on Tanzania for it provides for all other sectoral information systems.

The aforementioned discussions show that both the government and the information professionals as well as some International agencies are deeply concerned with the development of library and information systems and services in Tanzania. The progress is slow for several reasons, but the awareness of the need for establishing a national policy and thereby improving the existing state of information systems, networks and services, by making use of appropriate information technology, is already evident.

CHAPTER 4

EFFECTS OF AGROCHEMICALS ON THE ENVIRONMENT OF TANZANIA

4.0 INTRODUCTION

The term 'Agrochemicals' has been used here as a generic term comprehending fertilizers and pesticides developed artificially for agricultural use. Agrochemicals are being used world wide by farmers for the purpose of improving and/or increasing the quality and quantity of crop output. In their use, it is only their beneficial effects that have been taken into consideration for a long time. But, that they can also have adverse effects especially on the environment have been recently recognised. For the purpose of this study, largely the commonly used chemical fertilizers and pesticides have been taken into consideration especially from the point of view of their adverse effects on the environment. It is now commonly acknowledged that there is a definite correlation between excessive uses of agrochemicals and environmental degradation. The study has been kept confined within the geographical boundary of Tanzania.

4.1 FERTILIZERS

Fertilizers are defined as chemicals or natural substances spread and mixed with soil so as to make it richer and stimulate plant growth (Reijnttes et al 1992). Farmers today are interested in incorporating certain components of modern agricultural technology into their farming systems if they have the means and opportunity to do so. Fertilizers are used for improving the mineral nutrition of plants. Fertilizers may be of the following varieties:

(1) Organic fertilizers. These are usually the manures and waste materials. They provide small amounts of growth elements; and also serve as conditioners for the soil.

(2) Inorganic fertilizers. Ammonium phosphate, and potassium nitrate are examples of inorganic fertilizers.

(3) Natural fertilizers. Naturally occurring substances, such as, Chilean sodium nitrate, and calcium sulphate are examples of natural fertilizers.

(4) Simple mixed fertilizers. This refers to a simple mixture of two or more fertilizers.

(5) Complete fertilizers. A balanced mixture of nitrogenous, potassium, and phosphorus fertilizers is normally referred to as complete fertilizers.

Most of the inorganic fertilizers are commonly known as commercial fertilizers. They are used to supply one or more of the three major elements, namely, Nitrogen (N), Phosphorus (P) and Potassium (K) in suitable chemical form. They are marketed in both dry and liquid forms. Dry forms include powdered, granulated and pelleted forms. Liquid forms are obtained in high pressure, and low- or non-pressure forms. Mixed fertilizers in solutions are usually non-pressure liquids.

There are various methods in which fertilizers are applied. The choice of the method depends upon such factors as: (1) the kind of the crop and the stage of its growth; (2) application rates; (3) physical and chemical properties of the fertilizer; and (4) the type of the soil.

There are two basic application-methods that are usually used. One of them is known as the bulk spreading. In this method, fertilizers are spread over the entire area by using large machines which cover many acres in a short time. The other one is known as precision placement. In this method, fertilizers are applied in a definite relationship to the seeds or plants. This method requires more equipment and time; but usually, smaller amounts of

fertilizers are needed to produce a given increase of yields.

Apart from the types of fertilizers mentioned above, there are other substances known as micronutrients. These occur as impurities in fertilizer-grade chemicals. The supply of micronutrients is not yet a very significant activity in the fertilizer industry. Although such nutrients are essential materials; but, natural supplies in the soil are adequate in most instances. The principal micronutrients include, zinc, boron, iron, manganese, and copper.

4.1.1 Use of Fertilizers: Historical Background

The use of fertilizers dates back to early thirteenth century. Among the materials first utilized by man for fertilizers were animal manures, bones, wood ashes, wool wastes, guano, fish, chalk, and marl. The Celts and other European people are known to have used chalk, marl, wood ashes, and compost, some hundreds of years before Christ. In America, the first white settlers found that the South American Indians used fish for fertilizing purposes. Nevertheless, the extensive employment of fertilizing materials have become common only during the last 100 years. However, chemical salts which contain plant nutrients were not generally used as fertilizers until during the last 90 years. (Collins 1962). As already pointed out in Chapter 1, artificial fertilizers gained accelerated use after the World War II.

Indeed, there are many types of fertilizer with different effects on the environment. It is possible to study the effect of each type on the environment. The major types include nitrogenous, potassium, phosphorus, and mixed fertilizers.

4.1.1.1 Nitrogenous Fertilizers

Nitrogenous fertilizers, formerly called ammoniates, may be classified into two groups, such as,(1) the organic nitrogenous fertilizers; and (2) the inorganic or mineral nitrogenous

fertilizers. The organic nitrogenous fertilizers, with the exception of urea, and calcium cyanamide, are derived from animal and plant sources. The mineral forms are derived from inorganic sources. The two synthetic compounds, urea and calcium cyanamide, are classified by chemists as organic compounds. But, many agronomists think that on account of their high solubility they should be grouped with the inorganic nitrogenous materials. The mineral nitrogenous fertilizers are readily soluble in water; whereas, the organic nitrogenous fertilizers, with the exception of urea and calcium cyanamide are not. The percentage of the nitrogen-content of various nitrogenous fertilizers is shown in Table 7.

TABLE 7

NITROGEN-CONTENTS OF N-FERTILIZERS

N-FERTILIZERS	NITROGEN CONTENT (in %)
Urea	45-46
Ammonium nitrate	33.5
Complex fertilizers	varies
Anhydrous ammonia (used as such)	82
Ammoniated superphosphate	varies
Ammonium Sulphate	20.5
Nitrogen solutions (used as such)	varies
Calcium nitrate	15.5
Sodium nitrate	16
Ammonium sulphate nitrate	varies
Calcium cyanide	28
Ammonium phosphate	varies
Other nitrogen fertilizers	varies

Source: Collins G.H. (1962) Commercial Fertilizers.

4.1.1.2 Phosphate Fertilizers

The term 'Phosphate' is applied to fertilizers that contain phosphorus. The world consumption of phosphate fertilizers is not as large as that of nitrogenous fertilizers. The principal phosphate fertilizers, and the percentage of their respective phosphate-content are listed in Table 8.

TABLE 8

PHOSPHATE-CONTENTS OF P-FERTILIZERS.

MATERIAL	PHOSPHATE CONTENT (in %)
Ordinary superphosphate	16-22
Concentrated phosphate	44-47
Complex fertilizers	varies
Basic slag	17.5
Ground phosphate rock	varies
Ammonium phosphate	20-46
Other phosphate fertilizers	varies

Source: Collins, G.H.(1962). Commercial Fertilizers.

4.1.1.3 Potassium Fertilizers

The element potassium is widely distributed in nature. It occurs in rocks, soils, and in saline residues of salt lakes; as well as in the water of oceans, lakes, and rivers; and in the tissue of plants, and animals. The principal potash ore, supplies more than 90% of the world total, as potassium chloride.

4.1.1.4 Mixed Fertilizers

These are the fertilizers that contain Nitrogen (N), Potassium (K) and Phosphorus (P). They are commercial fertilizers, designed mainly to supply one or more of the three major elements mentioned above, in a suitable chemical form. The fertilizers are graded in the order, N-P-K; and the number for each component indicates the percentage of the total weight of each of the three components. Mixed fertilizers are mainly convenient for the farmer since his soils need nutrients in certain proportions.

A mixed fertilizer may be simply a mechanical mixture; or the constituent materials may be reacted to form a "chemical" mixture. In early days of the industry, the mechanical mixture

was the prevalent type; today chemically reacted products occupy an important place in the industry. The chemically mixed fertilizers usually are made by processes involving ammoniation of some of the combinations of phosphoric acid, sulfuric acid and superphosphates.

4.1.2 Effects of Fertilizers on the Environment

Farmers, world wide, have been using fertilizers for many years for their fast effects on the soil so as to increase or maintain plant yields. It is during the recent years, that farmers and scientists in general, have come to realize their adverse effects on the environment. Generally, the adverse effects of fertilizers on the environment manifests in several ways. For example, they affect the soil; they cause depletion of micronutrients; they release nitrous oxide to the atmosphere, they cause the depletion of the ozone layer; and they cause water pollution.

With regard to the disturbance to the soil life and soil balance, artificial fertilizers increase the decomposition of organic matters, leading to the degradation of soil structure, high vulnerability to drought, and lower effectiveness in its productivity. Imbalanced application of acidifying minerals, usually present in N-fertilizers, may also decrease soil pH; and lower the availability of phosphorus to plants. All these factors have adverse effects on living organisms in the soil.

The continuous use of only artificial nitrogenous- phosphate and potassium (NPK) fertilizers leads to depletion of micronutrients in the soil, such as, zinc, iron, copper, manganese, magnesium, molybdenum, and boron. This phenomenon may become responsible for affecting directly the health of plants; and indirectly the health of animals, and human beings. The reason being that these micronutrients are not replaced by NPK-fertilizers. As a result, production eventually declines; and the occurrence of pests and diseases increases.

The use of nitrogenous chemical fertilizers in developed and developing countries, contributes to global risks arising from their releasing of nitrous oxide to the atmosphere and above. In the atmosphere, nitrous oxide depletes the ozone layer. Besides, by absorbing certain wavelengths of infra-red light, it increases global temperatures (green house effect); and destabilises the climate. This could lead to changes in weather patterns; and rise in the sea level. The ultimate result is the increase of risks for agricultural production. A rise in the sea level would have grave consequences for low lying delta and estuarine regions. In view of these dangers, worldwide restrictions on the use of N- fertilizers in future cannot be ruled out. Therefore, greater effort is needed to promote more efficient and less polluting use of N-fertilizers. Besides, it is essential to use more of alternative sources of nitrogen. For example, crop wastes, animal and green manures, legumes in rotations, tree crops and blue-green algae, and nitrogen-fixing bacteria in rice paddies are all safe alternative sources of nitrogen

The use of excessive amount of potassium leads to poor fertility in dairy cows grazing intensively in fertilized pastures. High levels of nitrate in grass are suspected of causing liver damage in cows (Collin 1988).

Nitrogen fertilizers cause water pollution. Normally, all the chemicals are not taken up by plants, and the excess is leached out of the soil into streams, rivers, lakes, seas, and oceans. This may cause algal bloom. When they die the bacteria that consume them use so much oxygen in the water that it lessens oxygen supply for other organisms like fish which may die as a result. A good example is the extent of pollution of Lake Victoria, in North-Western Tanzania. The lake is now considered to be highly polluted to the extent that in some areas, the people living around the lake are discouraged from using its water for drinking purpose. Cases of fish dying from undiagnosed causes have also been reported in the news media. Recently the lake has been infested with the water hyacinth which threatens marine navigation

and life. It is suggested that proliferation of weeds has been encouraged by sewage disposal into the lake from neighbouring towns and industries of Tanzania, Kenya and Uganda (Daily News, February 23 1995). This could be one side of the story. But Lake Victoria basin is famous for the production of maize, coffee, cotton, banana and even sugar-cane on the Kenyan and Ugandan sides. The production of these crops rely heavily on the application of chemical fertilizers and pesticides. Studies done to analyze the water of the lake by Stephens (1987) found various residues of chemical fertilizers and pesticides.

4.2 PESTICIDES

We should also examine the adverse effects of pesticides on the environment. We may begin by providing a working definition of pesticides. Then we may examine the historical background of their use, before analysing their effects on the environment.

Pesticides are defined as chemical or natural substances that control pest populations mainly by killing the pest organisms be they insects, disease causing organisms, weeds, or animals (Coen Reijnttes 1992).

Bull (1982) defines a pest as an organism having an undesirable effect on crops, livestock, or health of an animal; or plant, living where people would prefer it not to live; at least in such large numbers. Pesticides not only kill pests; but most of them are capable of killing other plants or insects or even human beings when given in excessive dosages.

Pesticides can be categorized in two main ways. In one way, by the type of the pest upon which they are designed to act. In the other way, by their chemical make up. Thus, the former category includes insecticides for insects, herbicides for weeds, fungicides for plant diseases caused by fungi. The later category includes organochlorines (DDT, endrin, dieldrin and BHC also known as HCH), diazonon, dimethocite, carbamates (carbofuran, aldicarb,

carbonyl etc.), and pyrethroids.

4.2.1 **Use of Pesticides: Historical Background**

Pesticides, like fertilizers, have been used for many years. The ancient Romans were known to have used burning sulfur to control insects. They were also known to have used salt to keep weeds under control. The ninth century chinese used arsenic mixed with water to control insects. Early in the 1800's, pyrethrin and rotenone were discovered to be useful as insecticides for control of many different insect species. Paris green, a mixture of copper and arsenic, was discovered in 1865; and subsequently used to control the Colorado potato beetle. In 1882, a fungicide known as Bordeaux mixture, made from a mixture of lime and copper sulfate, was discovered to be useful as a fungicide for the control of downy mildew in grapes. Mercury dust was developed in 1890 as a substance for seed treatment; and subsequently, in 1915, liquid mercury was developed as a substance for seed treatment to protect seeds from fungus diseases. (Bohmont 1983).

The first synthetic organic insecticides and herbicides were discovered and produced in early 1900's. This was followed by the subsequent discovery and production of hundreds of synthetic, organic pesticides, starting in the 1940's. Organic phosphates began to be commercially produced during the 1950's. In the late 1950's carbamates were developed; and they included insecticides, herbicides, and fungicides. The 1960's saw a trend toward the development of specific and specialized pesticides. They included systemic materials; and "prescription" type of pesticides. Presently, there are over 900 active pesticide chemicals, being formulated into over 40,000 commercial preparations (Bohmont 1983). The use of pesticides is world wide; and its market is growing in both volume and value. Between 1972 and 1982, the market grew in real terms by annual average growth rate of 5%. The use of

Pesticides grew from 1,900 million kgs (4,100 million pounds) in 1976, to 2,300 million kgs (5,000 million pounds) by 1985.

In the third world, imports of pesticides grew at an average rate of 15% a year between 1974 and 1977. The average pesticide use in the third World is nearly 100 grams (3.5 oz) per annum for every person. This amount is considerably less than that in the rich countries. (Bohmont 1983)

As noted in Chapter I, Tanzania imports and formulates many types of cheap pesticides; the major categories being insecticides, fungicides and herbicides. In July, 1986, in Tanzania, there were 370 registered pesticide-products, formulated from about 165 pesticide compounds (Tanzania Government Gazette, 1986). One technical material may be used to make many pesticide formulations; and the formulations are usually physically and chemically different from each other. For example, each of the insecticides, such as, diazinon and cypermethrin, are registered under 10 different trade names. And each product is being manufactured by at least five different companies. Each trade name signifies one specific and unique formulation. Each product is registered separately and independently. The choice of pesticides and their usage in Tanzania, have already become a matter of great anxiety as far as their adverse effects on its environment are concerned.

4.2.2.1 **Insecticides**

This is the main category of pesticides, accounting for 55% of the market share for agrochemicals in Tanzania. The most common class is organochlorine group which includes DDT, aldrin, lindane, endosulfan and dieldrin. After being the leading insecticides in the World Market for 30 years, chlorohydrocarbons began to be unpopular some 15 - 20 years ago. In Tanzania, some studies on the hazards caused by their use started just recently, from

1977, compared to 1950s in the United States. Some insecticides have been found to be persistent in the environment (Ak'habuhaya 1988). Because of their lipid solubility they bioaccumulate in the food chains. Some of them like DDT, lindane, aldrin and dieldrin have been found to be carcinogenic i.e. cancer causing agents. The findings have caused a lot of concern over their long term effects not only on the environment, but also to the health of the people. Moreover, many pests have become resistant to chlorohydrocarbons. Due to the similarities in organochlorines, resistance to one chlorohy-drocarbon may closely be followed by resistance to other compounds (Stephen 1987).

Of all the organochlorine insecticides, only one is known to be easily biodegradable; and thus, it does not bioaccumulate. This compound is known as methoxychlor. Surprisingly, this insecticide, which is the safest of all the organochlorine insecticides, is not among those imported in the country (Journalist Environmental Association of Tanzania (JET) 1994).

The second class of insecticides is the organophosphorus group which includes sulfotep (bladafun), metamidophos, and thiometon. These compounds are extremely potent; and they achieve the desired insecticidal capability through the application of low quantities. Usually only a few hundred grams per hectare are recommended; thereby, reducing the danger of undesirable residues in the harvested product. Organophosphorus insecticides are easily degraded hydrolyticaly, enzymatically, and biologically. Even though they are regarded as environmentally safe, they are yet extremely poisonous (JET 1994).

The third category of insecticides is the carbamate group, which includes insecticides, like carbaryl and carbofuran. Synthetic carbamates are simple analogues of the natural product physostigmine (estrin). Insecticidal carbamates are effective even against insect pests which are resistant to organochlorines like DDT. Carbamates are biodegradable; and thus, do not accumulate in the environment, and along food chains.

4.2.2.2 Fungicides

This category of pesticides is mostly imported/formulated for use in coffee growing areas. The most common one is copper oxychloride (blue copper), which is regarded to be environmentally tolerable, despite its soil accumulative properties. Other fungicides imported in Tanzania, include kocide, red copper, delan, etc. Fungicides currently account for about 43% of the market share for agrochemicals; which is up from only 23% in 1970 (JET 1994).

4.2.2.3 Herbicides

Herbicides used in Tanzania, are mostly organic. These include atrazine, simazine, ametryn, diqut, and since 1987 paraquat. Some are known to be environmentally unsafe. Herbicides share of the agrochemical market since 1990, has fallen to less than 4% from 11% in 1970 (JET 1994).

4.2.3 Effect of Pesticides on the Environment

The use of pesticides, though necessary, has hazardous effects; as they regularly strike at non-target species as much as they strike species for which they are intended. Moreover, applications of pesticides cannot always be confined to an intended area; nor does their effectiveness cease after the pest population has been reduced. In many cases, the effects could continue; but, with unpredictable results. These inherent risks, associated with the use of pesticides, have given rise to the controversies surrounding their use.

It is now widely acknowledged that the use of any pesticide has inherent spill-over effects. Generally, pesticides are poisonous; and capable of harming organisms other than the target species. Use of pesticides, therefore, causes major difficulties in terms of environmental protection. To start with, the broadspectrum activity of these chemicals warns that non-target

organisms are affected. For example, heavy and continuous use of pesticides, often eliminates the pests' natural predators. Besides, the health of farm workers and other people who apply the pesticides, is at risk as a result of carelessness or ignorance. Much of the effects of pesticide-residues are still unknown, as their routes of transfer and action are new to mankind. The two major groups of persisting agrochemicals (JET 1994) include chlorinated hydrocarbon insecticides (such as, DDT which can survive for 12 years after only a single application); and those compounds containing heavy metals, such as, lead, mercury and arsenic. In the developed countries human food products should contain amounts of residues which are rated as safe for consumption. They have legal provisions for the enforcement of the standards which have been set for the protection of the consumer; and, indeed the environment. Unfortunately, the story is different with respect to developing countries including Tanzania. In many Third World countries, such legal provisions are lacking; and even where they have been instituted, the monitoring and enforcement forces are usually weak, and therefore, ineffective.

Tanzania imports different types of pesticides; and much of it require extreme care in its handling, storage and application. This implies that the authorities, organizations, and institutions, responsible for controlling and monitoring their usage, should have up-to-date and precise information about those pesticides. The relevant items of information about those pesticides are as follows:

(1) The chemical properties of each pesticide irrespective of the brand or market name it carries;

(2) Its level of toxicity;

(3) Its safety levels; and

(4) The methods of handling, storing, and applying each of those pesticides.

The task of compiling this mass of information is not an easy one. It calls for the establishment of a modern, well equipped and adequately staffed Information Centre primarily dealing with all information that is pertinent for the purpose. But Tanzania has not yet been able to establish such an important institution. It is true that a number of institutions and agencies have already been established with the objective of providing effective mechanisms for the monitoring, control, and regulation of the importation, and use of pesticides in the country. Since their methods of data collection, analysis, storage, dissemination, and retrieval of information are still traditional, their perfomance in the area of information service is not satisfactory.

4.3 AGROCHEMICALS RELATED INFORMATION

4.3.1 Situation in General

The organizational and institutional framework for regulating the manufacture, formulation, importation, and the use of agrochemicals in the country is already in place. Quite a few organizations and institutions have been established for this purpose, for example, the Tropical Pesticide Research Institute within the Ministry of Agriculture and Livestock Development and the National Environment Management Council within the Ministry of Natural Resources, Tourism and the Environment. In the course of conducting the survey for this study, it was discovered that there was hardly any coordination of their activities. Different organizations and institutions possessed relevant data and items of information of various degrees; but, there was no well established mechanism for sharing those data and items of information. Besides, there was no information service, in the true sense of the term, which could serve the real purpose under consideration.

Information is for use. This is the fundamental principle that governs all information services. For the purpose of protecting the environment from the adverse effects due to imbalanced usage of chemical fertilizers and pesticides, appropriate information services are essential. The users of pertinent information, for the purpose mentioned above, are many, such as, decision makers, planners, managers, researchers, extension workers, and farmers. These categories of users are identifiable among those who are primarily concerned with the environment as a whole; as well as, among those who are primarily concerned with agrochemicals as a whole.

The information services are to be designed and rendered in such a way that these categories of users of information, in both the groups, get an opportunity of being fully conversant with the specific subject of "adverse effects on environment due to usage of chemical fertilizers and pesticides". Once it can be ensured by the information services rendered by an information support system, many positive results can be expected from these categories of information users. They themselves would be in a position to devise mechanisms to protect the environment from the adverse effects of chemical fertilizers and pesticides due to their imbalanced usage.

Each of the organizations and institutions collects and stores data and information to serve its respective limited purpose of regulatory activities. As a result, the use of collected data and information remains totally restricted. The concept of sharing information resources among the related organizations and institutions is totally absent. This leads to duplication of data collection, and to unnecessary wastage of time and money for that. Awareness about the adverse effects on the environment due to imbalanced usage of chemical fertilizers and pesticides is there; but, it is mostly confined among those who are in authority, or engaged in research. The mechanism for creating awareness among the farmers is quite weak. Besides,

relevant information is not readily available in the form that can be used for creating this awareness.

However, the most commendable aspect of this situation is that the responsible persons concerned with the environment of Tanzania on one hand, and the use of agrochemicals on the other, do realize the problem with great concern. They even categorically express that they would very much appreciate it if an appropriate information support system is established to overcome the existing difficulties standing in the way of creating awareness about the problem as widely as possible. It is in response to this expressed sentiment that this study has been taken up. Let us now examine the institutional capacity and utility of some of the national institutions established to deal with agrochemicals and the environment in the country.

4.3.2 Tropical Pesticide Research Institute (TPRI)

According to Ak'habuhaya (1988), the Tanzania Parliament, in 1979, passed an act which delegated the work to supervise, regulate and control the manufacture, sale, and use of pesticides in the country, to the Tropical Pesticide Research Institute (TPRI). Subsection 2 of Section 4 of the Act, states as follows:

"...The institute, for the purpose of ensuring effectiveness of pesticides use in the production of crops, fibres, livestock, and for the protection of public health and safety, shall

(1) Supervise and regulate the manufacture, importation, distribution, sale, and use of pesticide in the United Republic of Tanzania;

(2) Administer regulations made under the provisions of this act..."

Within TPRI, this task is done by the Pesticides Registration and Control Division of the Institute. The Division, headed by the Registrar of Pesticides, registers all pesticide-products, pesticide-dealers, formulators, and fumigators in the country; and issues operational

permits for carrying out their pesticide related activities. In July, 1986, the Institute released the first ever list of registered or approved pesticide-products in Tanzania. The list consisted of 370 products grouped into three categories. These were as follows:

Category 1: Provisionally approved products. These were products approved for use for a maximum period of two years.

Category 2: Products for restricted use only. These were registered for use against specific target pests.

Category 3: Products for experimental purpose. These were products registered for laboratory, or field tests only. They were not meant for any public use.

The summary of the list of pesticides registered are presented in Table 9.

Table 9

SUMMARY OF THE LIST OF PESTICIDES REGISTERED

CLASS	REGISTRATION GROUP			
	PROVISIONAL	RESTRICTED	EXPERIMENTAL	%
Insecticide	124	25	41	51.4%
Herbicides	69	-	21	24.3%
Fungicides	37	1	30	18.4%
Nematicides	3	3	2	2.2%
Acaricides	4	-	3	1.9%
Rodenticides	3	-	2	1.4%
Molliscicides	1	-	-	0.3%
Avicides	1	-	-	0.3%
Total	242	29	99	100%
Total Products	370			
Total Compounds	167 active ingrdients			
Total Registrants	about 45; most of them foreign			

Source: Ak'habuhaya, J. and M. Lodenius.(1988). Pesticides in Tanzania.

The Institute has pesticide-inspectors whose duties are to pay visits to all types of pesticide-premises for checking:

(1) If the pesticide-products being handled (used, sold, formulated etc.) have been registered;

(2) If the pesticides are handled in proper manner, and that the workers involved have proper protective clothing;

(3) If the premises are well suited for the type of pesticide-activities being undertaken there; (this consists of checking the suitability of the store; the existence of fire fighting equipment; the availability of antidotes needed; etc.); and

(4) If the pesticide being used, has the right physical and chemical properties. (For this purpose the inspectors may take samples of the product in order to verify this at the

TPRI laboratories).

It may be noted here that TPRI also participates in monitoring the adverse effects on the environment due to imbalanced use of pesticides.

TPRI has never been very effective due to a number of difficulties, some of which are beyond its control. They are as follows:

(1) Its location. TPRI is situated far from the major ports of entry of pesticides and active ingredients. Daresalaam is situated 600 km away; and Tanga' 300 km away. The pesticide formulating industries in the country, which are mostly in Daresalaam and Morogoro, are about 500 km away from major ports. The problem is compounded by poor communication facilities. As a result, testing the imported or formulated pesticides to ascertain if they conform to the internationally or locally acceptable standards, becomes difficult. There have been reports of importers and formulators taking advantage of such weaknesses to introduce into the market expired and even internationally banned or highly restricted pesticides like Aldrin, Lindane, Dieldrin, Chlordane, Heptachlor, Cyhexatin, Ethlene Dibromide, Fluoroacetamide, Chlordimeform, Dinoseb, and 2,4,5-T.

(2) It appears that TPRI does not have complete Information about the operations of institutions and individuals dealing with pesticides, i.e., local formulators and importers. Information sought by researchers in this regard is never made easily available by TPRI (JET, 1994). If TPRI is not well informed, it is not possible to expect the ordinary people to be aware of the risks they could be subjected to through the use of some pesticides.

(3) Local pesticide-formulators, and importers are on record for being hesitant in releasing statistics on their products, or imports. This attitude could account for the failure of TPRI to have accurate and up-to-date data on this important subject. It could also reflect on the

ineffectiveness of TPRI in the enforcement of the country's laws and regulations on safe use of pesticides.

There are many importers, and formulators of pesticides in the Tanzanian market; but, for the purpose of this study, we'll pick just two examples. The examples will reveal the magnitude of the problem relating to the continued use of some of the pesticides, which have either been banned in other countries; or their use has been restricted due to their negative impacts on the environment and the people. On the other hand, they will also reflect the ineffectiveness of TPRI to act as the government's watch-dog against abuses in the importation and use of pesticides in the country. The two major importers, among others, are the Tanzania Cotton Marketing Board (TCMB), and the CIBA-CEIGY.

The Tanzania Cotton Marketing Board (TCMB)

TCMB has been found to be one of the main user of DDT concentrates in the country, particularly through its continued promotion of U-COMBI as a major pesticide in the eradication of cotton pests. U-COMBI has been found to have DDT concentration of 35%. Quantities and values of U-COMBI imported from 1986 to 1991 together with regional distribution are presented in Table 10. The import of other pesticides imported by TCMB for use in cotton growing areas are presented in Table 11.

operations, and in doing so it improves the coordination and efficiency and even reduce costs. The principle of sharing, which is made possible by the establishment of electronic communications links between the nodes, has led to the development of Local Area Networks (LAN), Metropolitan Area Network (MAN) and Wide Area Networks (WAN).

(1) Local Area Network (LAN) is a communications network connecting computers within the same building or within a limited geographic area. The two main purposes of LAN are to link work stations within a facility so that they may share peripherals (such as storage devices, hardware, and printers); and to allow work stations to communicate with each other (Gore and Stubbe 1984, Hutchison and Sawyer 1988). A LAN can be connected to a WAN.

(2) Metropolitan Area Network (MAN): It links computer resources that are more widely scattered in a city. MAN is an intracity network, and its major advantage is to allow access to outside sources of data.

(3) Wide Area Network (WAN). In contrast to the LAN, the WAN provides communications over long distances. It links resources scattered around the country and/or the world.

The principle of networking is indeed relevant to the proposed ISSEAET if the latter has to play a significant role in the information sector especially in equipping the nation with the requisite tools and services in the control of environmental pollution that could be caused by the use of agrochemicals.

5.3.2. ISSEAET'S INFORMATION SYSTEM'S NETWORK

It is widely recognized that no library and/or information/documentation centre, would be able to acquire all relevant documentary and other information sources and to provide all desired services by itself (Rajagopalan. 1986, De Gennaro. 1979 and Neelameghan. 1991). The recognition has paved the way for the sharing of resources and information (i.e. networking). It is proposed that ISSEAET has to network its activities to enable it to meet user demands effectively.

The proposed configuration for ISSEAET will be a Star Network with a file server. The file server will control all data traffic between other computers/terminals (i.e. nodes), and other peripherals connected to it. Later on it will control communications to locations outside the LAN, that is, to the WAN. The proposal recognizes some of the administrative roles the ISSEAET network has to fulfil, namely:

(1) Coordinating the activities of its constituent nodes (i.e. departments).

(2) The setting and implementation of standards. There are various kinds of standards, such as:

(a) quality standards;

(b) Standards of technical terms and symbols which provide easy understanding standard codes of practice. The standards set out the most efficient methods of installation, use and maintenance of equipments and recommended methods for technical operations. Standardization is now given much emphasis in the computer- readable information-transfer media.

(3) The training of employees and users particularly in Information Technology which is essential in the utilization of the services of ISSEAET .

ISSEAET's LAN network, once it is connected to the WAN, would facilitate its communication links with domestic, regional and international institutions which are dealing and/or concerned with the use as well as adverse effects of agrochemicals on the environment. Given the rapid developments in IT, the volume of literature on the market and changes in user needs, the LAN and WAN would enable ISSEAET to reasonably keep pace with new developments in order to serve its users in a more efficient and effective manner.

Given the position and location of Dar es Salaam as the capital of Tanzania enjoying, among other things, relatively developed IT facilities such as telecommunications and computer services, and the fact that NEMC is located in the city, ISSEAET would also have its headquarters in Dar es Salaam.

5.4 DOCUMENTATION CENTRE

According to Nhlapho (1986), Documentation involves the process of collecting, accumulating, classifying and making ready and accessible information or records of all kinds of intellectual activity. A documentation centre therefore brings together, processes and organizes relevant information in such a way that it is accessible to all those who require it. This is the role that ISSEAET has to play with regard to the information on agrochemicals.

The establishment of ISSEAET is an attempt to narrow down the gap between access and supply of information on the use of agrochemicals in the country and their adverse effects on the environment. Its success should enable the country to have a focal point where much of the information on agrochemicals could be easily obtained/accessed.

To meet the everchanging and varied user demands and/or expectations, the proposal is to have the activities of ISSEAET computerized, i.e., it has to take advantage of the new Information Technology. The computerization of the activities of ISSEAET is quite possible

and feasible since there has been a dramatic decrease in computer hardware costs and an increase in computer memory capacity. Khalil (1993), observes that nowadays microcomputers have speeds and memory capacities comparable to the most powerful minicomputers a few years ago. The processing, storage, retrieval and delivery process would therefore be much easier.

There are several arguments in favour of the computerization of ISSEAET, some of which include:

(1) Increased efficiency in activities which normally involve considerable amount of repetitive, time consuming and administrative work such as acquisitions, cataloguing and circulation. If staff time is released from such tedious work, Kesner and Jones (1984) believe that the professionals' time would be better utilized in collection development, user services, bibliographic instruction and Current Awareness Services.

(2) Having the issue of information on agrochemicals coordinated at one centre, it could make the subject receive the required attention by the concerned authorities, which would in turn put it in a unique place to advise and/or make observations which could help policy and decision makers to issue appropriate guidelines in the use, formulation, storage, transportation etc. of agrochemicals. Computerization would definitely facilitate the process of coordination.

(3) Given the volume of information being generated in this field, like other fields, it is only a computerized system that could cope with the amount of work involved in terms of storage, processing, retrieval and its dissemination to users.

(4) If considered from a cost/benefit angle, computerization is cost effective especially in the long term. No wonder many documentation centres and libraries are embarking on the adoption of new Information Technology in their operations.

The adoption of new Information Technology by ISSEAET won't solve the problems associated with the use of agrochemicals in the country. The impact of ISSEAET would only be felt and appreciated if the information being generated would reach the users and at the right time. ISSEAET would therefore count on the government for the necessary support and the cooperation of all institutions involved in the business of agrochemicals in the country. The government would be most helpful if, for example, it adopts a policy framework that would promote the activities of ISSEAET, and encourage other institutions in the country to cooperate with ISSEAET. It is quite possible that such cooperation won't be forthcoming much easily as many of these institutions are used to work separately; and they are responsible and answerable to separate authorities with different sources of funding for their operations. This could be a major obstacle which has to be overcome and, instead, emphasis should be directed at encouraging and promoting activities for pooling the available meagre resources together. The harmonization of available facilities would also minimize the duplication of efforts and the wastage of resources while maximizing benefits.

A policy framework should extend beyond cooperation between institutions dealing with agrochemicals. Other users of this kind of information, particularly the peasants, who are likely to be directly affected by the adverse effects of agrochemicals, should not be neglected or ignored. This category of users need to be informed and be knowledgeable. Promotion of village or zonal libraries and the strengthening of the agricultural extension services would be extremely helpful in this regard. Only the government has the resources for the time being to play such a role. These issues are important, and the government's commitment is essential if ISSEAET has to meet the stated objectives and goals.

5.4.1 MANDATE

The Act establishing NEMC mandates it to establish and operate, among other things, a system of documentation and dissemination of information (DDI). The proposal is to establish ISSEAET as a subsystem within the DDI under NEMC. ISSEAET would therefore derive its mandate from the Act establishing NEMC.

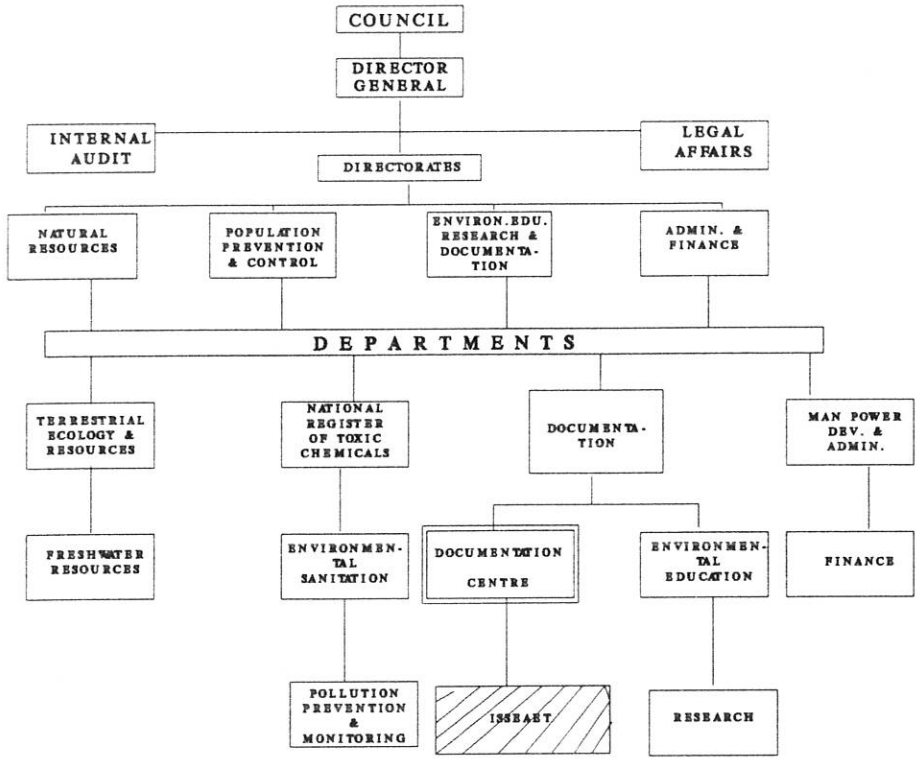
5.4.2 STRUCTURE

The country's information and documentation centres and their activities are not well organized (Sekimang'a, 1992). Their functions are also not well streamlined and coordinated. This has resulted in the fragmentation of information services and sometimes in unnecessary duplication of services (Chapter 4).

Lack of well-planned organizational structure means that users cannot take full advantage of available information and services. In view of the objectives and activities of ISSEAET, which have already been spelled out, and considering the economic and administrative conditions of the country it is being proposed that ISSEAET should be established as a subsystem within the NEMC. The position of ISSEAET within NEMC is illustrated in Figure 1.

The proposal stresses that ISSEAET would take advantage of the existing NEMC's organizational structure with as much flexibility in its management as possible. This could be possible if the horizontal and vertical lines of communication between and among its different sections, within NEMC and with other participating centres is established and clearly observed. It is expected that horizontal communication would promote team spirit and minimal competition among the different sections and would boost the morale of the workers. In vertical communication, a two-way communication model is preferred since it allows the flow of information from the top to the lowest

FIG.1 ORGANIZATIONAL CHART OF NEMC



employee and users, and vice versa. It is proposed further to establish a LAN which would improve not only its internal information communications but also the efficiency and effectiveness of ISSEAET.

5.4.3. NATIONAL COORDINATION

According to the Oxford Advanced Learner's Dictionary, to "coordinate" means to "bring or put into proper relations". There are several institutions involved in the field of environmental pollution in general and, specifically, on the use and effects of the agrochemicals. Some of these institutions are listed in Appendix 2. Their activities have to be brought together and harmonized. It is essential to recognize that many of these institutions have their own libraries which, however, perform much of their activities and services through the traditional manual operations. It is also worth noting that the exchange of information and services between them is also minimal. It is therefore possible that these institutions and/or their libraries can be unaware of each other's holdings.

The existing structure and mechanism doesn't promote the exchange and sharing of information between these institutions. Such condition does not allow the free movement and exchange of information among experts let alone reaching other users like some members of the general public who could be interested in environmental matters, particularly on the adverse effects of agrochemicals. The restrictions could be reflected in: (1) lack of standardization in the manner the data is collected and the terminologies used, (2) the existence of different centres of authority which could have different objectives and goals, and (3) the competition for the meagre national resources which could be reflected in the slow and uncoordinated adoption of new IT.

The existence of numerous centres where data and information on the use of agrochemicals could be generated and/or obtained to enhance knowledge and for research purposes is the most welcome development since the country does not have to start from the scratch. As noted earlier in the study, much of the information which is generated by these institutions is not coordinated and the data collection systems are weak. Such a shortfall is clearly demonstrated by the example of the Ministry of Agriculture and Livestock Development. The Ministry, which is the most important authority in the country in terms of having the experts, who can be relied upon for the collection of the necessary data on the use of agrochemical in the field, has acknowledged its weakness in the task of data collection. The 1982 Task Force charged with the preparation of the Tanzania National Agricultural Policy observed, "The Ministry's (i.e. Agriculture) progress in data collection has, over the years, been constrained by financial and human resources. Moreover, the monthly reports from the regions have been imprecise and they are received irregularly. Further, the multiplicity of institutions collecting data has led to problems of data accuracy, reliability, comparability, adequacy, currency, conflicts and contradictions" (Ministry of Agriculture, Task Force Report, 1982; p 131). These are the kinds of problems which ISSEAET could be expected to overcome through the generation and coordination of information on agrochemicals.

ISSEAET could be expected to bridge the gap by coordinating some of the activities of such national institutions through the promotion of:

(1) The exchange of lists of holdings, and relevant library publications. In so doing they will get to know who has got what;

(2) Contacts among the library professionals and discussions on subjects of interest in their information profession. Such contacts could be organized in the form of workshops, seminars, conferences and courses;

(3) Training of users in Information Technology and on different forms of information services offered at the centre.

(4) Building up inhouse databases of information on adverse effects of agrochemicals on the environment by collecting information through its own mechanism as well as by collecting/downloading from the databases of the participating centres; and

(5) Access to the databases of any organization/institution and/or individual through networks, thereby acting as the coordinating centre to a network of agrochemicals information in the country.

5.5 THE ADVISORY BODY

Among its activities, ISSEAET has to coordinate the activities of several institutions in the country. It is therefore proposed to establish an **Agrochemicals Technical Committee (ATC)** within the structure of ISSEAET. The ATC would play the essential function of liaising with other institutions in the country which are dealing with agrochemicals. ATC shall be composed of all ISSEAET's departmental heads. The Head of TPRI Library, and heads of libraries/information centres at the Ministries of Agriculture and Livestock Development, the Ministry of Natural Resources, Tourism and the Environment, the Ministry of Science, Technology and Higher Education, the Tanzania Science and Technology Commission, and the Sokoine University of Agriculture are proposed to be the members of ATC. It is proposed further that ISSEAET be headed by a Director who shall also chair the ATC meetings.

5.6 DATABASE

In order to provide necessary information on the adverse effect of agrochemicals and related areas the ISSEAET should develop and maintain a number of databases. Two different

categories of databases are proposed namely:

(1) An Integrated database containing:

a. Bibliographic records;

b. Profiles of Experts;

c. Profiles of institutions;

d. Profiles of information systems; and

e. Profiles of Projects; and

(2) A specialized database on agrochemicals.

Prototypes of these databases have been developed in course of this research. Information related to the input, processing and output of each of these databases are provided in the following subsections.

5.6.1 Integrated Databases

An approach to developing an integrated database was taken to facilitate concurrent search and retrieval of different ty pes of records namely (documents, profile of institution, profile of experts, profile of projects, etc.) through a single search on a single database. The Integrated database approach of ABNCD (Abebe et al. 1992) has been chosen to incorporate records of five different kinds of items related to the bibliographic, institutional, personal and project information sources. The name of the prototype integrated database is **Matab**. FDT of ABNCD database has been adopted for the **Matab** database which can incorporate all the various kinds of records such as bibliographic, experts, institutions, information systems, and projects. The FDT appears in the Appendix 3. The worksheets for each category of records have been adopted as they are in the ABNCD structure. They appear in appendices 4a through 4d.

5.6.1.1 Bibliographic records

The prototype **Matab database** contains bibliographic records comprising books, monographs, conference proceedings etc. Keeping the users' requirements in view, a simple FST has been designed (Appendix 5) which will allow users to retrieve documents with such keys as ISBN, authors, title, keywords etc. A display format named **Matab** (Appendix 6) has been designed to produce an output as shown in Figure 2.

FIGURE 2: SAMPLE BIBLIOGRAPHIC RECORDS

BIBLIOGRAPHIC RECORDS

Title: Soil Fertility and Fertilizers.
Author(s): Tisdale, S.L. et al
Publisher: Macmillian Co. New York
Year: 1985.
ISBN: 0-02-946760-8.
Descriptors: FERTILIZERS; SOIL FERTILITY; PLANTS.
Abstract: Different types of fertilizers, their effect chemical and physical properties are analyzed. Fundamental principles of soil fertility and fertilizer manufacturing and use are discussed in a manner suitable for training in inorganic chemistry and crop science. Emphasis has been placed on describing each nutrient, occurrence, forms, behaviour in soils and factors influencing availability and plants uptake.

Subject Heading: Fertilizers

5.6.1.2 Profile of experts

The prototype **Matab database** contains records of experts. Each record contains personal details of an expert such as name, nationality, address, qualification, specialization, employment record, assignment etc. With the users' requirement in view, a simple FST has been designed (Appendix 5) which will allow users to retrieve information on experts using keys such as name, address, qualification, specialization etc. A display format named **Matex** (Appendix 7) has been designed to produce an output as shown in Figure 3.

FIGURE 3: SAMPLE RECORD FROM THE PROFILE OF EXPERT

PROFILE OF EXPERTS

Name: Kibani, Tryphon.
Sex: Male.
Affiliation: Ministry of Agriculture and Livestock Development, Ukiriguru Agriculture Research Institute, Tanzania.
Address: P.O. BOX 4006, Mwanza, Tanzania.
Date of Birth: 1952-03-02.
Nationality: TZ.
Qualifications: Masters of Science, University of Reading, 1993. B.SC., Agriculture, University of Dar es Salaam, 1976.
Language: Kiswahili, Speak, Read, Write. English, Speak, Read, Write.
pecialization: Cotton diseases.
Marital Status: Married.
Work Experience: Senior Scientific Officer, Agricultural research, Tanzania Agricultural Research Organization, 1989-1992.
Current Work: R&D, Ministry of Agriculture and Livestock Development, Tanzania.
Project Title: Survey of Fusarian, Wilt Disease of Cotton in Western Cotton Growing Region in Tanzania.
Recommended By: John Ludalo, Principal Secretary, Ministry of Agriculture and Livestock Development.

5.6.1.3 Information Systems Profile

The prototype **Matab database** contains records of information systems. Each record contains data related to an information system, namely institution type, date started, address, personnel, objective, activities, information service offered, internal and external database etc. Keeping the users' requirements in view, a simple FST has been designed (Appendix 5) which will allow users to retrieve records with such keys as name of the system, principal officers, parent organization, type of institution, address, working language, services offered, descriptors, type of research, periodical publications, etc. A display format named **Matin** (Appendix 8) has been designed to produce an output as shown in Figure 4.

5.6.1.4 Records of Institutions

The prototype **Matab database** contains institutional records. Each record contains such items of information as name, address, working language, services offered, databases, classifications system, descriptors, discipline, activities, type of research, periodical publications, etc. Keeping the users' requirements in view, a simple FST has been designed (Appendix 5) which will allow users to retrieve documents with such keys as name of institution, address, parent organization, type of institution, services offered, descriptors, type of research, specific terms from objective, principal officers, etc. A display format named **Matin** (Appendix 8) has been designed to produce an output as shown in Figure 5.

FIGURE 4: SAMPLE RECORD FROM THE PROFILE OF INFORMATION SYSTEMS

INFORMATION SYSTEMS

Name:	Tropical Pesticide Research Institute Library, TZ.
Parent organization:	Ministry of Agriculture and Livestock Development, Arusha, Tanzania.
Type of Institution:	Parastatal, Research centre
Address:	P.O. BOX 3024, Arusha, Tanzania, Telephone 3557/3558
Working Language:	Sw. En.
Services Offered:	1. Bibliographic services on information relating to Pesticide research, plant diseases, animal disease, soil science, protection of stored products, pest control, weeds 2. Reference services on the same subject. 3. Referral service on the same subject.
Classification system:	Dewey Decimal Classification.
Descriptor:	Pesticide. Agriculture. Livestock. Research. Tropical. Tanzania
Discipline:	Agricultural Science.
Financial aspects:	Ministry of Agriculture and Livestock Development.
Date of establishment.:	1945.
Type of research:	Pesticide. Plant. Animal research.
Objective:	To provide information service in all subjects of the Institute.
Personnel:	Technical personnel, 5.
Note:	Its Information services cover the specific area of the effect of agrochemical on the environment.
Activities:	Data collection and reference services, inter-library loans, current awareness services and other library services.
Periodical Publicat.:	Annual Report.

FIGURE 5: SAMPLE RECORD FROM THE PROFILE OF INSTITUTIONS

```
                ***PROFILE OF INSTITUTIONS***

Name:           Ukiriguru Agriculture Research and Training
                Institute, Tanzania, Research Institute.
Parent
 Organization:  Ministry of Agriculture and Livestock
                Development, Tanzania.
Type of
  Institution:  Governmental, Research.
Address:        P.O. BOX 1433, MWANZA, TANZANIA.
Working
     language:  Sw. En.
Services
      offered:  Supporting research and training of agriculture
                and livestock officers and extension workers.
Descriptor :    Agriculture. Research. Ukiriguru.
Discipline:     Agriculture and Livestock Research.
Financial
      aspects:  Ministry of Agriculture and Livestock
                Development.
Date of
establishment.:1932.
Type of
     Research:  Agricultural. Livestock. Research.
Objective:      To train manpower for agriculture and livestock
                and offer agriculture extension services in the
                country; Training on land use; agrochemicals and
                food nutrition sciences.
Personnel:      Researchers and agricultural trainees, 150.
Note:           This institution is concerned with the study and
                research of agrochemicals including their
                effects on the environment.

Activities:     Training, research and dissemination of their
                research findings.
Periodical
   Publicat.:   Annual Report.
```

5.6.1.5 Records of Research Projects

The prototype **Matab database** contains records of research projects. Each record presents the essential features of a project such as project title, performing institution, principal officers, address, duration, descriptors, discipline, financial aspect, resource persons, objective, abstract, etc. Keeping the user's requirements in view, a simple FST has been designed (appendix 5) which will allow users to retrieve documents with such keys as performing institution, project

title, type of institution, descriptors, discipline, type of research, objective, resource persons, etc. A display format named **Matrp** (Appendix 9) has been designed to produce an output as shown in figure 6.

5.6.1.6 Specialized Databases

Two specialized databases named **Fertz and Pest** have been designed to provide information related to fertilizers and pesticides respectively. These records contain fields like manufacturers, trade name, common name, effect on the environment, toxicity etc.

These databases will provide information on fertilizers and pesticides that are necessary for users in their day-to-day research and other activities.

Separate FDT for **Fertz** database has been prepared keeping in view the necessary fields to be maintained; and it appears in Appendix 10. A separate worksheet for entering records on fertilizers has been designed (Appendix 11).

Keeping the user's requirements in view, a simple FST has been designed (Appendix 12) which will allow users to retrieve records with such keys as group name, common name, manufacturer, importer, properties, types of soil, effect on the environment etc. A display format named **Fertz** (Appendix 13) has been designed to produce an output as shown in Figure 7.

FIGURE 7: SAMPLE RECORD ON FERTILIZERS

```
                ***RECORDS ON FERTILIZERS***

Group:          Nitrogen Fertilizers.
Common name:    Ammonium Sulphate.
Manufacturer:   Tanga Fertilizers Company.
Importer:       CIBA-CEIGY.
Properties:     It is supplied as white granules or in liquid
                form.
Stability:      Denitrification process takes place in the
                presence of nitrosomonas bacteria.
Types of crops: Maize. Wheat. Rice.
Type of soil  : Alkalinic soil.
Effect on
      environ : Ammonia volatilization leaching and urea
                hydrolysis all contribute to accumulation of
                Nitrogen in the environment. This encourages
                plants to grow where they are not needed. Once
                a Nitrogen Fertilizer finds its way into
                drinking water, it may cause cancer, and
                cyanosis in infants.
```

Separate FDT for **Pest** database has been designed keeping in view the necessary fields to be maintained. The FDT appears in Appendix 14. A separate worksheet for entering records on fertilizers has also been prepared (Appendix 15).

Keeping the user's requirements in view, a simple FST has been designed (Appendix 16) which will allow users to retrieve records with such keys as group name, common name, manufacturers, importer, properties, effective against, adverse effect, etc. A display format named **Pest** (Appendix 17) has been designed to produce an output as shown in Figure 8.

FIGURE 6. SAMPLE RECORD ON RESEARCH PROJECTS

****RESEARCH PROJECTS***

Project title:	Analysis of chlorinated pesticide residue in the soil, water and agricultural products in lake Victoria zone.
Performing Inst.:	University of Daresalaam, Chemistry Department, Daresalaam, Tanzania.
Type of Inst.:	Parastatal, University.
Address:	P.O. BOX 35061, Dar es Salaam, Tanzania.
Project No.:	309 TANZ 159.
Language:	En.
Descriptors:	Chlorinated pesticide. Residues. Water. Soil. Agric. Products.
Geographical Area:	Lake Victoria Zone. Tanzania.
Specialization:	Agriculture.
Finance:	Ministry of Agriculture and Livestock Development.
Research Priority:	Analysis of chlorinated pesticide residues in the environment.
Date approval:	1993-01-20.
Date Start.:	1993-07-15.
Expected Compl.:	1995-07-15.
Type of Research:	Agricultural. Research.
Objective:	To find the amount of pesticide residue in the cotton growing area in order to determine the rate of pesticide pollution in the region.
Note:	The project is concerned with the areas of the effects of agrochemicals on the environment.
Abstract:	Soil water, cotton seed crude oil and cotton seed animal feed collected from the Lake Victoria Growing Areas of Tanzania and were analyzed for organochlorine pesticides residues and their metabolites by gas chromatography using an electron capture detector. Endosulfan 1; Endosulfan 11; Endosulfan sulfate; P,P'-DDE; p,p,-DDD and p,p-DDT were detected as organochlorine metabolites. Their amount were quantified in soil from the cotton farm, water from the pond in the farm, cotton seed crude oil and cotton seed animal samples from the vegetable factory in the area. The levels of the residue were found to be 20 times higher of what is allowed by FAO.

FIGURE 8: SAMPLE RECORD ON PESTICIDES

RECORDS ON PESTICIDES

Group:	Organochlorine
Trade name:	Sapa DDT 5
Common name:	DDT
Manufacturer:	Sapa Chemicals
Importer:	Sapa Chemicals
Formulator:	Sapa Chemicals
Properties:	DDT kills as contact and stomach insecticide. It highly persists; moderately toxic to mammals. Non-systemic and non-phytotoxic. The pp-'isomer forms colourless crystals. The technical product is a waxy solid
Solubility:	Practically insoluble in water, moderately soluble in petroleum oils and readily soluble in most aromatic, chlorinated solvents and lipids.
Stability:	DDT is dehydrochlorinated at temperatures above 50 degrees Centigrade, a reaction catalysed by ultraviolet light. In solution it is readily dehydrochlorinated by alkalis or organic basis
Toxicity:	Acute dermal LD50 for rats: 2510mg/kg. Acute oral LD50 for rats: 113-118mg/kg. WHO classification: "moderately hazardous"
Effective against:	Most insects except mites
Adverse effects:	Harmful to bees, fish, birds and livestock. DDT is a toxic chemical that kills many different species causing harm to non-target species. It is persistent in the environment due to the chlorine-carbon bond which is stable. A few bacteria and fungi in nature can break it as a result it accumulates in the ecosystem. Its mobility and persistence allow it to accumulate in the ecosystem causing a lot of environmental hazards, e.g. causes birds to lay eggs with thin eggshell resulting into low rate of reproduction; has been associated with cancer in human
Pre-harvest interval :	For edible crops 2 weeks

5.7 USER INTERFACE

In considering user interface for the computerization of ISSEAET activities it has been deemed appropriate to adopt the SISA (System Interface Search Assistance) developed at SISA by Molla Hunegnaw, and A. Neelameghan (1993).

SISA, is written in CDS/ISIS Pascal, and it is designed to assist end-users in performing search and retrieval in Micro CDS/ISIS databases. Major functions provided for by SISA include:

(1) selection of databases for searching;

(2) formulation of search expressions using CDS/ISIS search language and use of the different search capabilities of CDS/ISIS;

(3) retrieval and display of records using different display formats;

(4) saving of retrieved records selectively;

(5) storing of search queries and the results for review of search performances on each database.

On pressing option A in the modified menu from Figure 9, the SISA main menu, as shown in Figure 10, will appear.

FIGURE 9: MODIFIED CDS/ISIS MAIN MENU

SCHOOL OF INFORMATION STUDIES FOR AFRICA
ONLINE SERVICES

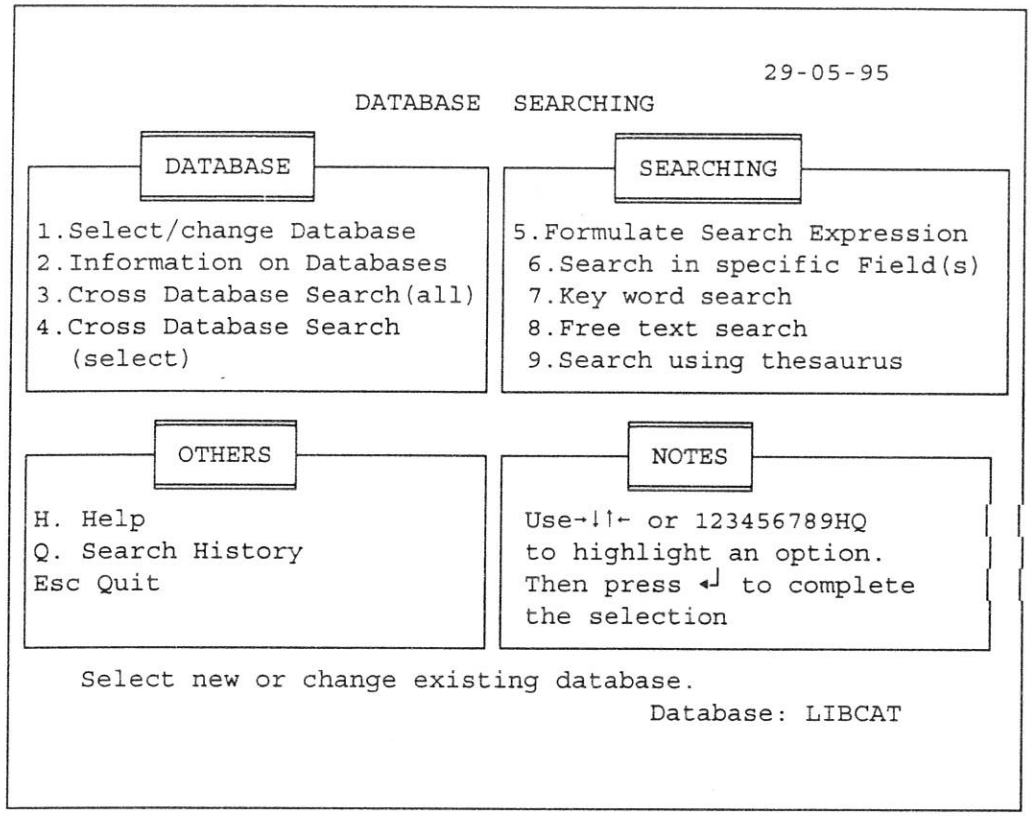
A - Search facility
O - Online Catalogue Search
U - Service Utilities
X - Exit

Enter selection

The options in Figure 10 are grouped in four sections - DATABASE, SEARCHING, NOTES, and OTHERS. A brief explanation of the highlighted option appears at the bottom of the screen. Whenever a database is selected, its name will appear at the bottom right of the screen.

To select an option, the cursor is moved to highlight the option, using appropriate arrow key(s) or by pressing the corresponding option digit, and then the <ENTER> key is pressed to select (as indicated in the notes).

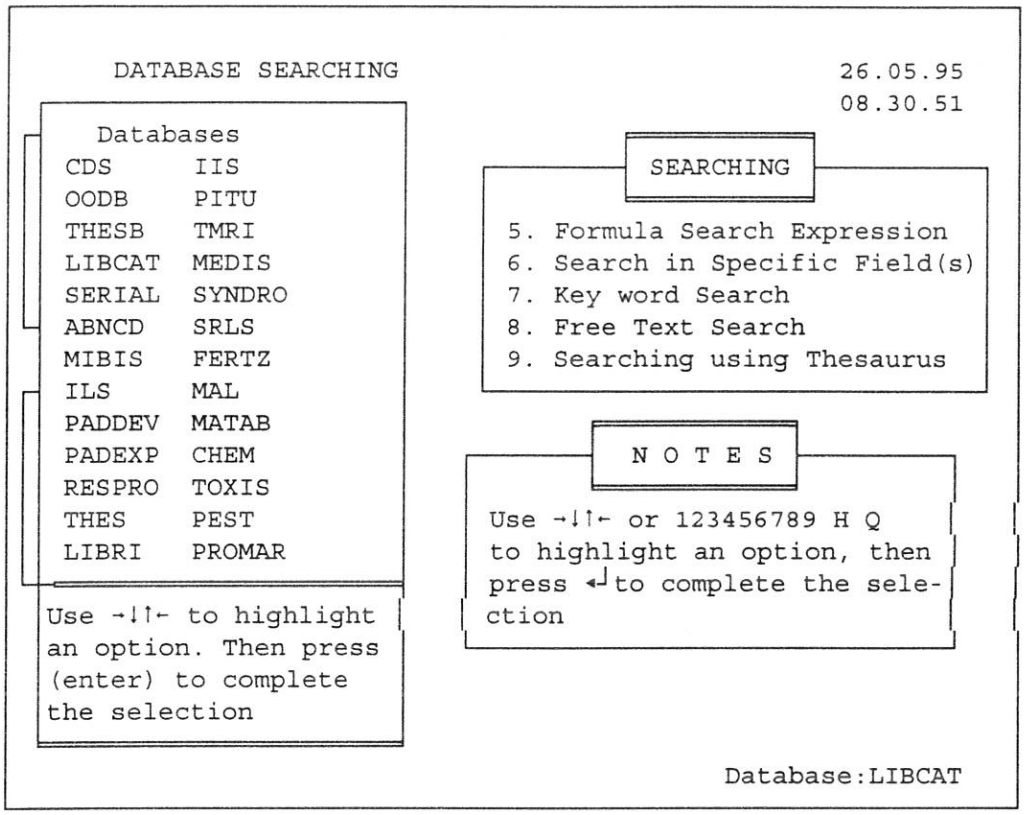
FIGURE 10: SISA MAIN MENU



5.7.1 Database Selection

Option 1 is for selecting a database or to change from a database in use to another. Names of available databases will be listed as shown in Figure 11.

FIGURE 11: LIST OF AVAILABLE DATABASE NAMES

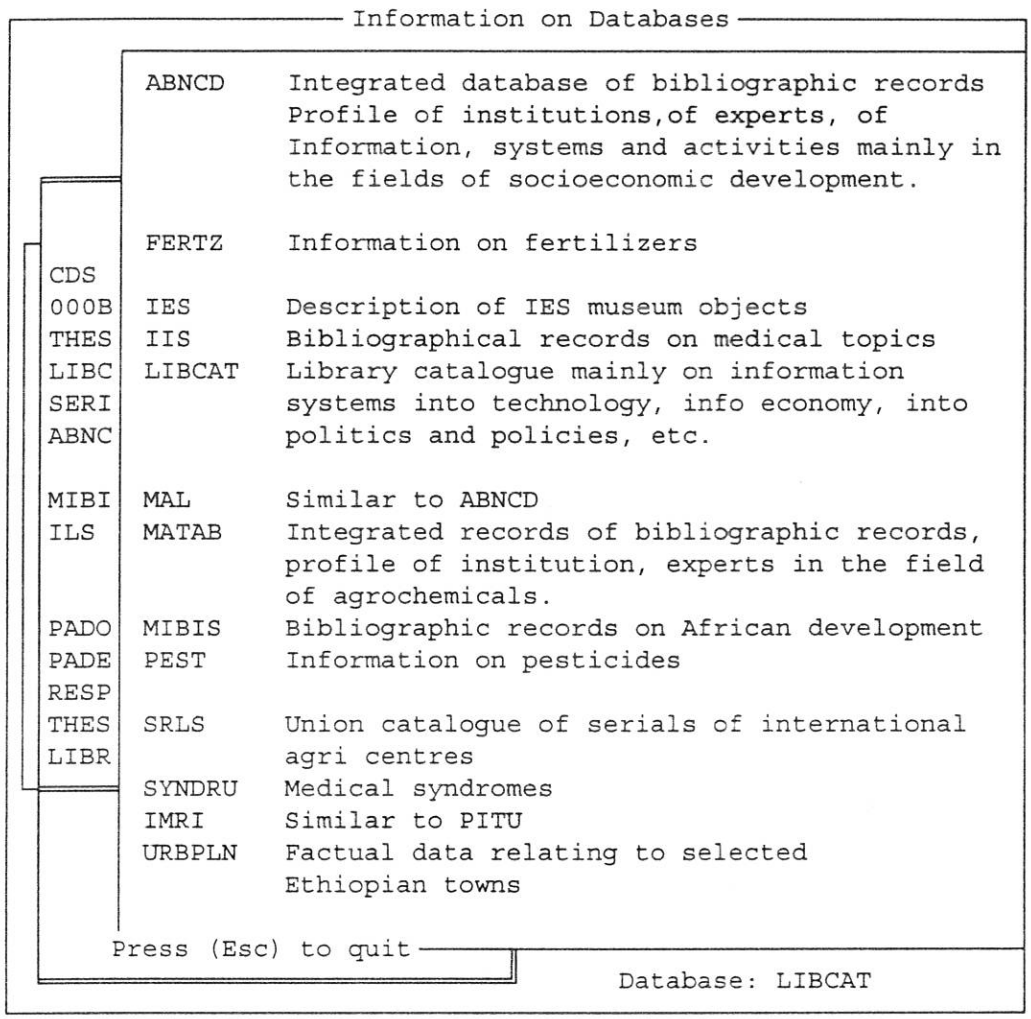


Using appropriate arrow keys, the desired database is highlighted and pressing <ENTER> will select it. More information about the databases can be displayed by pressing the F1 key (Figure 12). This is equivalent to using option 2. After selecting a database, the system will return to the main menu enabling selection of search options. The selected database name is shown at the bottom right of the screen. Pressing the ESC key will exit the menu.

5.7.2 Information on Databases

Selecting option 2 will present brief notes on the databases. A screen-full of information will be displayed at a time (Figure 12). PgDn and PgUp keys may be used to move from one page to another back and forth.

FIGURE 12: INFORMATION ON DATABASES SCREEN



5.7.3 Multiple Database Searching

Option 3 enables searching all of the CDS/ISIS databases in the system simultaneously, useful in selecting appropriate database(s) for further searches on a given topic, for example, 'Pesticide Information'. On selecting the option by pressing the <ENTER> key, the system will ask for a search expression. We may enter the key words

in upper or lower case, and press the <ENTER> key to initiate the search. Pressing F1 key displays brief help cues on formulating search expressions (Figure 13)

FIGURE 13: BRIEF HELP IN SEARCH FORMULATION SCREEN

```
Key in appropriate terms representing your information needs
press e.g. Pesticide for retrieving information on pesticide.
Terms may be combined as follows:
may be combined as follows:
 Agriculture and pesticide
 Fertilizer and pollution
 Automation not library automation
 Robert or John
Terms may be truncated by suffixing $ to the root terms e.g.
Network which will search  Network, Networking or Networks.
to execute earlier query: Key in set number e.g. #2

Press ESC to quit      For More help use option M in the
                       Main Menu
```

For the search term INFORMATION, the system displays data on the number of occurrences and number records (hits) in the

databases in the system (Figure 14).

FIGURE 14: DISPLAY OF MULTIPLE DATABASE SEARCH RESULT

```
SEARCH EXPRESSION(S) SUBMITTED
 Set   Data base   Hits   Search Expression


  1    LIBCAT       45    INFORMATION
  2    ABNCD         3    INFORMATION
  3    CDS          30    INFORMATION
  4    SERIAL        0    INFORMATION


   [Set No. ] select (M)ax (Q)uit
```

Three options are shown at the bottom of the screen. Typing in M and pressing <ENTER> will select the database giving the maximum number of hits (LIBCAT in this case) for further search. Another database can be selected by typing in the set number and pressing <ENTER> key. On the other hand, if a database is selected for search and the number of hits is greater than 0, the names of the display formats for the database will be displayed. Using arrow keys the desired format may be selected and pressing <ENTER> will display the records one by one. On displaying a record the system will request selection from one of the two options shown at the bottom right of the screen (Figure 15)

Pressing S key will save the record(s) in a file the name of which is to be keyed in a box on the screen. Using PgDn and PgUp keys enables moving forward and backward through the retrieved records.

FIGURE 15: SEARCH RESULT DISPLAY

```
TITLE          : Power shift: knowledge, wealth and violence
                 at the edge of the 21st century

AUTHOR(S)      : Toffler. Alvin
Publish        : New York: Bantam books
Year           : 1990
Collection     : 611 P: 459 ref.
Series         : Bantam books
ISBN           : 0-553-18052-5
Keywords       : Politics; Power; Future; Information
                 technology;
                 Mass Media; Civilization
Locat./Copy    : GRADUATE LIB. C.  1
                 SISA C.1
Call Number    : 328-34 1990 pow
Acc. No        : 12001
Doc. Status    : Book                                    PgOn

(Esc) to quit (S)ave
```

Option 4 (in Figure 10) permits selection of one or more databases for searching simultaneously. A list of names of databases will be displayed as shown in Figure 11. Using appropriate arrow keys the cursor is moved to the desired databases and pressing S key will select them for searching. Search and display procedures are similar to those for option 3.

5.7.4 Search Options

On selecting option 5 (in Figure 10), the system will display the list of search expressions, number of hits, etc. for previous searches, during the current session, if any, in the selected database. If a data base has not already been selected, the system will automatically execute option 1 (see above). Pressing <ENTER> key will display a blank screen with the prompt.

Enter search expressions: at the top of the screen. The search expression is keyed in at the cursor position.

Micro CDS-ISIS provides for searching using the index of terms created by the system

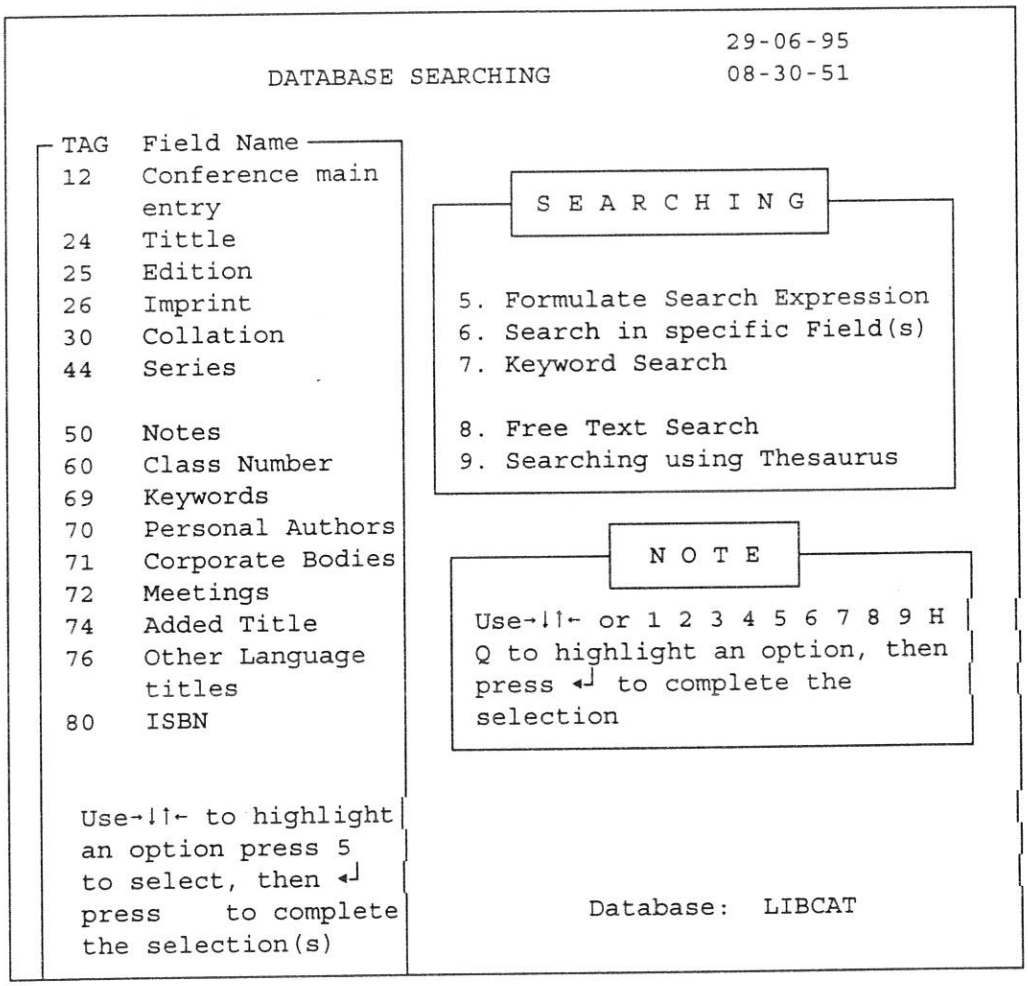
according to the techniques prescribed in the Field Select Table (FST) for each database, and also for free text searching. A user can display details of the search language of CDS-ISIS by pressing the option H in the main menu. Option 6 permits searching in specific field(s). Field tags and names will be listed for the database selected (Figure 16).

Using arrow keys to move the cursor and pressing S key, up to ten fields can be selected. Then pressing <ENTER> will initiate the search procedure (see for options 5 and 3).

Options 7 is equivalent to using option T in the EXGEN Information Retrieval Services menu of CDS-ISIS.

Options 8 may be used to search a string of characters in a field of a database. On selecting the option, the field tags and names will be listed as for option 6; however, in this case only one field can be selected. The system displays the prompt.

FIGURE 16: DISPLAY OF FIELD TAGS AND FIELD NAMES



Enter string to be searched: Entering a string and pressing <ENTER> will initiate the search, and records in which the string occurs in the selected field will be displayed. Further processes are similar to choosing option 5.

Searching via a thesaurus can be done by selecting option 9. In the demo the multilingual Macrothesaurus of OECD (Paris) has been interfaced.

5.7.5 Review of Search Performance

Selecting option Q will display the search history for each user. Data on the database searched, the number of hits and the number of records saved (deemed relevant to the query),

the respective search expressions, the option used, and the date of search will be displayed along with the user's name, address, interests, etc.

5.7.6 **Help Facility**

Selecting option H will provide details on how to use SISA and on the search language of CDS-ISIS. A beginner user may well start by selecting this option and understand the search capabilities of CDS-ISIS.

5.8 SYSTEM DEMONSTRATION

ISSEAET system would work as follows: A user could come up with a query, such as, "what type of fertilizer is considered agent of causing cancer?". He/She then gives search formulation, "Fertilizer * Cancer"

The user has to follow the following steps to get the right output.

(1) The first step is for the user to switch on the CDS/ISIS. The SISA interface screen shown in **Figure 9** would appear. On pressing **A**, SISA main Menu will appear as shown in **Figure 10.**

(2) To select the option, the cursor is moved to highlight it. Retrieval is possible by using appropriate arrow key(s) or by pressing the corresponding option digit. Here option **1** is selected and the screen will display names of available databases as shown in **Figure 11**.

(3) Using the appropriate arrow keys, the desired database **(FERTZ)** is highlighted and by pressing "Enter"it will be selected and retrieved on the screen. After selecting the database, the system will return to the main menu thereby enabling the selection

of **search options**. The selected database name is shown at the bottom right of the screen.

(4) More information on databases can be displayed by pressing the **F1 key**. The screen as shown in **Figure 12** appears. Scrolling **PgDn** and **PgUp** may be used to move from one page to another.

(5) On selecting **Option 3** and subsequent selection of **FERTZ DATABASE** by pressing **Enter** key, the system will ask for a search expression. At this point the "key" words, **"Fertilizer * Cancer"** is entered by the user. Pressing **F1** key displays **"brief help"** as shown in **Figure 13**.

(6) In following the steps as shown in section 5.7.3., searching for **Fertilizer * Cancer** the system displays an output screen as shown in **Figure 7**. Pressing **S** key will save the record(s) in a file name given by the user in a box on the screen. Using **PgDn** and **PgUp** keys enables moving forward and backward through the retrieved records.

(7) The user(s) can continue using the system as explained in Sections 5.7.4, 5.7.5 and 5.7.6 of the study.

5. 9 IMPLEMENTATION PLAN

Due to several constraints (time, funds etc.) a detailed implementation plan couldn't be undertaken in the course of this research. However, the major points that should be taken into account during the implementation have been discussed here. The overall economic condition in the country has to be borne in mind. The economic and industrial base is not well developed; and information technology has not been applied at satisfactory level. However, there is a trend in developing a better telecommunication infrastructure in the country which in turn will facilitate proper utilization of Information Technology in different walks of life.

The plan for implementation of ISSEAET needs to consider all these factors while, at the same time, it should give room for flexibility which allows any changes depending on the needs, availability of funds and equipments.

The first stage is planning and preparation. This includes site preparation, hardware and software installation, training of users and a security plan.

The ISSEAET Implementation Steering Committee (IC) will be formed to oversee the whole implementation process. Since the implementation plan involves specific and technical factors, a System Analyst (SA) would be hired on short-term consultancy. Liaison would be established between SA and IC. The SA would undertake the required feasibility study to determine the actual needs of ISSEAET. The SA would, among other things, encourage user participation throughout the implementation.

The implementation plan would therefore involve a thorough feasibility study which would specify:

- Hardware and software requirements;
- The cost of acquiring and the installation of the system;
- Staffing;
- System security; and
- System Review and Evaluation.

(1) Consideration of hardware and software:

The appropriate hardware and software and other peripherals should be specified. The SA, in collaboration with the IC, has to consider the most appropriate hardware for ISSEAET. The hardware to be chosen should be able to support the LAN and CDS/ISIS software which has been used in designing the prototype databases for ISSEAET. Other important software such

as WordStar, MicroSoft WordPerfect, Windows, DBase IV etc. may also be required to perform other functions. It is therefore important that the hardware to be installed should have the capacity to run the LAN being proposed.

(2) The Costs:

Consideration of the cost of the system would involve:

- the cost of acquiring and installation of the hardware and software. Different computer vendors need to be contacted; and among the various criteria for selection, conditions for after sales services are also to be considered;
- the cost of installing the appropriate telecommunications links;
- the cost of new staff;
- the cost of office equipment;
- the cost of manpower training;
- the cost of retrospective conversion etc.

(3) Site Preparation:

The areas that need to be considered for site preparation include:

- Power supply;
- Air conditioning;
- Site alteration if necessary; and
- Office equipments.

(4) Staffing:

ISSEAET staff have to be trained to enable them use the system. The SA has to plan the training schedule. What is important is that all the staff must become proficient in the

operation of the system before it becomes operational.

(5) System Security:

A security policy has to be developed for the protection of the software and databases.

(6) System Maintenance:

System maintenance involves the correction of faults and the enhancement of system functions. Procedures for such activities must be established. A system will continue to be maintained until it no longer becomes suitable thereby demanding the need to consider a change, and even its replacement.

A System Analyst would prepare an appropriate report which has to be submitted to the management of NEMC for consideration. After it is approved, the next phase will be the acquisition and installation of the system. This activity has to be surpervised by a consultant (it could still be the same SA). It is also recommended that a senior member of NEMC (who'll be fully conversant with computer knowledge) should be assigned to assist consultant with a view to take over the managemnt of the system thereafter.

Once the system has been installed, it has to be tested. This is important in order to verify whether the hardware and software and other peripherals are working satisfactorily. The testing has to be followed by system trials which also shall involve the users to test if their training has been useful. Trials could involve such areas like: input and output testing, file testing, computer procedures testing and clerical procedures testing.

System Review and Evaluation:

A review of the system will be needed to check if it is working satifactorily. The system review is a continuos process.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

An appropriate decision is a function of a number of factors, but the basic one is the availability of relevant, timely, and accurate information. The principle holds good in any situation. Appropriate decisions about the use of agrochemicals are essential for the protection of the environment. Information on the appropriate use of agrochemicals is, however, one of the areas where Tanzania has demonstrated to be weak and vulnerable. It lacks an effective and efficient information support system on agrochemicals. The situation as it prevails today may be characterized as follows:

(1) There is no effective communication and coordination between organizations and institutions charged with the monitoring and control of the use of agrochemicals. The available information is not therefore adequately shared.

(2) Inadequate agricultural extension services in the rural areas, where pesticides and fertilizers are mostly used, have contributed to the misuse of agrochemicals since farmers do not have access to information on their proper use and handling. As a consequence, the protection of the environment has become difficult as the agrochemical users, (i.e, the farmers) are not aware of their adverse effects on the environment.

(3) Due to the lack or inadequate information, banned and sometimes restricted and expired agrochemicals find their way into the country, and end up being used by the unsuspecting population.

(4) There is hardly any reliable data available on the extent of environmental degradation, pollution, and health hazards being caused by the use of agrochemicals.

(5) Information communication media like newspapers, pamphlets, radio and TV are in short supply and not well equipped with up-to-date information on the use of agrochemicals. In addition, they are the preserves of the urban areas.

The necessity of capturing and recording information into an organized national pool of information has been recognized. However, information products in terms of coverage, presentation and ease of use remain inadequate in terms of quality and timeliness, and hence, not responding to the expectations of the users (Sekimang'a, 1992). The observation was made with regard to the totality of Tanzania's information systems and services. A number of attempts are being made to redress the shortcomings in this sector (Sekimang'a. 1992, Materu-Behitsa. 1994). Success in this field would add up to the body of knowledge and facilities that could finally make the establishment of a truly National Information Support System in Tanzania a reality.

The Government concern with regard to the protection of the environment resulted into the establishment of NEMC. This is a positive development which has to be improved and strengthened. The proposal to establish ISSEAET has been made as an essential step towards this goal. The areas envisaged for strengthening may be summarized as follows:

(1) There is hardly any exchange of information between organizations and institutions dealing with agrochemicals. It is necessary to develop information communication networks between different nodes, i.e., institutions dealing with agrochemicals in Tanzania. ISSEAET has suggested for such a development.

(2) There is no evidence, at least the study could not find any, that much of the

information being generated reaches the users such as the agricultural extension workers and farmers in a form that could be easily understood and used. ISSEAET would provide the missing link through the information networks which would be established and strengthened.

(3) The Current Awareness and Information Dissemination services on agrochemicals are not well established. Few institutions are aware of each others holdings and research activities. With the establishment of ISSEAET the situation is expected to improve through the use of the information networks.

The need to overcome the apparent institutional and structural weaknesses in the information systems in the agrochemical subsector is the reason behind the proposal to establish ISSEAET within NEMC. Information on agrochemicals has to be collected, processed, repackaged and retrieved to meet the needs of different users -- decision makers, academicians, researchers, manufacturers, importers and formulators, agricultural extension workers and other individuals interested in the adverse effects of agrochemicals on the environment.

Decision makers have to recognise the pressing need for the delivery of usable information to the rural communities about the side effects of agrochemicals in order to raise their awareness on the risks they are facing with the misuse of agrochemicals. Such recognition presupposes the availability of relevant, timely, and accurate information. This would be made readily available to decision makers by ISSEAET. In addition, as a coordinating organ, ISSEAET would function as a national focal point where the required information could be easily accessed and retrieved. The provision of its products and services would be facilitated by the installation and use of computers and other products of advances in modern Information

Technologies . All interested users of agrochemical information could therefore have easy access to relevant, accurate, and timely information. Advances in Information Technologies provide wide opportunities in the methods used in research, education and information dissemination; and its successful utilization by ISSEAET would facilitate in agrochemical data and information recording, analysis, storage, retrieval, and dissemination.

Access to well-organized information on the use and adverse effects of agrochemicals is considered to be of great importance if the country has to devise appropriate policies and measures against health hazards, and environmental pollution. The lack of such information could lead to improper and indiscriminate use of agrochemicals with their attendant consequences, such as, the accumulation of residues in animals and plants, depletion of non-target and useful organisms, bioaccumulation along food chains, development of pesticides resistant strains (pests), and increased resurgence of new pests. In the totality of their effects, agrochemicals could affect the health of the people either directly through food consumption, or indirectly through the contamination of the water and soil which could in turn affect plant and soil productivity. The availability of different categories of information on agrochemicals would enable users to become aware of their side effects, and acquire the necessary knowledge on how to use them properly. The assurance of access to accurate information would also enable supervisory and control organs to adequately discharge their responsibilities.

Many developing countries like Tanzania have no technology, expertise, and financial capacity to embark on costly rehabilitation programmes once environmental degradation occurs. Tanzania's large territorial landmass, the sparse population, the economy based on traditional agricultural practices, an underdeveloped communications systems, an illiterate rural population, and weak and underdeveloped information systems (chapters 3 and 4), are factors that support the argument that the best and logical course of action open for the country

is to take the necessary precautionary measures. The few proven cases of environmental pollution caused by the use of agrochemicals could be just a warning that failure to take appropriate measures in time could lead to more serious consequences. The development of information infrastructures and systems on agrochemicals is one of the basic means of tackling the problem.

In conclusion, the proposed system could alleviate much of the problems by providing adequate and timely information to the researchers and, as such, they can take part in saving the country from environmental degradation. The research has also shown ample evidences which can justify the implementation of ISSEAET system in real life situation.

RECOMMENDATIONS

Any information support system, if it has to have any impact at all, should be compatible with the objective conditions prevailing in the country in terms of its policies and political orientation, socio-economic realities, and its existing information infrastructure. The recommendations being provided as part of this study should be construed as guidelines in the process of developing an information support system on agrochemicals and their impact on the environment. It is recommended that:

(1) The information infrastructure of the Ministry of Agriculture and Livestock development needs to be strengthened since it would compliment the activities of ISSEAET. The information unit attached to the Ministry does not have adequate trained manpower. Nor does it have appropriate machines and equipments necessary to practice modern information services efficiently and effectively. The Ministry has under it numerous agricultural research stations and centres in the country. The information service units attached to these stations and centres are all suffering from

the lack of trained manpower and appropriate machines and equipment necessary for collection, analysis, organization, storage, retrieval and dissemination of pertinent items of information on agrochemicals as a whole. The long-term goal should be to equip the information service units attached to the Ministry's research centres and stations with adequate number of trained manpower and appropriate machines and equipment which are all products of advances in modern information technologies. This should be considered essential to make those information service units components of the Wide Area Network (WAN) of ISSEAET.

(2) In order to materialize the above recommendation it would be necessary to make provision of adequate trained manpower in each of the information service units attached to the organizations and institutions concerned with agrochemicals on the one hand, and the environment on the other. To make it possible, it would be necessary to get adequate number of suitably qualified persons trained in advance in "Information Science", or "Information Studies". Such a training only would make them equipped with necessary knowledge and skills for carrying out sophisticated information work and service by using computers and other appropriate machines and equipment. Obviously, this recommendation is to be implemented in different consecutive phases, depending upon the availability of requisite resources.

(3) The development of the adequate number of well-equipped trained information service professionals will be of no use unless there is a simultaneous appropriate infrastructure development in all its essential components. The priority items in this infrastructural development should be the availability of appropriate computer hardware and software.

(4) The implementation of all these recommendations would call for an initial public sector expenditure of substantial amount both in local and foreign currency. Beside appropriate budgetary allocations by the national government, need would arise to explore the possibility of external funding specially from the donor countries.

(5) There has been a plan already adopted by the government to establish rural libraries across the country. But the progress has not been satisfactory. It would be necessary to implement this plan with all earnestness. It is through the services of these libraries that the rural population would be sensitized about the adverse effects of the misuse of agrochemicals.

It is only when the national information environment would be enriched by all these developments, that the full benefit of ISSEAET would be fully realized and highly appreciated. The relevant information required by decision makers, planners, managers, administrators, researchers, teachers, students, extension workers, and farmers would get what they must know to carry out their duties and responsibilities. This does not imply that the requisite information activities are to be started only when the situation is adequately enriched with all these developments. It should be initiated immediately with whatever resources available at this point of time. For the purpose of developing a computer-based information support system it becomes necessary to carry out a number of preparatory activities. These are mostly intellect-based manual activities. The products of such activities are prepared and maintained in such a way that they become readily amenable to conversion into computer readable forms. The initiation of preparatory activities should be in this line. The objective should be to develop it ultimately in the line of the proposed system, namely ISSEAET.

BIBLIOGRAPHY

Abdallah, A.M. 1991. Budget speech by the minister of agriculture and livestock development for the financial year 1991/92. Dar es Salaam: Government Printers.

Abdallah, A.M. 1992. Budget speech by the minister of agriculture and livestock development for the financial year 1992/93. Dar es Salaam: Government Printers.

Abebe, R., Bamuhiiga, B., Chisenga, J., Nxumalo, C., Sekimang'a, D., and Neelameghan, A. 1992. ABNCD+: A prototype for an integrated information storage and retrieval system. Microcomputers for Information Management. 9(3): 137 - 159.

Ak'habuhaya, J. and M. Lodenius. 1988. Pesticides in Tanzania. Helsinki: Department of Environment Conservation at the University of Helsinki No.10.

Alpern, L. 1991. ILO manual for labour information centre. Geneva: ILO.

Andrews, W.B. 1950. Response of crops and soils to fertilizers and manures. Virginia: William Byrd Press, Inc.

Bennet, H (Editor). 1986. Concise chemical and technical dictionary, 4th Ed. New York: Chemical Publishing Co. Inc.

Berry, L. 1994. Tanzania. In: Africa South of the Sahara. 23rd Ed. London: Europa

Publications Limited.

Bhattacharyya, G. 1978. Information sciences: a unified view through a systems-approach. Calcutta: IASLIC.

Bohmont, B.L. 1983. New pesticide users guide. New York: Reston Publishing Company.

Brown, L.R. and Erik P. Eckholm. 1975. Man, food and environment. In: Environment resources, pollution and society, 2nd Ed. Edited by Murdoch, W.W. Sunderland. Massachusetts: Sinauer Associates, Inc.

Brundtland, Gro Harlem et al. 1992. Our common future: World Commission on Environment and Development. New York: Oxford University Press.

Bull, D. 1982. Growing problem: pesticides and the Third World poor. Oxford: Oxfarm.

Chisenga, J. 1992. Information management in Zambia with special emphasis on the application of information technology: M.Sc (IS) Thesis, SISA, Addis Ababa: Addis Ababa University.

Collantes, A. 1993. Building a national bibliographic database in a third world country. In: Proceedings of NT'93: 6th international conference held in Puerto Rico on new information technology for library and information professionals, educational media specialists and technologists. Puerto Rico. November 13 -23, 1993. Edited by Ching-Chih Chen. West

Newton, Massachusetts: MicroUse Information, pp 69-73.

Collin, P.H. 1988. Dictionary of ecology and the environment. New Delhi: Universal Book Stall.

Collins, G.H. 1962. Commercial fertilizers, their resources and use. 5th Ed. Bombay. New Delhi: Tata McGraw-Hill. pp 1-11.

Conant, F. 1983. Resource inventory and baseline study methods for developing countries. New York: McGraw-Hill Company.

Crafts, A.S. 1967. The chemistry and mode of action of herbicides. New York: Interscience.

Daily News, february 23,1995. Tanzania Standard (Newspaper's) Limited, Dar es Salaam: Business Printers

Davis, G.B. and M.H. Olson. 1984. Management information systems: conceptual foundations, structure and development. 2nd Ed. New York: McGraw-Hill.

De Gennaro, R. 1979. Research libraries enter the information age. Library Journal 1 (January). pp 353-355

Debons, S.A. et al. 1988. Information science: an integrated view. Massachusetts: G.K. Hall & CO.

East African newspaper. March 1995. Nairobi: Nation Group.

FAO: Fertilizer year book. vol. 42. 1992. Geneva: FAO.

Golderg, E.D. and K.K. Bertine. 1975. Marine pollution. In: Environment resources, pollution and society, 2nd Ed. Edited by Murdoch. W.W. Sunderland, Massachusetts: Sinauer Associates

Gordon, C.E. 1985. Database management : objectives, system function and administration. New York: McGraw-Hill.

Gore, M.R. and J.W. Stubbe. 1984. Computers and information systems. 2nd Ed. New York: McGraw-Hill.

Government gazette No.3. 1972. Dar-es salaam: Government Printers.

Haravu, L.T. 1990. Problems, issues, and challenges for agricultural information systems and services in developing world: Keynote address delivered at the International Symposium on new horizon in agricultural information management, 13 - 16 March 1990, SDI-CAAS, Beijing, China.

Hassan, H.M. and C. Hutchison. 1992. Natural resources and environmental information for decision making. Washington, D.C.: The World Bank.

Hutchinson, S.E. and S.C. Sawyer. 1990. Computers: the User perspective, 2nd Ed. Boston: Richard D. Irwin, Inc.

Inter-Governmental Authority on Desertification and Development (IGADD). Five year development programme, 1993/98

Japan Consulting Institute. 1967. Report on basic survey for fertilizer project in Tanzania.

Khan, M.R. and H.J. Gijzen. Eds. 1990. Environmental pollution and its management in Eastern Africa: Proceedings of a Symposium held at the University of Dar es Salaam, September 11-14, 1989. Dar es Salaam. Faculty of Science.

Machunda, J.B. et al. 1982. The Tanzania national agricultural policy (Final Report). Ministry of Agriculture and Livestock Development. Dar es Salaam: Printpark (T) Ltd.

Malima, K.A. 1994. Speech by the minister of finance while introducing to the national assembly the estimates of public revenue and expenditure for the financial fear 1994/95 on the 16th June, 1994. Dar es Salaam: Government Printers.

Malima, K.A. 1993. Budget speech for the financial year 1993/94. Dar es Salaam: Government Printers.

Materu-Behitsa, M.M. 1994. Information support system for education planning (ISSEP) in

Tanzania. M.SC.(IS) Thesis. Addis Ababa. SISA, Addis Ababa University.

Mayagila, A.H. 19932. Hotuba ya waziri wa kilimo akiwasilisha makadirio ya matumizi ya fedha kwa mwaka 1992/93. Dar es Salaam: Government Printers.

McGraw-Hill Encyclopedia of science and technology. 1982. 5th ed. New York: McGraw-Hill.

McGraw-Hill encyclopedia of food, agriculture and nutrition. 1977. New York: McGraw-Hill.

Ministry of Agriculture. 1982. Bugdet speech by the minister of agriculture 1982/83. Dar es Salaam: Government Printers.

Mlaki, T.E. 1992. Educating agricultural information users in Eastern and Southern Regions of Africa. In: International workshop on management of agricultural information services held at ESAMI, Arusha, 22nd February - 6th March 1992. Edited by Musare, A. and J. Moeller. Bonn.

Molla, Hunegnaw and A. Neelmeghan. 1993. System Interface/Search Assistance for Micro CDS/ISIS. In: NIT "93: 6th International Conference. New information technology for library and information professional, educational media specialists and technologists, November 11-3, 1993. Puerto Rico. Edited by Ching-Chin Chen. West Newton, Massachusetts. MicroUse Information.

Moore, R. 1975. Man in the environment. New York: Alfred A. Knopf Inc.

Murdoch, W.W. (Ed.). 1975. Environment: resources, pollution and society. 2nd Ed. Sunderland, Massachusetts: Sinauer Associates, Inc.

Neelameghan, A. 1993. Information support for socio-economic development planning: General overview. (Lecture Notes). Addis Ababa: SISA. Addis Ababa University.

Neelameghan, A. 1991. International and Regional information systems and networks: Examples of recent experiences in developing countries. Paper presented at the Workshop on OIC information systems network (OICIS-NET) 21-24 July, Jeddah, Saudi Arabia.

Neelameghan, A. and M.A. Gopinath. 1974. Planning and integrated national information system for science and technology: A case study (Planning Series 2). In: Library Science 11 (3-4) September - December. pp 97-106.

Nega, A. 1992. National labour information network for Ethiopia (NALINET). M.Sc(IS) Thesis. Addis Ababa: SISA. Addis Ababa University.

Nhlapho, M.M. 1986. The place of a documentation centre in the supply of information in Swaziland. Problems and prospects. In: Coordination and improvement of national information services, Mbambane and Maseru workshop papers. Edited by Lutz Huttemann. Bonn: The German Foundation for International Development. pp 21-28.

Rajagopalan, T.S. 1986. Versatile integrated information systems and services: A scenario of current developments. In: Library and Information Science Horizon. Edited by Guha, B. New Delhi: Allied. pp 127-143.

Raju, S.P. 1986. Resource Sharing in University Libraries. In: Library and Information Science Horizon. Edited by Guha, B. New Delhi: Allied.

Reijnttes, B.H. and A. Waters-Buyer. 1992. Farming for the future: An introduction to low-external-input and sustainable agriculture. ILEA Netherlands. London: Macmillian.

Report on the first annual meeting of African fertilizer trade and marketing information network (AFTMIN). November 22-24, 1988. Lome.

Report of a study conducted by the Journalist Environment Association of Tanzania (JET). 1994. Dar es Salaam: Unpublished.

Rudd, R.L. 1975. Pesticides. In: Environment resources, pollution and society. 2nd Ed. Edited by Murdoch, W.W. Sunderland, Massachusetts: Sinaner Association Inc. Publishers.

Sekimanga's, D.A. 1992. A national policy on information systems and services for Tanzania: Formulation and strategy for implementation. M.Sc(IS) Thesis. Addis Ababa: SISA, Addis Ababa University.

Sheya, M.S. and Koda, G.R. 1987. The state of informatics in Tanzania. Policy issues and

strategies. In: Official report on the seminar on the informatics to economic development held in Arusha, Tanzania, 10-12 August, 1987.

Southern African Research and Documentation Centre (SARDC). Southern African environmental issues, 6. December 1993. Harare. SARDC.

Stephen, J. 1987. GLC analysis of endosulfan and other chlorinated pesticides in cotton products, soil and water. M.Sc. Dissertation. Dar es Salaam: University of Dar es salaam.

Tanzania Library Services Board. 1972. National policies of Tanzania. Dar es Salaam: The Board.

Tanzania Government. 1979. An act to establish the Tanzania Industrial Research Development Organization. Dar es Salaam: Government Printers.

Tisdale, S.L. at el. 1985. Soil fertility and fertilizers, 4th Ed. New York: Macmillian Publishing Company.

UNESCO. 1989. Mini-micro CDS/ISIS reference manual (Version 3.2) 7,Place de Fontenoy Paris: UNESCO.

UNIDO/Tanzania Government. 1992. Investor's guide to Tanzania: Land of Kilimanjaro and Zanzibar. Vienna: UNIDO.

United Nations Economic Commission for Africa. 1991. 1988 African Socio-Economic Indicators. Addis Ababa: UNECA

United Republic of Tanzania. 1979. Agriculture in Tanzania.

Dar es Salaam: Government Printers.

World of learning. 1994. London: Europa Publications. pp 1444.

World Bank. 1989. Sub-Saharan Africa: from crisis to sustainable growth. A long-term perspective study. Washington, DC: The World Bank.

GLOSSARY

Agrochemicals: Pesticides and fertilizers developed artificially for agricultural use (Collin 1992)

Database: Is a mechanised, formally defined, centrally controlled collection of data in an organisation (Gordon 1985)

Information Support System: Purpose-oriented information system designed to help in problem identification and/or finding solutions to problems, or a goal seeking system. Such a system should be capable of presenting analysed and synthesized data in a readily usable form to different user groups at different levels (Neelameghan 1993).

Fertilizers: These are materials added to the soil to supply elements needed for plant nutrition. The principal elements required are nitrogen, phosphorus, and potassium. Several others - calcium, magnesium, sulfur, boron, iron, zinc, manganese, copper, molybdenum, and chlorine - are needed in lesser amounts. They are supplied in such various ways as materials produced for the purpose, as incidental components and as compounds already present in the soil.(McGraw-Hill Encyclopedia 1982).

Network: Collection of data communications hardware, computers, communication software, communications media, and applications software connected so that users can share information and equipment. (Hutchinson and Sawyer 1990).

Pesticides: Pesticides is a broad term used to describe all chemical agents which are used to destroy animal and vegetable life which interferes with agricultural productivity. Thus insecticides, herbicides, fungicides and rodenticide used respectively, against insects, weeds, fungi and rodents are pesticides.(McGraw-Hill Encyclopedia 1977).

APPENDIX 1(a)

LETTER OF INTRODUCTION

Dear Sir/Madam

Re: **STUDIES ON ADVERSE EFFECTS OF AGROCHEMICALS ON THE ENVIRONMENT IN TANZANIA: A COMPUTER AIDED INFORMATION SUPPORT SYSTEM. QUESTIONNAIRE(s)**

I'm a graduate student at the School of Information Studies for Africa (SISA), Addis Ababa University, Ethiopia. I'm conducting a study on "Information Support System on adverse effects of agrochemicals in Tanzania. My study, among other things, involves identification of (1) environmental information users' needs,(2) information sources and environmental experts, and collection of data to be input for developing prototype databases for that purpose. The information you provide in the questionnaire(s) will facilitate the planning as well as the development of the Prototype Databases of profiles of Agrochemical Expert, Institutions, Information Systems and Environmental study Projects in Tanzania.

A computer-readable version of the prototype database(s) will be maintained by the National Enviromental Maintenance Council to provide upon request, services to researchers and other information seekers who wish to get such information, to the exitent feasible. It is expected that, later, the prototype database(s) can be used as a basis for the development of fairly comprehensive resource databases for all purposes relating to the use of agrochemicals in Tanzania.

Please return the completed questionnaire by 30th September, 1994 to:

Blandina Mataba-Cheche

P.O.Box 65453

DAR ES SALAAM, TANZANIA.

Thanking you in advance in anticipation of your cooperation.

Yours sincerely,

Blandina Mataba-Cheche.

APPENDIX 1(b)

QUESTIONNAIRE TO IDENTIFY AGROCHEMICAL INFORMATION NEEDS

1. Name (optional).....

2. Position .....

3. Affiliation/Employer .....

.....

4. Responsibilities/Duties.....

.....

.....

5. In executing your duties, what types of agrochemical information do you need? For example, do you need answers to the following questions :

1. What are all the agrochemicals mostly in use in Tanzania

2. What are their ingredients they are made of?

3. What are their bneficial effects? on soil/on yields/etc?

4. What are their adverse? on soil /on water on yields/etc

5. How to prevent their adverse effects?

6. How to cure their adverse effects ?

7. What do they do in other specific countries?

8. Who are doing research in all these areas, and where?

9. What are the results of all those reaserches? and

10. Similar such question relating to differnt countries institution /experts including those in Tanzania. .....

.....

.....

.....

.....

6. Do you write any reports? [ ] Yes [ ] No

(Please tick)

7. If yes, at what intervals? (Please tick)

[ ] weekly [ ] monthly [ ] quarterly [ ] yearly

Other (please specify)

.....

.....

8. What is included in the reports? (Please tick as appropriate)

[ ] agrochemicals used [ ] effects of the agrochemicals on the environment

[ ] budgets [ ] reviews

Any other (please specify)

.....

.....

.....

9. Are there special forms/formats used for the preparation of the reports?

If yes, please attach sample forms

10. Where do you usually get the information you need for the preparation of the reports and other purposes?

[ ] from the same office

[ ] from another office. Give name of office

.....

[ ] From reports. Give names of reports

[ ] official reports

[ ] routine reports

[ ] From library/information centre/document centre. (please give name)

.....

Any other source? Please specify

.....

.....

11. How do you get the information/data that you need.

[ ] send somebody for it [ ] get it yourself

[ ] by telephone [ ] ask the librarian

Any other, please specify

.....

.....

12. Do you get adequate information for writting reports?

.....

If no what problems do you encounter ?

.....

.....

.....

13. Do you have an information/library/documentation centre catering to your needs? (please tick). [ ] Yes [ ] No

14. If yes, for what purpose do you use its facilities?

[ ] borrow books

[ ] consult journals/reference documents

[ ] on-line search of databases

Any other. Please specify

.....

15. Does the information system mentioned above provide any of the following services? Please tick.

[ ] current awareness service (the librarian/information worker regularly informs the users about new additions to the collection and their contents)

[ ] selective dissemination of information (new information provided to people in their areas of interest)

[ ] question and answer services (technical query service)

[ ] reference services

[ ] referral services

[ ] translation service

[ ] reprographic (copying) service

Any other. (Please specify)

.....

16. Do you feel that your information center meets your information requirements? Please tick one.

[ ] very much [ ] slightly [ ] does not

17. If you do not go to the Information center regularly, what's the reason

[ ] Too busy

[ ] Library is far

[ ] Library does not have relevant materials.

Any other

.....

....

18. Under whose authority do you think the Environmental Information Support System should be? (please tick three in order of priority)

[ ] Ministry of Environment and Natural Resources

[ ] Ministry of Agriculture

[ ] Sokoine University of Agriculture

[ ] National Environmental Management Council

[ ] National Library

[ ] Independent

19. What is the frequency of receiving queries/questions about environmental pollution caused by the use of agrochemicals?

[ ] Daily

[ ] Weekly

[ ] Monthly

20. What categories of people frequently ask for what information?

.....

.....

.....

.....

21. Please, give any additional remarks or comments concerning your information requirements, problems in obtaining the information, how the information is presented, and any suggestion on how provision of agrochemical information can be improved.

.....

.....

22.It is assumed that you must be collecting and storing certain type of information about the use of agrochemicals in your personal files .

What type of information on agrochemicals do you store

.....

In what form are they stored ?

.....

.....

23. What are your considered opinions about the need, feasibility and usefulness of computer aided information support system on adverse effects of the use of agrochemicals in Tanzania? Would it be more efficient and effective than a manually operated system?

.....

THANK YOU

APPENDIX 1(c)

QUESTIONNAIRE FOR PROFILES OF INSTITUTIONS DEALING WITH AGROCHEMICALS

1. Name of institution

.....

2. Mailing address

.....

Telephone ..... Fax ..... Telex .....

3. Working language(s)

.....

4. Nature of Work:

[ ] Agricultural Research only

[ ] Agricultural Research Partially

[ ] Agricultural research as a support to the major occupation of the institute

[ ] Teaching/academic

[ ] Extension Services

[ ] Consultancy

[ ] Others (please specify)

.....

.....

5. Name of Sponsor/Parent body

.....

6. Year of establishment

.....

7. Objective

.....

.....

8. Teaching Institution

8.1. Entry qualifications

.....

8.2. Graduation requirements

.....

.....

.....

.....

.....

8.3. Academic year

.....

8.4. Length of course:

Part time .....

Full time .....

8.5. Application method

.....

.....

8.6. Enrolment capacity

.....

8.7. Teaching staff

Qualification	Required	Present
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

8.8. Sponsored projects/departments

.....

.....

.....

9. Please list any publications produced by your institution.

Name	Periodicity
.....	.....
.....	.....
.....	.....

THANK YOU

APPENDIX 1(d)

QUESTIONNAIRE FOR PROFILE OF INFORMATION SYSTEMS

1. Name (of information institution)

.....

.....

2. Date of establishment .....

3.Mailing address

.....

Telephone .....

Telex ..... Fax .....

4. Sponsor/Affiliation/Parent body

.....

.....

5. Working language(s)

.....

6. Name of the head

.....

Qualifications/Designation

.....

.....

.....

7. Staff establishment (Professionals, semi professionals, supporting staff, etc)

Qualification	Number
.....	.....
.....	.....
.....	.....
.....	.....

8. Objectives

.....

9. Activities

(attach additional sheet if required)

.....

.....

.....

.....

10. Subject specialization

.....

.....

11. Information services provided

[ ] current awareness service

[ ] SDI service

[ ] Lending service

[ ] reference service

[ ] referral service

[ ] technical query service

[ ] review service

[ ] translation service

[ ] reprographic (copying) service

12. Holdings

Type	Quantity
Monographs	.....
Bound volumes of periodicals	.....
Current journals	.....
Current newspapers	.....

13. Machines and equipment

Audio visual equipment .....

Computers

Type	Model	Software
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

13. Computer readable Databases

Database Name	Coverage (period)	
On CD-ROM	.....	.....

Locally developed ....

....

International databases

(on-line access)

Name Coverage

....

....

....

4. Use of standards

1. Formats

2. Manuals

3. Codes

4. Vocabulary control device (Schemes for classification/subject-heading lists/thesauri etc.)

.....

.....

15. Please list any periodical publications by your institution.

Name Periodicity

....

....

....

THANK YOU

APPENDIX 1(e)

QUESTINNAIRE FOR RESEARCH PROJECTS IN PROGRESS

1. Research project title

.....

.....

2. Project reference number .....

3. Duration.....

4. Name and address of institution at which the work is being done

.....

.....

5. Name of head of project/consultant

.....

.....

6. Source of financial support

.....

.....

7. Time limit of expenditure .....

8. Objectives of the project

.....

.....

.....

9. Scope

.....

10. Methodology and approach

.....

.....

.....

.....

11. Equipment

.....

.....

12. Current activities and progress

.....

.....

.....

.....

13. Future plans

.....

.....

.....

14. Major references

.....

.....

THANK YOU

APPENDIX 1(f)

EXPERTS PROFILE QUESTIONNAIRE

Last name ..... Other name(s) .....

Year of birth ..... Sex ..... Nationality .....

Permanent mailing address

..... Telephone: Office ..... Home .....

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

E-Mail .....

ACADEMIC QUALIFICATIONS

1. Field of study

.....

Degree .....

Year obtained ....

Name and place of institution

.....

2. Field of study

.....

.....

Degree..... .....

Year obtained .....

Name and place of institution

.....

3. Field of study

.....

.....

Degree .....

Year obtained .....

Name and place of institution

.....

.....

.....

FIELD(S) OF SPECIALIZATION

.....

.....

.....

IMPORTANT PUBLICATIONS

1..... .....

.....

2.....

.....

3.....

Working language(s).....

EMPLOYMENT RECORD

1. Current employer

....

Title of post

.....

Duration: from ..... to .....

What type of agrochemicals do you handle?

CHEMICAL NAME PURPOSE

....

....

What is its effect on the environment

.....

.....

.....

2. Last employer

.....

.....

Title of post

.....

Duration: from ..... to .....

Description of duties

.....

.....

3. First employer

.....

.....

Title of post

.....

Duration: from .. to .....

Description of duties

.....

.....

.....

CONSULTANCY OR EXPERT ASSIGNMENTS UNDERTAKEN

1. Description of assignment

.....

.....

Duration: from ..... to.....

Place

.....

.....

2. Description of assignment

.....

Duration: from ..... to .....

Place

.....

THANK YOU

APPENDIX (1g)

INTERVIEW FOR ASCERTAINING THE INFORMATION NEEDS OF PROFESSIONALS DEALING WITH THE USE OF AGROCHEMICALS IN TANZANIA

INTERVIEW GUIDELINE

- Person's status
- Place of work
- Brief introduction to the purpose of interview
- What type of sources of data/information do you need for execution of duties (e.g. reports, minutes of meetings, research reports, etc.)
- Is there a library/information service at your Institution/Ministry?
- What services does it provide?
- In the short/long term plan of the organisation (mention name of specific organisation) is there provision for the establishment of an information centre?
- What are your opinions about the existing information which support the execution of your activities? (Is it adequate? Is it timely?)
- What are your opinions on the usefulness of information in planning and decision making?
- What are your opinions about the prospects of establishing a Computer aided Information System to Support on adverse effects of agrochemicals in Tanzania?
- What do you think should be the immediate areas of concern such an information suport system?
- What are the possible sources of funds?
- What are your general opinions about the role of appropriate information/accurate data in the general performance of activities in your area of concern, and in the study of environmental pollution in general?

APPENDIX 2

PARTICIPATING CENTRES

Environmental issues in the country are considered by more than one authority. These institutions are expected to collaborate very closely with ISSEAET, hence the reason why they have been termed as participating centres in the collection, analysis, storage and dissemination of information with regard to the use and adverse effects of agrochemicals in the country.

1) Under the Ministry of Science, Technology and Higher Education, there is:

(a) The National Radiation Commission; and

(b) The Tanzania Commission for Science and Technology

(2) Within the Ministry of Agriculture and Livestock Development, a number of Research institutions have been established, each mandated to conduct research in one or several crops or livestock development. Some of the research institutions include:

(a) The Tropical Pesticides Research Institute (TPRI), Arusha;

(b) Lyamungu Coffee Research Station - coffee and beans

(c) Mlingano Research Institute - sisal and soil

(d) Ukiriguru Research Institute - cotton, cassava and sweet potatoes

(e) Ilonga Research station - maize, soyabeans, millet, peas

(f) Tengeru Research Station - horticulture and vegetables

(g) Kibaha Research Station - sugarcane

(h) Makutupora Research Station - grapes

(i) Tumbi Research Station - tobacco and agroforestry

(j) Kifyulilo Research Station - tea

(k) Uyole Agricultural Centre - Irish potatoes, maize, beans and pyrethrum, beef and dairy farming

(l) National Coconut Development Project (NCDP) - coconut

(m) Maruku Research Station - banana

(n) Katrin Research Station - Rice

(0) Seliani Research Station - wheat and barley

(p) Naliendele Research Station - cashewnut, groundnut and sesame

(q) Dakawa Research Station - maize and rice

(r) Mpwapwa Livestock Research Centre - beef and dairy farming

(s) Kongwa Livestock Research Centre - pasture

(t) Tanga Livestock Research Centre - pasture

Source: Ministry of Agriculture: Budget Speech for the Financial Year 1992/93 (Appendix B, p.58)

(3) The Morogoro based Sokoine University of Agriculture, being an institution of higher learning, undertakes research programmes in soils, agrochemical effects on crops, soils, and dairy farming.

APPENDIX 3

MATAB FIELD DEFINITION TABLE

Tag	Name	3Len	3Type	3Rep3	Delimiters/Pattern3
_ 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	Bibligraphical 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		9999-99-99
_ 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	Documetalist (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 refernce(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 9999-99-99

_ 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	Specilization	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	Commitee'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 4(a)

WORKSHEET FOR BIBLIOGRAPHIC RECORDS

Record status: .....

Date record entered..... Date record changed.....

Bibliographic level..... Bibliographic level of parent.....

Country of origin.....

Record number of parent.....

Record number(s) of other language version(s).....

Language of analysis..... Language of text.....

Language(s) of summaries.....

Title.....

Parallel title(s).....

Translated title- English.....

Translated title- French.....

Translated title- Spanish.....

Translated title- Other.....

Persona author(s).....

Corporate author(s).....

Affiliation.....

Other associated institution(s).....

Meeting.....

Edition..... Publisher.....

Date of publication/issue- free form.....

- ISO form.....

Part Statement.....

Project.....

Note(s).....

ISBN..... Document number.....

Title of Serial.....

Title of parent (M/C).....

Personal author(s) - parent.....

Personal author(s) - parent.....

Primary descriptors.....

Secondary descriptors.....

Geographic descriptors.....

Local descriptors.....

Proposed descriptors.....

Abstract.....

Broad subject heading.....

Processing status.....

Location.....

Number of copies.....

Documentalist.....

APPENDIX 4(b)

WORKSHEET FOR PROFILE OF EXPERTS

Type of record(999)E Date record entered.....

Record heading PROFILE OF EXPERT.....

Name of person.....

Sex.....

Affiliation.....

Address.....

Date of birth.....

Assignments.....

Nationality.....

Formal educational qualifications.....

Language competence.....

Discipline.....

Work experience.....

Current work.....

Project title.....

Recommended by.....

Honours and awards.....

Membership in associations.....

Marital status.....

Remarks/Notes.....

Person entering data.....

APPENDIX 4(c)

WORKSHEET FOR RECORDS OF PROFILE OF INSTITUTIONS AND INFORMATION SYSTEMS

Record type(999)i Record heading PROFILE OF INSTITUTIONS.....

Date record entered .....

Principal officers.....

Name of Institution .....

Trans. name of instn.....

Parent organization .....

Address .....

Location .....

Working language .....

Associated entities.....

Services offered.....

Descriptor.....

Geographical area.....

Discipline.....

Financial aspects.....

Resources (equipment).....

Membership in societies.....

Honours and awards.....

Date of establishment.....

Type of research.....

Objectives.....

Personnel.....

MFNs of publications.....

Note.....

Activities.....

Periodical publicat. .....

Person entering data.....

APPENDIX 4(d)

WORKSHEET FOR RECORDS OF RESEARCH PROJECTS

Record type(999)P Record heading RESEARCH PROJECTS.....

Date record entered.....

Project title.....

Principal officers.....

Performing institutions.....

Type of institution.....

Other associated institutions.....

Address (Phone, etc).....

Project number(s).....

Contract number(s).....

Language of project.....

Location..... Duration.....

Current status of project.....

MFNs of Related Projects.....

Descriptor.....

Geographical area.....

Discipline.....

Financial aspects.....

Resources (equipment).....

Research priority.....

Committe's Decision.....

Date:Proposal/Approval.....

Date:Starting..... Expected completion.....

Date:Actual completion..... Date terminated.....

Type of research.....

Recommended by.....

Objectives.....

Resource Persons.....

Resource Persons type.....

Personnel.....

MFNs of publications.....

Note.....

Abstract/Description.....

Person entering data.....

APPENDIX 5

FST FOR MATAB DATABASE

DataBase Name: MATAB FST for Inverted File FST Name: MATAB

ID	IT	Data extraction format
- 100	4	(v100/)
- 110	1	mhl,v110
- 111	1	mhl,v111^a
- 111	0	(v111^a/)
- 111	0	(v111^b/)
- 300	2	(v300/)
- 302	0	(v302^a/)
- 310	2	(v310/)
- 320	0	(v320^a/)
- 525	1	(v525^a/)
- 625	2	(v625/)
- 700	0	(v700^s/)
- 831	0	(v831^a/)
- 831	0	(v831^b/)

- 831	0	(v831^c/)
- 834	0	(v834^a/)
- 834	0	(v834^b/)
- 834	0	(v834^c/)
- 895	0	(v895^n/)
- 900	0	(v900/)
- 954	0	(v954^a/)
- 955	0	(v955^a/)
- 960	1	mhl,v960
- 961	0	(v961/)

APPENDIX 6

DISPLAY FORMAT FOR BIBLIOGRAPHIC RECORDS

Please enter/edit format (@xxxxx to use predefined format)

IF v999: 'B' then mdl,c25,'*** BIBLIOGRAPHIC RECORDS ***'##/"Title:1 00(0,17)/"Author(s): "v110(0,17)/"Publisher: "v121/"Year: "v122/"ISBN: "v160/"Descriptors: "v300(0,17)/"Abstract: "v310(0,17)/"Subject Heading: "v320(0,17)/fi

APPENDIX 7

DISPLAY FORMAT FOR EXPERT RECORDS

Please enter/edit format (@xxxxx to use predefined format)

IF v999: 'E' then mdl,c25, '***PROFILE OF EXPERTS***'## "Name: "v110/"Sex: "v836/"Affiliation: "v112(0,16)/"Address: 'v116(0,16)/,"Date of Birth: "v447/"Assignments: "v556(0,16)/"Nationality: "v830/"qualifications: "v831(0,16)/"Language: "v525/"Specialization: "v832/"Marital status: "v835/,"Work experience:"v833(0,16)/"Current work: "v834(0,16)/"Project title: "v200(0,16)/,"Recommended by: "v850(0,16)##

APPENDIX 8

DISPLAY FORMAT FOR INFORMATION SYSTEMS AND INSTITUTIONS RECORDS

Please enter/edit format (@xxxxx to use predefined format)

mdl, c25,IF v999:'i' then '*** PROFILE OF INSTITUTIONS ***'else IF v999:'S'then '***INFORMATION SYSTEMS***'fi fi##"Name: "v111(0,22)/" Parent organization: "v112(0,22)/,"Type of Institution: "v960/"Address: "v116(0,22)/"Working language: "v525/"Services offered: "v900(0,22)/"Databases Int.: "v894(0,22)/"Databases Ext.: "v895/"Classification System:"v896/"Descriptor: "v300(0,22)/"Discipline: "v320/"Financial aspects: ",v700/,"Date of establish.: "v443/IF v999:'i' then "Type of Research: "v961 fi/"Objective: "v625(0,22)/"Personnel: "v570(0,24/"Note: "v150(0,22)/"Activities: "v310(0,22)/"Periodical Publicat.: ",v899/##

APPENDIX 9

DISPLAY FORMAT FOR RESEARCH PROJECTS

Please enter/edit format (@xxxxx to use predefined format)

If v999:'P' then mdl,c25'***RESEARCH PROJECTS***'##"Project title: "v100(0,18)/"Performing Inst.: "v111(0,18)/"Type of Inst.: "v960/"Address: "v116/"Project No.: "v954/"Language: "v525/"Descriptors: "v300(0,18)/"Geographical Area:"v302(0,18)/"Specialization: "v320/"Finance: "v700(0,18)/"Research Priority:"v965(0,18)/"Date Approval: "v442/"Date Start.: "v443/"Expected Compl.: "v444/"Type of Research: "v961(0,18)/"Objective: "v625(0,18)/"Note: "v150(0,18/"Abstract: "v310(0,18)##fi

APPENDIX 10

FIELD DEFINITION TABLE FOR FERTZ DATABASE

Tag	Name	Len	Typ	Rep	Delimiters/Pattern
10	Group	50	X		
20	Common name	70	X		
30	Manufacturer	80	X	R	
40	Importer	50	X	R	
50	Properties	500	X	R	
60	Stability	500	X		
70	Crops used on	100	X	R	
80	Type of soil	200	X	R	
90	Adverse effect Envirn.	1000	X	R	

APPENDIX 11

WORKSHEET fOR FERTILIZERS RECORDS

Group.....

Common name.....

Manufacturer.....

Importer.....

Properties.....

Stability.....

Crops used on..... Type of soil.....

APPENDIX 12

FIELD SELECT TABLE FOR FERTZ DATABASE

ID	IT	Format
10	0	v10
20	0	v20
30	0	(v30/)
40	0	(v40/)
50	2	(v50/)
70	0	(v70/)
80	1	(v80/)
90	2	v90

APPENDIX 13

DISPLAY FORMAT FOR FERTZ DATABASE

Please enter/edit format (@xxxxx to use predefined format)

mdl,c25 '***RECORDS ON FERTILIZERS***'##"Group: "v10/"Common name: "v20/"Manufacturer: "v30/"Importer: "v40/"Properties: "v50(0,18)/"Stability: "v60(0,18)/"Types of crops: "v70(0,18)/"Type of soil: "v80(0,18)/"Effect on Environ:"v90(0,18)##

APPENDIX 14

FDT FOR PEST DATABASE

Field Definition Table (FDT) Data Base: PEST

Tag	Name	Len	Typ	Rep	Delimiters/ Pattern
- 10	Group	50	X	R	
- 20	Trade Name	70	X		
- 30	Common Name	70	X		
- 40	Manufacturer	100	X	R	
- 50	Importer	100	X	R	
- 60	Formulator	100	X	R	

- 70 Properties 1000 X

- 80 Solubility 100 X

- 90 Stability 100 X

- 100 Toxity 500 X

- 110 Effective against 100 X

- 120 Pre-harvest interval 100 X

- 130 Adverse Effect 1000

- 140 Source(s) of Information 500 R

APPENDIX 15

WORKSHEET FOR RECORDS ON PESTICIDE

Group.....

Trade Name.....

Common Name.....

Manufacturer.....

Importer.....

Formulator.....

Solubility.....

Stability.....

Toxicity.....

Effective against.....

Pre-harvest Interval.....

Source(s) of Information.....

APPENDIX 16

FIELD SELECT TABLE FOR PESTICIDES

ID	IT	Format
10	0	v10
20	0	v20
30	0	v30
40	0	(v40/)
50	0	(v50/)
70	2	v70
130	2	v130

APPENDIX 17

DISPLAY FORMAT FOR PESTCIDE DATABASE

mhl.c25,'***RECORDS ON PESTICIDES***'##"Group: "v10/"Trade name: "v20/"Common name: "v30/"Manufacturer: "v40/"Importer: "v50/"Formulator: "v60/"Properties: "v70(0,18)/"Solubility: "v80(0,18)/"Stability: "v90(0,18)/"Toxicity: "v100(0,18)/"Effective against:"v110(0,18)/."Adverse Effect: "v130(0,18)/"Preharvest interv:"v120(0,18)/"Sources of inform:"v140/##

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