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

A SURVEY OF INFORMATION REQUIREMENTS OF AGRICULTURAL EXPERTS, MINISTRY OF AGRICULTURE, KENYA

BY
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Dedication

In memory of my late loving father
Mzee Alphonce Osoro Machogu

" I will always remember you dad"

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ABSTRACT

This study surveys the information requirements of agricultural experts in MoA, Kenya. Specifically, to assess the information needs; to find out the extent to which these needs are met; to establish from where the experts obtain information; to assess the information seeking behavior of agriculturists; to find out the problems encountered by the experts when seeking information and to offer suggestions towards effective information delivery to the agriculturists based on the survey results.

Agriculture information plays a very important function in agricultural management. Regardless of this fact, the currently existing agricultural information systems within Ministry of Agriculture do not fully perform their vital role in agricultural management, as it is believed to. In particular, the Library Information Services (LIS) has failed to provide information to its users; the library is disseminating outdated information, relied on infrequently revised monographs at the expense of current sources of information (Chepukaka, 1998). The available information is ineffectively disseminated; therefore, there is a need to improve linkage between agricultural information and agricultural management, in view of the fact that the current paradigm is to set up agricultural information systems that tie the users to the information resources.

A survey, using a semi-structured questionnaire was used to gather data. Seventy-six agricultural experts were sampled using stratified and purposive sampling techniques. The data was analyzed by use of descriptive statistics.

The study revealed that the experts' information needs were greatly influenced by the nature of the work they do, and the information needs in turn influences their information seeking

habits. The agricultural experts have placed high importance on technical, market, and socio-economic information. They rely on informal sources of information such as colleagues. They do not rely on library collections to satisfy their information needs. It was noted that card catalogue as an information retrieval tool is still dominant in the MoA libraries. Limiting factors to effective use of agricultural information by the experts was mainly due to the fact that the information sources are scattered at different locations.

To address the problem of information sources scattered at different places within MoA and outside sources, a Ready Reference database system for MoA was proposed, designed and a prototype developed. The objective of the proposed database system is to direct users to sources of information that satisfy their information needs. It was also recommended that: Selective dissemination of information should be a major component of agricultural information services, teaching of information seeking skills, formulation of an agricultural information policy, management support, modernization of the MoA information services, future studies to consider applying other data-gathering techniques like interviewing, observing the businesses of MoA in operation and examining documents in particular those used to record or display information among others.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Identification of information requirements of users is essential to the design of information systems in general and to the provision of effective information services in particular.

According to Devadason and Lingam, (1996) the unstable changing environment calls for continual research to ensure that the needs of the information users are satisfactorily met and that information professionals acquire the required expertise to cope with the operational management of the information resources and plan for the future. Identifying information requirements is a vital link in the chain of operations from information gathering to dissemination. However, one might spend a lot of time, effort and money mining the various information sources and gather a great deal of sound information that does not answer the key questions of the user's decision-making/action taking. Hence, before initiating, developing or tuning any information center/system, the relevance of information to be gathered for users must be checked thoroughly, which in turn depends on the identification of information requirements.

Thus, an understanding of the nature and number of users, their activities vis-à-vis information requirements, information seeking behavior etc., will help an information worker develop an appropriate information system which satisfies identified information requirements.

Fidel (1999), in reviewing user-centered approach to the design of information systems,

points out that rather than teaching a user how to adapt to an information system, it is better to find out how users look for information and design systems that adapt to users searching behavior. That means that information systems should be designed according to what users need. It also means that different groups of users may require different types of information system.

Fidel states that "the more the system fits a user's needs and searching behavior, the more likely is the user to find useful information ... it is important to design systems in which users can easily find information that is useful, systems that are responsive to the way users search them".

1.2 The Agriculture sector in Kenya

The agricultural systems of Sub-Saharan Africa (SSA) countries in general, and Kenya in particular, display two common features: a high proportion of the population is engaged in agricultural activities, and relatively low output per farmer. Again, in most of these countries agriculture is the mainstay of their economies and accounts for sizeable percentages of the Gross Domestic Products (GDP).

In Kenya the agricultural sector is the base for economic growth, employment creation and foreign exchange generation. The sector is also a major source of the country's food security and a stimulant to growth of off-farm employment, both of which are primary concern to the government. These are obvious considerations given that approximately 80% of the country's population live in rural areas and depend on agriculture for their livelihood.

Kenya with a population of about 28 million and an annual growth rate of 0.03% has an

agricultural Gross Domestic Product (GDP) of about 26%, indirectly contributes a further 27% through its linkage with other sectors, employs approximately 70% of the labor force and generates 60% of the total foreign exchange and 75% of industrial raw materials (MPND, 2000).

The government has emanated policies that regulate the development of agriculture. One such policy is the sessional paper no.2 of 1994 on National Food Policy, which states:

" The major national objectives in Kenya's Development policy are food self-sufficiency, food security, employment creation, income generation, generation of foreign exchange earnings, rural-urban balance, and overall growth."

The agricultural sector has an enormous task of meeting these national objectives. The major role of the Ministry of Agriculture is therefore to co-ordinate all the activities that lead to the fulfillment of the stipulated objectives.

Within the government and the private sector there are players who are expected to act towards the fulfillment of the stated national objectives. These players will need information as a key resource or in the development of the agricultural sector. The management of information resources, therefore, becomes crucial.

1.3 Information and agricultural development

One basic attribute of information is that it must help in solving problems. For this to be possible it must be relevant to the user's needs at any given time. In the agricultural sector, information is one of the appropriate tools among more direct ones, which can be relied on, to

increase food production. According to Ensua-Mensa (1995), effective information delivery service, coupled with applied research and good practical training, can enhance agricultural development programs. Also the status of research including the stock of knowledge, and the rate of new ideas are important if any rapid development is to take place.

According to Blackenbury, 1984 quoted by Entsua-Mensah (1995), increased agricultural productivity depends largely on the dynamics of technical changes associated with the farming system. In his opinion, some of the decisive factors include the generation of innovative knowledge through research; the dissemination of innovative ideas through extension services; and the reaction of the potential adopters (i.e. the farmers) to these ideas. Thus, it is implied from the above that there is the need to create awareness among the stakeholders in the agricultural sector in general so as to enable them to adjust their agricultural management practices to support increased agricultural production.

1.4 Statement of the problem and justification

Research in the area of agricultural information needs/requirements has already been done. Two such studies, which focused on agricultural information in Ethiopia and Sudan, are worth mentioning so as to highlight how these studies differ from the present one or how the present one compliments these two studies.

Nagat (1994) carried out a needs assessment study with a view to developing a national agricultural information system in Sudan. Her study focused at a national level, while the present study focused at an enterprise level, that is a system geared to giving support within the organization in this case the Ministry of Agriculture (MoA).

Gashaw (1992) undertook an assessment study with a view of finding ways of exploiting the existing agricultural information resources in Ethiopia so as to establish a national agricultural information network in the country. His study was concerned with the establishment of a National Agricultural Network, while the present focused on public agricultural management system in Kenya with a view of enhancing the performance of agriculturists in the MoA.

Gashaw (1992) and Nagat (1994) studies were of a national outlook since they focused on agricultural information in a more general manner. The current study complimented these studies; it looked at agricultural information requirements with special reference to government agricultural management systems in Kenya. The need to study information requirements of government agricultural experts stems from the following factors:

Despite the role of agriculture in the country's economy, the past few years have shown a slow economic performance in the agricultural sector, the growth in this sector fall to 1.2 % in 1999 from 1.5 % recorded in 1998. Inadequate information services have been identified as one of the key constraints hindering agricultural development besides fall in prices of coffee and tea on the international market and inadequate rainfall in the major food growing areas (MPND, 2000).

Secondly, agriculture information plays a very important function in agricultural management. Regardless of this fact, the currently existing agricultural information systems within Ministry of Agriculture do not fully perform their vital role in agricultural management, as it is believed to. In particular, the Library Information Services (LIS) has failed to provide information to its users; the library is disseminating outdated information, relied on infrequently revised monographs at the expense of current sources of information

(Chepukaka, 1998). The available information is ineffectively disseminated; therefore, there is a need to improve linkage between agricultural information and agricultural management, in view of the fact that the current paradigm is to set up agricultural information systems that tie the users to the information resources.

Thirdly, the need for adequate agricultural information has been further stressed by the MoA, through the Agricultural Information and Resource Center (AIRC) on the assertion that information on agriculture was required and useful in decision-making process at levels in the sector. The AIRC needs, therefore, to identify the type of data to be sought, collected and maintained to meet its objectives.

Fourthly, Kenya's agriculture is evolving from subsistence practices into the technology driven market-oriented tendencies of this millennium. Farming is being commercialized, for example, horticulture, fishing, floriculture, ostrich farming, snail, crocodile, due to scarcity of land; the need for agricultural information is, therefore, poised to become crucial. Given the dynamism of the agricultural industry, the future belongs to those who are able to keep abreast with the rich harvest of available information. Such players are then able to formulate policies and strategic measures to ensure that they are one step ahead of competition. Besides, for an agriculturist to be able to construct the future and strategies properly he needs relevant data on various agricultural variables. Accurate information is practically indispensable in this quest.

With the aforementioned issues in mind and the fact that no known data-generated user study has been carried out to survey the information requirements of agriculturists in MoA, Kenya. It is against this background that a survey was carried out to identify the information

requirements of the agricultural experts in the MoA, Kenya.

1.5 Objectives

1.5.1 General objective

The main objective of this study is to assess information requirements of Agricultural Experts in the MoA, with a view to identifying and improving on the weakness of the system. The output of such improvement will be an attempt to design a prototype information system whose aim will be to help the experts become more efficient in their duties in MoA.

1.5.2 The specific objectives

The following are the specific objectives of the study:

1. To assess the information needs of agricultural experts in MoA, Kenya;
2. To find out the extent to which these needs are met;
3. To find out the existing agricultural information services and sources available in the MoA in terms of availability and accessibility;
4. To assess the information seeking behavior of agriculturist in MoA;
5. To investigate the extent of use of agricultural information by agricultural experts;
6. To identify problems agriculturists in MoA experience when seeking information;
7. To offer suggestions towards effective information delivery to the agriculturists in MoA;
8. To recommend an appropriate agricultural information system for the agriculturalists; and
9. To design, develop, and demonstrate a prototype information system for the recommended agricultural information system.

1.6 Significance of the study

This study will assist to identify the information requirements of agricultural experts. This information will be used to solve the problems that these group of users encounter in seeking and using information for their day-to-day activities. In addition, this study will provide an opportunity for all the beneficiaries of the agricultural information systems to make suggestions to improve the existing agricultural information systems;

Upon implementation, the results of the study will enable the appropriate provision of relevant and up-to-date information to the agricultural experts. This will improve agricultural decision-making/action taking, hence increased agricultural production and living standards of the farming community. This will also contribute to the overall growth of the country's economy;

It is hoped that the findings of this study will assist policy makers and information professionals in the MoA in designing and developing an appropriate information support system, which will promptly satisfy the identified information requirements of the agricultural experts;

The information professionals in the MoA are also beneficiaries of this study. The study is to assist them to appreciate the limitations of the present agricultural information systems; as a result it will streamline the existing information systems (e.g. libraries, information centers) for optimum utilization;

1.7 Scope and limitations

This study focused at information requirements of government agricultural experts in Kenya

with special reference to the MoA headquarters. Detailed issues on agricultural production, services and management were not dealt with but were looked at from an information point of view. The identified government agricultural experts were selected from the technical staff of the MoA. The survey did not include provincial and district technical personnel, since samples of their activities are represented at the departmental level in the Ministry headquarters, Nairobi.

1.8 Methodology

Research Methodology is a systematic procedure adapted by researchers to conduct research. Saraharel (1991) defines methodology as 'the study of methods by which we gain knowledge.' It deals with cognitive processes imposed on research by the problems arising from the nature of its subjects. This section examines in detail the methodology adopted in carrying out this research.

1.8.1 Target population

The study was conducted among agriculturist in the MoA. The participants were 76 technical staff of the Department of Agriculture, MoA headquarters, Nairobi. These are qualified scientists with a minimum of a first degree in agricultural sciences, charged with the responsibility of formulating policies and initiating projects in their respective areas of specialization as well as superintending extension workers who in turn transfer information on advances in agriculture to the rural farmers and pastoralists.

1.8.3 Sampling method

Participants of the study were selected purposively; the participants were divisional chiefs and heads of units (proportionate to the number of units in a particular division). Purposive sampling technique was helpful in examining the target MoA information user population. It is the best technique to select cases with purpose (Neuman, 1994). Selecting subjects who represent the population by displaying certain common attributes is easier and meaningful than considering the traditional random technique that may mislead to include non-users and non-active members (Berg, 1995

1.8.4 Data collection instrument

The data collection tool was a questionnaire (Appendix I), which included questions on the following subheadings: personal information; information needs; information systems, services and sources; information use pattern, feasibility of improving access to information; media of communications; effectiveness of information services; problems and general comments. The questionnaire was used because it was easier to implement and involved less time on the part of the researcher.

Pretesting of the questionnaire

The dependability of the questionnaire was ascertained by pretesting it among five agriculturalists. The results of the pilot survey highlighted the following weakness in the questionnaire:

Out of context questions such as "How do you start and end your search for information?"

This question yielded information that was not relevant to the objectives of the study.

Duplicate questions were also highlighted; examples of such questions were

"Whenever you visit a library do you consult a librarian?" "Do you consult an information officer in your topic of research?"

Unanswered or unfilled questions were excluded from the questionnaire, such questions were: "Who to you report to?" "Who reports to you?" "Do you hold meeting?" "Is information part of your discussions?"

The results made it necessary to redesign the questionnaire and a total of seventy- six questionnaires were distributed to the sample population by the researcher.

1.8.5 Data analysis, Presentation and interpretation

The responses derived from the questionnaires were translated into codes, and number values were used to represent data values. Some items in the questionnaire were precoded while those that were not precoded were assigned codes during data analysis. Coding involved assigning a number to each characteristic response indicated by a respondent on the questionnaire. For example, all the yes/no responses were coded by assigning a '1" to a "yes" and a '2' to a "no" response. The codes were just classification scheme that aided in data reduction.

All data were collected and then analyzed by use of descriptive statistics in order to determine frequencies and percentages. The frequencies and percentages of each question were calculated and presented in a tabular form.

The content analysis method was applied to analyze responses from open-ended items. According to Keringler (1973) in Dane (1990) content analysis is "... objective and

quantitative method for assigning types of verbal and other data into categories".

The responses were analyzed and categorized into some meaningful way. Codes were assigned in some cases and then analyzed by use of descriptive statistics in order to determine frequencies.

1.8.6 System development methodology

A data-oriented approach was used for designing the proposed system; a data-oriented approach is concerned with the structure of the data and the relationships between the data required by the application areas and user groups. The advantage of this approach is that it separates the definition and the structure of the data from the application programs and stores it in the database. If new data structures are added or existing structures are modified then the application programs are unaffected, provided they do not directly depend upon what has been modified.

The entity-Relationship model was used to produce a conceptual data model. E-R Modeling approach has the advantage of simplicity and a simple transformation to an appropriate database scheme. The resulting conceptual data was then refined into a logical model by employing and adopting the relational database design. The target DBMS for the construction of the database was Microsoft Access 2000.

1.9 Organization of the thesis

The thesis consists of five chapters, chapter one deals with the background information of the study, chapter two deals with related studies, chapter three presents the survey results, chapter four describes the prototype of the proposed information system and chapter five deals with

the conclusion and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

Prior to the start of this study, a review of relevant literature was done; the information was valuable to the conceptualization and design of the current study. This chapter, therefore, reviews literature on the concept of information, information needs/requirements, information seeking behavior, and agricultural information user studies.

2.1 The concept of information

The concept of information can be perceived as something between data and knowledge that is 'communicated or received concerning a particular fact or circumstance' (Random House Dictionary). The most cited and perhaps the most useful definition of information is 'that which reduces uncertainty'. In considering a source of information, 'information is a symbol or string of symbols which have potential for meaning (Faibisoff, 1978, cited by Fidel, 1999)

2.2 Agricultural information

The ultimate consumer of agricultural information is the farmer or other agricultural practitioners. However, agricultural information is an umbrella term encompassing information generated from a large number of sources, which may be aimed at a range of user groups and required for different purposes. Aina (1990) defines agricultural information as "all published and unpublished knowledge on all aspects of agriculture". He identifies four main categories of agricultural information:

Technical/scientific: This type of agricultural information arises from research and development work aimed at increasing agricultural production by providing high yielding

crop varieties, controlling major pests and diseases, developing new methods of crop production, and so on;

Commercial: This includes information relating to agricultural credits and cooperatives, national prices for exports commodities, information on agro-based products and so on;

Social: This includes information on traditional agricultural practices, local cultures, background information on local communities, availability of labor and so on;

Legal: All legislation relating to land tenure and to the production, distribution, sale etc of agricultural produce belongs in this category;

He concludes that this categorization is by no means exhaustive, but it includes the main type of agricultural information.

2.3 Information users

The literature also defines users as those for whom information systems have been created - 'the ultimate beneficiaries' (Fleming, 1990). He further adds that there are users who know exactly what they need in appropriate terms. He notes that it is important to realize that there are different categories of users of a community, environment or system. It is this view that the present study attempted to establish whether agricultural experts actually know their information requirements.

2.3.1 Agricultural information users

Users of agricultural information systems comprise of research workers, specialists advisors,

general advisors, teachers of agriculture and related subjects, students, administrators, industrial scientists and technologists, merchants/sales people and journalists. Each of these groups collects, exploits and generates specific sources of information.

Russell (1983) in Adio, (1993) is of the opinion that agricultural information users have being neglected for the past years and advises that priorities should be given to them because they play a key role with farmers in the food production chain. The users and the farmers, therefore, represent the beginning and the end of the agricultural information chain.

In the same vein, Dukkitt in Adio (1993) describes agricultural professionals as those who possess qualities, abilities, knowledge and skills to imagine breath vision, analyze and solve problems. He also believed that they should be resourceful, possess communication skills and have a sense of service and to be flexible so as to handle and analyze results easily. The current study attempted to establish if the MoA agriculturists possess these characteristics

2.4 Information requirements

Information requirements studies are closely related to user studies, market analysis, user surveys, information analysis, community analysis and information needs assessment that are widely applied in the study of user needs in library and information science. According to Ocholla (1999), the focus of user studies and information requirements is to gain knowledge on aspects such as who needs information, what is the information, for what purpose are they seeking (why), how is the information sought, when is it needed, and where is information required. The information gathered helps to respond to user requirements.

The Encyopedia of Library and Information Science enumerates a number of purposes behind user surveys, including assessing the adequacy of collections, determining the level of user

satisfaction, discussing patterns and levels of use, identifying sources of information that users turn to, and soliciting suggestions.

Skelton (1973) quoted by Maughan (1999) notes the underlying objective of most user studies is to acquire data that can be cumulated for use in developing or improving information systems and services. She further notes that most user studies have been conducted to increase the understanding of a particular local situation and, therefore, cannot reasonably be expected to be capable of wider application or to be compared to other studies.

Croft, Speth, and Philips quoted by Maugahan (1999) all describe how user surveys can reveal interesting and important information about user perceptions and priorities and therefore, are useful in planning information systems, budgeting and allocating limited resources in planning new services.

To realize the tasks of the society, groups and individuals need adequate information. A precondition to giving adequate information is knowledge of the user's needs in a special field, or of the person to be supplied. Similarly, the development of new information services, or the reorganization of the existing ones requires the knowledge of the demands of the potential or future users. In addition, it is useful to know the opinion of those for which the already existing services are made and who uses them. It is in the same vein that the present study was design, to find out the user's preferences, before fine-tuning the existing MoA information systems.

According to Herpay (1991), information requirements do not grow as quickly and to the extent as quantity and quality of knowledge and information methods do. The users are not

familiar with the recent results, events, methods, opportunities, and environmental changes, instead they insist on old, perhaps dated information, instead of the recent up-to-date achievements. She further points out that information specialist must know two fundamental facts as starting points:

> Users are not aware that they are not in possession of adequate information, only the changes of the circumstances make them realize it; in most cases users do not know exactly the kind of information they want. The users need help in the delimitation and exact formulation of their requirements presented often uncertainly in obscure questions and urgent requests.

In other words, users must not be supplied only with the information requested, but with the information actually wanted.

Despite that in theory the need of the information requested starts from the requirements of society and of the group involved, in practice people are to be provided with information. For this reason, the personality and abilities of the user must be considered as well. Information requirements of the individual users are formed under the influence of several objective and subjective facts.

Herpay, 1991, lists some of these aspects:

> Information requirements of a special group or person depend on the individual capabilities e.g. the composition of the group; education, and qualification; awareness; knowledge of languages.
>
> Information requirements are influenced by the specialty of the user's work. The narrower the field concerned, or the unit examined, the greater the variability in information requirements. In the narrower partial fields of science and technology essential and revolutionary changes are more frequent than in comprehensive, broader fields. For this reason, the analysis of the information requirements is necessary by branches, specialties, institutions and concrete enterprises.
>
> There are differences in the extent and character of the information requirements in the various scientific and technical fields as well. The time spent studying the information is different by specialties.

> Because of development, information requirements continuously transform. The greater extent of the research work, the rise of new fields of knowledge, the formation of new relations with the neighboring fields, the extended demands for quality of product, the education and professional development of the individuals and special groups raise new requirements even in information or put to an end to other ones. Up-to-date information has to adapt itself continuously to the changes.

Are the information requirements of individual agriculturists formed under the influence of several objective and subjective facts?

2.5 Information need

Information is normally sought to meet a need. Needs are 'very significant messages within the human system.' They are dynamic forces which create instability within the person and which lead to a cycle of behaviors that ultimately will correct this instability (Havelock, 1979). Reneker (1993) notes that information needs arise whenever individuals find themselves in a situation requiring knowledge to deal with the situation as they see it fit and that information needs arise in all aspects of everyday life.

According to Vernon (1999) a study of the information needs can help achieve some tangible outcomes. He lists some examples:

> Information systems can be developed through shortening of the "prototyping" period; and
>
> Information systems can become more effective through a closer match of the user's information needs, their information users, and their ways of working. In system development information needs study might exclude anything for which a user and a use have not been identified.

Coover (1969) quoted by Ogunrombi and Marama (1998) is of the opinion that, a user's information needs is absolutely necessary to the management of information centers/libraries. Information becomes useful only when it is packaged in the right format, delivered to the right user at the right time. Consequently, according to Cronin (1984) any library in the

business of providing services to its user groups should provide functional service, which will correspond as closely as possible to the needs of the users. Do the MoA information units provide functional service? This study attempted to establish these facts.

2.6 Information seeking behavior

This concept relate to how users look for information. According to Fidel (1999) it means what a user does from the moment she realizes that she is about to make a decision till the time she makes a decision. Another concept that is related to information seeking behavior is searching behavior, which refers to the interaction with the information system, which includes the interaction with a librarian.

Faibisoff and Ely (1974) cited by Fidel (1999) identified some general patterns of seeking and searching behavior, these included: people tend to seek out information which is most accessible; people tend to follow habitual patterns when seeking information, users and potential users of information are often unaware of sources and how to use them; face to face communication is a primary source of information; different types of persons use different sources of information; the nature and content of information needed is variable and complex; varying from discipline to discipline and from group to group; there is a wide range of need among users in the quality of information required; the quantity of information exceeds the capacity of the individual to use it; the information needs of individual change at different stages of his career and with change in project.

These generalizations show patterns that are common to information seeking, but they also point out that behavior is situational, depending on the particular situation of a user when she search for information. The most promising finding here is that people tend to follow habitual

patterns when seeking information. This implies that identification of seeking patterns for a certain group of users; an information system can be designed to accommodate these patterns. Therefore, studying patterns of seeking and searching behavior of government agricultural experts is most promising for the development of an information system for them.

Sowole (1995) quoted by Ogunrombi and Marama (1998) stated that information seeking behavior results from the recognition of some needs, perceived by the user, who as a consequence makes demands upon formal information systems such as libraries, information centers, or resource persons to satisfy the perceived needs.

The commentaries the above scholars on the study of information needs assessment, information seeking behavior gave the researcher insights and a general understanding of the general concepts and background information of the subject area of the research.

The scholars/researchers ideas seem to concur with each other, hence there is a general consensus that user studies and information assessment studies are useful when reorganizing or planning a completely new information system, which is to be acceptable to the users. The present study is based on the same notion.

2.7 Agricultural information user studies

Adio, (1993) carried out a survey to investigate the use of the International Institute of Tropical Agriculture (IITA) library by the agricultural scientists of the university of Ibadan, Nigeria. The survey included 200 questionnaires that were sent to users. To complement the responses of the respondents, a questionnaire as well as the interview technique was utilized to elicit responses from the librarian of IITA on the size of their stock, the services they

In this study, problems of agricultural information dissemination were identified as: status differences between extension agents and their client;, agent's inadequate knowledge of the communication process; lack of inter-agency cooperation both in programme planning and in implementation; extensions general lack of interest in traditional media; the use of print media, the technical language used in communicating information are incomprehensible to the farmers; inadequacy of existing extension programmes. What problems limit the effective use of agricultural information in MoA?

Ogunrombi and Marama (1998) using a questionnaire interview and observation methods researched on the information-seeking behavior of farm managers in Bauchi, Nigeria. This study examined the information needs and requirements of farm management personnel in the tertiary institutions and agricultural research institutes. Coupled with the role of libraries in these institutions in providing qualitative and timely agricultural information for this category of staff. The objectives of the study were: to assess the information seeking behavior of farm managers, to determine the level of availability of information materials that meets the needs of the farm managers, to determine the usefulness or otherwise of library services offered to the managers, to identify the hindrance to optimal use of libraries by farm management personnel and to offer suggestions towards effective information delivery to the farm managers.

Their research revealed that farm managers have various information needs closely related to their specialties. It was also found out that manager's source their information from both oral/personal (conference, seminars, workshops, symposia, study visits and personal communication with colleagues) and documentary sources. The current study too sought to find out whether this also applies to the agriculturalists in MoA.

Vernon (1999) carried out an assessment of information needs for the management of agricultural research and how these needs have been incorporated into a Management Information System. To identify the information needs two main methods were employed. The first standard systems analysis, the main entities were identified and their attributes described. This was followed by an analysis of the several processes of the agricultural research cycle. The results of this information assessment have been incorporated into a Management Information System. A working prototype has been tested.

In a study of the problem associated with the management of information by and for agricultural advisors, Agar (1984) suggests that more need to be put into the production of information that meets the needs of the job. This study compliments Agar's that is to establish if the situation as since then and to what extent management of information by and for the agricultural users has been improved.

2.8 Studies conducted in Kenya

Before embarking on this study, it was pertinent to review studies conducted in Kenya in relation to agricultural information. The following studies were reviewed:

Vaid (1982) in Kaigi (1983) carried out a short survey on the field level extension workers in Kenya, This survey was done between 1980 and 1981 with the aim of finding out the most frequently used sources of information, and the problems encountered when using them. The majority of the extension workers were found to use District Agricultural Office, VOK radio (the present Kenya Broadcasting Corporation), Agricultural Information Center (AIC) and finally personal visits by ministry staff. Fifteen channels were analyzed and the least popular channel was found to be 'non-governmental organizations, colleagues were not found to be

very useful as a source of information. The study concluded that this was due to the distance separating the field level extension workers, coupled with poor means of communication.

Kaigi (1983) carried out a study on current awareness service for agricultural information users in Kenya, with special reference to MoA, Kenya. The study examined information needs and information seeking behavior of the different agricultural stakeholders. She further described different kinds of CAS and showed their implication for Kenyan agriculture. The study proposed a Kenya AGRIS-based Current Awareness Service (KASS). Kaigi (1983) focused on the role of CAS in the dissemination of agricultural information in MoA, while the current study was focused on assessing the information requirements of the agriculturalists with a view of identifying and improving on the weakness of the agricultural information systems.

Gundu (1985) carried out a study on agricultural information diffusion to small-scale farmers in Kenya. The objectives of the study were to evaluate agricultural information diffusion to small-scale farmers so as to offer suggestions towards effective information delivery to the farmers. This study focused on farmers, while the present study specifically addressed the information requirements of agricultural experts in MoA, who are the main consumers of agricultural information while the farmers are beneficiaries of the same.

Chepukaka (1998) also carried out a study on the effectiveness of agricultural information services in Kenya. The objective of this study was to assess the effectiveness of agricultural information services with special reference to library information services. He used a questionnaire, observation methods to collect user views of the information services.

Chepukaka (1998) recommended a current Awareness service and selective dissemination of information to enable actual and potential users to know all information services available.

These studies were valuable to the researcher; they provided a general overview of the agricultural information infrastructure, agricultural information users, existing information systems/services and information sources in the Kenya. Further, they highlighted research methodologies that were employed and the results of these studies.

In addition, the studies revealed that no comprehensive practical study has been carried out to survey the information requirements of the agricultural experts in MoA. Furthermore Chepukaka (1998) study established that the existing information services are not supporting the agriculturists in their daily jobs. Using a questionnaire the current study attempted to assess information requirements of agricultural experts in the MoA, with a view to identifying and improving on the weakness of the system. The survey results are presented, interpreted and discussed in the next chapter.

CHAPTER THREE

DATA PRESENTATION, INTERPRETATION AND DISCUSSION

This chapter presents the findings of the study as provided by the agricultural experts. Interpretation and discussion of the analyzed data is given. Questions have been analyzed individually and findings tabulated and recorded as frequencies and percentages.

The chapter is divided into the following sections:

- Personal data of the respondents;
- Respondent's information needs;
- Existing services/systems and information sources;
- Information use pattern;
- Feasibility of improving access to information;
- Media/channels of communication;
- Assessment of the MoA information Services; and
- General comments

3.1 Response rate

Table 1. Response rate

	Response	Percentage
Questionnaires sent out	76	100
Questionnaires received	56	73.6
Percentage of response rate		73.6

Out of a total of 76 questionnaires handed out, 56 were fully or partially completed and

returned, representing 73.6% response rate (Table 1)

3.2 Personal data

3.2.1 User groups by divisions

Table 2 User groups

User Groups	Response	Percentage % of Total
Extension	10	17.8%
Livestock production	8	14.2%
Planning	7	12.5%
Veterinary services	5	8.9%
Land development	5	8.9%
Farm management	4	7.1%
Crops	4	7.1%
Research extension and Liaison	4	7.1%
Project management and evaluation	4	7.1%
Training and development	3	5.4%
Horticulture	2	3.6%

The survey made an attempt to identify various user groups of the MoA agricultural information systems/services by their respective divisions. A summary of this is given in Table 2.

The results show that the main users groups of MoA information services are the extension division.

This is due to the fact that extension services division comprises of many units as compared to the rest. As indicated earlier the questionnaires were distributed proportionally according to the number of units in a division.

3.2.2 Status of the respondents

The study required respondents to indicate their job titles/designations. This was to help in

the categorization of the respondents into chief, senior, and junior officers. This is reflected in Table 3.

Table 3. Job titles/designations

Job title/designation	Response	%
Assistant Agricultural Officers and Equivalent	2	3.6
Agricultural Officers and Equivalent	18	32.1%
Senior Agricultural Officers and Equivalent	16	28.6%
Assistant Director of Agriculture and Equivalent	9	16.1%
Deputy Directors	5	8.9%
Senior Deputy Directors	1	1.8%
TOTAL	51	91.1%

3.2.3 Years of practice as an agriculturist in MoA

Table 4. Years of practice

Years	Response	%
0 - 10	10	17.9%
11- 20	27	48.2%
21- 30	15	26.8%
31- 40	2	3.6%

The respondents were asked their years of work experience in the MoA, those who started working 11-20 years ago were the majority with 48.2%. A detailed analysis is shown in Table 4.

Years of practice of a user of information are relevant in the identification of information requirements. The age in an organization is an important aspect in information seeking. Fleming (1990) noted that different individuals have different approaches to problem solving because their thought processes (cognitive styles) work differently because of age. These different cognitive styles contribute to differences in information seeking.

3.2.4 Duties and responsibilities

A total of 85.7% of respondents indicated their duties and responsibilities whilst 8% did not. A summary of the duties and responsibilities indicate that the respondents are engaged in extension activities, consultancy, policy formulation, policy implementation, monitoring and evaluation. They are also engaged in general administration and supervision of subordinate staff. They act as advisors to government on agricultural issues, coordinators of projects and programmes and providers of advisory services to various agricultural agencies. Given the variety of tasks the respondents perform, it may be assumed that they will have to rely on a considerable amount of information in order to perform their duties efficiently.

3.2.5 Educational background of respondents

It is pertinent to highlight the technical/professional qualifications of the respondents since this is critical to their management role in agriculture. In addition, to explore the link between level of education and information requirements, it necessitated identifying the respondent's educational levels. The respondents were asked to indicate their qualification(s). Table 5 shows the characteristics of the agriculturists by level of education.

Table 5. Level of education

Level of education	Number	Percentage %
Bsc. in Agriculture	20	35.7%
Bsc Agriculture Economics	4	7.1%
Msc Agriculture	4	7.1%
Msc Agriculture Economics	4	7.1
Other	4	7.1%
Bsc. Range Management	3	5.3%
Msc Agricultural Engineering	3	5.3%
Msc. Animal Production	3	5.3%
Msc. Agricultural Extension	3	5.3%
Bsc in Agribusiness	2	3.5%
Msc. Land and Water Management	2	3.5%
Msc Agronomy and Soil Science	2	3.5%
Msc. Horticulture	2	3.5%

Table 5 is very revealing as far as the educational background of the respondents is concerned. All the categories are represented. This result was expected because to be designed an expert, an entrant should have at least a first degree. Kuhlthau (19900 observed that people actively construct their view of the world by assimilating new information with what they already know or have experienced. The agriculturists are therefore able to assimilate any new information.

3.2.6 Distribution of agriculturists by specialization

Table 6. Specialization

Specialization	Number	Percentage % of Total
Agricultural Economics	11	19.6%
Agricultural Extension services	10	17.9%
Livestock production	9	16.1%
Others	7	12.5%
Agricultural Engineering	4	7.1%
Range Management	3	5.4%
Project Monitoring and Evaluation	3	5.4%
Crop Protection	2	3.6%
Pest Management	2	3.6%
Agronomy	2	3.6%
Horticulture	2	3.6%
Agricultural Manpower Development and Training	2	3.6%
Home Economics	2	3.6%
Animal Health	2	3.6%
Veterinary Services	2	3.6%

Fourteen areas of agricultural operations were identified and the respondents were asked to indicate their areas of specialization. Areas of agricultural specialization were in line with the type of technical/professional training one had undertaken. Table 6 summaries the responses.

The results reveal that the consumers of agricultural information in MoA comprises of consumers with a higher special education such as agronomists, agricultural engineers, agricultural economists etc. in the agricultural structures

3.3 Information needs

3.3.1 Information needs of agriculturists

The expressed information needs of the agriculturists are summarized and ranked in Table 7 below.

Table 7. Ranked order of expressed information needs of the agriculturists

Information Needs	Number	Percentage (%)
Technical information	42	75%
Marketing information	31	55.4%
Socio-economic trends	30	53.6%
Pricing information	28	50%
Climate information	23	41%
Technological information	23	41%
Farm management	21	37.5%
Import and export policies and procedures	21	37.5%
Legal information	20	35.7%
Financial sources and terms of credit	19	33.9%
Trade information	18	32.1%
Transportation information	17	30.4%
Crop production	14	25%
Product quality control	14	25%
Use of pesticides	12	21.4%
Agricultural exhibitions and fairs	12	21.4%
Others	7	12.5%

"Other" information needs

- Up-to-date information on rapid change information on new crop varieties;
- Information to assist in formulation of research proposals and writing up research results;
- Data on availability of water resources to enable apportionment of water for irrigation and industrial use;
- Specific data on quality of all crops farmed in Kenya (by region, province, district);
- Specific data on livestock production (by number,) and production of livestock products such as honey, beef, milk etc.;
- Information to guide farmers in managing activities so as to maximize returns;
- Information on small-scale farmers to assist them in deciding what to grow on commercial basis;

- Domestic Informal commodity market information;
- Information on impending disaster hat would threaten Kenya's security e.g. famine, floods, fires etc.;
- Agricultural personnel at sub-location levels (names and grades);
- Information of specification on agricultural goods that are imported into Kenya (whose specification do not exist in Kenya)

The findings indicate that the respondents have a variety of information needs. Technical information ranked highest (75%). This is because the primary concern of the agriculturists is to offer technical advice to other players (farmers, agricultural processors, agro-businesses, pastoralists etc.) in agriculture in order for them to achieve optimal farm yield.

Further the survey results indicate that the list on Table 7 is not exhaustive for them to make choices. Under 'other' the respondents opened up and indicated various information needs. This result is an indication that no one can categorically claim to know all the information needs of agricultural experts. This is due to the fact that agriculture sector is an information dependent sector where there are new and rather complex problems facing the different practitioners in agriculture.

3.3.2 Nature of information required

Respondents were asked to indicate the nature of information required for their work. Table 8 presents the results.

Table 8. Nature of information

	Response	Percentage of total
Detailed information	42	75%
Brief (factual)	22	39%
Summarized	12	21%
Other	0	0

The study showed that the majority of the respondents preferred detailed information. Detailed information is generally obtained from technical reports, provincial and district reports, and journals. The rest used brief and factual information most of the time. Brief and factual information comprises basic data or information that generally requires less time to consult. It may include consulting statistical abstracts, statistical data, MoA policy papers such as sessional papers, agricultural acts, financial orders, etc.

There is a correlation relationship between nature of information and type of job an expert does. Therefore, the nature of information required by the agriculturists is affected by the requirements of the problem at hand or a decision to be made. The preference for different types of information only serves to indicate the frequency of use of that information, and does not mean that the other kind of information is not used at all.

On the contrary, a number of the experts indicated they used both kinds of information. Much of the information required to meet the daily information needs of the experts is available in their office collection (mini libraries).

3.4 Existing information systems/services and information sources

3.4.1 Use of information resources

The respondents were asked to indicate information sources they use to satisfy their information needs. The experts were provided with a list of 18 information resources to

choose from, Table 9 below summaries their responses.

Table 9. Information sources

Information sources	Response	Percentage (%)
Technical reports	49	87.5%
Attending conferences and seminars	42	75%
Colleagues	39	69.4 %
Agricultural periodicals/journals	38	67.9%
Conferences/seminar papers	35	62.5%
Policy briefs	31	55.4%
Agricultural data reports	30	53.6%
Your professional associations	28	50%
Agricultural status reports	26	46.4%
Situational reports	22	39.3%
Agricultural reviews	20	35.7%
Agricultural legislation	17	30.4%
Databases	16	28.6%
Fact sheets	7	12.5%
Agricultural indexes/abstracts	6	10.7%
Other	4	7.1%
Bibliographies	3	5.4%

The results indicate that the majority of the respondents (87.5%) read technical reports as their main source of information. The findings indicate that there is a high utilization of the available information resources by the agriculturists. The other major sources include seminars and conferences (75%), colleagues (69.4%, and agricultural periodicals 67.9%

Reliable and authoritative sources like bibliographies (5.4%), indexes/abstracts (12.5%), and Fact sheets were ranked poorly as information sources for the agriculturists. To this, the information units should encourage users to rely on various information through exposure to a wide variety of information search strategies.

The results show that there is a high utilization of various documentary sources; particularly

there is a high use of the technical (87.5%). In this case then it becomes necessary for the MoA to ensure that they stock intellectual properties that will adequately meet the needs of their users. To achieve this, the collection development policies of the MoA information units should reflect user needs.

The results show that there is a preference for informal sources, and in particular, the importance of personal contacts as sources of information would demand that the policy makers promote greater interaction between the agriculturists and other stakeholders through regular seminars, workshops and exhibitions, as well as professional bodies. At the same time copies of papers delivered at such meetings should be deposited in respective units for referral purposes.

Even though this study has not come out with a clear division between the use of a particular information resources and the specific nature of work there are indications that the nature of ones work can in fact influence the information resources used by the agricultural experts. More important, though, is that the popular information resources for all activities should be identified for collection development purposes.

3.4.2 MoA information units used by the agriculturists to get information

The respondents were asked to state the MoA information systems where they obtain information sources that they use for their work activities. The units/ areas suggested to them and how they were rated are listed in Table 10.

Table 10. MoA information units used by agriculturists to get information

Information resources	Response	Percentage
MoA Headquarter Library	39	69.6%
Agricultural Information Center (AIC)	18	32.1%
Kenya Agricultural Documentation Center (KADOC)	18	32.1%
Veterinary Services Library	9	16.1%
Livestock Production and Development Library	8	14.3%
Others	3	5.3%

MoA head office library (69.6%) featured prominently in this study as the most popular MoA Information service. The MoA has five information services (libraries) at the Head office although housed at different physical locations. These libraries are stocked with agricultural literature to ensure that the clientele especially the agriculturists at the head office, keep abreast of current trends in the different specialties of agriculture.

3.4.3 Usefulness of the information resources

The respondents were asked to rate the MoA information systems and others in terms of their usefulness. Their responses are given in Table 11

Table 11. Usefulness of the information resources

Information resources	Very useful	Useful	Fairly useful	Not useful
Individuals/Colleagues	17 (30.4%)	14 (25%)	12(21.4%)	2 (3.6%)_
Ministry of Agriculture Library (MoA HQ Library)	10 (17.9%)	12 (21.4%)	27 (48%)	2 (3.6%)
Kenya Agricultural Documentation Center (KADOC)	5 (8.9%)	9 (16.1%)	15 (26.8%)	10 (17.9%)
Veterinary Services Library	5 (8.9%)	3 (5.4%	8 (14.3%)	9 (16.1%)
Livestock Production and Development Library	4 (7.1%)	4(7.1%)	11(19.6%)	6 (10.7%)
Other				
Agricultural Information Center (AIC)	6 (10.7%	4(7.1%)	11(19.6%)	9 (16.1%)

The findings indicate that the respondents do not rely on library collections to satisfy their information needs; only 39.3% respondents rated head office library as a useful source of information, 55.4% of the respondents rated colleagues as useful also. Further analysis of the data as represented in table 12 above indicate that among the 69.9% of the respondents who sought information from the MoA head office library only 17.9% said that the services were 'very useful'.

This result confirms what Rouse and Rouse (1984) says that information seeking is affected by the seekers knowledge about the source and information seeking process is affected by the amount of information available at the particular source. So, if information seekers do not think that the source has any information to offer, they will not consult that source.

3.4.4 Non-use of the MoA agricultural information services

The respondents were asked to gives reasons for non-use of the MoA information services. Table 12 summarizes the responses.

Table 12. Reasons for non-use MoA information services

Reasons for non-use	Response	Percentage %
The collection is not relevant to my subject area	13	23.2%
The Information held is outdated	10	17.9%
Not aware that they provide agricultural information	2	3.6%
No appropriate retrieval tools (e.g. catalogues, indexes, etc.)	2	3.6%
They are located far away	1	1.8%
Whenever I visit, the operations are closed	0	0

Other reasons given by the respondents for not using the MoA information services included: They did not get the kind of information they were looking for; hence those sources were not useful. Some indicated that they did not use the information units simply because the services are not computerized, they felt that manual searching of information is tedious and therefore not interesting.

3.4.5 Frequency of use of the MoA information services/units

To assess the relevance and quality of the libraries respondent's opinion was sought on how regularly they patronize their information units for various purposes. This is because there is a positive correlation between qualitative information services and the extent/level of patronage/ use of the available facilities. Respondents were asked to indicate how often they used MoA information units; they were assisted by listing the reasons for using the services. Table 13 summarizes their responses.

Table 13. Frequency of use one's information unit/library

	Once a year	Once a month	Once a fortnight	Once a week	More than once a week
Writing a report	22 (39.3%)	10 (17.9%)	4 (7.1%)	4 (7.1%)	1 (1.8%)
Update knowledge	20 (35.7%)	10 (17.9%)	3 (5.4%)	3 (5.4%)	1 (1.8%)
Update on the collection	20 (35.7%)	7 (12.5%)	0	1 (1.8%)	2 (3.6%)
Looking for specific information in my area	19 (33.9%)	18 (32.1%)	28(50%)	20(35.7%)	3 (5.4%)
Carry out agriculture research	19 (33.9%)	5 (8.9%)	1 (1.8%)	1 (1.8%)	1 (1.8%)
Borrow ready materials	18 (32.1%)	15(26.8%)	5 (8.9%)	2 (3.6%)	0
Read newspapers	11(19.6%)	4 (7.1%)	3 (5.4%)	2 (3.6%)	9(16.1%)

The agriculturists visited their libraries for a variety of reasons, as indicated in Table 13. The results indicate that the agriculturists had more than one reason for using the libraries. Some reasons were, however, considered secondary to others.

The results show that the participants in the research rarely patronized their libraries/information units. This is a clear indication that the information services are under utilized and have not been fully appreciated by the agriculturists.

3.4.6 Reading of periodicals

The respondents were asked to indicate if they read agricultural periodicals as a source of information in their specialized areas. Table 14 summarizes their responses.

Table 14. Response on reading of periodicals

Response	Number	Percentage of total
Yes	28	50%
No	27	48.2%

Those who do not read periodicals were further asked to give reasons. They gave the following reasons: the available journals are out of date and the libraries have failed to bring current acquisitions, some are not aware of the existence of periodicals in their areas of specialization in the MoA libraries. While others pointed out that a periodical guide to alert them of new journals is lacking in the MoA. Some respondents indicated that they did not have enough time to browse through the many journals received in their offices.

3.4.7 Computer literacy

Respondents were asked if they were computer literate. Table 15 summarized their responses.

Table 15. Response on computer literacy

Response	Number	Percentage of total
Yes	53	94.6%
No	3	5.4%

Further the respondents were asked about the computer programs they used. Table 16 summarizes the responses.

3.4.8 Computer programs used

Table 16. Computer programs

	Number	Percentage of total
Word-processing	52	92.9%
Database management	26	46.4%
Statistical analysis	23	41.1%
Internet services (e-mail)	20	35.7%
Web browsing	12	21.4%
Literature searches	8	14.3%
CD-ROM database searches	4	7.1%

The results indicate the majority (94.6%) of the respondents are computer literate. The

respondents were further asked to indicate the programs they use. The results show that the level of information technology skills among the experts is limited. They may have received little or no training in using information technology, and that which has been received appears to have been provided on a rather ad hoc basis.

3.4.9 Location of computer

The respondents were further asked to indicate the location of the computer they use. Listing possible locations assisted the respondents. Table 17 summarizes the responses.

Table 17. Location of Computers

	Number	Percentage of total
In my office	45	80.4%
In the office of the head of department	9	16.1%
Colleague's office	6	10.7%
Home	3	5.4%
Computer room	1	1.8%
In the library	0	0

The results show that the majority of the respondents have the computers in their respective offices. There is an almost a 1:1 relationship between respondents and computers.

3.4.10 Computerized information services as an aspect of enhancing users job performances

The respondents were asked to indicate how the use of computerized agricultural information services would enhance their agricultural operations. The respondents summary of the benefits to be derived from computerized services are as follows: will hasten compilation of reports; quicker analysis of data; quick reference to data and information; ease of updating of data and information; provision of ready information and therefore faster decision-making; authenticity of information and reports; able to compare performance of similar projects; easy

responses are summarized in Table 19:

Table 19. Awareness of new information/documents

	Most used	Occasionally used	Least used
Seminars/workshops	28 (50%)	17 (30.1%)	0
Colleagues	24 (42.9%)	12 (21.4%)	3 (5.4%)
Current awareness service	22 (39.3%)	24 (42.9%)	3 (5.4%)
Publishers catalogue	10 (17.9%)	11 (19.6%)	12 (21.4%)
Book reviews	8 (14.3%)	12 (21.4%)	10 (17.9%)
Periodicals	8 (14.3%)	16 (28.6%)	7 (12.5%)
Library bulletins	7 (12.5%	9 (16.1%)	12(21.4%)
Bibliographies	3 (5.4%)	5(8.9%)	10 (17.9%)
Accession lists	3 (5.4%)	5(8.9%)	15(26.8%)
Selective dissemination of information (SDI)	3 (5.4%)	4 (7.1%)	15(26.8%)
Other sources	3 (5.4%)	0	0
Indexes and abstracts	2 (3.6%)	8 (14.3%)	15 (26.8%)
Subject issued by librarian	0 (0%)	3(5.4%)	22 (39.3%)

The experts' use of information was greatly influenced by their needs. The needs determine the kind of information required, where to find the required information and how it should be accessed.

The results reveal that the experts employ a number of methods to access new information. Top of the list was the use of seminars and workshops (50%). A majority of the respondents had high regard for seminars and workshops, found them useful, and of second importance were colleagues (42.9%).

Seminars, workshops/conferences are a source of new information and a number of the experts consider conferences/seminars organized by professionals and academic organizations very useful in updating the agriculturist with current events.

Current Awareness Service (CAS) was equally used as a source of new information. However, those who benefit much from this service are those who visit the libraries were new materials are either displayed in the library or circulated to the experts in their officers.

The library bulletins and accession lists are only used at the MoA head office library. The librarian circulates a periodical publication highlighting new books received together with the contents of periodicals received by the library over a given time.

SDI services ranked poorly with 5.4%. SDI is a specialized information service where information is taken to the user. This service is not used because is it non-existence at MoA information units.

3.5.2 Information/document retrieval tools

The respondents were asked to indicate the information retrieval tools they use to retrieval information. The participants were provided with a list of suggestions appearing in Table 20.

Table 20. Information retrieval tools

	Most used	Occasionally used	Least used	Non-Respondents
Library card catalogue	46(82.1%)	25 (44.7%)	9(16%)	35 (62.5%)
Asking the library staff for the information	20(35.7%0	15(26.8%)	8(14.3%)	13(23.2%)
Agricultural subject indexes	8(14.3%)	15(26.8%)	7(12.5%)	26(46.4%))
Agricultural subject catalogue	8(14.3%)	16(28.3%)	9(16.1%)	2341.1%)
Agricultural abstracts	5(8.9%)	16(28.3%)	7(12.5%)	28(50%)
Bibliographies	4(7.1%)	3(5.5%)	14(25%)	35(62%)
Agris CD-ROM databases	2(3.6%)	0	22(39%)	32(57%)
Caris CD-ROM databases	0	0	22(39%)	34(60%)
CAB CD-ROM databases	0	1(1.8%)	20(35.7%)	35(62%)

The agricultural experts have several ways of identifying and retrieving information in their libraries. The study revealed that majority of the respondents relied on the traditional card catalogue (82.1%). This still is the case because MoA information systems are still manual, maybe an introduction of the automated catalogue and electronic databases are likely to reduce its popularity. At the same time, some experts retrieve information materials simply by browsing through the bookshelves.

3.6 Feasibility of improving access to information

3.6.1 Use of other's information facilities

Respondents were asked to indicate if they used libraries and information facilities of other agricultural sectors. The responses are shown in Table 21.

Table 21. Use of others' information facilities

Response	Number	Percentage of total
Yes	36	64.3%
No	20	35.7%

In total 64.3% of the respondents sought information from libraries of other sectors in addition to their own information units. This suggests that the information available in their libraries is not adequate, hence the need to consult outside sources. The majority of the experts visited university libraries followed by Kenya Agricultural Research Institute (KARI) and International agencies such as the World Bank, ICRAF, ILRI, and GTZ.

3.6.2 Non-use of other's information facilities

Non-users of other's information facilities were asked to give reasons. Table 22 summarizes their responses.

Table 22. Reasons for non-use of other's information facilities

	Number	Percentage of Total
Facility is located far away	7	12.5%
Collection are not relevant	3	5.4%
Time factor	7	12.5%
Other	5	8.9%

Responses for non-use of other's libraries and information facilities are shown in Table 22. Out of the 35.7% who did not use 12.5% said the facility is located far away, 12.5% said time factor was the issue, while the other reason was that collections are not relevant 3 (5.4%).

3.6.3 Problems affecting the effective use of agricultural information

Table 23. Problems experienced by users

	Number	Percentage of total
The information resources are scattered at different locations within the MoA	51	91.1%
Incomplete information (e.g. annual reports have gaps between varies years)	40	71.4%
Sieving through massive information resources before the retrieval of the relevant document is too tedious	26	46%
Lack of tools for synthesizing the information from different sources	24	42.9%
Difficulty to link related information in the printed documents	15	26.9%
Difficult to analyze information available in printed form	14	25%
Other	3	5.4%

Majority of the respondents (91.1%) indicated that their main problem in the use of agricultural information was because the information resources are scattered at different locations. This result implies that they are unable to know where and who has which information and in which formats. Hence, another information need highlight in this result is 'information where to find information".

3.6.4 Formal cooperation

The respondents were asked to indicate if they wished to have formal cooperation with other agricultural information systems outside MoA. Their responses are summarized in Table 27.

Table 24. Cooperation

Response	Number	Percentage of total
Yes	54	96.4%
No	0	

The respondents indicated a need for a formal cooperation with other agricultural information systems. Such cooperation will widen their information source base; hence satisfy their information needs.

3.6.5 User's preferred information institutions to be networked with MoA information systems

The respondents were asked to indicate the institutions that they could like to be networked with the MoA. Table 25 summarizes the responses.

Table 25. Preferred institutions for networking with MoA

Institutions	Responses	Percentages %
Local universities	34	60.7%
Kenya Agricultural Research Institute (KARI)	22	39.3%
FAO	17	30.4%
ICRAF	9	16.1%
Central Bureau of Statistics (CBS)	8	14.3%
ILRI	8	14.3%
KETRI	6	10.7

These preferences reveal that the respondents have used the information services and sources of these institutions. The majority of the respondents have the desire for a network with the local universities; faculties of agriculture, most of the agriculturists were trained in these universities and are therefore aware of the information source held by these institutions.

3.6.6 Use of services and information generated from national and international bodies

The respondents were asked to indicate if they used services and information generated from national and international bodies

Table 26. Use of services and information generated by outsides agencies

Response	Number	Percentage of total
Yes	51	91.1%
No	5	8.9%

Table 27: Name of organization and frequency of use

Name of organization	Most used	Rarely used
Kenya Agricultural Research Institute	2 (5.4%)	3 (8.1%)
Local Universities (Faculties of Agriculture	5 (13.5%)	6(16.2)
ICRAF	1(2.7%)	2(5.4%)
KETRI	0	1(2.7%)
WORLD BANK	0	2(5.4)
ILRI	0	2(5.4%)
GTZ	2(5.4%)	0
FAO	1(2.7%)	3(8.1%)
RELMA	1	0
KNLS	0	1(2.7%)
CBK	1	1(2.7%)
CBS	0	1(2.7%)

Out of 56 respondents who filled the questionnaire 19 respondents left this item blank, 18 who filled the questionnaire admitted using the facilities but failed to mention while 19 respondents indicated at least using information generated by other bodies.

Although, almost all the respondents admitted using the information sources generated from national and international bodies, 32.1% respondents failed to mention the information facilities used. While 19 respondents at least mentioned the information sources they used. Table 27 summarizes their responses.

As indicated earlier, information generated by the national and international bodies is mainly technical. Technical information was frequently mentioned as the kind of information the experts needed to carry out their jobs. This explains why almost all the respondents sought information sources that are generated by national and international bodies. The

information generated by national and international bodies is current, the sources are updated frequently. This is in agreement with Rouse and Rouse (1984) 'the choice of information sources by humans is affected by update rates'.

3.6.7. Level of knowledge in information search and usage

Table 28. Ability to seek, identify and retrieve the required information

	RATING							
	Excellent		Good		Fair		Poor	
	No.	%	No.	%	No.	%	No.	%
Seek	3	5.4	27	48.2	14	25	11	19.6
Identify	7	12.5	24	42.9	18	32.1	6	10.7
Retrieve	2	3.6	19	33.9	25	44.6	9	19.1

The results show that the level of information skills among the experts appears to be low. The results indicate that the professionals have received little or no training in using a library. The provision of training the experts in information skills, and may be information technology would appear a cost-effective first step in improving awareness and use of information.

3.7 Media/channels of information

3.7.1 Media for obtaining information from the library

Respondents were requested to state the media/channels they use to obtain information. Suggested areas and how the respondents responded appear in Table 29.

Table 29. Media used to ask for information from the libraries

	Mostly Used	Occasionally Used	Rarely used	Not used
Telephone	14(25%)	8(14.3%)	8(14.3%)	8(14.3%)
Internal memo	3(5.4%)	7(12.5%)	11(19.6%)	13(23.1%)
Personal visit to the information center	30(53.6%)	15(26.9%)	2(3.6%)	2(3.6%)
Asking other people to contact the library on your behalf	4(7.1%)	3(5.4%)	7(12.5%)	19(33.9%)

Face to face communication is the main means of communication used by the respondents when they are in need of information or documents in the library. Over half of the respondents make personal visits (53.6%) to the libraries to look for information. The fact that the experts make personal visits to the libraries to seek information, then the physical facilities and the general outlook of the information facility should be attractive to motivate the agriculturists to use the facilities often.

3.7.2 Media used by library staff to convey feedback to users

Table 30. Media used to communicate feedback to users

	Mostly Used	Occasionally Used	Rarely used	Not used
Telephone	19 (33.9%)	6 (10.7%)	5 (8.9%0	11 (19.6%)
Internal memo	5 (8.9%)	1 (1.8%)	9 (16.1%)	19 (33.9%)
Library staff brings the feedback to your office	4 (7.1%)	11 (19.6%)	6 (10.7%)	16 (28.6%)
Delivering the required relevant document	12 (21.4%)	6(10.7%)	7 (12.5%)	14 (25%)
Sending a photocopies of the required document	3 (5.4%)	6 (10.7%)	5 (8.9%)	18 (32.1%)
Other	5 (8.9%)	1 (1.8%)	0	0

The findings reveal that the library staff use the telephone (33.9%) and deliver the

required documents to the users. To be effective, MoA should modernize its services, hence introduce electronic document delivery services to replace the manual services

3.7.3 Users' preferred media for alerting new publications/articles

The respondents were asked to indicate the means they could like to be informed of new publications/articles. Their responses are summarized in Table 33.

Table 31. User's preferred media for alerting new publications

	Most preferred	Least preferred	Non-respondents
Telephone	11 (19.6%)	14 (25%)	31 (55.4%)
Routing Slips	16 (26.8%)	13 (23.2%)	27 (48.2%)
Written memo	29 (51.8%)	5 (8.9%)	22 (39.2%)
Accession lists	15 (26.8%)	10 (17.9%)	31 (55.4%)
Library bulletins	26 (46.4%)	9 (16.1%)	21(37.1%)
Displaying the new publications at a strategic place	39 (69.6%)	4 (7.1%)	13 (23.2%)

The results show that a majority of the respondents preferred new publications to be displayed at strategic places, the most strategic places could be at the entrance of the building, on the floor that houses the agriculturists and in the libraries.

3.8 Assessment of the MoA information services

3.8.1 User satisfaction with information services

The participants were asked to indicate if they were satisfied with the MoA information services. Table 32 gives their responses.

Table 32. Satisfaction of the MoA information services

Response	Number	Percentage of total
Satisfied	3	5.4%
Not satisfied	50	89.3%

The majority of the respondents (89.3%) indicated that they were not satisfied with the MoA information services. Respondents who are not satisfied with the information services were further asked to give reasons for dissatisfaction. The following reasons were frequently mentioned:

The collection is not relevant to their areas of specialization, books and journals wanted were not available, and most of the reading materials are out of date. However, some of respondents who are dissatisfied with the information services failed to indicate their areas of dissatisfaction. This would be attributed to their insufficient experience with the services to be able to evaluate the services.

3.8.2 Users opinion of the MoA information systems

The respondents were asked to give their opinion of the MoA information services. Six features were listed for them to indicate whether that aspect is adequate or inadequate.

Table 33. User's opinion on the different features of the information systems

	Adequate	Inadequate	Non-respondents
Periodicals (in terms of titles and relevance)	6 (10.7%)	49 (87.5%)	7 (12.5%)
Library Services	7 (12.5%)	38 (67.9%)	11 (19.6%)
Technical reports	6 (10.7%)	49 (87.5%)	5 (8.9%)
Books and others	1 (1.8%)	47 (83.9%)	8 (14.3%)
Audio-visuals	5 (8.9%)	40 (71.4%)	11 (19.6%)
Library staff (in terms their ability to search for relevant information)	5 (8.9%)	33 (58.9%)	18 (32.1%)

The results show that there was a general consensus among the respondents that

the MoA information systems in respect of the listed aspects were inadequate. It is equally significant to note that a good number of the respondents as summarized in Table 34 did not give their opinion of the information systems.

Those who did not give their opinion are probably those respondents with no or inadequate information about the different aspects asked of the systems. Another probable reason would be that the respondents are non-users of the services hence have no idea of what is going on in information units.

3.8.3 Responsiveness of library staff and other personnel

The respondents were asked to indicate how readily library staff and other personnel were in providing them with information to satisfy their information needs. Table 36 gives their responses.

Table 34. Responsiveness information providers

	Always	**Often**	**Rarely**	**Never**	**Non-respondents**
Colleagues from within	14 (25%)	25 (44.6%)	11 (19.6%)	0 (0%)	5 (8.9%)
Library staff	16 (28.6%)	21 (37.5%)	13 (23.2%)	3 (5.4%)	3 (5.4%)
Colleagues form other sectors	6 (10.7%)	18 (32.1%)	19 (33.9%)	2 (3.6%)	11 (19.6%)
Office clerks/assistants	2 (3.6%)	7 (12.5%)	15 (26.8%)	12(21.4%)	20 (35.7%)

About 37.5% of the respondents seek library staff assistance 'often' while (28.6%) did 'always'; this would be attributed to the fact that these personnel are within easy reach of the agriculturists. Further, colleagues from within were consulted, 'often' (44.6%). The results also indicate low usage of office clerks and assistants as agents for gathering information for

them. Probably the agriculturists themselves have their own ways of finding out what they require.

3.9 General comments

Respondents were asked to make general comments on agricultural information and information systems in Kenya as a whole. This was optional. Some of the frequently mentioned users comments are given as follows:

- There should be an integrated agricultural information system that can be shared by all stakeholders in the agricultural sector;
- Appropriate training of agricultural information personnel should be mandatory for efficient and effective information services;
- Use of libraries by MoA staff is very poor and need encouragement and improvement;
- Periodical, journals and other technical and scientific bulletins are lacking;
- Access to both internal data/information and international data/information is inadequate;
- Inadequate funding of the library service in the MoA;
- There is a great need to modernize the agricultural information services in particular the MoA head office Library services;
- Agricultural information systems should be networked so as to improve availability and accessibility of information;
- Agricultural information systems require further development, co-ordination and inter-

linkages. An umbrella organization (body) to co-ordinate the agricultural information system should be formed;

- Emphasis should be acquisition of primary data then secondary data/information;

- Information is available but scattered in many places; many users of information are therefore unable to pinpoint where to get what information. In the present liberalized agricultural economy, the gap in information is even more acute;

- The management of information is poor and many times not accessible. Each division clings to its relevant information without any willingness to share. Information sharing culture is not existent;

- Agricultural information is not well co-coordinated; a lot of information from workshops, seminars is shelved only to gather dust. Information should be handled to the libraries for proper handling and to be shared by all who need it. It should be sent to the library for referral purpose;

- Decision-makers in the MoA are ignorant on the value and benefits of electronic information exchange;

- The information management within the MoA needs upgrading through modernization of facilities. Use of information technology should be the ultimate goal for information management especially in the area of information capturing, storage, retrieval and transfers.

3.10 Design alternatives

The analysis of the data obtained from the participants clearly show that one basic problem that has plagued the whole agricultural sector has been lack of a well developed formal information infrastructure that would be lied on to satisfy the requirements of policy makers, technical staff, researchers, extension workers and the farmers.

Under normal circumstances the existence of an effective information system would enable the information produced by the information professionals in information centers/libraries to be repackaged for dissemination to different stakeholders in agriculture.

One of the several ways, that such a system could be rectified would be to strengthen the existing MoA information system by equipping them with the requisite technologies and developing appropriate information systems, which satisfy the experts' information requirements has identified in the study. Such appropriate information systems should include: agricultural technical information system, agricultural market information system, agricultural data information systems, agricultural technology information system, and information reference system among others in order to fully satisfy the MoA agriculturists information requirements.

In order to address, one of the major information requirements i.e. " information on where to find information", this study proposed Reference Information System. The following are some of Reference Information system options:

- Reference systems which are part of an integrated Library Information System, these are library house-keeping systems that are purpose built software

packages which support acquisition, cataloguing, circulation control, reference services and on-line public-access catalogues;

- Reference systems that incorporate a user-guidance facility, which leads the user on his path by himself. This system could be in-house built or off-shelf package.
- A Ready reference system to specifically direct users to information sources.

The study opted to develop the third option, Ready Reference System. The choice is based on the following reasons: The first option is out of reach for the researcher in terms of acquisition of the software, and the second option requires a lot of time to incorporate the required features, and probably experienced designers to develop it. The weight for the third option lies on the fact that the general-purpose software that is to be customized to meet the users needs and requirement is available in SISA. In addition, to realize some objectives of the Msc programs, there was an obvious reason to adapt the third choice so as to demonstrate some system methodologies that have been achieved by the researcher while in the school.

CHAPTER FOUR

PROPOSED MOA READY REFERENCE DATABASE SYSTEM (MOARRDS)

The main objective of the proposed Ready Reference Information System is to direct the user to a wealth of information sources. These sources include technical, marketing information available within and outside MoA, which satisfy his information needs, thereby enabling information seekers to undertake research and promotional activities in agriculture and allied disciplines.

4.1 Justification for the proposed MOARRDS

The proposed database system is to maintain agricultural information resources. The survey results revealed that one of the limiting a factor to effective use of agricultural information was "the information resources are scattered at different locations within MoA (91.1%). This highlights another information need of the experts' 'information on where to find information'.

To enable the experts know where to locate and find information there is a need to develop a computerized Ready Reference System. The proposed database system is to provide a complete, accurate and timely reference information to the MoA users. In addition to direct them to information sources which hold information on technical, market, socio-economic trends, technological among others as highlighted in Table 7 which are the main information needs which apply almost to of the agricultural experts.

Further, the following survey results justify the proposed MOARRDS:

- Colleagues (55.5%) were ranked highest as useful sources of agricultural information and MoA head office library (39.3%). The results show that the MoA information units still play a pivotal role in information access for the experts;
- On the selection of information sources used by the agriculturists to get information the main one were: technical reports (87.5%), conferences/seminars (75%) and colleagues (69.4%);
- The use of other's information facilities (64.3% also suggests that information available within MoA units is not adequate, hence need to consult outside sources. Further majority of the agriculturists (91.1%) makes use of information generated by national and international bodies.

It can be concluded that MoA information unit, colleagues, external institutions and seminars/workshops are important sources of agricultural information. It becomes necessary to develop a database, which maintains and records information about these sources used by the respondents to get information to satisfy their needs.

The survey results also showed that the card catalogue (44.6%) is still popular information retrieval tool (ranked highest). The problem with this card catalogues is that they are infrequently updated, and the fact that they are manual makes information searching tedious and error prone, it is also inadequate and inefficient in terms of meeting the user's information requirements. Manual searching in library catalogues is a thing of the past. The use of and the access to information holding through electronic catalogues simplifies the information search because then existing information holdings are searched completely independent of

their location.

Further, these days computerized information systems have been found to be effective and efficient in locating and retrieving information. They offer multiple accesses to information sources and are able to link related information sources.

The above-mentioned reasons calls for a need to adopt a computerized database system, which brings together all related information sources that satisfy information needs of the respondents.

4.2 System requirements

4.2.1 User interface requirements

The interface is a very important component of any user-centered system, it is a mechanism by which the end-user request specific responses. It handles all user input to the system and responses from it.

The user interface is to provide the following services:

- Provision for interactive database access;
- Access to bibliographical data
- Access to other Institutions' collections;
- Easy reference of publications, agricultural professionals, and institutions.

4.2.2 Database requirements

According to Connolly and Begg (1999) a database is a ' shared collection of logically related data and a description of this data, designed to meet the information needs of an

organization.' A database is therefore a collection of data needed to support and document the business of an organization.

The objectives of a database according to Kendall and Kendall (1998) include:

- Ensuring that data can be shared among users for a variety of applications;
- Maintaining data that are both accurate and consistent;
- Ensuring that all data required will be readily available;
- Allowing the database to evolve and the needs of the users to grow; and
- Allowing users to construct their personal view of the data without concern for the way the data are physically stored.

The proposed MOARRDS is to contain information on the existing information sources and summary of their contents. Namely:

- Agricultural institutions;
- Agricultural professionals (resources persons);
- Bibliographical information sources; and
- Agricultural events

Agricultural institutions profiles: The study found out that external agricultural institutions and MoA information units are the main sources of information for the experts. To direct the users to a directory of agricultural institutions that do generate, acquire and disseminate agricultural information is necessary. The data to be captured about agricultural institutions are: InstitutionId, Name, Address, Subject collection, Type of Institution (e.g. development

agency, research) and Contact person.

Bibliographical information sources: Bibliographical details of information collection held by different institutions thereby creating a union list of agricultural information sources, to show what each institution or information service has on agriculture and allied disciplines. Data for input includes: AccessionNo, ClassNo, Title, Author, Edition, Place of publication, Publisher, Date of Publication, Keywords, Location.

Agricultural professionals profiles: Colleagues/individuals were ranked highest as sources of information. It is, therefore necessary to include profiles of the agricultural professionals in the database. The data for the input include: Personal Identification Number, Name, Institution, Specialization, Keywords, and Address.

Agricultural events profiles: Other information sources used by the agriculturists as identified in the study are seminars/workshops, fairs and exhibitions. There is a need to capture data on agricultural events: the past as well as forth-coming agricultural events. The data includes: EventId, EventName, Event Place, Event Date, Organizers)

4.2.3 Functional requirements

The following information is displayed to ensure that the appropriate information is available to the agricultural information users and the information providers.

- Display list of bibliographic resources available in the agricultural institutions by title, author, keywords;
- Produce a list of all or part of the professionals who specialize in a particular area in agriculture.

- Produce a listing of all the forth-coming agricultural events during a given specific month (s) or past agricultural events;
- Display/search by different characteristics (such as Keywords, Institutions name, Professional Name etc.) of a specified profile or the entire database.

4.3 The design of the MOARRDS

The previous section has defined the requirements of the proposed MOARRDS as deduced from the survey results. The next step was to design the proposed system based on the system requirements. Various methodologies or approaches have been devised to support and facilitate information system development.

A design methodology is a structured approach that uses procedures, techniques, tools, and documentation aids to support and facilitate the process of design (Connolly and Begg, 1999). In other words, a methodology is a structured approach for analyzing and modeling a set of requirements for a database in a standardized and organized manner.

The database approach has been employed and adopted for the proposed MOARRDS. The database approach is a concept, which was devised to solve the limitations of the file-based systems, where for example the definition of data is embedded in the application program, rather than being stored separately and independently, and there is no control over the access and manipulation of data beyond that imposed by he application programs.

Justification for the choice of a database approach lies on the following reasons (Connolly and Begg, 1999):

- It separates the structure of the data from the application programs and stores it in the database. If new data structures are added or existing structures are modified then the application programs are unaffected, provided they do not directly depend upon what has been modified;
- It has a single, large repository of data, which is defined once and used simultaneously by many departments or users;
- Instead of disconnected files with redundant data, all data is integrated with a minimum amount of duplication; and
- The database holds not only the organizational operational data, but, in addition, it holds a description of this data.

4.3.1 Conceptual data modeling

Database design begun by producing a conceptual data model, which was then refined into a logical model (relational data model). Conceptual data modeling is the process of constructing a model of information use in an organization, which is independent of implementation details, such as the target DBMS, application programs, programming languages or any other physical consideration (Connolly and Begg, 1999). According to Worboys (1995) conceptual models provide:

- A framework that allows an expression of the structure of the system that is clear and easy to communicate to users;
- Conceptual models contain sufficient modeling constructs so that the complexity of the system may be captured as completely as possible;
- Conceptual models have the capability for translation into implementation-dependent models (i.e. logical and physical data models) so that the system

may be designed and built.

To be able to understand the meaning of the data and to facilitate communication about the defined system requirements of the MOARRDS, the Entity-Relationship (E-R) modeling technique has been used to construct the conceptual model.

4.3.1.1 Entity-relationship model (E-R Model)

The E-R model is a high-level conceptual data model developed by Chen (1976) to facilitate database design. The proposed MOARRDS requirements are expressed in the form of collections of entities and their relationships about which the system is to have information and the relevant properties of such entity collections. The E-R model offers three fundamental concepts for the representation of information about the application: entities, relationships and attributes.

Entities represent any thing about which we want to represent information. According to Connolly and Begg (1999) the basic concept of the E-R model is an entity type, which represents a set of 'objects' in the 'real world' with the same properties. An entity type has an independent existence and can be an object with a physical (or 'real') existence or an object with a conceptual (or 'abstract') existence.

Attributes are properties of an entity type, in a relational database model an attribute is named column of a relation.

Relationship is an association of entities, and this association has to be meaningful.

Cardinality of a relation is the number of tuples it contains.

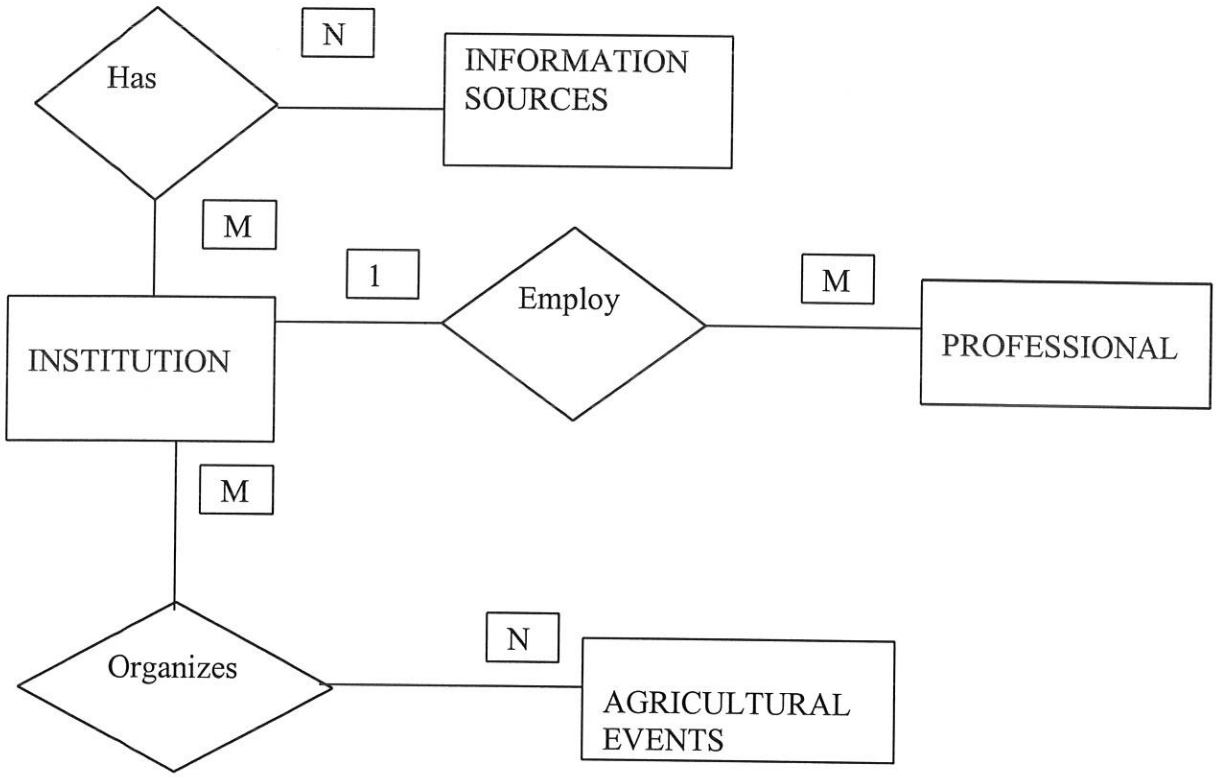
The suitability of an E-R Model lies in the following factors:

- The E-R model makes it easier to visualize the system than make sense of long textual descriptions of a user's requirements specifications;

- E-R model represents entities and how they relate to one another more easily;
- The E-R Model provides facilities for specifying cardinality and other logical constraints on the entities participating in a particular relationship;
- E-R Modeling approach has the advantage of simplicity and a simple transformation to an appropriate database scheme. Each entity and relationship in an E-R Model transforms into a relation in the database scheme.

The system requirements of the proposed MOARRDS have been modeled in the following E-R Model.

Figure 1: Entity-Relationship Diagram



The E-R diagram shows:

Four Entity Types (Rectangles): Agricultural Institutions, Information Sources, Professional, Agricultural Events and Three Relationships (the diamonds): has, employ, organizes are

requirements of relational database design each entity and relationship in the E-R model results into a relation in the database schema. The entity types derived from the MOARRDS E-R model result into the following partial set of relation schemas:

Bibliographical information sources (AccessionNo, Class No, Title, Author, Edition, Place of publication, Publisher, Date of Publication, Keywords)

Agricultural institutions ((InstitutionId, InstitutionName, Address, Subject Area, Contact person, Type)

Agricultural professionals (PIN, Name, Specialization, Address, Institution)

Agricultural events (EventId, EventName, EventDate, EventPlace, Organizer)

The requirements of a relational database model are to create suitable sets of relations. The transformation of the E-R model into relational model requires the decomposition of M: N to identify an intermediate entity and be replaced with two 1: M relationships to newly identified entity. For 1: M relationship a copy of the primary key of the relation in the one side relationship is posted in the relation in the many side of relationship. For 1: 1 relationship the primary key of one relation is posted in the relation which has total participation.

The Agricultural Institution - Bibliographical Information Sources relationship has M: N, this has been decomposed and a third table - intermediate entity (Institution-Sources) created to link these two relations. The relationship takes for its identifier the identifiers of the participating entities i.e. (AccessionNo, InstitutionId), where the AccessionNo is from the relation Bibliographical Information Sources, and InstitutionId from the relation Agricultural Institution. These two keys are linking attributes (foreign keys), which connects/links Agricultural Institution to Institution-Source relations, and Bibliographical Information

sources to Institution-Sources.

The Agricultural Institution-Agricultural Events has M: N relationship is decomposed resulting into a third table Institution-Event - intermediate entity (renamed Organizer for clarity) takes its identifiers from the participating entities i.e. InstitutionId, EventId that serve as linking attributes (foreign keys).

To link Agricultural Institutions and Agricultural professionals that have 1:M relationship, a copy of the primary key attribute (InstitutionId) of the Agricultural Institution is posted on the Agricultural Professional relation rather than have an extra relation.

The final set of the proposed relational database schema for the MOARRDS is as follows:

Information Sources (AccessionNo, Class No, Title, Author, Edition, Place of publication, Publisher, Date of Publication, Keywords)

Agricultural Institutions (InstitutionId, Name, Address, Subject Area, Contact person, Type)

Institution-Sources (AccessionNo, InstitutionId)

Agricultural Events (EventId, EventName, EventDate, EventPlace, OrganizerName)

Organizers (EventId, InstitutionId)

Professionals (PIN, Name, Specialization, Address, InstitutionId)

4.4 Data dictionary

A data Dictionary is an important component in the design of a database. It specifies the data used in the system, input, input types, size and other properties as specified below:

Relation: Institution

No	Name	Type	Size	Indexed	Key
1	InstitutionId	Number	10	Y	PK
2	Address	Text	30		
3	Contact Person		20		
4	Subject Collection		50		

Relation: Bibliographical Information Sources

No	Name	Type	Size	Indexed	Key
1	Accession No	Text	10	Y	PK
2	Class No	Text	30	N	
3	Title	Text	255	Y	
4	Author	Text	50	Y	
5	Edition	Text	10	N	
6	Place of publication	Text	50	N	
7	Publisher,	Text	50	N	
8	Date of Publication,	Number	4	N	
9	Keywords	Text	255	Y	

Relation: Institution-Sources

No	Name	Type	Size	Indexed	Key
1	Accession No	Number	10	Y	FK
2	InstitutionId	Number	10	Y	FK

Relation: Professionals

No	Name	Type	Size	Indexed	Key
1	PIN	Number	10	Y	PK
2	Name	Text	30	N	
3	InstitutionId	Number	10	Y	FK
4	Specialization	Text	50	Y	
9	Keyword	Text	255	Y	

Relation: Agricultural Events

No	Name	Type	Size	Indexed	Key
1	EventId	Number	10	Y	PK
2	EventName	Text	255	Y	
3	EventDate	Number	10	Y	
4	EventPlace	Text	50	Y	
5	Description	Text	255		
6	Participants	Text	255		

Relation: Organizer

No	Name	Type	Size	Indexed	Key
1	EventId	Number	4	Y	FK
3	InstitutionId	Text	255	Y	FK

4.5 Prototyping

Microsoft Access is the target DBMS to implement the prototype MOARRDS. It therefore becomes necessary to be aware of the functionality of the Microsoft Access DBMS.

Microsoft Access is a typical PC-based DBMS capable of storing, sorting and retrieving data for a variety of applications. The DBMS package provides the tools to create table, queries, forms and reports, and to develop customized database application using the Microsoft macro language or the Microsoft Visual Basic for Applications language. Microsoft Access can be used as a standalone system on a single PC or multi-user system on a PC network. Microsoft

Access was used because it is a relational DBMS, which has features that support the following operations:

- Data definitions and manipulations; and
- Integrity constraints that the relations must satisfy;

A table was created for each relation. Thus for the MOARRDS database - the Agricultural Institutions, Agricultural Professionals, Agricultural Events, Bibliographical Information sources, Institution, Information-Sources, and Organizer tables were created. In order to answer users inquires or to satisfy the functional requirements, queries or views have been created by relating two or more tables and selecting some rows/columns that satisfy some condition.

One such query that has been created was a Professionals-Institutions Query that links the Agricultural Professionals and Agricultural Institutions tables. It also selects rows that contain a given keyword value supplied by users.

Some queries do request the user to enter a parameter (e.g. "Enter the keyword you want to search for?") Entering a keyword the systems displays a report for the user to browse through if the condition is satisfied. As shown in figure 2, only selected columns such as professionals, specialization, address, qualifications, sex, and experience are included in the view.

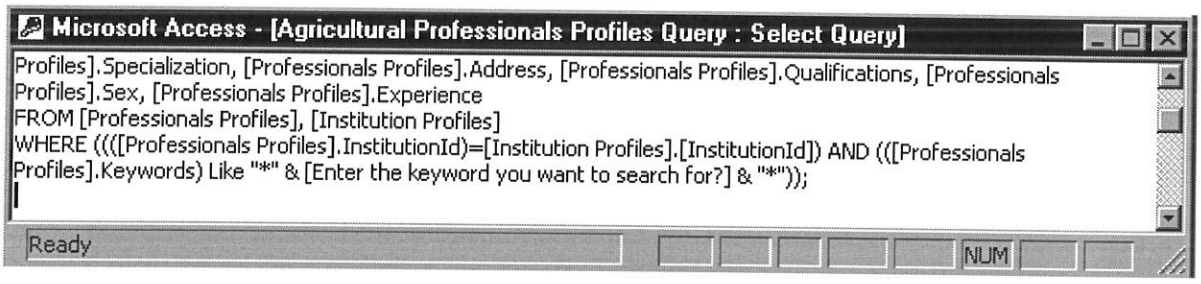


Figure 2: Agricultural Professionals Profiles Query

4.6 User evaluation of the prototype

Evaluation is an important aspect of system work; it was, therefore, necessary to show the prototype to the users to solicit for comments so as to improve the prototype. The prototype was demonstrated to some SISA teaching staff and a few students, since it was not possible to show it to the actual users (the agricultural experts in Kenya). They suggested that the prototype should incorporate some features like add new record, delete record, and save record in the forms since these are frequently required functions. Based on their recommendation these features were included. However, prior to the suggestions, these functions were performed using the Microsoft Access standard Menu.

4.7 Overall screen flow of the prototype

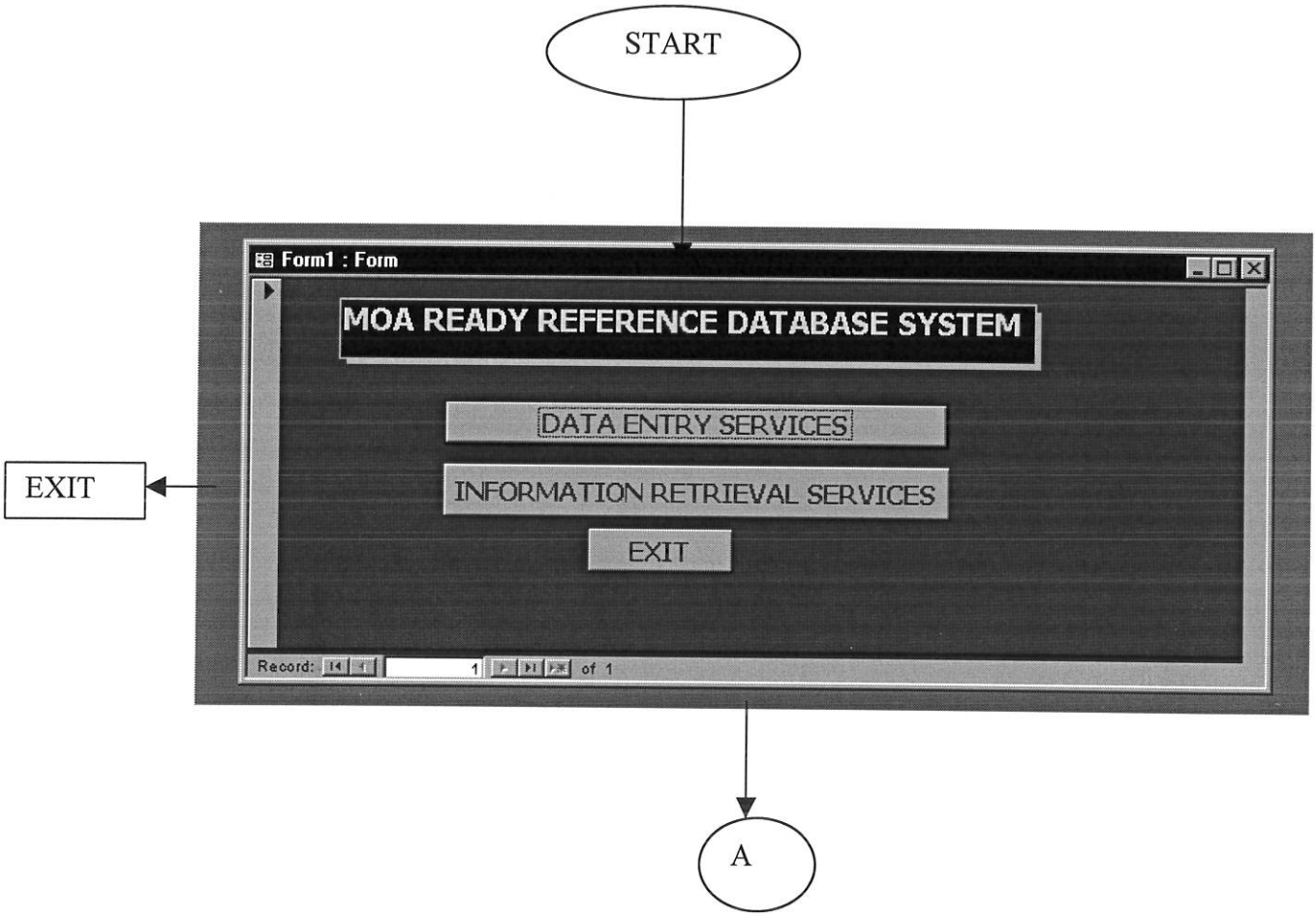


Figure 3. Form 1 First Screen

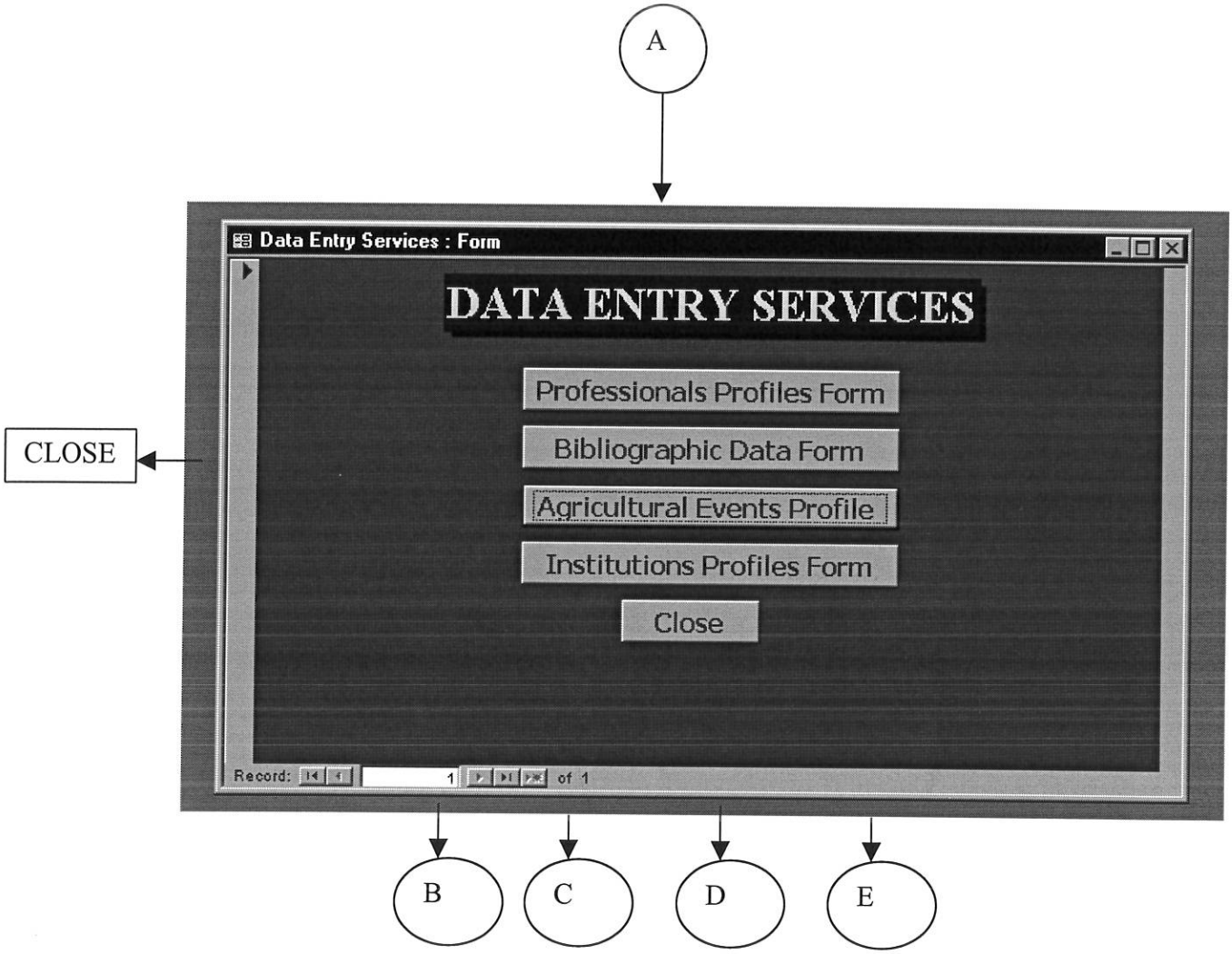


Figure 4: Data Entry Services: Form

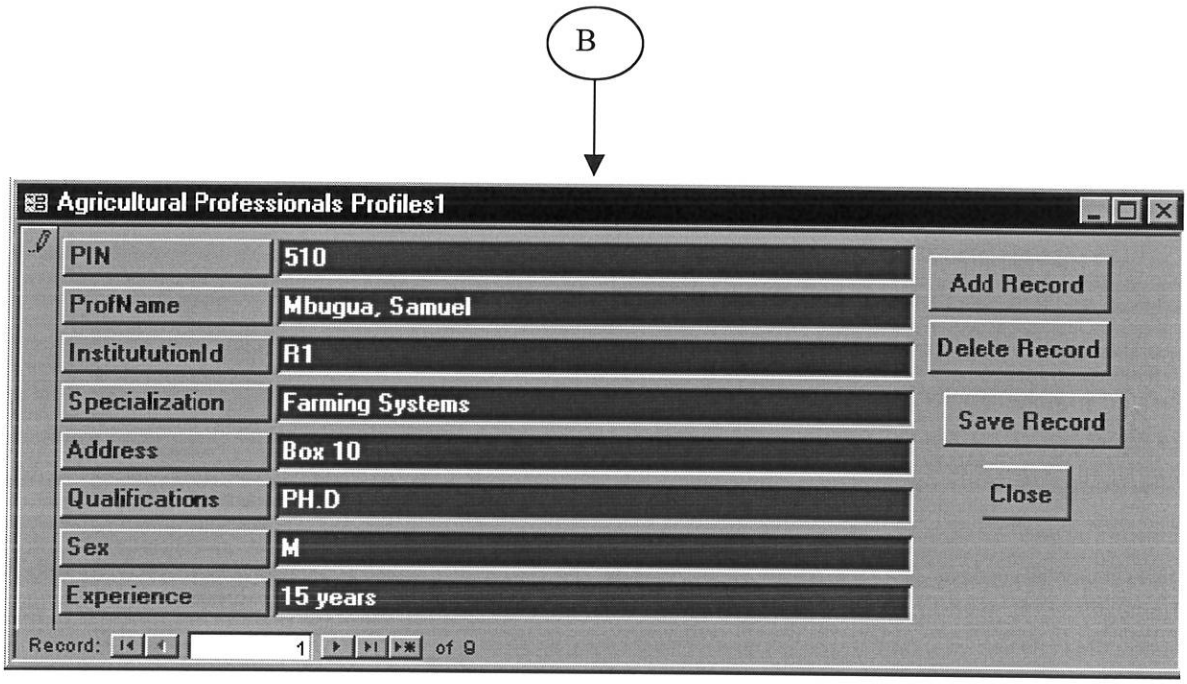


Figure 5: Agricultural Professional Profiles Form

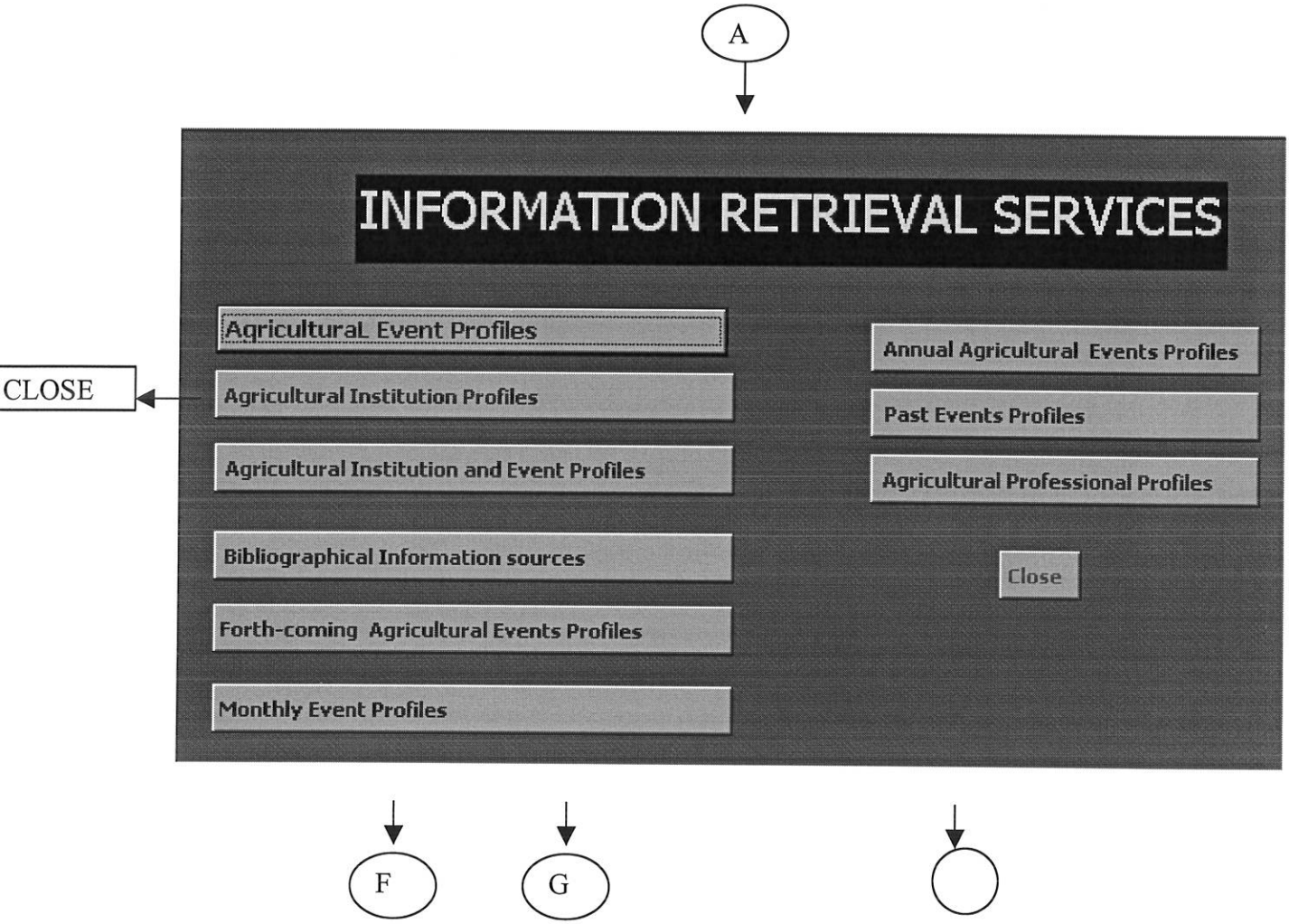


Figure 6: Information Retrieval Services Form

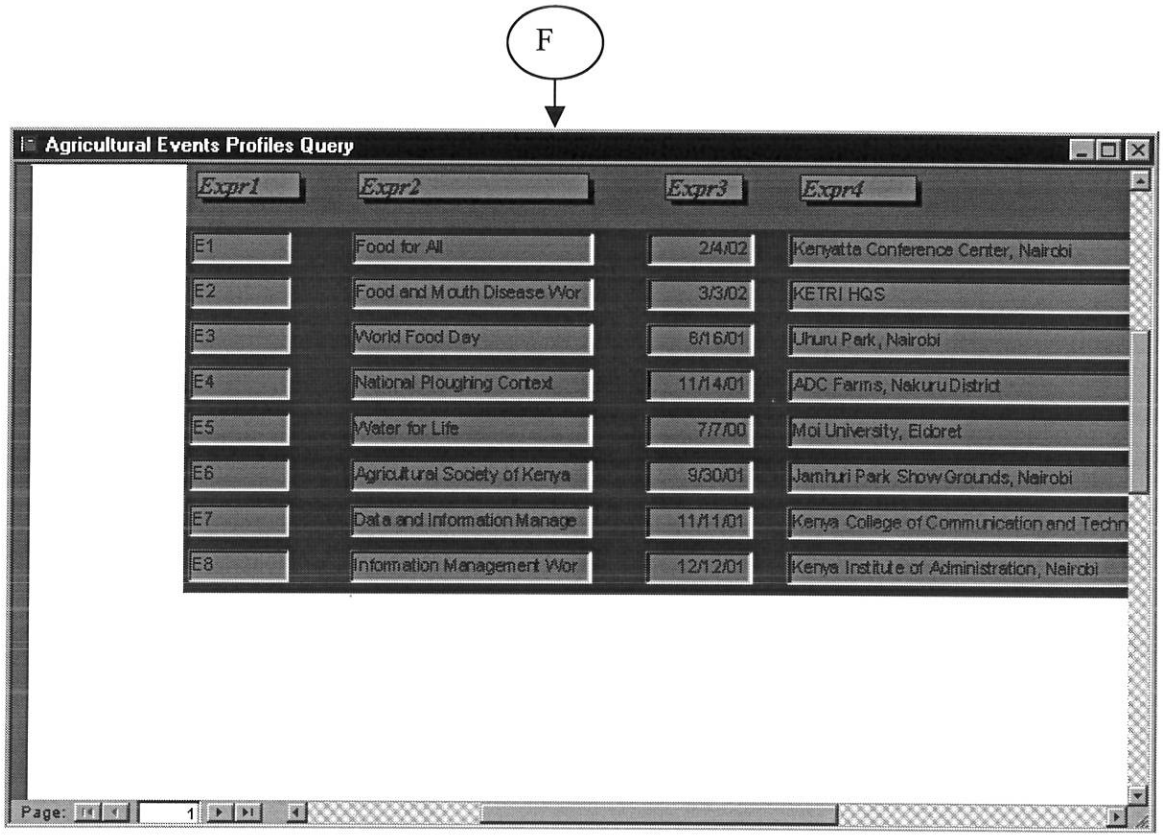


Figure 7: Agricultural Events Report

4.8 Demonstration of the prototype

To start the prototype Program, assuming that windows 2000 is being used, one has to:

Click on the start button on the Task Bar of windows 2000.

Select the Program submenu on start menu;

Click on the MOARRDS database application.

The system prompts the user to enter the database password. If the password is correct the database is opened, and the Main Menu is displayed (figure 3).

The Main Menu has two options: When a user selects Data Entry Services, the Data Entry Services form is displayed (figure 4) for him to enter data or perform data maintenance functions (add, delete, update etc) for the various types of information including professionals, institutions, bibliographical information sources, organizers and agricultural events (figure 5).

Assuming a user wants to retrieve or search for information, he is supposed to click on the option Information Retrieval Services; the system displays a list of options to select from as shown in the Information Retrieval Services form (figure 6) so as to satisfy his information needs.

Clicking on the option of his choice, the system displays a report (figure 7) for the user to browse or check if what is displayed is what he needs. For example if a user clicks on Agricultural Professionals Profiles, the system ask the user to enter the parameter value, this case the system asks the user "Enter the keyword you want to search for" (figure 8). The

The analysis of the usefulness of the MoA information systems revealed that the systems are generally weak and gaps in information do exist and are therefore of no valuable contribution to the development of the MoA agriculturists, in terms of resources for their job performance and update of knowledge in various agricultural fields. This has prompted the experts to seek information from other libraries and agricultural institutions.

The level of information technology skills among the majority of the experts appears to be limited. It seems that the experts have had little opportunity to access computers and those who have, therefore, had little cause to consider their potential use. They have received little or no training in using information technology, and that which has been received appears to have been provided on a rather ad hoc basis.

The study also identified limiting factors to effective use of agricultural information among the experts as: The information resources are scattered at different locations, the experts are unable to know where and who has which information and in which format; incomplete information; sieving through massive information resources before the retrieval of the relevant document is too tedious, lack of tools for synthesizing the information from different sources.

The neglect of agricultural information systems and services within MoA could be attributed to the lack of a national policy that stresses the role of the information services in the promotion of agricultural productivity.

Based on the study results the current study proposed a Ready Reference Database System to address one of the information requirements of the experts "information on where to find

information" The objective of the system is to direct users to information sources held by MoA information units, external institutions, and professionals. The proposed system is to alleviate some of the following problems which users have been experiencing with the existing system:

- Automating the bibliographical database facilitates updating of the database thereby solving the problems of having infrequently updated card catalogues that are mentioned by users;
- Gives users multiple access points to information as well;
- The system facilitates the production of reports, indexes and catalogues of information sources; Searching for information sources can be achieved by using any of the characteristics as specified in the queries so as to satisfy information needs; and finally it allows navigation of records.

5.2 Recommendations

The study recommended that MoA extend the result of this study by incorporating the following features/ facilities in the proposed Ready Reference Information System:

- A user-friendly search catalogue should consist of a redundant access to catalogue contents. To enable different user groups, such as the agricultural experts, scientists, students, agricultural advisors, farmers and politicians who have different approaches to the search for information sources. In addition the vocabulary of the navigation system as well as the catalogues structure to be designed according to the needs of these user groups.

- User-Guidance facility - the knowledge about the information needs of the users and about

their approaches in searching and selecting information sources to be implemented in the user guidance. The user guidance leads the user on his path by himself.

- The indexing of the catalogue contents to be realized with the help of standardized term lists and thesauri. A management vocabulary to be developed in a continuous feedback with the users based on the contents of the whole system and on the structure. The vocabulary to mirror the user requirements and to react flexibly to new developments, new research directions.

- Internet connection to access on-line information sources, address and contact persons of research and other institutions and additionally events like seminars, scientific conferences, fairs and exhibitions where further information can be found.

- Realization of the reference information system – the system should have a team of agriculture science editors or information professionals (with agricultural background) to monitor the contents of the database. This encompasses the search for new relevant information sources and checking of the availability and functioning of already included sources.

Apart from the MOARRDS, the study also proposes the following course of actions, which if implemented carefully should initiate and facilitate a process of development of agricultural information services.

- MoA information units should be given the necessary assistance in order to improve the acquisition of information resources identified by the experts, such as technical reports,

Agricultural periodicals/journals, Technical reports, Situational reports and Agricultural data reports among others.

- The poor readership of the participants especially reading of technical journals/periodicals in ones area of specialization should be investigated further to found out the root causes for poor readership.

- The existence of private libraries in individual offices should be dismantled and all documents to be kept in the libraries. In the same vein, the libraries should ensure efficient storage and retrieval of such information.

- In order to exploit the information held by colleagues or private contacts effectively, such information should be provided through appropriate electronic document delivery services and should entail access to full-text documents on-line.

- The result reveals that the agriculturists in MoA depend very much on personal contacts as a source of information. There is the need, therefore, for a systematic organization of seminars, workshops and exhibitions on a regular basis for all stakeholders at all levels of the agricultural sector.

- This study also reveals that the information seeking skills of a majority of the agriculturists is low. The provision of training experts in information skills, information technology would appear a cost-effective first step in improving awareness and use of information. Ideally the areas, which should be included in such a training program, are:

- Skills in searching electronic databases and the Internet;
- Information awareness;
- Critical appraisal (how to determine the quality of information and relevance for its purpose once items have been located)

- Current awareness information, preferably Selective Dissemination of Information (SDI) services should be a major component of agricultural information services. Thus the need has to be met with abstracting and indexing services, which, for optimum utilization and maximum convenience of users should be provided on the basis of SDI. The major agricultural institutions should be charged with the responsibility of providing CAS and be adequately funded to fulfill this mandate. The reports, project documents, bulletins should be made available on a regular basis to all levels in the agricultural sector.

- The increased use of other libraries and information generated by other national and international bodies should, in turn, serve as an indicator for the improvement of the inter-lending services. Hence, efforts should be made in the area of resource sharing among agricultural libraries in Kenya. Ideally a distributed database system is appropriate because data/information are scattered within the MoA information units (Head office Library, AIC, KADOC etc.) This system is to allow the data to be shared globally while keeping some degree of control, for example on database modification, with the local sites.

- MoA should develop a comprehensive agricultural policy that incorporates information infrastructure and services as a vital component in the agricultural management systems. The policy should map out strategies for the planning and implementing

of a well organized and efficient agricultural information systems and networks to provide accurate, adequate and timely information to all agricultural workers in the country.

- The improvement of the agricultural information provision in Kenya calls for management support/initiative. First it is important that the government and all those in agricultural decision-making understand that modern agricultural efforts must be supported by good library and documentation services which will give agriculturists answers to daily questions, keep them informed of the advances in their fields of specialization, provide exhaustive coverage of the publications which relate to their work as well as those of their colleagues elsewhere, which may be significant to research.

- Agricultural information systems in Kenya must make use of new information technologies (such as on-line information services, Internet, establish electronic databases) in order to make information technology and dissemination faster, easier, and more efficient. The potential role these new technologies as valuable aid to development and particularly its relevance to the traditional sector in Kenya have barely been considered. The new information technologies could be used for promotion of agricultural extension, the promotion of crop devastation, and improvement of primary health and education among the rural population.

- There is also need for information professionals in Kenya to lobby and work for more active participation in project development and implementation. This is to say that they need to be actively involved at problem identification stage and research to enable the professionals to give relevant services to the users.

- The study also recommends that MoA should address the other information requirements of the agricultural experts as identified in the study i.e. design appropriate systems to satisfy the following information needs: technical, market, socio-economic trends, technological information among others.

- Future Studies: The present study recommends the application of other data-gathering techniques – interviewing agriculturists, observing the businesses of MoA in operation, and examining documents (in particular those used to record or display information). A combination of two or more methods would yield better results than one. A questionnaire does not lend itself easily to probing a respondent, as could do interviewing technique for example.

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Appendix I.

SURVEY OF INFORMATION REQUIREMENTS FOR AGRICULTURAL EXPERTS: THE CASE OF MINISTRY OF AGRICULTURE, KENYA

Please make a tick √mark against the many items as relevant

1.0 PERSONAL DATA

1.1. Your job title/designation .....

1.2 Name of your department/division .....

1.3 Highest level of technical/professional training:

[ ] Diploma in Agriculture....
[ ] Bsc. in Agriculture
[ ] Bsc in Horticulture
[ ] Bsc in Agribusiness
[ ] Bsc in Agricultural Engineering
[ ] Bsc. in Agriculture Extension
[ ] Msc. in Agriculture
[ ] Msc. in Agriculture Extension
[ ] Other (please specify) .....

1.4 How long have you worked in the MoA? .....

2.0 INFORMATION/USER NEEDS

2.1 What is your area of agricultural specialization?

[ ] Agricultural Engineering
[ ] Crop Protection
[ ] Agricultural Extension services
[ ] Pest Management
[ ] Veterinary Medicine
[ ] Livestock production
[ ] Agronomy
[ ] Horticulture
[ ] Home Economics
[ ] Agricultural Manpower Development
[ ] Agricultural Training
[ ] Agricultural Economics
[ ] Project Monitoring and Evaluation
[ ] Other (please specify) .....

[ ] In the Office of the Unit/Head of Department
[ ] Colleagues Office
[ ] In the Library/or information center
[ ] Home
[ ] Other (please specify)
.....

If No, would you like a computer training arranged for you?

[ ] Yes [ ] No

3.6 How would the use of computerized agricultural information services enhance your agricultural operations/activities?

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

3.7 In your opinion how can the present agricultural information systems (mentioned in item 2.4) most effectively meet your information needs?

	Effective 1	Not effective 2
Provide up-to-date information sources	1	2
Employ professional information staff	1	2
Automate the information services	1	2
Provide Selective Dissemination of Information (SDI)	1	2
Train users in information searching skills	1	2
Establish specialized information units in the department	1	2

Other opinion (please specify)

1. ..... 1 2
2. ..... 1 2

4.0 INFORMATION USE PATTERN

4.1 How do you get to know about new information materials in your field of specialization?

	Most used 1	Occasionally used 2	least used 3
[ ] Publishers catalogue	1	2	3
[ ] Indexes and abstracts	1	2	3
[ ] Book reviews	1	2	3
[ ] Bibliographies	1	2	3
[ ] Periodicals	1	2	3
[ ] Subject issued by Librarian	1	2	3
[ ] Accession lists	1	2	3
[ ] Seminars, workshops etc	1	2	3
[ ] Current awareness services	1	2	3
[ ] Library bulletins	1	2	3
[ ] Colleagues	1	2	3
[ ] SDI (Selective Dissemination of Information)	1	2	3
[ ] Other sources: (please specify)			
1.	1	2	3
2.	1	2	3

4.2 Do you visit libraries?

[ ] Yes [ ] No

If Yes, do you consult an information worker in the process of information seeking?

[ ] Yes [ ] No

If No, why not?

.....

.....

4.3 The following are the tools used to get information. Please make a tick Mark against the most appropriate to you and rate them in order of frequency of use.

Most used 1	Occasionally used 2	Least used 3		
[ ] Author Title Catalogue		1	2	3
[ ] Title Catalogue		1	2	3
[ ] Agricultural Subject Indexes		1	2	3
[ ] Agricultural Subject Abstracts		1	2	3
[ ] Bibliographies		1	2	3
[ ] Agris CD-ROM databases		1	2	3
[ ] Caris CD-ROM Databases		1	2	3
[ ] CAB CD-ROM Databases		1	2	3
[ ] Agricultural Subject Catalogue		1	2	3
[ ] Asking the Library Staff for the information		1	2	3

[ ] Other (please specify)

.....

.....

.....

.....

4.4 Do you use the libraries and information facilitates of other agricultural sectors besides your own when undertaking an agricultural operation/activity or making an agricultural decision?

[ ] Yes [ ] No

Most used 1	Occasionally used 2	Least used 3		
1.		1	2	3
2.		1	2	3
3.		1	2	3

If No, why not?

[ ] Facility is located far away
[ ] Collection are not relevant
[ ] Time factor
[ ] Other (please specify)

.....

.....

4.5 What problems do you encounter in getting relevant information for your work?

[ ] Sieving through massive information resources before the retrieval of the Relevant document is too tedious
[ ] Difficult to analyze information available in printed form
[ ] Lack of tools for synthesizing the information from different sources
[ ] Incomplete information (e.g. annual reports have gaps between varies years)
[ ] Difficulty to link related information in the printed documents
[ ] The information resources are scattered at different locations within the MoA
[ ]Other (please specify)

.....
.....

4.6 Would you recommend a move to formalize co-operation with other agricultural information systems in order to enrich information resources in your area?

[ ] Yes [ ] No

Please give names of information centers or institutions you would like to be networked with in order of the most preferred?

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

4.7 Do you make use of services and information generated from national and international bodies in your subject areas?

[ ] Yes [ ] No

If Yes, please give names of such organization in order of the most frequently used?

	Most used	Rarely used
	1	2
1.	1	2
2.	1	2
3.	1	2

If No, why not?

.....
.....

4.8 How would you rate your unit's capacity to seek, identify and retrieve the information you need?

	Excellent 1		Good 2	Fair 3	Poor 4
Seek	1	2	3	4	
Identify	1	2	3	4	
Retrieve	1	2	3	4	

5.0. CHANNELS OF COMMUNICATION

5.1. How do you communicate with the library when in need of reading or research materials? Please indicate the frequency of use of such channels?

Mostly Used 1 | Occasionally Used 2 | Rarely used 3 | Not used 4

[ ] Telephone 1 2 3 4
[ ] Internal memo 1 2 3 4
[ ] Personal visit to the information center 1 2 3 4
[ ] Asking other people to contact the library on your behalf 1 2 3 4
[ ] Other (please specify)
1. ..... 1 2 3 4
2. ..... 1 2 3 4
3. ..... 1 2 3 4
4. ..... 1 2 3 4

5.2 For any request you make to the library staff, by what means do they communicate a feedback to you

Mostly Used 1 | Occasionally Used 2 | Rarely used 3 | Not used 4

[ ] Telephone 1 2 3 4
[ ] Internal memo 1 2 3 4
[ ] Library staff brings the feedback to your office 1 2 3 4
[ ] Delivering the required relevant document 1 2 3 4
[ ] Sending a photocopies of the required document 1 2 3 4
[ ] Other (please specify)

1. ..... 1 2 3 4
2. ..... 1 2 3 4
3. ..... 1 2 3 4

5.3 What mode of communication would you like library the staff to use to communicate the results of your queries (information needs)?

	Most preferred 1	Least preferred 2
[ ] Telephone	1	2
[ ] Delivering the relevant documents to your office	1	2
[ ] Sending a written memo to your office	1	2
[ ] Sending the information in a diskette (making softcopy for you)	1	2
[ ] Other (please specify)		
1.	1	2
2.	1	2

5.4 How would you like to be informed of new publications and articles received by the library in your area of interest?

	Most preferred 1	Least preferred 2
[ ] Telephone	1	2
[ ] Routing Slips	1	2
[ ] Written memo	1	2
[ ] Accession lists	1	2
[ ] Library bulletins	1	2
[ ] Displaying the new publications at a strategic place	1	2
[ ] Other (please specify)		

6.0 ASSESSMENT OF THE MOA F INFORMATION SERVICES

6.1 Are you satisfied with information services offered by the MoA?

[ ] Yes [ ] No

If Yes, please give areas of satisfaction?

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

If No, why not? Please give areas of dissatisfaction?

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

6.2 Please state your opinion with regard to the following in respect of the information systems of the MoA.

	Adequate 1	Inadequate 2

[ ] Periodicals (in terms of titles and relevance) 1 2

[ ] Library Services 1 2
[ ] Technical reports 1 2
[ ] Books and others 1 2
[ ] Audio-visuals 1 2
[ ] Library staff 1 2
[ ] Other (please specify)

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

6.3 How readily available are the following in providing you with information?

	Always 1	Often 2	Rarely 3	Never 4			
[ ] Library staff				1	2	3	4
[ ] Colleagues from within				1	2	3	4
[ ] Colleagues form other sectors				1	2	3	4
[ ] Office clerks/assistants				1	2	3	4
[ ] Other (please specify)							
1.				1	2	3	4
2.				1	2	3	4
3.				1	2	3	4

6.4 What general comments can you give on agricultural information systems in Kenya as a whole?

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

DECLARATION

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

Leah Osoro

June 2001

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

Getachew Jemaneh

Woinshet Abdella