

CHAPTER 1

THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION

The focus of this research is the need for the provision of access to digital agricultural information resources and services via portals to researchers in agricultural research organisations in sub-Saharan Africa, with emphasis on the Southern African Development Community (SADC) region.

1.1.1 Portals

There is no generally accepted definition of a portal. This is illustrated by the different definitions given by several authors, amongst others, Grolier Incorporated (1980), Morrison (2000), Rowley (2000:62), Berkman (2000), and Hurwitz (2001). Most current definitions of portals depend largely on the nature of the environment in which they are being applied. In addition, there are different types of portals, with different features. Therefore, part of the research was an attempt to come up with an acceptable, general definition of an information portal. This is discussed and presented in Chapter 3 of this thesis.

Portals have many aspects for research. These include research on their applications, design features, technology used, and many more. In the past few years, a number of commercial firms, especially large software corporations such as Microsoft, IBM, Oracle, and Computer Associates International, among many others, have started developing portal systems (portal software). Research on the deployment and use of portals in corporate organisations is another area that has attracted a lot of attention. One of the many organisations that have conducted studies in this area is the Delphi Group.

In 1999, the Delphi Group surveyed 300 Fortune 500 companies to establish to what extent corporate portals have been deployed in these corporations. The findings showed that 55% had already started implementing corporate portals, while the remaining 45% were yet to implement portals (The Delphi Group 2000a). A market survey of the expected deployment trend of corporate portals, and deployment strategies, conducted by the Delphi Group in 2000 (The Delphi Group 2000b), revealed that:

- Larger companies had recognised the potential for portal technology and were implementing portals at a faster rate than smaller companies.
- General business, where customer satisfaction is mission critical, was ahead of education and government in the implementation of portals. None of the 46 education organisations that responded to the survey had completed deployment, and only one government organisation out of 63 had deployed portal technology.
- The most common strategy for deploying corporate portals overall was a phased deployment by business unit, followed by an enterprise-wide roll-out or a phased roll-out by department.

Today, many organisations, especially corporate organisations, are implementing portals through which their staff and clients can access various types of content developed within the organisation. Through the same portals, staff and clients can also be directed to other relevant digital information resources and services on the Web. Although it appears that the development of portals is largely driven by e-commerce, portals appear to have great potential and useful applications in organisations where consumption and generation of information and knowledge are among the major activities. Among these organisations are agricultural research organisations.

1.1.2 Agricultural research

According to Beye (2002:1), agriculture forms the mainstay of the economy in most developing countries. In 1997 it contributed on average 40% of the Gross Domestic Product (GDP) and more than 60% to foreign exchange earnings in 1977. In spite of this being the case, Africa and other continents have not been experiencing growth in agricultural yields. This is due to a number of factors, among them the decline in external agricultural assistance from multilateral organisations. Furthermore, there has also been a reduction in funding for agricultural research. Yet, agricultural research holds the vital key to improving food security, reducing poverty and sustaining broad-based economic development (Beye 2002:2).

Agricultural research is an ongoing exercise and it requires various inputs, among them information and knowledge. These come from both within and outside agricultural research organisations. There are several sources of information and knowledge in agricultural organisations, including researchers, journal articles, research reports, farmers, and conference proceedings, agricultural theses and dissertations, CD-ROMs and online databases, as well as the Internet and the World Wide Web, among others.

The Internet and the Web have become a source of agriculture information for many people, including agricultural researchers. According to Besemer, Addison and Ferguson (2003:2), the Internet has changed the information landscape in the field of agriculture and natural resources. The relatively small investment required to set up a website enable a great many institutions to become instant information providers. This has resulted in some problems, and as noted by Besemer, Addison and Ferguson (2003:2) who state that:

The trend of proliferation of websites has continued for a number of years. As a result, the current system of agricultural information services is at times rather incoherent, and those in search of high quality

information often have difficulty separating the wheat from the chaff. There are a great number of services, but potential users often have problems finding and accessing relevant information in usable formats.

There are just too many websites that point to sources of information rather than the information itself, making it difficult for information end-users, agricultural researchers in this case; to get the information they are really looking for in good time. This is a problem that could be addressed by the use of portals in agricultural research, probably based on the concept of portals used in corporate organisations.

The question of access to information on the Web also raises the issue of access to relevant content. Overall, coverage of local content, which could be useful and relevant to local agricultural research situations, is generally low. Much of the local content is locked up in drawers or stored on hard disks of computers belonging to researchers. As a result, in most cases, much of the content accessed via the Web has more significance to users in developed countries than in developing countries. The use of portals by agricultural research organisations in sub-Saharan Africa could allow for the integration of local and external content into the overall agricultural information system serving the needs of agricultural researchers in developing countries. In cases where organisations do not have access to the Internet, access to local content could be provided via a portal accessed on the intranet.

1.1.3 Motivation for the research

The main motivation for the interest in information portals in agricultural research organisations is the following:

- Agricultural research organisations have a very important role to play in improving the economies of developing countries. According to Kaniki (1992:83), “agricultural research and the information generated from such

research are important stimulants for accelerating agricultural production development in a country. To carry out their work, these organisations require various resources, among them information and knowledge. Therefore, efficient provision of access to relevant information and knowledge to agricultural researchers could contribute to quality research, through which “a country is able to select appropriate technology and information, which, if applied, can help productivity” (Kaniki 1992:83), and thus contribute to the overall growth of the country’s economy.

- Since 1998, this researcher has been involved in training workshops, as a consultant for the Technical Centre for Agricultural and Rural Co-operation (CTA) of the Netherlands. These workshops dealt with website design and development and were held for staff working in libraries and documentation centres of agricultural research organisations in the Southern African Development Community (SADC) region. One major observation made during the workshops is that there is great potential for improvement in the provision of access to digital agricultural information services via websites to researchers in the SADC region. However, there is need to investigate the use of advanced internet and web-based tools other than ordinary websites. The portal, with its ability to allow information end-users to personalise and customise the content and interface to suit their needs (Morrison 2000), stands out as the most promising tool that could be used in the provision of access to digital information resources. Noticeably, there is also a general absence of guidelines for the deployment of advanced websites or information portals in agricultural research organisations.
- It is the researcher’s assumption that except for the major reasons or objectives for implementing portals, experiences gained in corporate organisations could also be applied to a large number of other organisations. Therefore, organisations such as agricultural research organisations should be able to use portals in the provision of access to digital information

services to researchers. However, there is a need to investigate the actual potential applications of portals in agricultural research organisations and define the exact nature and features of a portal that could serve the information needs of researchers in these organisations.

1.2 STATEMENT OF THE PROBLEM

Taking into account the information provided above on portals and agricultural research and the motivation for the research, the core problem underlying the research was formulated as follows:

What is the nature and application possibility of agricultural information portals in the provision of web-based, value-added information services to researchers?

Based on the above statement of the problem, the purpose of the research was formulated as follows:

To study intranets, extranets, and portals, and possible portal development methodologies, and the need for provision of information via portals in the SADC region with the purpose of identifying features and design parameters that could be incorporated into the definition of the nature of an agricultural information portal and model guidelines for the deployment of such portals in agricultural research organisations.

Based on the above purpose of the research, the expected major outcomes and contributions of the research are the:

- Identification of the necessity to provide access to digital information resources and services via information portals in agricultural research organisations, especially in the SADC region

- Definition of the nature, features and application possibilities of an agricultural information portal
- Development of model guidelines that could be used by agricultural information specialists, information technology specialists and agricultural research organisations, especially in the SADC region, when deploying agricultural information portals.

1.2.1 Statement of the sub-problems

Arising from the statement of the research problem and purpose of the research, the following five sub-problems were formulated:

First sub-problem: What are intranets and extranets and how are they being used use in the provision of access to digital information resources and services to end-users in corporate organisations?

The above sub-problem is addressed in Chapter 2, with a view to examining the development and use of intranets and extranets in corporate organisations, and identifying the major features of these technologies that could be incorporated into the design of an agricultural information portal.

Second sub-problem: What are portals and how are they being used in the provision of digital information and services to end-users in corporate organisations?

Chapter 3 addresses the above sub-problem. The chapter further identifies the features of good portals that could be incorporated into the design of an agricultural information portal.

Third sub-problem: What are the international trends in the provision of access to digital agricultural information via websites, and what may be learnt from the trends regarding the resources and services that could be provided via an agricultural information portal?

The above sub-problem is addressed in Chapter 4 in which the results of a survey and a content analysis of various websites of international agricultural research organisations are reported.

Fourth sub-problem: To what degree have agricultural research websites been developed, and is there a need for the use of portals other than ordinary websites in the provision of access to web-based, value-added information services and resources to researchers in agricultural research organisations in the SADC region?

The above sub-problem is addressed by the survey on the necessity of information portals in the SADC region and a discussion of the results reported in Chapter 6. In addition, some aspects relating to the state of the provision of access to agricultural information via websites in the region is addressed in Chapter 4.

Fifth sub-problem: What is an agricultural information portal and are there any suitable models or guidelines (if any) that could be adopted (or developed) for the deployment of agricultural information portals in agricultural research organisations?

The above sub-problem is addressed in Chapter 7. According to Longman's Dictionary of Contemporary English – New Edition, a model is "... a person or a thing that is a perfect example to be followed or copied" (1987:668), and guidelines are "informal rules or instructions on how something should be done" (1987:465).

The results of this research could culminate in the definition of an agricultural information portal; facilitate the identification of its major features, and the development of guidelines for the deployment of such a portal in agricultural research organisations.

1.3 LIMITATIONS OF THE RESEARCH

1.3.1 Focus of the research

This research was primarily concerned with the deployment and use of portals in agricultural research organisations. It was largely limited to the:

- Definition of the nature and identification of application possibilities of agricultural information portals
- Development of guidelines for the deployment of agricultural information portals in agricultural research organisations.



The development of a prototype of an agricultural information portal was not part of the research. This could, however, be a phase in the testing and refining of the guidelines that have been proposed.

1.3.2 Websites

Regarding the study of the provision of access to agricultural information via websites, the study was limited to publicly accessible websites of international agricultural organisations, regional agricultural organisations operating in sub-Saharan Africa, and agricultural research organisations in the SADC region. Owing to their nature, for example restricted access, websites accessed via intranets were not included in the study.

1.3.3 Agricultural research organisations and information end-users

Sample populations regarding the state of the development and the necessity of portals for agricultural researchers were drawn from major public agricultural research organisations in the 14 member countries of the Southern African Development Community (SADC). During the time of the study the SADC member countries were Angola, Botswana, Democratic Republic of Congo (DRC), Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

For practical reasons, only SADC member countries that have English as official language or as one of the official languages were included in the study. For this reason, Angola and Mozambique, whose official language is Portuguese, and the DRC, where the official language is French, were not included in the study.

The choice of the SADC region as a case study on the use of portals in agricultural research organisations in sub-Saharan Africa was based on the assumption that with South Africa at the centre, the SADC region has a relatively well-developed information and communication infrastructure in sub-Saharan Africa. It was, therefore, expected that the implementation and use of information communication technologies in agricultural research organisations would be widespread. Thus the SADC region would provide an infrastructure and conditions suitable for the study in sub-Saharan Africa. Portals are ICT-based tools and can only be implemented where the ICT infrastructure exists.

1.4 IMPLICATIONS OF THE RESULTS/FINDINGS

In spite of the above limitations and boundaries of the research, to a large extent the findings may be generalised with regard to most developing countries and the proposed guidelines for planning the deployment of portals can be:

- Used by all types of organisations involved in the generation and management of information and knowledge.
- Useful and relevant to information specialists and information technology specialists working in agricultural research organisations involved in website or portal management.
- Used by individual consultants involved in the development of advanced websites and information portals.
- Incorporated into library and information science schools' curriculum to teach students how to plan and deploy advanced websites and information portals in organisations.

1.5 DEFINITION OF TERMS

The following terms, that are used but not defined anywhere in the thesis, need to be explained or defined from the onset to ensure that the reader and the researcher attach the same meaning to them:

- *Information Specialist*: Refers to a professionally qualified person in the field of information studies, information science, information management or knowledge management. In the context of this thesis, information specialists include information managers, subject specialists, librarians, and documentalists, responsible for the management and provision of agricultural information services to information end-users in agricultural research organisations. The terms *Information Specialist* and *Information Management Specialist* are used interchangeably in the thesis.
- *Information Technology Specialist*: Refers to individuals involved in developing or managing ICT-based information systems. These include

system analysts, programmers, network administrators, webmasters, database administrators, information technology managers and many others.

- *Digital information resources*: Refers to information resources stored in digital format on computer servers and accessed on electronic networks, such as the Internet, intranet and extranets. The terms *electronic*, *web-based* and *digital* are used interchangeably in the thesis.
- *Digital information services*: Refers to services that are provided and made available via the Internet, intranets and extranets. These may include services such as electronic reference services, web-based selective dissemination of information and current awareness services, online help desk services, and many others
- *Information needs*: Kaniki (1992:83) observed that there is confusion about the definition and understanding of the concept *information needs*. Mainly, this is because both “information” and “need”, which make up the concept *information needs* – are difficult terms to define and understand. However, for the purpose of this research, the writer adopted Kaniki’s (1992:83-84) definitions of *information* as ideas, facts, imaginative works of mind and data of value potentially useful in decision-making, answering questions, problem solving, etc., which can reduce uncertainty; and of *need* as a state of lack of desirable requisite(s) or commodity (i.e. information) necessary to deal with a situation as an individual sees fit.
- *Value-added information services*: Refers to the provision of access to both current high quality information and archives (for continuous availability) from a variety of sources. In the context of this research, information specialists are expected to play a critical role in ensuring that the quality of information provided to researchers is of high quality.

- *Website*: Refers to a collection of web documents stored on a web server and accessed via the Internet, intranet or extranet. Web documents or webpages will refer to documents coded in hypertext mark-up language (HTML) or extensible mark-up language (XML) and mounted or posted on a web server. The documents may contain any or all of the following: formatted text, inline graphics, hyperlinks within documents, links to other HTML documents, and links to documents in other formats. Documents created on the fly (dynamic webpages) from databases and displayed by web browsers are also included in the definition.
- *Brochureware*: In the Web environment, brochureware, according to Whatis.com (2002), refers to websites or pages that are produced by taking an organisation's printed brochure and translating it directly to the Web without regard for the possibilities of the new medium. In extreme cases, all the copy in the brochure will be used as is and visual images will be copied as well. The result will almost always be static and uninteresting.

1.6 RESEARCH METHODOLOGY

A research design is a plan or guide for data collection and interpretation, with sets of rules that enable the researcher to conceptualise and observe the problem under study (Adams and Shvaneveldt 1991:103). In this research, a combination of three research methods was used in data collection: literature review, questionnaire survey and cases studies.

1.6.1 Literature review method

Hart (1998:13) defines literature review as "...the selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfil certain aims or express certain views on the nature of the topic and how it is to be investigated, and

the effective evaluation of these documents in relationship to the research being proposed”.

Chapters 2 and 3, and a large part of Chapter 7 are based on literature reviews. The reviews involved a detailed study of relevant journal articles, conference papers, digital documents (websites and portals), and technical reports relating to various aspects of the Internet, the World Wide Web, intranets, extranets and portals. Noticeably, much of the literature available, especially on portals, was in digital format, accessed via the Web.

1.6.2 Survey method

Surveys are methods of data collection in which information is gathered through interviews or questionnaires. Surveys have the ability to allow researchers to gain information quickly and require relative little effort in gaining large amounts of data (Edwards and Talbot 1994:29). In this study, questionnaires were used to collect information from agricultural research organisations, information end-users (researchers), information specialists and information technology specialists in the SADC region on the following:

- Existence of problems associated with using paper-based information resources that could be addressed by using information portals
- Availability and access to tools for manipulating digital information resources
- Availability of websites and how they are being utilised by researchers
- Availability of tools and facilities for developing information portals in agricultural research organisations

- Types of information resources used by researchers for different types of information needs
- Frequency of use or need to use/access services or facilities or conduct activities that could be done via an information portal.

The whole of Chapter 6 is based on the data and information that was collected from the questionnaires.

1.6.3 Case studies

Yin (1984:13) describes the case study methodology as an “empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. Bell (1992) states that case study research operates much in the same way as other research methods: evidence is collected systematically, the relationship between variables is studied and the study is methodically planned. Generally, the use of observation and interviews are employed. However, no method is excluded and the methods used for collecting data are chosen with regard to the suitability of the task (Bell 1992).

Chapter 4 is based on the case study of various websites and an analysis of their content to determine the global trends in the provision of agricultural information via the Web.

1.6.4 Study population and sample populations

Different sources of information for the thesis were identified. These included websites (and portals), agricultural research organisations, researchers, information specialists and information technology specialists.

1.6.4.1 Websites

Websites of international agricultural organisations were examined to establish trends in the provision of access to agricultural information resources and services via websites. The sites were also used to identify information resources and services that could be incorporated into an agricultural information portal. Samples of the sites included in the study were selected from the Agricultural Research on the Web (AROW), an online directory of agricultural research organisations that have websites.

In addition to the websites of international agricultural organisations, websites of regional agricultural organisations in sub-Saharan Africa, and organisations in the SADC region were also used as sources of information. Even in this case the sites were selected from AROW directory.

1.6.4.2 Agricultural research organisations

This category was made up of agricultural research organisations located in the SADC region. These are organisations from which the samples of researchers were also selected. Information specialists and information technology specialists, who also provided information via questionnaires, were also drawn from these organisations. Chapter 5 gives a detailed description on how the various study populations of agricultural research organisations, researchers, information specialists and information technology specialists, and samples were selected

1.6.4.3 Researchers

This study population was made up of researchers working in selected agricultural research institutions in the SADC region. The study sample was selected in consultation with agricultural information specialists working in the target agricultural research organisations.

1.6.4.4. Information specialists

Information specialists responsible for the provision of agricultural information services were asked to complete a questionnaire designed to collect information on the various information services and facilities provided to researchers in the various organisations.

1.6.4.5 Information technology specialists

Information technology specialists responsible for managing ICT facilities or developing information systems in the target agricultural research organisations in the SADC region were asked to complete questionnaires designed to obtain information about the ICT facilities available to information end users in the organisations.

1.6.5 Data analysis



The data collected for the study was both qualitative and quantitative. Themes or categories were developed from the literature review for the qualitative data, while data collected from interviews, questionnaires and case studies was analysed and categorised into instances of occurrences (frequencies) and matched against the themes. Instances of occurrences were processed using SPSS statistical software and then analysed. Conclusions were drawn from the results of the analysis.

1.7 OUTLINE OF THE THESIS

Altogether, the thesis is arranged in eight chapters and eight appendices. Chapters 2, 3, 4, 6 and 7 address each of the research sub-problems indicated in Section 1.2.1. The content of each chapter is summarised below.

1.7.1 Chapter 2: Intranet and extranets

Chapter 2 discusses intranets and extranets as information management tools. The discussion includes an examination of the historical development and major components of Internet and World Wide Web technologies, on which intranets and extranets are based. It also reviews various definitions of intranets and extranets, examines major technical components of intranets and extranets, their application in organisations and the benefits, and intranet and extranet models. Good features of intranets and extranets are outlined. The chapter also proposes a definition of intranets and extranets.

1.7.2 Chapter 3: Portals

In Chapter 3 the focus is on portals as information management tools, with emphasis on their use in the provision of access to digital-based information resources and services. Various definitions of portals are reviewed. The chapter also identifies and discusses various types of portals, and identifies features of good portals that could be incorporated into the design of agricultural information portals. The chapter concludes with a definition of an information portal.

1.7.3 Chapter 4: Agricultural information websites

Chapter 4 presents an analysis and discussion of the study of the global trends with regard to the provision of access to digital information resources and services on publicly accessed websites of international agricultural-based organisations. It also examines the situation in Africa, particularly the SADC region, and compares the results with global trends.

1.7.4 Chapter 5: Need for agricultural research information via portals: survey design and data collection

This chapter presents the design of the survey and data collection mechanism that was developed for the collection of information to establish the state of the development and need for portals, other than ordinary websites, in the provision of web-based, value-added information services to researchers in agricultural research organisations in the SADC region. Overall, Chapter 5 outlines and discusses the research themes examined in the survey, the objectives of the survey, the choice of study populations and samples, the design of the questionnaires and instrument testing.

1.7.5 Chapter 6: Need for agricultural information and services via portals: results of a survey

Chapter 6 presents the findings, an analysis and a discussion of the survey on the necessity of the provision of information services and resources to researchers of agriculture research organisations in the SADC region via improved websites or information portals..

1.7.6 Chapter 7: Guidelines for planning the deployment of agricultural information portals

Based on the results of the survey discussed in Chapter 6, and the findings in Chapters 2, 3, and 4, Chapter 7 defines an agricultural information portal and outlines the possible applications of the portal in agricultural research organisations. Major components of the portal are outlined, and the need to adopt formal development approaches when developing portals is discussed. Finally, the chapter proposes and discusses guidelines for deploying agricultural information portals in agricultural research organisations.

1.7.7 Chapter 8: Summary, recommendations and conclusion

Chapter 8 is a summary of the major findings relating to the five sub-research problems, and presents the recommendations based on the major findings, conclusions and possible areas for further study that are drawn from the research set out in Chapters 2, 3, 4, 6, and 7 of the thesis.



CHAPTER 2

INTRANETS AND EXTRANETS

2.1 INTRODUCTION

Corporate organisations have for years been implementing and using local area networks (LANs) and Wide Area Networks (WANs) as infrastructures for providing employees, clients and partners with access to corporate information resources. However, there are several problems associated with LANs and WANs that have forced organisations to look for alternative means of providing access to corporate information resources. The major problem has mainly to do with the information access and retrieval processes on these networks. The process, generally, involves the following activities:



- Login to a computer
- Find out where the information resources or files are located on the network and in what format they are stored
- Start and run application software capable of reading the relevant files
- Open the file(s) in the application software and page down to the desired information
- View, copy or print the information
- Close the file(s), application software and logout (Bernard 1999).

In addition to locating information on the LANs or WANs, information end-users also have to learn how to use the various application software systems needed to access different information resources stored on the networks. Other problems

associated with authorising, processing and delivering information to corporate information-end users include:

- Use of incompatible, proprietary multiple-data formats
- Expensive, multiple-data interfaces
- Frequent upgrading of publishing tools
- Out-of-date information locked in obsolete systems, and
- Redundancy and duplication of information across networks (Bernard 1999).

For years, corporate organisations and information systems specialists have been working on a number of projects aimed at solving the above problems. The development of different types of document management systems and the adoption of various types of information management and storage standards has been one way of trying to attend to the problems. The development and adoption of internet and web technologies in corporate organisations since the early 1990's has led to the development and use of intranets and extranets as tools for information management. Intranets and extranets are replacing traditional LANs and WANs as the major means of authorising, processing and providing access to corporate information resources. In addition, organisations are also using websites accessed over intranets and extranets to provide access to specialised information resources.

A number of organisations and individuals are also developing and marketing various intranet and extranet products or solutions, and these can be purchased and implemented to provide an intranet/extranet-based information management solution within organisations. Arising from the above developments and the availability of a number of different intranet and extranet products/solutions is the need for organisations to choose and implement suitable intranets or extranets that meet their needs. The choice of a suitable intranet/extranet system or solution is based on a number of factors, among them the features of intranets and extranets.

The purpose of this chapter is to discuss and examine intranets and extranets as information management tools with the aim of addressing the following research sub-problem:

What are intranets and extranets and how are they being used in the provision of access to digital information resources and services to end-users in corporate organisations?

To address the above research sub-problem, a study of literature on intranets and extranets was conducted. This chapter is based on the results of the study.

The chapter begins with the review of Internet and World Wide Web technologies on which intranets and extranets are based. It then examines the development and application of intranet and extranet technologies to information management, and the provision of access to corporate information resources and associated benefits. It also examines the various definitions of intranets and extranets and discusses the major technical components of intranets and extranets. Resulting from the literature review, an outline and discussion of features of good intranets and extranets is given.

2.2 INTERNET AND WEB TECHNOLOGIES

Intranets and extranets are both based on Internet and World Wide Web technologies and protocols. For this reason, and in order to have a clear understanding of the technologies underlying intranets and extranets, this section discusses internet and web technologies and protocols.

2.2.1 The Internet

The Federal Networking Council (United States) defines the Internet as the global information system that:

(i) is logically linked together by a global unique address space based on the Internet protocol (IP) or its subsequent extensions/follow-ons, (ii) is able to support communications using the transmission control protocol/Internet protocol suite or its subsequent extensions/follow-ons and/or other IP-compatible protocols, and (iii) provides, uses or makes accessible, either publicly or privately, high-level services layered on communications and related infrastructure described herein (Leiner et al. 1997a: 34).

The Internet was born out of various research activities into computer networking conducted around the world, especially in the United States (US), in the 1960s. Two major activities leading to the direct development of the Internet as we know it today were the US Department of Defence Advanced Research Projects Agency's (ARPA)¹ research on how to build networks that could withstand partial outages and still function (Krol 1994:13; Benson 1995; Dusold 1996:4), and the parallel research into packet-switching conducted by Leonard Kleinrock of Massachusetts Institute of Technology (MIT) in the US, 1961-1967, Paul Baran of Research and Development (RAND) in the US, 1962-1965, and Donald Davies of the National Physical Laboratory (NPL) in the United Kingdom (UK), 1964-1967 (Gillies and Cailliau 2000:4-46; Leiner et al. 1997b:17). Ironically, none of the researchers knew about the others' work.

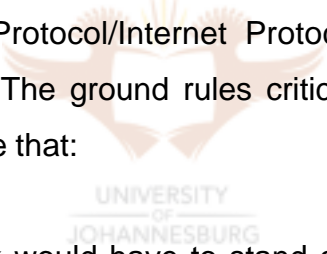
2.2.1.1 Internet protocol

Before the arrival of ARPANET, the only way of connecting networks was by using circuit-switching methods in which networks interconnected at the circuit level, passing individual bits on a synchronous basis along a portion of an end-to-end circuit between a pair of end locations (Leiner et al. 1997b:19). However, the

¹ The Advanced Research Projects Agency (ARPA) changed its name to Defence Advanced Research Projects Agency (DARPA) in 1971, then back to ARPA in 1993, and then back to DARPA in 1996 (Leiner et. al. 1997a:35).

concept of the Internet was based on the idea of open-architecture networking in which there would be multiple independent networks of rather arbitrary design, that is packet-switching networks like ARPANET, packet satellite networks, ground-based packet radio networks and other networks connected together (Leiner et al. 1997b:19). Unfortunately, the Network Control Protocol (NCP) that was used on the ARPANET, which tended to act as a device driver, did not have the ability to address networks and computers beyond the Interface Message Processor (IMP) machines on the network.

The limitations of NCP meant that a network communication protocol was required to connect independent networks and computers to ARPANET. In 1973 Robert Khan of Bolt, Beranek and Newman (BBN) teamed up with Vinton Cerf of Stanford University and worked on the detailed design of a protocol that would connect independent networks and computers to ARPANET and it became to be known as the Transmission Control Protocol/Internet Protocol (Leiner et al. 1997b:20-21; Gillies & Cailliau 2000:40). The ground rules critical to Khan's thinking about the protocol to be designed were that:

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- Each distinct network would have to stand on its own, and no internal changes would be required to any such network to connect to the Internet.
 - Communication would be on a best-effort basis. If a packet didn't make it to the final destination, it would be shortly retransmitted from the source.
 - Black boxes would be used to connect the networks; these would later be called gateways and routers. The gateways would retain no information about the individual flows of packages passing through them, thereby keeping them simple and avoiding complicated adaptation and recovery from failure nodes.

- There would be no global control at the operations level (Leiner et al. 1997b:20).

In May 1974, Cerf and Khan wrote a paper entitled "A Protocol for Packet Network Internetworking" which was published by the *IEEE Transactions on Communications* (Dusold 1996:7). In the paper, they described how to achieve:

"...a reliable connection over unreliable packet networks by using techniques like fragmentation and reassembly, sequence numbers, acknowledgments, timeouts, retransmissions and more. The priority was reliability" (Child 2000).

The Transmission Control Protocol/Internet Protocol (TCP/IP), described in the paper by Cerf and Khan, has now become the basic communication language between computers connected to the Internet. The TCP layer of the protocol:

"...manages the assembling of a message or file into smaller packets that are transmitted over the Internet and received by a TCP layer that reassembles the packets into the original message. The lower layer, Internet Protocol, handles the address part of each packet so that it gets to the right destination. Each gateway computer on the network checks this address to see where to forward the message. Even though some packets from the same message are routed differently than others, they'll be reassembled at the destination" (Whatis.com 2001).

TCP also detects errors or lost data and triggers retransmission until the data is correctly and completely received. The development of TCP/IP meant that computers and networks using different protocols, different from the IMPs, could now be connected to ARPANET.

In 1982, the Defence Communication Agency (DCA) and DARPA decided that TCP/IP would be the standard communication protocol to be used on the ARPANET (Dusold 1996:8, 10) and on 1 January 1983, ARPANET changed to TCP/IP and the Internet, as we know it today, came into existence (Dusold 1996:10; Leiner et al. 1997b:23; Gillies & Cailliau 2000:44). Thereafter other networks, like BITNET (Because Its Time Network), which were running protocols different from TCP/IP, started to get connected to ARPANET using gateways. As a result, ARPANET grew and was later split into two networks: a network of research computers called ARPA Internet, and a network of military computers called MILNET (Benson 1995; Leiner et al. 1997b:23; Gillies & Cailliau 2000:44). Seven years later, in 1990, the World Wide Web was born as one of the services that can be accessed via the Internet.

2.2.2 The World Wide Web

It is quite difficult to define the World Wide Web. However, according to Tim Berners-Lee, the inventor of the Web, the Web is not a physical thing that exists in a certain place but a space in which information can exist (Berners-Lee & Fischetti 1999:39). The fundamental principle behind the development of the Web was that:

“...once someone somewhere made available a document, database, graphic, sound, video, or screen at some stage in an interactive dialogue, it should be accessible (subject to authorisation, of course) by anyone, with any type of computer, in any country. And it should be possible to make a reference – a link – to that thing, so that others can find it” (Berners-Lee & Fischetti 1999:40).

The Web rides on top of the Internet (Berners-Lee & Fischetti 1999:7). It is designed around hypertext documents and networked-based information retrieval (Johnson 1994:2). Web documents have highlighted words or phrases that act as links to other documents or resources on the Web. Information resources on the Web are held on computers located around the world and these can be accessed by anyone

who has a computer, a client browser installed on the computer, and accessed to the Internet. The World Wide Web is the universe of network-accessible information, the embodiment of human knowledge (World Wide Web Consortium 1992).

The World Wide Web was first developed as a tool for collaboration in the high energy physics community at the Conseil Européen pour la Recherche Nucléaire - CERN (CERN 1997), also known as the European Laboratory for Particle Physics located in Geneva, on the border between France and Switzerland. One factor that led to the development of the Web was the ever-growing problem of keeping track of documents produced at CERN. CERN attracted a large number of engineers and scientists who used its laboratory facilities. Unfortunately, there was no coherent way of keeping track of all the documentation produced by scientists and as a result a great deal was being lost (Gillies & Cailliau 2000:178). In 1984, efforts were started at CERN to address the documentation problem and years later, in March 1989, Tim Berners-Lee prepared an information management proposal in which he addressed the concerns of information management at CERN about loss of information. He proposed a solution based on a distributed hypertext system (Berners-Lee & Fischetti 1999:25; Gillies & Cailliau 2000:180). In September 1990 he started work on his hypertext project, and was later joined on the project by his colleague, Robert Cailliau (Berners & Fischetti 1999:27-28; Gillies & Cailliau 2000:196-201). Subsequent work on the project by Tim Berners-Lee, Robert Cailliau, and later a number of individuals (both within and outside CERN) and organisations, led to the development of the World Wide Web infrastructure as we know it today. Appendix 1 provides a timeline of some of the major activities/events in the development of the Web.

2.2.2.1 Web protocols

Information publishing, transfer and location on the Web are made possible by three basic web protocols or rules. These are the hypertext transfer protocol (HTTP),

Hypertext Mark-up Language (HTML) and the Uniform Resource Locator (Johnson 1994:8; Berners-Lee & Fischetti 1999:38-46; Gillies & Cailliau 2000:206).

Hypertext transfer protocol

The Hypertext Transfer Protocol (HTTP) is a set of rules for exchanging files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web (Novicecomputing.com 2001). An HTTP transaction comprises a *Request* sent by the *Client* to the *Server*, and a *Response* returned from the *Server* to the *Client*.

Hypertext mark-up language

The Hypertext Mark-up Language (HTML) is a document-layout and hyperlink specification language (Musciano & Kennedy 1996:7; Spainhour & Quercia 1996:7). HTML is made up of mark-up codes called tags or elements that are used to define the syntax and placement of contents of the document and tell the browser how to display that content.



Uniform resource locator

The Uniform Resource Locator (URL), originally conceived as Uniform Resource Identifiers (URI) by Tim Berners-Lee (Berners-Lee & Fischetti 1999:67), is a standard way of indicating the location of a resource (documents, images, downloadable files, services, electronic mailboxes, and other resources) on the World Wide Web. URLs in general take the form "protocol://address" where:

- *protocol* is something like http, gopher, FTP, telnet, mailto, and so on; while
- *address* is the actual computer server and pathname (if any) of a given resource

The following is an example and explanation of the URL of *A Beginner's Guide to URLs* web document:

<http://archive.ncsa.uiuc.edu/demoweb/url-primer.html>

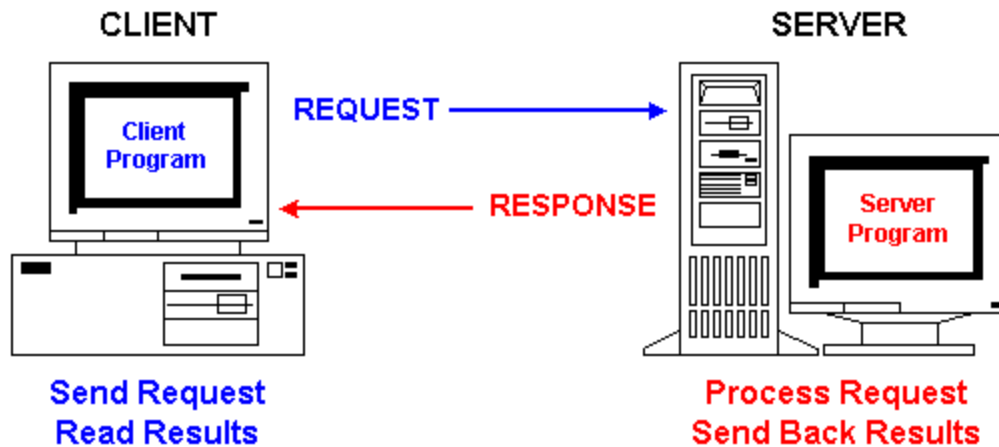
- *HTTP*: The resource is requested for using the hypertext transfer protocol.
- The location of the resource is on a computer with the domain name *archive.ncsa.uiuc.edu* [Located at the National Centre for Supercomputing Applications (NCSA) at the University of Illinois at Urbana Champaign (UIUC)].
- The resource (document) is located in a folder/directory called *demoweb* on the *www.ncsa.uiuc.edu* computer.
- The file name of the resource (document) is *url-primer.html*.

2.2.2.2 Web architecture



The World Wide Web is based on a client-server model, which involves three components: the client, the server, and the network. The central computer where the network operating system, the web server program, and webpages (html and associated files) are installed is called a *server*. Computers that use the resources managed by the server are called *clients*. Client computers run web browsers (Microsoft Internet Explorer, Netscape or Opera) as client software used to retrieve webpages and other internet resources. The server is connected via a *network* to client workstations. The server stores and manages the data; and the client accesses, updates, processes and formats the data; the network provides the conduit between the two.

Figure 1: Relationship between client and server computers (Network Solutions 1996).



The advantages of the client server model, in the web environment, include easy scalability, workload distribution and bandwidth conservation (Privador 2000).

Easy scalability

Adding a new user is possible by just telling the user which server to connect to. The user does not have to install separate client interfaces or big front-ends for each application - all that the user needs is a web browser. The server's configuration does not have to be changed when additional users are added (aside from authentication requirements).

Workload distribution

The server is not responsible for rendering the pages for each user separately; the client application (user's web browser) handles this task, leaving the server free for system-wide searches.

Bandwidth conservation

The server only sends HTML files and images over the Internet; sending completely laid-out pages would require a lot more time at constant communication speeds.

2.2.2.3 Web applications and uses

Since its invention in 1990, the World Wide Web has become the most advanced internet service. Access to the Web opens up a number of opportunities to organisations and individual users. The Web is being used for the electronic commerce (e-commerce), distance education, electronic publishing, communication and many more. Appendix 2 provides examples of the many applications and uses of the World Wide Web in the world today.

2.3 INTRANETS



The evolution of intranets can be traced back to the origins of the World Wide Web at CERN. During the early days of the Web, Tim Berners-Lee and Robert Cailliau set-up a web server (info.cern.ch), which they used to manage their WWW project, store and share all the project related information (Berners-Lee & Fischetti 1999; Gillies & Cailliau 2000). The web server program was later installed on one of CERN's mainframe computers and the CERN telephone book was made accessible in hypertext format using the line mode client browser (Berners-Lee & Fischetti 1999). The above arrangement, although not explicitly called "intranet", highlights some of the basic features associated with today's intranets, i.e. accessible only to staff within the organisation; and based on the web server and web client interaction model.

The use of the term "intranet" is relatively new. Before the term was used, the internal use of internet and web technologies was called by different names, such as internal webs, internet clones, corporate webs or private webs (Hills 1998:5).

According to Shah (1996) and Back Office Systems (1999), the earliest known printed reference to the term "intranet" is in the April 24, 1995 edition of *Digital News & Review* in a story entitled "*Intranets Fuel Growth of Internet Access Tools*" by Stephen Lawton, although Steven L. Telleen claims to have coined the term "IntraNet" way back in 1994 (Telleen 1998; An Interview with Steve Telleen 1997).

2.3.1 What is an intranet?

One notable feature in the literature is that there are several definitions of the term *intranet*, each emphasising one particular aspect of intranets. For example, Darwinmag.com (2002) defines an intranet as:

"a network within an organisation that uses internet technologies to enable users to find, use, and share documents and webpages. Corporations use intranets to communicate with employees. In some large companies intranets are used as the primary way for employees to obtain and share work-related documents, share knowledge, collaborate on designs, access e-learning—and learn about company news"(Darwinmag.com 2002).

Telleen (1996a) defines an intranet as:

"...a communication infrastructure based on the communication standards of the Internet and the content standards of the World-Wide Web. Therefore, the tools used to create an intranet are identical to those used for internet and web applications. The distinguishing feature of an intranet is that access to information published on the intranet is restricted to clients in the intranet group. Historically this has been accomplished through the use of LANs protected by Firewalls" .

Hills (1998:4) defines an intranet as “a network based on the Internet’s transmission control protocol/Internet protocol (TCP/IP). It uses the World Wide Web (WWW or the Web) tools, such as hypertext mark-up language (HTML), common gateway interface (CGI) programming and Java”. Kirsch (2000:3) describes an intranet as an internal computer network (for data communication, data transfer, intra-organisation transactions, etc.) using internet standards, protocols and World Wide Web technology available only to company employees or to other insiders. The network is inaccessible to outsiders. Irving and McWilliams (1998:11) define an intranet as “a private corporate network that uses Internet products and technologies. Access to an intranet is controlled by the organisation which established it and is often just restricted to employees”. This definition is closer to the one provided by the Hong Kong University of Science and Technology (HKUST) Cyberspace Centre which defines an intranet as:

“...a company-specific network that uses software programs based on the Internet TCP/IP protocol and common internet user interfaces such as the web browser. Simply put, an intranet is the application of internet technologies within an organisation private LAN or WAN network” (HKUST Cyberspace Centre 1997).

Thomas and Plumley (1997:4) define an intranet as “a private network... that uses internet tools, software, and protocols to distribute information and data to the computers connected to the network”.

According to Nanfito (1996), an intranet is an:

“internal internet utilising TCP/IP technology and the browsing software of the World Wide Web. Intranets bundle information management and corporate communication schemes within one, easily accessible interface, the “universal client” of the web browser. Intranets provide integrated gateways between the desktop and data environments,

providing collaborative work environments and facilitating effective information on demand".

Todd Campbell (2000) sees an intranet as:

"...a private communications network created using the same hardware, software, and communications infrastructure used to build World Wide websites, ... intranets make it easier than ever to share data documents and information; they offer the promise of workplaces where all employees have access to the up-to-date information they need exactly when they need it".

Wagner and Engelmann (1997:4) indicate that an intranet is

"...a network of computers, software, documents, and databases that generally works just like the Internet, except that it is only accessible to employees and selected guests. Because of this access restriction, corporate organisations can use an intranet to publish information that is proprietary, confidential, under development, or otherwise not ready for public viewing".

While almost all the definitions cited above refer to an intranet, explicitly or implicitly, as a type of network, Hernandez (1999) refers to an intranet as an internet website.

He states that:

"An intranet is similar to an Internet site, but is limited to a company's private use. Located within the firewalls of a firm's server in order to prevent unauthorised access, the intranet -- or private office website -- is an internal communications network that can be used to circulate and store the types of materials currently piled in the storeroom."

From the above definitions of an intranet, it is quite clear that intranets are being defined with emphasis either on the basic network technologies used or web (-site) technologies or information management and communication facilities they provide. Thus intranets are seen either as a network, a website or a corporate information management and communication infrastructure. However, in spite of the large number of definitions with different emphasis, it is clear that the following features are associated with intranets:

- Private networks in organisations
- Use of internet and web technologies and standards
- Information management and communication.

2.3.2 Technical components of an intranet

Components of an intranet include a computer network, web server software, web client software, web authorising software, TCP/IP network protocol, network operating systems (NOS), a central website, publishing guidelines, information discovery tools, and security policies (Hernandez 1999; Pedley 1999).

2.3.2.1 Computer network

An intranet starts with a network (Thomas & Plumley 1997:4), and the network forms the backbone of the intranet (Irving & McWilliams 1998). The basic computer network hardware requirements in an intranet environment are similar to those of an ordinary LAN. Generally these include server machines that run the network operating system in addition to controlling how computers in the network share resources, workstations used to access resources held on server machines, network cables, and network hardware (adapter cards, routers or network hubs) that are used to connect the various hardware components of the intranet.

2.3.2.2 TCP/IP

The Transmission Control Protocol/Internet Protocol (TCP/IP), as seen from the various definitions of an intranet above, is a key component of an intranet. As opposed to running different type of protocols, as is the case on most traditional LANs, computers on an intranet network use the TCP/IP protocol to communicate with each other.

2.3.2.3 Network operating system (NOS)

The network operating system (NOS) is run on the server machine and controls the way different hardware and software in a network function together properly (HKUST Cyberspace Centre 1997). Among the popular intranet NOS are Windows NT server from Microsoft, Novell Netware from Novell and UNIX, an Open Source system. Client workstations in an intranet can run a number of operating systems, for example Windows 95/98/2000/XP, Windows NT Workstation, Macintosh, OS/2 and UNIX operating systems.

2.3.2.4 Web server software and web client software

Like the Internet and the World Wide Web, intranets are based on the client-server model. A web server program is used to publish documents, which are accessed by client programs called web browsers. There are a large number of web server software programs available for use on intranets. These include Microsoft Internet Information Server (IIS), running under Windows NT and Windows XP operating systems; Apache Web Server, originally developed for the UNIX environment; Netscape Communication Server, and many more. Regarding web browsers, the major ones are Microsoft Internet Explorer, Netscape Navigator and Opera. In addition to web browsers, plug-ins - software programs that extend the capabilities of Web browsers - are also required. These include plug-ins like Adobe Acrobat Reader used to read documents published in Portable Document Format (PDF), and Apple QuickTime, Shockwave, Real Player and Microsoft Media Player used

for viewing and listening to streaming audio, video, animations, and multimedia presentations on the Web. Almost all the web servers, web browsers and plug-ins are available for free and can be downloaded from the Internet, obtained from the suppliers or found on CD-ROMs sold with a large number of magazines on computers and computer related subjects in most bookshops.

2.3.2.5 Web publishing software

Organisations have a wide choice from a number of application software used for the development of the information content on the intranet. These include publishing tools like Microsoft FrontPage, Adobe GoLive, Dreamweaver, HotDog Pro, Hot Metal Pro and many more. In addition, the latest versions of word processing software, like Microsoft Word and Corel Word Perfect, can also be used for publishing content on the intranet. Organisations may also decide to use database systems such as Oracle, MySQL, Microsoft Access with appropriate scripting languages, for example JavaScript, VBScript and PHP to generate dynamic webpages.

2.3.2.6 Central website

A central website is a major feature of an intranet. It is the entry point to the information resources held on intranet servers. All access to the intranet is through the interface provided on a central website. The intranet's website is just like any other internet website: the only major difference is that access to the site is restricted to authorised users within the organisation.

2.3.2.7 Information discovery tools

Information published on the intranet should be easy to find otherwise it will be useless. For this reason, intranets have a number of tools that are used to locate information. These include local search engines, push technologies, and even people (information specialists). Versions of popular search engines like InfoSeek

and Google are also available for use on intranets. In addition, the use of sitemaps also assists in information discovery on intranets.

2.3.2.8 Security system

First and foremost an intranet is intended for employees' use only within the organisation. Therefore, security of the information on the intranet is a big issue, especially if the intranet is also used to gain access to the public internet. Generally, firewall software or hardware, or both, is used to block outside connections and to prevent unauthorised access to the intranet. Proxy servers and network monitoring tools can also be used to block unauthorised access to external internet websites by employees of the corporation. In addition, certain types of information accessed on the intranet, for example information relating to salary, personal to holder contracts, etc. may not be for use by all those using the intranet. Therefore, organisations may also implement policies relating to the security of and access to certain types or categories of information on the intranet. In general, unauthorised access to certain parts of the intranet within an organisation is protected by usernames and passwords.



2.3.3 Intranet applications

Intranets have several potential uses in the provision of information services to information end-users. These can be appreciated by examining the various intranet applications that are examined in this section.

Several authors, among them Bowen and Wong (1996), Nanfito (1996), Thomas and Plumley (1997:14-15), Wagner and Engelmann (1997), Hills (1998), Shepherd (1998), CIO Communications (1998a & 1998b), Bernard (1999), Irving and McWilliams (1998), and Telleen (1999) have outlined and discussed the various intranet applications in corporate organisations. These include the applications discussed below.

2.3.3.1 Publication of corporate information

Intranets are being used for the publication, distribution and provision of access to various types and formats of corporate information. Corporate information includes *human resources related information* such as employee manuals, health and safety information, bonus and compensation information, recruitment procedures, organisation charts, and internal job openings; *inventory related information*, such as stock lists, price lists, and suppliers' lists; and sales related information, which include customers' lists, sales statistics, contracts, sales status reports, sales trend analysis, product updates, inventory, and multimedia sales presentations.

2.3.3.2 Training

Corporate organisations are also using intranets to conduct training programmes for their employees and provide access to various training materials and facilities. These include providing access to web-based learning facilities such as WebCT, computer-based training (CBT), training manuals and documentation, course registration facilities, audio and video training materials, and course schedules.

2.3.3.3 Project management

Intranets are also being used for project management activities such as collaboration on project work, publication and distribution of project lists, project team rosters, project status reports and project ranking.

2.3.3.4 Online communication

The use of intranets for online communication include posting of announcements on web-based notice boards, collecting feedback on issues affecting the organisation, provision of chat room facilities, and publishing and distribution of newsletters.

2.3.3.5 Distribution of information resources

Corporate organisations are also using intranets to distribute information resources that have traditionally been held in electronic format, such as test data, spreadsheets templates, documentation templates, software applications and utilities, and many more.

2.3.3.6 Knowledge management and preservation

The use of intranets in knowledge management and preservation include videotaping staff members discussing their subject areas of expertise and then putting transcripts on the Web, and knowledge sharing and creation using electronic chatboard facilities accessed on the intranet.

2.3.4 Benefits of using intranets

Intranets are about communication inside organisations (Hills 1998:3-15), and their major benefit is improved information communication (speed of information transfer and feedback) within the organisation. Telleen (1996b) believes that the benefits of intranets are derived from improved communication and innovation within the organisation. According to the Federation for Enterprise Knowledge Development (FEND) (1997) intranets provide inexpensive, standard environments for managing corporate information. They make it quicker and easier for people to access the information they need to make more informed decisions faster.

In addition to improved information communication, other benefits associated with intranets relate to their potential to reduce costs. Bernard (1999), Hills (1998:3-15) and Shepherd (1998) identify the following cost-saving benefits associated with the use of intranets:

- Some savings on office supplies, paper, printing, and copying, especially if manual work relating to these activities is reduced or stopped.

- Some savings on travel and accommodation, trainers, rooms and equipment for courses delivered via the intranet rather than in a conventional classroom environment.
- Some savings on communication related costs such as telephone calls, faxes, memorandums and letters, through the use of electronic mail facilities.
- Some savings on travel and accommodation related costs for meetings that could instead be conducted online.

In addition, the use of intranets also results in:

- Drastic reduction in the amount of file and shelf space required for storing print-based documents.
- Better control of redundant and out-dated information through a single-point storage and access.
- Improved productivity through quicker access to information resources, knowledge and skills.



2.3.5 Disadvantages of using intranets

One of the major disadvantages of using intranets is that intranets are said to be contributing to the state of information overload or intranet content overload in corporate organisations. According to Nall of General Electric Appliances "on a typical intranet, information overload and irrelevancy is overwhelming" (Konicki 2000). This is illustrated by Aneja, Rowan and Brooksby (2000) in their discussion of the intranet situation at Intel Corporation. They indicated that Intel's intranet had over one million URLs with more than 100 new websites introduced every month, in addition to the various information from sources such as e-mails, news, documents,

reports, articles, digital files, video and audio files and transaction data, which employees have to process. This situation leads to information overload for employees who are not always able to find the right information or to filter the information they need.

Both Nall (Konicki 2000) and Aneja, Rowan and Brooksby (2000) indicate that one potential solution to the problem of information overload on corporate intranets is the implementation and use of portals, specifically corporate portals. In this light, the next chapter will briefly discuss the concept of information overload and look at portals as a means of managing information overload on intranets in corporate organisations.

2.3.6 Factors that influence the popularity of intranets

The deployment of intranets, especially in corporate organisations, is growing at a very fast and steady pace. According to research from the Gartner Group and Forrester Research, cited by McCarty (2001), in 2001 it was estimated that companies were to spend nearly US\$64 billion on intranets world wide and are expected to spend US\$200 billion each year by 2010. A study of the literature available indicates that the popularity of intranets may be attributed to a number of factors, among them the following:

- Increased information efficiency
- Low technology requirements
- Financial gains
- Ease of use
- Employee communication.

2.3.6.1 Increased information efficiency

The deployment of intranets facilitates fast access to corporate information and multiple data formats. Using the platform independent intranet technologies ensures open access to information at all times. The inherent data collection and dissemination model offered on an intranet is faster and therefore more efficient than other means of data distribution (Morell 1997). Using web-based technologies also makes it flexible and easier to update information on the intranet, as this can be done in one place and the new information is immediately available to everyone (Bowen & Wong 1996).

2.3.6.2 Low technology requirements

For some time now organisations have been implementing and using LANs, and in some cases WANs, for data communication and information sharing. In addition, LANs and WANs have been used for sharing computer facilities such as printers, hard disks for storage space, software and computer files, computer processing capacity and many more. With these networks in place, many intranet solutions can be implemented and achieved very easily by using the existing hardware and network configurations within the organisation (Cameron 1996). This reduces the amount of money required in the initial phases of implementing an intranet.

In addition, another feature of most LANs and WANs is that most of them are a mixture of many network protocols, for example IPX, SNA and AppleTalk protocols. In an intranet environment, these protocols can be replaced with the IP protocol, which can handle both LAN and WAN traffic. The IP protocol is supported by a large number of computing platforms (Strom 1995).

2.3.6.3 Financial gains

Black (1997) and Campbell (1996) have illustrated reductions in expenditure in corporate organisations in terms of an intranet's implementation costs, training and

running costs. Other studies have illustrated cost savings by distribution of fairly static information such as phone directories, mailing lists, price lists, policy and training manuals, requisition forms and marketing materials (May 1996, Black 1997; Bannister 1997; McGrath & Schneider 1997). Nanfito also indicates that intranets have a positive impact on return on investment (ROI) in that they:

Reduce the number and kinds of computers needed to perform the specific areas of the business of the corporation; reduce the number of user accounts on disparate machines necessary for employees to do their work; reduce the technical staff requirements; and free up resources for other competing groups within the organisation to make use of as needed (Nanfito 1996).

2.3.6.4 Ease of use

In a LAN environment, users have to learn how to use various application software systems to be able to access and use files or resources created using those systems. Although short cuts to resources can be created, generally to access any file or resource, users must identify the server on which the resource is stored on the LAN, and then open layer upon layer of folders, or directories, to get to the file or resource (Thomas & Plumley 1997:5). Intranet users do not have to learn how to use various software interfaces to access data in multiple software platforms. All that is required to retrieve information from different software platforms is a web browser interface (Bernard 1999; Bowen & Wong 1996; Telleen 1995). Files are displayed as documents on a webpage, and navigation through web-based information accessed over the intranet is much easier than accessing information using traditional linear methods (Nanfito 1996; Telleen 1995). The web browser functions as a “universal client”, providing access to both local and remote information, such as data, documents, online databases, electronic mail, and many more (Nanfito 1996). The ease of use of intranets is extended to electronic

publishing, distribution, and implementation of information across intranets (Wodehouse 1997).

2.3.6.5 Employee communication

The use of intranets in corporate organisation is improving the speed of information transfer and feedback within organisations. Unlike the paper-based communication model where information may have to pass various intermediaries, on intranets information is pushed directly to the employees' desktop computers. In addition, employees also withdraw the information that they require from the information depositories on the intranet.

2.3.7 Intranet models

The effectiveness of information communication using an intranet may depend largely on the underlying intranet communication model adopted by the organisation. In addition, the implementation of an intranet should be based on a good development model as this may have an impact on its operation. It is, therefore, important to highlight some of the available intranet communication models and intranet development models. This section reviews the intranet communication models identified by Gonzalez (1998), and the general intranet development model proposed by CIO Communications (2001a).

2.3.7.1 Intranet communication models

Gonzalez (1998) identifies four intranet communication models: i) the publication model, ii) the asymmetrical interaction model, iii) the symmetrical interaction model, and iv) the synchronous virtual environment model. These models are briefly discussed below.

Publication model

The publication model is a one-way communication model and is used for distributing information to a group. In an intranet environment based on this model, generally static type of information is published and accessed or withdrawn by the users. The types of information published include product catalogues, policy manuals, internal job listings, conditions of service, and training materials.

Asymmetrical interaction model

The asymmetrical interaction model allows for a two-way, time delayed didactic communication. In this model, information or services are provided on the intranet and users can act or respond in their own time. This model is suitable for internal surveys, self-paced online tutorials and even e-mail-based communications.

Symmetrical interaction model

The symmetrical interaction model is a multi-directional communications model and provides numerous feedback loops. On the intranet, facilities for this type or model include provision of chat room and other facilities that can be used for sharing knowledge, information and expertise, building communities of interest or of practice, and product development by virtual teams.

Synchronous virtual environment model

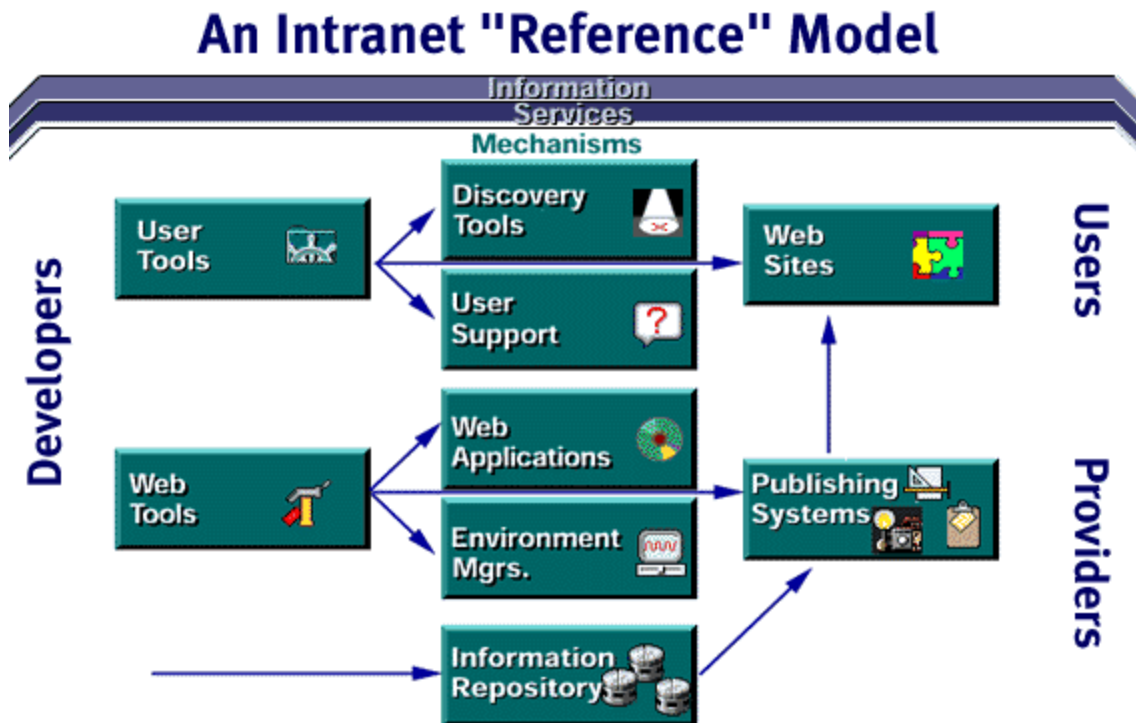
The synchronous virtual environment model is a real-time, dynamic, multi-directional communication model. In an intranet environment, it provides for fully integrated communication applications and opportunities with hypertext links that make it easy to move from one application to the next. The virtual space supplements and complements physical space.

In practice, organisations implement a combination of the above models to implement a suitable intranet solution.

2.3.7.2 Intranet development model

Figure 2 below, shows a general intranet development model, the *Intranet Reference Model*, developed by the CIO Communications (2001a), which can be used by individuals and organisations in developing their own specific models.

Figure 2: Intranet reference model (CIO Communications 2001a).



The above model aims at providing guidelines and answering a number of questions relating to the development of intranets in organisations. It focuses on the mechanisms, information and services that are needed to support large-scale web use. It covers the following nine types of mechanisms:

- User tools
- Discovery tools
- Support systems
- Web toolbox for developers and publishers
- Web applications (or gateways to existing applications)
- Environment managers
- Shared or reference pages
- Publishing systems
- Information repositories.

User tools

User tools are collections of the tools that intranet users may use on the intranet. These include tools such as web browsers, plug-ins like Real Player, QuickTime Player, Adobe Acrobat Reader, and many others. When implementing an intranet, decisions should be made regarding the types of user tools to be used on the intranet, and these tools should be configured, packaged and tested together. In addition, support should also be provided to users of these tools. According to CIO Communication (2001a), providing users with tested packages and licensed tools will reduce the amount of time required for support, simplify the update process, reduce the amount of training and documentation, and make it easier for new users to get up to speed on the intranet.

Discovery tools

Information discovery tools ensure that information on the intranet is visible and reduces the time users spend on searching for information. Information discovery tools may include consistent page navigation aids, local search engines, search directories, and the use of push technologies. CIO Communication (2001a) indicates that in addition to using technology for information discovery on intranets,

many organisations are realising the need for a new expert - the "information seeker." This can be someone trained in information science (for example the corporate librarian), or people who are experts in functional areas and who spend part of their time finding "good" information for others. In this study, such a person is referred to as an information specialist.

Support systems

User support is critical in an intranet environment and should be provided to all categories of users. Assistance may be provided in the form of access to lists of Frequently Asked Questions (FAQs), access to problem reporting systems, and even an online help desk. It should be noted that, in general, good training on how to use the intranet goes a long way in empowering users on how to deal with a number of problems that may arise.

Website tools

Developing websites requires the use of various types of tools. These include webpage development and design tools such as HTML editors, graphics editors, image map editors, program development tools like Java, CGI, ActiveX, Perl; database access tools; form processing tools, and many more. It is generally advisable for organisations to develop a web toolbox, a collection place for descriptions, reviews and links to anything that makes it easier for web developers and intranet users to create or use the web

Web-based applications

The organisation should also identify the various types of web-based applications to be conducted on the intranet. These may include intranet applications discussed in Section 2.3.3.

Environment managers

Intranets can get complicated and therefore need to be properly managed. The use of environment managers - tools for use in the management of the intranet - can help a lot. These include tools for link validation, user administration, document control, statistics tracking and reporting, version control, HTML validation, site viewers, and other security tools (CIO Communication 2001a).

Shared or reference pages

Intranets provide access to various types of information and sometimes it is very difficult to know where users should to start from, and how to keep abreast of constant changes to information. Therefore, in addition to various webpages that may be developed, it is important to develop a central internal homesite. This is a set of webpages with classes of information of greatest interest across the enterprise, with a consistent set of navigation tools. This provides a consistent starting place for intranet users, and navigations to relevant internal, and possibly external, resources available (CIO Communication 2001a).

Publishing systems

There is need to put in place web publishing guidelines and standards to assist developers in creating and positioning content on the intranet. These may include the use and sharing of graphics or icons, HTML editors, HTML templates, and many more. Publishing guidelines and standards also ensure consistency of the site.

Information repositories

The web information repository is a collection of shared information used by the enterprise on the external web server, for example, as well as internally (CIO Communication 2001a). Decisions should to be made on how and where the core

business information is to be stored on the intranet. It is also important to decide how information is going to be kept up-to-date and accurate. Issues of security and level of access to information need to be seriously considered and implemented.

2.3.8 Internet and intranets

The major difference between intranets and the Internet are bandwidth and privacy (Bort & Felix 1997:xxix). The Internet is an open, public network, while an intranet is a secure, internal, private network. Information access on the Internet sometimes is very slow and frustrating due to limited internet bandwidth or the transmission capacity of the lines that carry the Internet's electronic traffic (Wagner & Engelmann 1997:305).

Furthermore, unlike the Internet, intranets (Irving & McWilliams 1998; Baker 1997):

- Allow corporate organisations to publish information which may not be made available to the general public over the Internet, for example, information that may be classified as confidential and not for external consumption.
- Are more manageable and controllable in as far as deciding on what should be published and who has access.
- Retrieve information retrieval faster because, generally, there are fewer users and the system does not have to rely on external telecommunication facilities such as telephone lines.
- Yield a higher percentage of useful hits with regard to information searching and retrieval.
- Provide more secure information resources than the public Internet.

Intranets, when connected to the Internet or the public telecommunication network, allow external access to the information resources of the organisation. In this case, they are called *extranets*. Extranets can also be used to provide services available on the intranet to employees, partners and clients who are unable to get to the physical location of the enterprise office. Taking this factor into account, the sections below, examines extranets in greater detail.

2.4 EXTRANETS

Corporate organisations have, for years, been conducting communication with business partners, vendors or suppliers and, in some cases, customers using electronic data interchange (EDI) systems and dial-up to host systems. In addition, WANs have been used to enable staff working in branch offices located in various geographical locations to gain access to computer resources at the main office. With the development and adoption of intranet technologies, corporations have realised that there is need to exploit these technologies and provide access to some of the information or products held behind the intranet firewall to their customers, partners or suppliers. One way of doing this is to build applications for use outside the business, thus leading to duplication of resources. However, companies are building external networks called *extranets* that reach out to people who may physically work outside the firewall but who are an important part of the business strategy, product-delivery system, or customer-support apparatus (Barksdale 1999).

Extranets can also be used to provide employees working in places away from the office, or those who for one reason or another are unable to get to the office, with access to the enterprise's information resources and facilities. Extranets could provide an infrastructure through which agricultural research organisations and agricultural information specialists could provide various information resources and services to agricultural research scientists and other agricultural information end-users.

2.4.1 What is an extranet?

Like intranets, extranets also seem to have various definitions. Telleen (1998) defines an extranet as a set of content shared by a well-defined group, but one that crosses enterprise boundaries, while the CIO Communications defines an extranet as

"...a private network that uses Internet protocols and the public telecommunication system to securely share part of a business's information or operations with suppliers, vendors, partners, customers, or other businesses. An extranet can be viewed as part of a company's intranet that is extended to users outside the company" (CIO Communications 2001b).

Reisman (1997) defines an extranet as the:

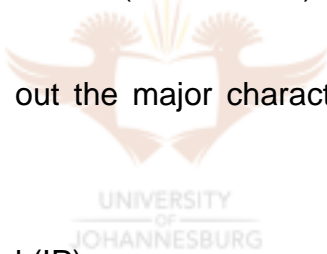
"...use of internet/intranet technology to serve an extended enterprise, including defined sets of customers or suppliers or other partners. It is typically behind a firewall, just as an intranet usually is, and closed to the public (a "closed user group"), but is open to the selected partners, unlike a pure intranet. More loosely, the term may apply to mixtures of open and closed networks".

Baker defines an extranet as "secure websites that may be accessed by clients to obtain and view information about their matters or accounts, collaborate on work, product development and co-ordinate events and parties" (Baker 2001). Milligan sees an extranet as "a website on the public Internet that requires penetration of security barriers to access the site" (Milligan 1999). Kirsch looks at an extranet as a portion of a website on the Internet or an intranet on which the company allows certain third parties, for example suppliers or vendors, licensees, customers, or members of an organisation, to access all or portions of the website or the intranet

through some secure method (Kirsch 2000:3). Baker offers the simplest definition when he states that an extranet is an intranet that is open to selective access by outside parties (Baker 1997:xi). Bort and Felix define an extranet as a business-to-business intranet that allows limited, controlled access between a company's intranet and designated, authenticated users from remote locations (Bort & Felix 1997:xv).

Generally, from the above definitions, it is clear that extranets use a combination of intranet and Internet infrastructures. They are hybrids - part Internet, part intranet (Office.com 1999), and as Tebbe (1996) points out, they combine the best of both worlds. An organisation can take advantage of the speed and richness of an intranet application and extend it beyond its firewall with the reach and function of the Internet, and thus, if done right, allow it to create an application that dramatically enhances the way its does business (Tebbe 1996).

The above definitions bring out the major characteristics of extranets, and these are:

- 
- Using Internet Protocol (IP)
 - Using public telecommunication system, and thus the Internet infrastructure
 - Implementing tight security for extranet resources
 - Opening the intranet to trusted outsiders.

The extranet's use of the intranet and Internet infrastructure has several advantages, among which the major one is that it ensures that the users rely on standard web browsers that can be used across a variety of hardware and software platforms without concern for the underlying details. Interacting with data, viewing

data, searching for data, and reporting on data, are all simplified by virtue of web-based technology (Miller 2000).

2.4.2 Technical components of extranets

The sub-problem addressed in this chapter aims at highlighting the good features of extranets. To ascertain these features, it is important to discuss the various components of extranets. In general, the major technical components of extranets are the same as those of intranets. However, since extranets are geared towards customers, suppliers and partners who are generally external to the organisation, four critical components are added to the list and these are

- Internet infrastructure
- Remote access server
- User interface
- Security - generally implemented in form of a firewall.

2.4.2.1 Internet infrastructure

In most cases, access to information resources on extranets is gained through the Internet infrastructure. This being the case, extranet users – business partners, customers, suppliers and many others – only need to have access to the Internet, and this can be through the use of a dial-up connection, or a leased line connection, or possibly an Integrated Services Digital Network (ISDN) line.

2.4.2.2 Remote access server

A remote access server, also called a communication server, is a computer and associated software that is set up to handle users seeking access to the intranet from remote locations. The remote access server also acts as the firewall server. (See Section 2.4.2.4: Security, below.)



2.4.2.3 User interface

Extranet users access the intranet through an interface on an external website. Therefore, the user interface is an important feature of extranets. A good user interface should be able to integrate data from both structured sources, such as relational databases and data warehouses, as well as from unstructured sources, such as news feeds (Miller 2000). This interface could be a portal.

2.4.2.4 Security

There is a high risk factor associated with opening up a corporate intranet to external access and therefore corporate organisations need to put in place various security measures to protect their information resources from abuse. Extranet security features include authentication and authorisation in the form of usernames, passwords, digital certificates, and even smart cards (Cunningham 1999). Authentication is used to check and ensure that the computer or person attempting access to the extranet resources is on the list of those allowed to access the extranet, while authorisation or access control verifies that the person attempting to access specific extranet resources has the authority to do so. In general, firewalls are used to implement an intranet/extranet security.

A firewall is a computer program or hardware device that filters the information that is fed into and extracted from the intranet (Tyson 2001). All messages entering or leaving the intranet pass through the firewall, which examines each message and blocks those that do not meet the specified security criteria. There are several types of firewall techniques that include the following (Tyson 2001; Baker 1997; Webopedia 2001a):

- *Packet filtering*: Examines each packet entering or leaving the network and accepts or rejects it based on user-defined rules. Packet filtering is fairly effective and transparent to users.

- *Application gateway*: Applies security mechanisms to specific applications, such as FTP and Telnet servers.
- *Circuit-level gateway*: Applies security mechanisms when a TCP or UDP (User Datagram Protocol) connection is established. Once the connection has been made, packets can flow between the hosts without further checking.
- *Proxy server*: Intercepts all messages entering and leaving the network. The proxy server effectively hides the true network addresses.
- *Stateful inspection*: Compares certain key parts of the packet to a database of trusted information. Information travelling from inside the firewall to the outside is monitored for specific defining characteristics, and then incoming information is compared to these characteristics. If the comparison yields a reasonable match, the information is allowed through, otherwise it is discarded.



2.4.3 Extranet applications

Organisations are using extranets largely to conduct business activities, provide access to information resources and communicate with customers or clients, suppliers and business partners located outside the intranet firewall. The use of extranets ensures:

- Quick communication between companies and their customers, partners, and suppliers.
- Quick receipt of inputs and comments on product features from key customers before the product is put on the market.

- Quick transmission and processing of order requests, resulting in quick delivery of orders.

Besides basic communication, there are a number of other applications and potential applications of extranets, such as the following (Baker 1997; Bort & Felix 1997; Cubukcu 1998; Bernard 1999; Irving 1998 & McWilliams; Milligan 1999; Office.com 1999):

- Manufacturing companies can use extranets to co-ordinate design, manufacturing, scheduling and delivery across the supply chain.
- Software and high technology firms can leverage the Internet to provide support to customers and partners, and to access remote workers all over the world.
- Financial services and banks can use secure extranet applications to dramatically reduce the cost of proprietary networks for financial transactions.
- Digital media and publishing companies are looking to extranets to dramatically accelerate the design and production cycles for film, video, multimedia and graphics.
- Health care organisations are seeing the promise of secure extranet systems for linking hospitals and insurance organisations.
- Insurance firms are using extranets to link to corporate databases and to enable electronic forms processing and online sign-ups. These systems reduce paperwork and decrease the turnaround time for claims processing.



- Retail companies are using extranets to link with suppliers and to connect franchisees to the corporate office.
- Corporations are using extranets for e-commerce purposes. They are conducting their sales and marketing activities and transactions over extranets.
- Shipping companies are using extranets for submitting documents, purchase orders and advanced shipping notices; getting access to delivery receipts, and bills of lading. In addition, clients and partners have access to real-time global shipment data and can track the location of their packages from anywhere in the world.
- Shareholder communications: Organisations can use extranet applications to communicate with shareholders. Distribution of shareholder information, earnings reports, including voting by proxy, could all be conducted on the extranet.



2.4.4 Benefits of using extranets

There are several benefits and potential benefits associated with the use of extranets. Writing about the use of intranets and extranets at Boeing Company, Kim indicates that “the primary benefits of an extranet are reduced transactions costs, freeing employees’ time for other higher ‘value-added’ tasks, and improved process efficiencies and relations with business partners and customers” (Kim 1998:176). The above benefits are supported by a number of authors, including Kirsch (2000) and Office.com (1999). Below is an outline of some of the benefits associated with extranets:

- Reduction in transaction costs, reduction in communication times, and reduction in transaction errors and delays.

- Cost savings on communication related costs when expensive courier service deliveries and fax transmissions are replaced by electronic mail communication and file transfer facilities over the extranet.
- Facilitates the sharing of ideas and plans between the corporation and its partners and thus fosters collaboration.
- Provides travelling employees with the ability to access the corporation's data using standard tools such as a computer, a web browser and access to the Internet.
- The corporation's information resources are made available to its clients, suppliers, partners and travelling employees seven days a week and 24 hours a day.
- The use of web-based technologies ensures that clients and partners do not need to install several custom applications software on their computers in order to access the system.



2.4.5 Extranet models

Available extranet models generally refer to the way information is provided or accessed on the extranet. Bort and Felix (1997) classify extranets into the following three models:

- Secure intranet access model
- Specialised application model
- Electronic commerce model.

2.4.5.1 Secure extranet access model

In this model, customers, suppliers and business partners are allowed to log directly into the company's intranet, and perform specific tasks. This being the case, the intranet must have tight security features and the company also needs to trust the external users of its intranet. An example of this extranet model include a case in which business partners or suppliers are allowed access to information regarding products under development and are asked for their opinions.

2.4.5.2 Specialised application model

In the specialised application model, a company may decide to develop an application or a service specifically for a particular business partner or for a category of partners or customers. In this model, internal employees have access to the product through the intranet while external users access the product through the extranet. Provision of access to a supplier's bidding forms and information is one application in this extranet model. This model requires a moderate amount of trust of those accessing the system because access is limited to specified categories of users that the company knows well.

2.4.5.3 Electronic commerce model

This model uses electronic commerce techniques to approach certain specific partner segments (Bort & Felix 1997). In this model, extranet applications include the conduct of business transactions such as access to product information and placing orders through the extranet. This model implies limited trust of the users of the system.

2.5 FEATURES OF GOOD INTRANETS AND EXTRANETS

From the detailed study of the literature on intranets and extranets, the following features of good intranets and extranets were identified. Good intranets and extranets are:

- Goal oriented
- Based on employee centred design and user centred design
- Platform independent
- Sustainable
- Based on proven project management methodology
- Have a content management policy
- Provide relevant information content
- Have Terms of Use (TOU) for external users.

2.5.1 Goal oriented



Good intranets and extranets are designed and implemented to achieve and support well-focused goals, objectives or processes that benefit the organisation, its customers, partners and suppliers. For example, some organisations are developing intranet and extranet solutions with the specific goal of improving communication. Therefore, intranets and extranets should be well focused on their goals.

2.5.2 Employee/user centred design

Staff within the organisation use intranets and the success of intranets depends largely on how much employees incorporate them in their daily work activities. A good intranet is one that is designed with the employees in mind. Unfortunately, this seems not to be the case in most organisations.

According to Kendall Whitehouse, “most corporate intranets are designed to serve the needs of the organisation and not those of the employee. Content is organised by corporate structure instead of user interest, and information is generic rather than personalised” (Wharton School of Business 1999). Barnes also points out that most organisations launch into intranet design with company goals as the focus (Barnes 2001). A common ground should be found between user and business goals. The inability to take into account employees’ needs have led to a number of intranet project failures. Involving employees and taking their needs into consideration ensures that the intranet is relevant and useful. If users do not find immediate value in using the intranet, they will not use it (Barnes 2001). Therefore, making the site useful to the employee and partner need to come first.

While a good intranet is designed around the employee’s needs, a good extranet should be designed with the customer in mind (including suppliers, vendors and partners). For this reason, it should have a good user interface. According to Miller (2000) the user interface should be simple, clear and easy to use, but still provide access to extensive information behind it.

2.5.3 Platform independence

Platform independence is the key to the success and wide spread adoption of intranet and extranet technology (Pedley & Plumely 1999). The use of web-based technologies allow for a range of different software platforms to be linked by a single common access interface. In addition, the Web supports a wide range of data types for distributed information transfer, and offers a flexible development environment for site and application assembly, transaction management and software deployment activities (OneSoft Corporation 1998:57). Therefore, good intranets and extranets are not locked into proprietary software systems: they are based on an open systems platform.

2.5.4 Sustainability

Good intranets and extranets must be sustainable. When planning for the implementation of an intranet in the organisation, careful thoughts should be given to the evolving information realities within the organisation. Provision must be made for a maintenance plan and resources allocated to manage the intranet (Nanfito 1997:16-20). This also applies to extranets.

2.5.5 Project management methodology

Intranets are technology projects; their design and implementation should follow proven project management methods (Nanfito 1997:17). They should not be allowed to evolve organically; otherwise they may end up in a disorganised mess. The rules of project management must be followed if the intranet is to succeed (Irving & McWilliams 1998). The same applies to extranets. Good extranets are implemented based on sound project management methodology.

2.5.6 Content management policy

Intranets are used for publishing, distributing and managing information content within an organisation. A good intranet should have an effective content management policy in place. The policy should empower non-technical staff and help them to contribute to the content of the intranet. The policy should also clearly outline the guidelines and controls for viewing, modifying, and managing what gets posted on the intranet. These guidelines should be very simple so that various departments or employees can be made responsible for the creation and dissemination of information content on the intranet. The Information Technology Department can then concentrate on managing the infrastructure (paths to data and not the data itself). The content should be delegated to the divisions because that's where accountability is (Kim 1998:174). Telleen (1996b) supports this view. He writes that the key characteristic of the intranet technology is its ability to shift control of electronic information management from the technology specialists back

to the information creators, and control of information flow from the information creators to the information users.

2.5.7 Provide relevant information content

Good intranets and extranets provide relevant, timely and up-to-date information content. Unfortunately, this seems not to be the case with many intranets. Leonard Fuld, President of Cambridge, Massachusetts - based consulting firm Fuld & Co. is quoted by McCarty in saying that:

"...most corporate intranets are mess-quagmires of disorganised or inaccurate content that cloud managers' ability to make quick decisions. It's like walking into a room with piles and piles of paper. You know there's paper there, but you don't know what pile has what you need. Search engines might get you to a pile, but not to the exact paper" (McCarty 2001).

Good intranets and extranets should be properly organised for easy access and information retrieval, otherwise they could lead to a situation of information overload within the organisation.

2.5.8 Terms of use agreements

In addition to the above features, a good extranet should provide all those accessing the facilities with the Terms of Use (TOU) agreement. This is an agreement that governs each party's use of the extranet and the information exchanged on the extranet (Kirsch 2000:4). Depending on the existing relationship between the corporation and the users of its extranet facilities, the TOU agreement may be in print-hard copy or as a "click-wrap" agreement accessible on the extranet's central website. According to Kirsch (2000:5-8), the TOU agreement may include the following provisions:

- Authority: permitted activities
- Persons permitted to access the extranet
- Restrictions on usage
- Prohibited conduct
- Technical compatibility with the extranet
- Confidentiality
- Security
- Privacy
- Trademarks and copyrights
- Waivers and disclaimers
- Indemnification
- Modifications to TOU
- Modification of services
- Site specific rules
- Termination
- Choice of law, forum, dispute resolution.



2.6 SUMMARY

The purpose of this chapter was to address the second sub-research problem, namely:

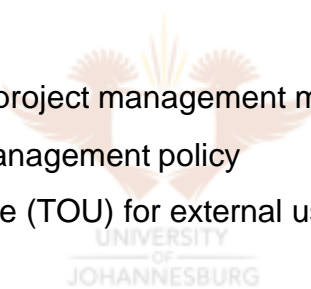
What are intranets and extranets and how are they being used use in the provision of access to digital information resources and services to end-users in corporate organisations?

Reviewing and discussing the following has addressed the above sub-research problem:

- Internet and web technologies
- Development and application of intranets and extranets in corporate organisations
- Definitions of intranets and extranets
- Major technical components of intranets and extranets
- Intranet and extranet models.

Resulting from the literature review, the chapter identified the following as the major features of good intranets and extranets. Good intranets and extranets are:

- Goal oriented
- Based on employee centred design and user centred design
- Platform independent
- Sustainable
- Based on proven project management methodology
- Have a content management policy
- Have Terms of Use (TOU) for external users.



Taking into account the various definitions, and the above major features of intranets and the various intranet applications discussed in this chapter, the following definition of an intranet has been formulated and will be applied to the term throughout this thesis:

An intranet is a private, internal and secure information management and communication network based on the Internet and World Wide Web technologies and protocols.

With the above definition in place, it becomes easier to define an extranet. In the context of this study:

An extranet will refer to a private, secure information management and communication network based on the Internet and World Wide Web technologies and protocols, which is open for access to selected groups of external users.

The above two definitions are applicable to various types of organisations and do not restrict intranets and extranets to the business or corporate world. Although much of the available literature emphasises the use of intranets and extranets in corporate organisations, intranets and extranets may be applied in any type of organisation.

Now that intranets and extranet have been discussed and their good features identified, the next chapter is devoted to the study of the applications of portals in corporate organisations. The chapter will also attempt to identify the features of good portals that could be incorporated into an agricultural information portal.

CHAPTER 3

PORTALS

3.1 INTRODUCTION

We live in an information age in which information and communication technologies (ICTs) play a very important role in the generation and management of information and knowledge in organisations. ICT is defined as a diverse set of technological tools and resources used to communicate and to create, disseminate, store, and manage information (Blurton 1999:46). ICT encompasses a wide range of rapidly evolving technologies such as:

- Television and radio
- Telecommunication facilities - telephones, faxes, and satellites
- Computers
- Smart cards and credit cards
- Internet, the World Wide Web, intranets and extranets
- Computer-mediated conferencing and videoconferencing
- Software applications.

ICT came about as a result of the digital convergence of computer technologies, telecommunication technologies and other media communication technologies. With ICT it has become easier to generate and distribute information throughout the organisation and over long distances to a large number of people in the shortest possible time. For example, an electronic mail message can be sent to all employees within the organisation or to millions of people around the globe within seconds. The use of ICT has resulted in a rapid increase in internal communication in organisations and also in external communication with clients, partners and suppliers. There is also an accelerated increase in the amount of electronic information that is

being produced, and it has become extremely easy to distribute information in organisations.

The deployment and use of ICT in organisations is resulting in too much information being produced and made available to people within organisations. This is, in some cases, resulting in a state of information overload for information end-users. Owen (1999) states:

"At first a blessing, e-mail has become a curse to those whose inboxes are deluged daily with "FYI" messages and other information that, previously, would have been too cumbersome or time-consuming to deliver in the old mediums."

This so-called "curse" was already observed in the 1990s by Telleen (1995) who indicated that information overload was a malady of our time, and that the technologies that were supposed to help the problem seem only to have made it worse.

Information overload is increasing and is having a negative impact on individuals and the operation of organisations. For example, Edmunds and Morris state that it is apparent that an abundance of information, instead of better enabling persons to do their job, threatens to engulf and diminish their control over the situation (Edmunds & Morris 2000:17). In addition, people are being buried under an avalanche of information (Weil & Rosen 1997:210). Furthermore, information overload is costing businesses and individuals valuable time, effort and additional resources... and the costs are rising (Nelson 2000). There is, therefore, an urgent need to control it.

The negative impact of information overload on individuals and organisations is further highlighted in the results of a study of 1,313 junior, middle and senior managers in the United Kingdom, United States, Australia, Hong Kong and Singapore by Reuters Business Information (1997). The key findings of the study were that:

- Two thirds of managers attributed tension at work between colleagues and loss of job satisfaction to stress associated with information overload.
- One third of managers suffered from ill-health as a direct consequence of stress associated with information overload.
- Almost two thirds (62%) of managers testified that their personal relationships suffer as a result of information overload.
- 43% of managers thought that important decisions are delayed and the ability to make decisions is affected as a result of having too much information.

Fortunately, ICT can be used and in some cases are already being used in reducing information overload. For example, portals, based on Internet and web technologies, which allow information end-users to personalise and control the type of information that they would like to access or pull, could be used to control and reduce information overload in organisations. Some organisations are in fact already deploying portals, although in some cases this is being done more in response to the organisations' electronic commerce needs.

The purpose of this chapter is to discuss portals as information management tools with emphasis on their use in the provision of access to web-based information resources and services. The chapter also aims to identify the features of good portals that could be incorporated into the design of agricultural information portals. In this light, the chapter addresses the third research sub-problem:

What are portals and how they are being used in the provision of digital information and services to end-users in corporate organisations?

In addressing the above problem, the chapter begins with a brief discussion of the problem of information overload in organisations, with a slight emphasis on corporate organisations, and how this could be reduced or controlled by using the portal model of information distribution. It also reviews the development and use of portals in the provision of access to web-based information resources, and gives some definitions of portals found in literature. The chapter further examines four types of portals identified from the literature studied, discusses the features of good portals that could be incorporated into the design and development of an agricultural information portal, and looks at the various technologies/tools required for the implementation of a portal.

3.2 INFORMATION OVERLOAD

It is quite difficult to define the term *information overload*. According to Butcher (1998:53), the term can mean several things, such as having more relevant information than one can assimilate, or it might mean being burdened with a large supply of unsolicited information, some of which may not be relevant. Feather (1998:118) describes information overload as the point where there is so much information that it is no longer possible to use it effectively. It is, therefore, clear that in general, information overload is associated with too much information being made available.

The problem of information overload is not totally new. It has existed for many years, although in recent years it has become more widely recognised and experienced owing to the rapid advances made in information and communication technologies that have exacerbated the effects of information overload. The use of ICT has transformed the generation, distribution and access to information. The amount of information being produced on virtually all types of subjects is huge and this is now presenting problems to information end-users on how to manage and access such information.

3.2.1 Information overload in organisations

Today, information and knowledge are seen as the key to success, especially in corporate organisations, and many employees have to deal with an overwhelming amount of information from many sources as part of their jobs. As a result, most employees in corporate organisations are experiencing the problem of information overload. As indicated by Telleen (1995), in-baskets or in-trays, paper or electronic, of knowledge workers are generally full of various information documents. This may be made up of “junk mail”, advertisements, information that may be needed “just in case”, and “out of phase” information that may be needed later. As a result, employees have to find a way of managing the information. Telleen (1995) indicates that knowledge workers probably file half of the “just in case” information (just in case it is needed) and all of the “out of phase” information. When information is needed, knowledge workers are faced with a high volume, low-density personal information system that may have the additional complexities of multiple formats or media.

In general, information overload at work places can be placed in two major categories, pushed information and pulled information. Pushed information is information that arrives at the workspaces of individuals by memos, letters, newspapers, e-mail, telephone calls, as well as junk mail that lands in in-boxes. Pulled or retrievable information, on the other hand, is the information that individuals tap from the Web [or other information depositories], when a question is answered or background knowledge on a topic is acquired (Kirsh 2000). Individuals have greater control over pulled information in that they intentionally decide what information sources to consult. However, pulled information, when there is too much of it to choose from, may create the problem of information overload. This is the situation with regard to most of the information pulled from intranets and extranets in organisations. Most intranets and extranets have millions of webpages, in addition to various types of data and documents that are stored in disparate systems that are accessed or pulled by information end-users.

The abundance of information in organisations has created a need for a way of reducing and managing information overload. In organisations where intranets are in place, the use of portals has been indicated as one possible solution to the problem of information or content overload (Aneja, Rowan & Brooksby 2000; Konicki 2000). Portals could be used to help individuals decide what information they should pull from the information depositories in an organisation and what they would like to have pushed to them. In this light, the section below looks at portals as tools for providing access to digital information available on the Web and in organisations.

3.3 PORTALS

According to O'Leary (2000), the explosive growth of the Web has made it much harder for any individual website to be seen, or for any individual consumer to make sense of it. Hence, the portal, an organising principle that brings like-minded businesses and customers together, to their mutual benefit. Using portals, information is obtained, advertisements are seen, products are purchased, and everyone is happy. Portals have become one of today's biggest web trends and corporate organisations are setting up portals to attract customers to their websites and, in some cases, to use them as mediums for Business-to-Business (B2B) e-commerce tools (O'Leary 2000). The results of market surveys conducted by the Delphi Group in 1999 and 2000, (see Section 1.1.1) show that more and more large corporations are implementing portals.

The underlying principle of the portal model of information management is that the provision of access to web-based information resources and services should respond to the information end-user's preferences and usage of these resources and services. A portal-based information system monitors the information end-user's use of the resources and services. This enables the system to aggregate various information services and resources and make them available to the user via the portal. Overall, the portal model of information management and distribution, in

addition to its potential in the reduction of information overload in organisations, also has great potential for use in the provision of information services targeting individual end-users by information specialists. What then, is a portal?

3.3.1 Towards defining portals

The available literature on portals indicates that there are several types of portals. Most definitions of portals depend on the nature of the environment in which they are being applied. In most cases, the word portal means different things to different people. The following definitions of portals have been picked from the literature study done:

- (Noun). 1. A doorway, an entrance, or gate; especially, one that is large and imposing. 2. Any entrance or means of entrance: a portal of knowledge (Grolier Incorporated 1980:1021).
- Application that provides a personalised and adaptive interface enabling people to discover, track, and interact with other people, applications, and information relevant to their interests (Morrison 2000).
- Website that provides an entry point to the Internet, and offers value-added services such as directories, searching, information news, and links to related websites (Rowley 2000:62).
- “Supersite” on the Internet that provides a comprehensive entry point for a huge array of resources and services (Berkman 2000).
- Web address destination to which people with some common set of characteristics, interests, or needs go to gather information, interact with

data, experience entertainment, exchange thoughts, or conduct transactions (Hurwitz 2001:110).

From the above definitions one may conclude that a portal is seen either as a software application, or an Internet website, or an entry point to information resources. These different views of what a portal is make it quite difficult to give a generally acceptable definition. However, portals can best be understood and defined by examining their historical development and looking at their major features or components.

3.3.2 Brief history of portals

Many of the first portals were created as online services, for example American Online (AOL), CompuServe, and Prodigy, and they sought to accommodate their subscribers (Pflieger 2000). Later, internet search engines like Yahoo!, Excite, Lycos and many more transformed themselves into web portals, and popularised the concept of portals.

In the early days of the Web, there was need to organise web information resources for easy retrieval. This led to the development of internet search engines like Yahoo!, AltaVista and many others. These search engines attracted a lot of web users to their sites because it was easy to search for information resources on these sites. With more users visiting search engine sites, it was easy to start selling advertising space on these websites, and later demand for advertising space outstripped the available space. Consequently search engines started looking for other ways to attract visitors to their sites.

"...as demand for ad space outstripped the available number of webpages at their sites, portal companies started bulking up with news and contents, stock quotes and product promotions, shopping, custom homepages and free e-mail - just about anything they could think of that

would both create advertising space and keep the largest number of users coming back" (Caruso 1999).

To target as many people as possible, the portal needed to fit the needs of the users as closely as practical. This led to the incorporation of features and facilities on the websites that could keep track of the habits and build profiles of the website users, and thus generate advertisements and contents that suit individual needs. In addition, features to allow users to personalise the portal, in terms of appearance and the types of content they would like to see, were also added to the sites. The result was the emergence of web portals, which are discussed in the section on types of portals below.

3.3.3 Types of portals

There is no generally accepted system for classifying portals. However, four major broad categories of portals emerge from the literature: web portals, vertical portals, affinity portals and enterprise information portals (EIPs). There are also several sub-categories of portals under the EIP category. In spite of the various categories of portals, it should be noted that sometimes a suitable portal implementation might require an integration of multiple types of portals blended into a hybrid solution.

3.3.3.1 Web portals

A web portal is described as a website or service that offers a broad array of resources and services, such as e-mail, forums, search engines, and on-line shopping malls (Webopedia 2001b). These portals are designed to act as gateways to the Internet, and they provide access to a wide range of web-based resources and services including:

- Internet search and navigation
- Free web- based e-mail facilities
- Free homepages hosting

- Entertainment information
- Stock market information
- Foreign currency exchange information
- Customised news and weather information
- Sports
- Horoscopes
- Planners and calendars
- Real-time chat facilities
- Message boards
- Original content on various subjects
- Shopping facilities, and much more.

Web portals are also referred to as internet portals or horizontal portals because they provide general information content and other services to a general audience. However, the term web portal is generally used to refer to mega-websites because many internet users use these sites as their starting points or entry points for their web surfing.



A large number of public web portals are sponsored by the major search engine and browser providers, and may include alliances with other major players on the Internet (Bertland 2001). This arrangement is one of the disadvantages of web portals in that they often point users to sites that live under the same corporate umbrella as they do, rather than to the most relevant or informative sites on a given topic (ZDNet 2002).

a) Examples of web portals

Popular examples of web portals (mega-websites) include Excite, Lycos, MSN, Netscape Netcenter, Yahoo! and American Online (AOL). Below is a brief description of the services and facilities provided on web portals.

Excite at <http://my.excite.com/myexcite/my.jsp>

Facilities provided on Excite include access to free e-mail facilities, a search engine, subject directory, and links to other search and shopping sites. Users can also design a personalised page, which includes news, sports, weather, stocks and much more.

Free Lycos at <http://www.lycos.com>

The Lycos portal provides access to a search engine, subject directory, news, chat, stock news, shopping, and free e-mail, among many other facilities and resources.

MSN.COM at <http://www.msn.com>

MSN.COM is Microsoft Corporation's portal. This portal offers many of the standard services including free e-mail, and a good selection of items/tools from which users can create their own personalised pages.



Netscape Netcenter at <http://www.netscape.com>

Netscape Netcaster provides access to news, stocks, software, and a subject directory from Excite. Users can search the Web using search engines provide on the portal. There is free e-mail access, and users can also design their own personalised page, and download the latest Netscape software.

Yahoo! at <http://www.yahoo.com>

Yahoo! offers news, weather, stock market information, and much more, including facilities for searching Yahoo's web directory. Yahoo! also has features/tools for designing a personalised page as well as News Clipper for keeping up with the

news about the topics the user is interested in. The portal also provides access to free e-mail (Yahoo! mail), personal website design and hosting facilities. Users can also create virtual briefcases in which they can store their electronic files.

AOL Anywhere at <http://www.aol.com>

AOL Anywhere Web portal is the official website of America Online (AOL). It offers access to shopping facilities, web-based e-mail facilities, web information channels, personal home pages facilities, and allows users to personalise the site.

b) Features of web portals

Arnold (1999) identifies four main features of web portals:

- Search and directory services
- Desktop-like applications
- Personalisation tools for information, entertainment and layout
- Community features.



Search and directory services

Most web portals start off as search engines. Therefore, their primary activity is still to provide access to Internet search facilities. This being the case, they provide access to search interfaces and at the same time maintain extensive directories that contain pre-indexed sites, sorted by categories.

Desktop-like applications

Web portals also provide users with access to facilities that could be referred to as desktop-like applications. For example, most portals provide access to free e-mail services, allow users to create their own personal websites, set up calendars to

organise the day's activities, create virtual briefcases for the storage of electronic files, and much more.

Personalisation

The ability to allow users to personalise the site (portal) according to their personal interests is a major feature of web portals. In all of the examples of the web portals reviewed above, users are able to personalise the portal to suit their individual preferences. This is done through the "My" option, for example "My AOL", or "My Yahoo!", or "My Excite", or "MY MSN", or "My Lycos", or "My Netscape", available on web portals. Users are able to customise the appearance of the portal and also indicate the type of content they would like to access on the portal.

Community features

Web portals also provide facilities that enable users to interact with other users, and thus create their own virtual communities. These include chat rooms and online discussion forums. According to Arnold (1999) some portals also promote special events, like an opportunity to chat with famous people or question experts.

Unfortunately, in as far as provision of access to specialised information resources is concerned; web portals have not fared well. One of their major shortcomings is that they try to provide all types of information to end-users, and end up overwhelming the users. Often the result is information overload. According to Burns (1999):

"...by trying to be all things to all people, horizontal internet portals have become cumbersome, bulky, and inefficient. Horizontal sites have become an inefficient internet experience for individual users with specific interests, expectations, and needs".

As a result of the above problem, another type of portal, the vertical portal, has emerged as a viable and compelling response to the needs and wants of increasingly more discriminating and sophisticated internet users (Burns 1999).

3.3.3.2 Vertical portals

Web portals are the immediate ancestors of vertical portals. However, as opposed to web portals, vertical portals, also known as niche portals or vortals, have a tightly focused information content area geared toward a particular category of audience. The development of vertical portals may be compared to the development of specialised publications in the publishing industry. The industry started out with a handful of publications and now has thousands of publications that target specific groups. For example, people interested in computers read computer magazines like *SA Computers*, *PC Magazine*, *PC World*, and many others to keep abreast of the latest developments and news in the computer industry. Advertisers looking to target computer specialists, buyers or consumers place their advertisements in these computer specific magazines because they know their target audience reads them. Therefore, vertical portals have great potential for use in electronic commerce, especially business-to-business. Rupley (2000), citing the Gartner Group, indicated that by the year 2004 vertical portals will make up 37% of a US\$7.3 trillion e-commerce business-to-business (B2B) market.

a) Examples of vertical portals

There are several examples of vertical portals accessible on the World Wide Web. The *Vertical Portals.Com* main directory available at <http://www.verticalportals.com> lists around 150 vertical portals on various subject areas including animals, art, beauty, computers, entertainment, food, music, news, real estate, sports, travel, vehicles and many more. Below are three examples of vertical portals that focus on information technology, soccer and the pharmaceutical industry. Two of the

examples, ZDNet.com and Socccernet.com, have been my favourite sources of information on IT and soccer for well over 3 years.

ZDNet.Com

ZDNet operates the world's leading vertical portal for people who want to buy, use, and learn about information technology. The site's audience ranges from consumers to information technology professionals. ZDNet's vertical portal, accessed at <http://www.zdnet.com> provides information content relating to information technology and this includes:

- Information technology news
- Product reviews
- Information technology updates
- Careers and training information
- Software information
- Information technology prices
- Downloads of various software products/utilities
- Newsletter delivered via e-mail
- Search facilities for the ZDNet portal or the Web
- Access to 15 other ZDNet international sites.

Socccernet.Com

Socccernet.Com was launched in 1995, and is part of the Entertainment and Sports Programming Network (ESPN). Accessed at <http://www.socccernet.com>, Socccernet.com is a vertical portal for football fans worldwide. It provides access to the most up-to-date football news, views and match scores. Although there is a slight emphasis on the English Premier League, the portal also provides information from around the globe. The portal provides the following information and facilities to users:

- Facilities for checking the latest football scores
- Football live commentaries of selected soccer matches
- Search engine for searching Soccernet or the Internet
- Online poll facilities on various (current) topics
- Links to English football club websites
- Profiles for players in the English League
- League fixtures, results and league tables
- List of leading goal scorers in Europe
- List of the ESPN World Club Top 25 teams
- Access to betting facilities
- Access to fantasy league games (portal users can play as managers of fantasy soccer teams)
- Links to other ESPN sports related sites.

Pharmaceutical Online



Pharmaceutical Online at <http://www.pharmaceuticalonline.com> is an information source for the Pharmaceutical Manufacturing industry. Visitors to the portal can find information on pharmaceutical products and suppliers, read current headlines, and keep up with the latest information in the pharmaceutical industry. The portal provides facilities for signing up as a member of the portal. Signed up members receive a free e-mail newsletter covering industry news, trends, events, and more; and they can also request free information and quotes from companies in the buyer's guides, storefronts, and other areas within Pharmaceutical Online. The Portal also provides access to:

- A searchable database of over 48,000 medical, pharmaceutical and healthcare acronyms and abbreviations
- Conversion and calculation tools (i.e. measurement converters, world time zones, and currency exchange rates converters)
- Trade publications, free to qualified professionals

- Online services such as consulting services, meetings and events, management services, work clothing and uniforms, and many more
- Online buying and selling facilities
- News headlines
- Discussion forums
- Events calendar.

Unlike web portals, the above three vertical portals, ZDNet.com, Socccernet.com and Pharmaceutical Online, do not provide access to e-mail facilities, stock information and other types of general information generally associated with web portals. This is very common with vertical portals.

b) Features of vertical portals

When is a portal a vertical portal? In his article *When is a website a vortal?* Peek (1999) indicates that what qualifies as a vortal is somewhat slippery. However, he goes on to identify a number of features that makes a portal a vortal, and these are that vortals:

- Offer more than just content and they have something that differentiates them from being virtual versions of magazines.
- Unlike web portals, vortals do not require a search engine to the outside world.
- Belong to the broad web community and as the term is currently being deployed, it does not apply to sites that exist behind firewalls or sites that require passwords.

- Have clearly defined focus in terms of content and target audience. For example, women.com and ivillage.com focus on women; zdnet.com, cmpnet.com, and cnet.com focus on computers.

In addition to the above features, vertical portals generally do not provide access to common web portal elements like e-mail services, stock exchange information, weather reports, bulletin boards, and many others. They concentrate more on providing specific information content to their defined user groups, than providing general information. Since vertical portals focus on defined user groups, most of them rarely provide facilities for personalisation. Perhaps it is assumed that the information provided is relevant to the portal users. This is a major disadvantage of the vertical portal model of information provision.

3.3.3.3 Affinity portals

Affinity portals are portals that aggregate information geared towards specific community groups, specific ethnic groups, specific age groups, alternative lifestyles, religions, and other groups, that are perceived to form a community or market. In addition to targeting specific groups, affinity portals also include the kinds of features that web users would find on web portals, including e-mail, shopping, chat areas, news and financial information, among others.

Tedeschi (2000) indicates that the main attraction of affinity portals is that companies involved in the development of portals can work closely with associations or institutions that already cater to such groups to build portals aimed at their own memberships. This approach, in theory, puts a sane ceiling on marketing costs associated with the development of web portals and ensures a loyal user base. According to Hu (1999) affinity portals are luring users as well as advertisers away from larger, more general web portals such as Yahoo, Excite, Lycos and Go.com.

a) Examples of affinity portals

There are several examples of portals that fall into the affinity portal category. A very good example is the WeMedia.Com available at <http://www.wemedia.com>. This portal targets people with disabilities and was launched in 1999 by a magazine publisher, We Media, to coincide with the United Nations International Day of Disabled Persons (Hu 1999). The portal hopes to give home-bound disabled people the ability to purchase goods and perform daily tasks online. It concentrates on news, sports, accessible technologies that provide assistance, politics and advocacy, shopping, employment, education, finance, and real estate from a disability perspective (We Media 2002). Facilities and resources provided on the portal include:

- Free bi-weekly e-mail newsletter
- Downloads (i.e. WeMedia talking browser)
- News and features
- Sports news
- Virtual shopping facilities (eBay Auctions and WeMedia Market)
- Chat/discussion facilities (We Forum)
- Services (careers, education, house and home, money).

3.3.3.4 Enterprise information portals

While Web portals, vertical portals and affinity portals concentrate on harnessing the vast information resources of the Web in order to make them easily accessible to internet users, enterprise information portals (EIPs) - also sometimes called by other terms like enterprise resource portal, knowledge management portal, corporate portal and corporate information portal - concentrate primarily on harnessing internal corporate information resources and selected external information resources for the benefit of the organisation. In general, EIPs provide

access to information resources on the corporate intranet and to selected information resources available on the Internet (CNET Networks 1999).

Enterprise information portals have attracted a lot of interest from system developers, vendors and information technology analysts/consultants. As a result of competing interests, it has been quite difficult to define these types of portals. Commenting on the various efforts to define EPs, Firestone states that:

"...the process of definition is a 'political' business - an attempt to persuade the Investment/IT and ultimately the user community to define EIP in a manner favouring one's own vendor or analytical interests. If a vendor gets its favoured definition accepted, it gets to say that a competing vendor is not really an EIP vendor, or lacks this or that required EIP characteristic. If an analyst or consultant gets his or her definition accepted, he/she gets a boost for his/her mind share and all the rewards that accompany such a competitive advantage over other consultants or analysts" (Firestone 1999).

Indeed, there are several definitions or descriptions of EIPs. For example, in the report prepared by Shilakes and Tylman of the Enterprise Software Team, Merrill Lynch defines enterprise information portals as:

"...applications that enable companies to unlock internally and externally stored information and provide users with a single gateway to personalised information needed to make informed business decisions" (Merrill Lynch 1998:1).

Merrill Lynch further states that EIPs are an amalgamation of software applications that consolidate, manage, analyse and distribute information across and outside of an enterprise, including business intelligence, content management, data warehouse and market, and data management applications (Merrill Lynch 1998:1)

Detlor (2000:91) defines corporate portals as single-point web browser interfaces used within organisations to promote the gathering, sharing, and dissemination of information through the enterprise. They offer corporate organisations means by which they can manage and access information from disparate sources across the corporation.

When discussing the emergence of corporate information portals, the Director of Knowledge Technologies Research at International Data Corporation (IDC), Gerry Murray, indicated that corporate portals must connect users not only with everything they need, but (also) with everyone they need, and provide all the tools, for example groupware, e-mail, workflow, and desktop applications -- even critical business application users need to work together (Murray 1999).

Authors like Roberts-Witt (1999) and Murray (1999) have indicated other sub-types or sub-categories of portals that fall under the corporate portal category. According to Roberts-Witt (1999), other broad types of corporate portals include:

- *Data portals* that deal primarily with structured data, such as sales and inventory numbers that are found in corporate databases.
- *Information portals* that deal more with unstructured data, such as e-mails, texts and other documents.
- *Collaborative portals* that are focussed on tying in more group interactive functionality.

Murray (1999) identifies the following four types of corporate portals:

- *Enterprise information portals*, which connect people with information.

- *Enterprise collaborative portals*, which provide collaborative computing capabilities of all kinds.
- *Enterprise expertise portals*, which connect people with other people, based on their abilities, expertise, and interests.
- *Enterprise knowledge portals*, which combine all of the above to deliver personalised content based on what each user is actually doing.

It should be noted that the definition of enterprise information portals, as defined by Merrill Lynch (1998:1), to a large extent covers the other types or categories of corporate portals briefly described above.

a) Features of EIPs

Merrill Lynch (1998:4, 10-12) indicates the following as being among the major features that an enterprise information portal should have. EIPs should:

- Integrate internal and external information and applications on a common browser-based desktop.
- Enable users to create a customised view of the information resources that have been made available to them.
- Support the search process by providing a range of relevancy tools such as thesauri and intelligent agents that require little, if any training in their use.
- Ensure that the security of information assets is managed on a highly effective basis so security management does not become a burden that overwhelms the organisation.

- Enable the expertise of the organisation to be identified and utilised within an overall knowledge management strategy.
- Provide effective information access to unlock the often hidden assets within an organisation from tangible assets, information from disparate depositories (documentation and data), and tacit knowledge held by the employees.
- Enable physical and virtual teams to be set up and supported by specific information resources, albeit inside the organisation or located with a supplier and/or customer.
- Manage the creation, storage and distribution of documents of all types.
- Distribute knowledge proactively to staff by building profiles of each information user and delivering relevant material that will add immediate and obvious value to their decision-making process.
- Deliver an open, flexible IT architecture platform, allowing integration and support for the entire organisation's IT applications.
- Adapt to changes in the IT architecture of the company through business-based technology.
- Deliver all the information and applications that are essential to business success across one, secure, personalised and scalable browser-based interface.

b) Benefits of implementing EIPs

The main benefit of implementing EIPs in corporate organisations, according to Aneja, Rowan and Brooksby (2000), is increased employee productivity that results from the following improvements:

- Organised and structured information, which is easier to navigate.
- Quick access to relevant personalised news, information, services, applications and documents.
- Highly interactive and personalised interface that provides targeted information based on employees' roles and preferences.
- Enhanced search capabilities that reduce the amount of time necessary to find sought after information.
- Filtered, targeted and categorised information so users receive just what they need.

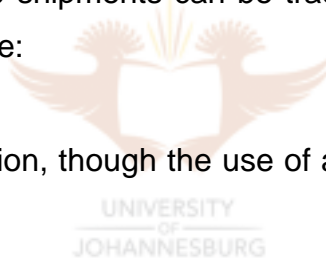
c) Examples of EIPs

A large number of EIPs are located behind firewalls (intranet portals), and are, therefore, quite difficult to access for the purpose of review and analysis. However, there are organisations whose activities involve the provision of services to clients around the world, and these have portals (extranet or e-commerce portals) that are publicly available and accessible over the Internet. These portals exhibit some of the characteristics of EIPs. Three examples of such portals (the DHL Worldwide Express portal, the Microsoft Corporation portal and the South African Airways [flysaa.com] portal) are briefly discussed below.

DHL Worldwide Express

As seen in Chapter 2, by using extranets, shipping companies are providing their clients and partners with facilities to access real-time global shipment data and track the location of their packages from anywhere in the world. Generally, this is being done through EIP portals accessed via extranets. Among the shipping companies that provide such facilities is DHL Worldwide Express. The DHL portal interface, accessible to clients and the general public, is available at <http://www.dhl.com>. The major service provided on the portal, in addition to other types of information resources, is the package tracking service. The facility enables DHL clients to track the movement of their parcels by entering the airway bill number. Information on the destination of the parcel, its location, routing and, if delivered, the name of the person who signed for the documents/parcel, is provided once the correct airway bill has been entered. Up to 10 shipments can be tracked at one time. Other facilities provided at the portal include:

- Location information, though the use of a clickable map, of DHL's offices around the world
- Submission of comments through the use of a form
- Search facilities for the DHL site
- DHL masterclass site where DHL provides users with various information documents, for example the DHL corporate report, eCommerce report and eBusiness white paper
- Service bulletins with information about temporary circumstances around the globe, which may affect the service DHL can offer in certain countries or regions



- Information on how to complete DHL's airway bills.

Microsoft Corporation

While Microsoft Corporation MSN portal at <http://www.msn.com> is a Web portal, the Corporation's portal at <http://www.microsoft.com> is classified as a corporate portal. This portal provides Microsoft's clients and partners, access to several services and products. These include:

- Information on all Microsoft products
- Software downloads
- Site search facilities
- Support services such as software updates, newsgroups, technical database searching, access to frequently asked questions (FAQs), and access to support professionals over the Internet
- Information targeting small business, educators, journalists, Microsoft partners, information technology professionals, developers
- News
- Newsletter (Microsoft This Week!)
- Microsoft products training and certification information
- Free e-mail account with the MSN Hotmail.

The Microsoft Corporation portal, through its Profile Centre, also allows users to personalise the services.

South African Airways

South African Airways' [flysaa.com](http://www.flysaa.com) portal (<http://www.flysaa.com>) is the airline's electronic commerce portal. Any user of the portal can register on the site and obtain a username and a personal identification number (PIN) that allows him/her to

login and customise the portal. In addition to customisation, users can access the following information and services provided on the flysaa.com portal:

- Flight schedules
- Flight status information
- In-flight information
- Travel information
- Flight bookings
- Checking, claiming or redeeming voyager miles (requires voyager number and password or personal identification number)

3.4 FEATURES OF GOOD PORTALS

Part of the research sub-problem being addressed in this chapter is to identify features of good portals. The discussion above has highlighted several features of various types of portals. From the discussion it is clear that portals differ from ordinary websites and good portals should, therefore, have features and facilities that go beyond ordinary websites. Morrison, Buckey and Cappo (1999:9) point out that a portal allows users to:

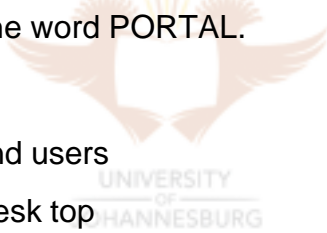
- Discover information quickly instead of searching for it
- Have consolidated access to applications
- Be part of a community
- Have access to critical resources.

In their article, *Building a personalised education portal*, Ethridge, Hadden and Smith (2000:13-14) identify and discuss several distinguishing features of portals. They state that:

- Portals facilitate the discovery of people, organisations, and content in a meaningful context.

- Portals are secure, offering user authentication, credential mapping, and sensitive data encryption.
- Portals are personalised, proactively providing customised desktops based on the user's role in the community or enterprise.
- Portals are adaptive.
- Portals are single points of service, that provide a framework for accessing multiple heterogeneous data stores including enterprise databases, e-mail, and other multimedia resources.

In his article, *Building successful portals*, Morrison (2000) groups the major characteristics of portals into six unique distinguishing features. The first letters of these characteristics spell the word PORTAL.

- 
- **P**ersonalisation for end users
 - **O**rganisation of the desk top
 - **R**esource division
 - **T**racking activities
 - **A**ccess and display of stored data
 - **L**ocation of important people and things.

The above features, implicitly or explicitly, also incorporate the features and characteristics identified by Morrison, Buckey and Cappel (1999:9) and Ethridge, Hadden and Smith (2000:13-14).

3.4.1 Personalisation for end users

Personalisation is the most critical feature of any type of portal. This is supported by Burns (1999) who states that, personalisation is the key to establishing a relationship with the user, whether a vertical or horizontal portal site model is used. A good portal should allow information end-users to personalise the portal appearance, content and application interface to suit their individual needs.

While personalisation is a major feature of portals, and is a critical factor in the reduction control of information overload, it should, however, be noted that complete or exact personalisation may not be feasible. Generally, the portal should allow enough personalisation to avoid too much unwanted information. It should also allow for flexibility and changes in the user's priorities and use of the portal facilities.

3.4.2 Organisation of the desktop

Portals help to organise end-user desktops, and this enables users to have access to the important information content they need. Together with personalisation, this feature, ensures that information end-users are able to reduce the state of information overload. Morrison (2000) indicates that by using this feature, corporate organisations are able to design desktop layouts that organise content in a way that suits their employees.

3.4.3 Resource division

Portals should have features that separate facilities into various layers for different categories of users. For example, system administrators should be the only people-accessing features relating to the administration of the portal. In organisations certain types of content, for example salary information and personnel information, may also be particular to certain departments and employees in those departments should be the only people to access the information.

3.4.4 Tracking activities

Portals should be able to track users' individual usage, interests, and behaviour. It is this feature that enables users to personalise the portal, in turn, the portal is able to present users with a personalised view of the information resources.

3.4.5 Access and display of stored data

Portals should be able to provide users with access to information from multiple heterogeneous data stores. These should include information from relational databases, multidimensional databases, document management systems, e-mail systems, web servers, news feeds and various file systems or servers.

3.4.6 Location of important people and things

A portal must make it extremely easy for users to locate people and any information they require. There must be ways to both passively discover and actively locate experts, communities and content related to a particular topic.

Other features, identified from the literature that should be added to Morrison's list above, are user authentication and taxonomy.

3.4.7 User authentication

In general, a portal's tracking capability is linked to the user's login and authentication facility. Users are requested to register and supply their username, password or Personal Identification Number (PIN), and these are stored in the database. This information, in addition to the information obtained during personalisation, and later on, past use of the portal, are used to provide content that is relevant and current to the user's needs.

The level of authentication for portals accessed over the Internet may differ from those accessed over intranets and extranets. Generally, most portals, especially vertical portals, accessed over the Internet provide seamless access for non-authenticated users until sensitive information is requested, at which stage it then prompts for a username and password. After authentication, a good web portal or vertical portal should provide a personalised view of the information resources available on the portal to information end-users known to the portal.

3.4.8 Taxonomy

The search and categorisation technologies on a portal should be linked to a well-defined taxonomy. The organisation of portal resources should be based on a well-defined categorisation system of content or subject. Using a well-defined hierarchy of subjects (taxonomy) facilitates easy retrieval and identification of information resources and services on the portal.

The above six features identified by Morrison (2000), plus user *authentication* and *taxonomy*, form the backbone of good portals. Therefore

"...if developers succeed in incorporating all these capabilities into a single application, they have built a basic portal design that can be targeted at all types of audiences and applied against a broad range of content and tool types" (Morrison, Buckley and Cappo 1999:8).

In this light, the above eight features should always be incorporated into the design and development of portals for use by information specialists.

3.5 WHAT THEN IS A PORTAL?

One of the goals of this study, as indicated in Section 1.1.1, is to formulate a general definition of portals. Taking into account the discussions on portals, the

various applications of portals, the general features of several types of portals, the features of good portals listed above, and Morrison's definition of a portal (2000), portals may be defined as follows:

Web-based applications accessed over the Internet, intranet or extranet, that provide a personalised and adaptive interface which enables users to discover, track, and interact with other people, applications, services and information relevant to their interests.

The above definition captures the major essence of portals, which is providing access to personalised information resources and services, while at the same time providing access to various information management tools through a web-based interface.

3.5.1 Information portal

While it is noted that the motivation behind the development of several portals, for example web portals, vertical portals, and affinity portals, is to attract users to the portal for business purposes, in the context of this study, portals are considered to be potential tools for digital information management and for providing access to well-organised, relevant information resources and services to end-users. The term "information portal" is adopted to refer to a type of portal whose major motivation is not e-commerce but to provide access to digital information resources and services. Information portals could be very useful in research and academic organisations, as well as organisations that do not have a profit motive for the development of the portal.

3.6 PORTAL TECHNOLOGIES AND TOOLS

A portal makes use of different types of technologies and tools. Discussing corporate portals, McCann (1999), citing the Delphi Group, Boston, indicates the

following categories of technologies that are applicable to the various types of portals discussed in this chapter:

- *Presentation technologies*: Standard web display technologies such as HTML, JavaScript and applets or Cascading Style Sheets plus data visualisation technologies like Web OLAP that run applications like an e-mail viewer within the browser.
- *Personalisation technologies*: Agents that filter information for individual users. They might suggest what users would be interested in and can learn from what users do.
- *Collaboration technologies*: Groupware technologies such as discussions, chat sessions and project libraries.
- *Process technologies*: Technologies such as online transactions that are the engines of various business or workflow processes.
- *Publishing and distribution technologies*: Storehouses of documents in portable formats like Portable Document Format (PDF) as well as publish/subscribe engines or other means of "pushing" information.
- *Searching technologies*: Both full-text search engines and ones that search descriptions of documents and other content.
- *Categorisation technologies*: Tools to create and maintain categories. Categories must be varied for different audiences that look at the same documents and data in different ways.
- *Integration technologies*: Tools to access disparate back-end data sources such as relational databases and ERP packages. In addition, tools that bring

in data feeds from the outside, such as news or stocks. Indexes structured and unstructured data from file systems, web servers and e-mail.

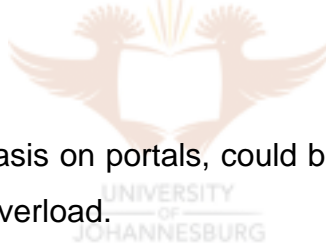
3.7 SUMMARY

The main purpose of the chapter was to address the following research sub-problem:

What are portals and how they are being used in the provision of digital information and services to end-users in corporate organisations?

In order to address the sub-problems, the chapter briefly examined:

- The question of information overload exacerbated by the use of ICT in organisations
- How ICT, with emphasis on portals, could be used to reduce and control the state of information overload.



In discussing the provision of access to web-based information and services using portals, the chapter looked at

- Historical development of portals
- Four broad types of portals (web portals, vertical portals, affinity portals and enterprise information portals), their major features, target audiences, and also provided examples
- Portal technologies and tools.

The discussion resulted in the identification of the following as the major features of good portals:

- Personalisation for end-users
- Organisation of the user's desktop
- Division of resources for different categories of users
- Tracking of individual's usage, interests and use behaviour
- Provision of access to multiple heterogeneous data resources
- Provision of facilities for locating information and people
- User authentication
- Taxonomy.

Furthermore, a general definition of a portal as *a web-based application accessed over the Internet, intranet or extranet, that provides a personalised and adaptive interface enabling users to discover, track, and interact with other people, applications, services and information relevant to their interests*, was formulated and adopted for the study. Based on this general definition, an information portal is, therefore, defined as a portal whose purpose is to provide access to web-based information sources and services to information end-users.

Taking the above definition of a portal into account, and the various portal applications discussed in this chapter, it may be said that agricultural research organisations can also adopt portal technology and implement information portals. The provision of web-based, value-added information services on information portals would have several advantages, among others that researchers would be able to personalise the portals to meet their individual information needs. Agricultural research organisations should, therefore, adopt and use the portal model when making provision for digital-based information services. After all, according to Pickering (2001):

"...there is nothing magical about portals, and neither is deciding where they are applicable. If you need to provide a single access point to disparate, voluminous information and the applications that process it, a portal is the answer" (Pickering 2001).

The next chapter looks at the use of websites in the provision of access to agricultural information resources and services. Emphasis is placed on identifying the international trends in the provision of agricultural information services via the Web by international agricultural organisations. This is done with a view of identifying the agricultural information resources, services and facilities that should be incorporated into an information portal that could be developed by agricultural research organisations.



CHAPTER 4

AGRICULTURAL INFORMATION WEBSITES

4.1 INTRODUCTION

As indicated in the previous chapter, business organisations are among the major users of portals in the world today. They are actively using portals to promote their products to potential clients; deliver digital services and information to their employees, clients, suppliers and partner organisations; conduct and manage business transactions (electronic commerce); and facilitate communications within corporate organisations and with external organisations and individuals. However, it should be noted that the use of portals in the provision of access to digital information and knowledge resources is not a monopoly for business organisations alone. Other organisations such as academic institutions, for example universities, colleges and schools; libraries, government ministries and departments, health institutions such as hospitals and clinics; professional societies and associations, and many more have also realised the benefits they could derive from the use of portals. They are implementing different types of portals and using them to provide information services and communicate with their staff, clients, citizens, students, and in some cases, the general public. Slowly, portals are becoming essential tools for information and knowledge management, especially in organisations where generation, management and distribution of information and knowledge are among the major activities. This should also be true for agricultural research organisations.

Agricultural research includes research on fish, trees, as well as crops and livestock and natural resources (ISNAR 2002), and the primary benefit from agricultural research is improved production (Johnson 2001). However, the major by-products of agriculture research are information and knowledge, and the premise of this research is that agricultural research organisations, in sub-Saharan Africa and the SADC region in particular, could benefit greatly from the use of modern information

communication technologies, such as information portals, in the management of the information and knowledge they generate.

For a clear picture of the situation regarding the use of websites in the provision of access to digital information resources by agricultural organisations in Africa and the SADC region, it was found necessary to compare the trends with what was happening around the world. Thus a survey of content on websites of international agricultural organisations was conducted. The objective of the survey was to address the following sub-problem:

What are the international trends in the provision of access to digital agricultural information via websites, and what may be learnt from the trends regarding the resources and services that could be provided via an agricultural information portal?

The results of the survey were to be compared with the trends in sub-Saharan Africa, with special emphasis on the SADC region.

The survey had the following limitations:

- Emphasis was placed on identifying the information resources, services and tools that are being provided on the websites of agricultural-based organisations rather than on whether the websites conform to the definition and incorporate the features of portals that are indicated in the previous chapter. It was assumed that even though they may not have the defined features of portals, they could provide useful insight regarding content, which could assist in establishing the requirements for the development of an agricultural information portal model for agricultural research organisations in the SADC region.

- It was noted that some organisations might also have internal websites accessed via their intranets or extranets. However, the survey did not extend to these websites because, generally, these sites are located behind firewalls and the researcher did not expect to have access to the sites
- The survey also did not try to establish the exact reasons why organisations developed their websites, or who the target audiences for the services provided on the sites were.

4.2 SURVEY OF AGRICULTURAL-BASED WEBSITES

In order to establish the global trends regarding the provision of digital information resources and services on agricultural-based websites, a survey was conducted of publicly accessible websites of international governmental organisations (IGOs) and international non-governmental organisations (NGOs) involved in agricultural research or agricultural information management. The choice of international organisations was based on the assumption that they have adequate funding, skilled human resources and ICT infrastructure to implement innovative use of the Internet and web technologies in their information and knowledge management activities. Therefore, it was expected that the findings of the survey of websites of international organisations could:

- Give reliable indications of the global trends in the provision of digital information resources and services on agricultural-based websites.
- Provide a basis for comparison of the trends in sub-Saharan Africa and the SADC region in particular.
- Be used later in the definition of some of the requirements for an agricultural information portal.

Websites of regional-based organisations in sub-Saharan Africa involved in agricultural research or related areas and organisations located in the SADC countries were also surveyed to establish the trends in Africa and the SADC region. Regional-based organisations included in the survey had membership from several countries in Africa, and overall they covered countries from North Africa, West and Central Africa, and East Africa.

4.2.1 Methodology

The survey involved the identification of websites of international organisations, regional organisations in sub-Saharan Africa and organisations located in the SADC region that are engaged in agricultural research and agricultural information management; and the examination, recording and codification of the information on each organisation's website. Recording of information on the websites was based on the following 11 variables identified by the researcher as being some of the major resources or services that could be provided via websites in agricultural research organisations:

- Electronic publications
- Online databases
- Tools
- Discussion forums
- Information retrieval facilities
- Data sets
- Online staff directories
- Links to useful resources
- News and events
- Journals
- Newsletters.

A matrix incorporating the above variables was designed and used in the codification of the information about the websites.

4.2.1.1 Electronic publications

Research organisations are among the major producers of various types of print-based information documents. These include technical research reports, monographs, posters, articles, and manuals. Providing or distributing these print-based documents to a wider community could sometimes be a nightmare. However, the advent and use of the Internet and web technologies has provided organisations with a cheaper and alternative means of publishing and distributing research documents - in digital formats. Via websites, documents can be made available in various digital formats, such as MS-Word, Portable Document Format (PDF), Hypertext Mark-up Language (HTML), Extensible Mark-up Language (XML). Generally, the documents are retrieved using the web browser or browser extensions and helper applications or plug-in applications - separate desktop programs invoked by a web browser to provide functionality that the browser itself does not provide. Examples of browser extensions and helper applications include Adobe Acrobat Reader for reading PDF files; and RealPlayer and QuickTime Player for movies and sound files.

4.2.1.2 Online databases

A large number of research-based organisations have libraries or documentation centres that have developed and maintained electronic bibliographic databases. In most cases, these databases are developed using different proprietary application software systems, and as a result end-users have had to learn how to use various database interfaces to search and retrieve records. By using the Internet and web technologies it is now possible to provide access to such databases using one single user interface system, the web browser. In addition, databases can easily be

accessed from different locations or field offices via the Internet, intranets and extranets.

4.2.1.3 Software tools

Researchers make use of various tools, for example software applications and models, to assist them in the processing and analysis of research data and results. In most cases, access to such tools is only possible if one is within the premises of the organisation and has access to the computer facilities where the tools are stored. Now it is possible to provide access to such resources via the organisation's website for use or downloading by staff within the organisation and those located in the field research offices. Documentation and instructions on how to use the resources, and in some cases online tutorials, can also be provided on the websites and can be accessed from any computer connected to the Internet.

4.2.1.4 Discussion forums



One of the major ways in which researchers share and disseminate their research results or outputs with their peers and interested individuals is by participating in forums such as conferences, seminars and workshops. Nowadays, this is also being done through electronic or virtual discussion forums and conferences accessed via the Web. Web-based discussion forums have an added advantage in that one does not need to travel to the location of the conference or seminar to participate in the discussions. In addition, all contributions can be archived in digital format and thus provide an easily accessible rich source of accumulated knowledge.

4.2.1.5 Information retrieval tools

As more and more digital information resources and services are provided via a website, the content on the site grows. This may lead to a situation where it

becomes difficult to locate information on the site. As a solution to this problem, organisations are using local search engines, sitemaps, and sometimes arranging information resources on the site according to a well-defined category of themes (taxonomy), to assist end-users in information discovery on the websites.

4.2.1.6 Data sets

The use of ICT in research has resulted in a rapid increase in the generation and storage of experimental data. As a result, large data sets are being stored on researchers' personal computers and those of the organisations. This data may have considerable value beyond the life of a particular research project, especially if the data is available to be re-worked by others and/or when technological changes open up new opportunities (Scott 2001). Re-using data sets prevents the duplication of expensive data collection activities. There are also other reasons for and benefits to sharing research data. For example, in its draft statement on sharing research data, the National Health Institute (2002) indicated that sharing research data:

- Reinforces open scientific inquiry
- Encourages diversity of analysis and opinion
- Promotes new research
- Makes possible the testing of new or alternative hypotheses and methods of analysis
- Supports studies on data collection methods and measurement
- Facilitates the education of new researchers
- Enables the exploration of topics not envisioned by the initial investigators
- Permits the creation of new data sets when data from multiple sources are combined.

Taking the above benefits associated with the sharing of research data into account, it is clear that it is very important to provide an easier way of accessing

data sets. In some way, this could easily be achieved by using the Internet and web-based technologies such as portals and web browsers.

4.2.1.7 Online staff directories

Internal staff directories are an important source of contact information. In some cases, visitors to an organisation's website do so to obtain contact information on the organisation or specific individuals in the organisation. In the early days of websites, staff contact information was provided in form of "static" webpages of staff lists indicating names, contact telephone numbers and e-mail addresses. The trend now is to provide access to an online, searchable staff directory. This arrangement makes it easier to retrieve and locate contact information on individuals within the organisation.

4.2.1.8 News and events

Traditionally, organisations updated their employees, clients and partners about happenings in the organisation through the use of notice boards or bulletin boards, internal memorandums and newsletters or bulletins. Organisations are now using the Web as a means of communicating information relating to news and events to their staff, clients and partners. Information relating to various events, such as meetings, conferences, workshops, visitors to the organisation, new research findings are now being posted on the organisation's website.

4.2.1.9 Electronic journals and newsletters

Among the most established means of communicating research findings is the use of scholarly journals and, in some cases, newsletters. Researchers publish and announce their research findings in scholarly journals and newsletters. In addition, some research organisations also publish in-house journals and newsletters. Making these journals and newsletters accessible in digital format via the Web

ensures their widest distribution, especially among those who have access to electronic networks. Distributing journals and newsletters via the Web is also cost effective, and ensures that research results and other relevant information reach the target audience in the shortest possible time.

4.2.1.10 Links to other useful websites

There are a vast number of information resources on the Web that can be accessed at no cost. Organisations are taking advantage of this situation by providing links on their websites to information resources they have found useful on websites of other organisations. This arrangement avoids duplication of resources, promotes sharing of information resources and assists employees and visitors to the organisation's websites in locating useful and quality information resources on external websites.

4.2.2 Sampling frame



Among the activities conducted during the design of the survey was to find or construct a listing of agricultural-based organisations that have a presence on the World Wide Web to serve as a sampling frame. After searching the Internet for potential sampling frames, the following two online international databases were examined in much more detail as their contents were seen to be relevant to the survey:

- Agricultural Research on the Web (AROW) - <http://www.isnar.cgiar.org/arow>
- Yahoo! Directory on agriculture - <http://dir.yahoo.com>

4.2.2.1 AROW

The Agricultural Research on the Web (AROW) is a worldwide directory of organisations and universities working in agricultural research that have a presence

on the Web. The International Services for Agricultural Research (ISNAR)² developed AROW. Founded in 1979 and headquartered in The Hague, the Netherlands, ISNAR's mission is to help bring about innovation in agricultural research institutions to increase their contribution to agricultural development for the poor (ISNAR 2001). ISNAR maintains the AROW directory in association with the web-based Information System for Agricultural Research for Development (WISARD) - <http://www.wisard.org> - of the International Agriculture Centre (IAC) of the Wageningen University and Research Centre, also based in the Netherlands.

The AROW directory allows for searching and browsing of records. Searching can be done on web addresses, organisation title, acronym, and country. Browsing of records is by region, regional organisations, international organisations, and individual countries. At the time of the survey (November - December 2002), AROW listed several websites of national agricultural organisations from around 132 countries in Africa, Asia, Europe, Middle East, Oceania, Latin America, the Caribbean and North America. The directory also included 29 websites of international organisations and 43 websites of regional agricultural organisations. The distribution of regional organisations' websites was as follows: 12 sites from Africa, 11 from Asia, six from the Caribbean, four from Europe, nine from Latin America and one from the Middle East.

4.2.2.2 Yahoo! Agricultural directory

Yahoo is the Web's oldest online directory. It was launched in 1994 by David Filo and Jerry Yang, Ph.D. students at Stanford University, and was the first online navigational guide to the World Wide Web resources (Yahoo 2001). Human editors organise website entries in the Yahoo! Directory into categories, making it easier to narrow and refine search queries (Search Engine Watch 2002).

² ISNAR closed its operations in The Hague on 31 March 2004, and a new ISNAR programme was relocated to Addis Ababa, Ethiopia, under the governance of the International Food Policy Research Institute (IFPRI). AROW and other ISNAR websites are archived at <http://www.isnar.cgiar.org/index1.htm>.

At the time of the survey, the Yahoo! Directory listed 2257 categories of websites under agriculture. These included 69 agricultural research centres in the following fields of agriculture:

- Agricultural Economics
- Agricultural Policy
- Agro-ecology
- Agronomy
- Animal Science
- Biotechnology
- Dairy Science
- Forestry
- Horticulture
- Irrigation
- Organic Farming
- Pest Management
- Precision Agriculture
- Sustainable Agriculture.



The 69 websites of agricultural research centres listed in the directory were all examined to identify sites of international agricultural organisations, and those based in Africa and the SADC region in particular, that could be included in the survey. The following observations regarding the contents of the Yahoo directory were made:

- Sixteen websites under the Consultative Group on International Agricultural Research (CGIR) featured prominently among the websites of the international agricultural research organisations listed in the Yahoo directory. These sites were also listed in AROW.

- A large number of the websites listed in the Directory belonged to national universities and institutions in the United States of America.
- Almost all of the websites of international agricultural research organisations listed in the Directory were also included in the AROW directory.
- Out of 11 SADC countries included in the survey, only South Africa and Zambia had one entry each among the 69 websites of research centres listed in the Yahoo directory.

Taking the above observations into consideration, AROW, although not quite comprehensive, was found to be a more suitable sampling frame for the survey than Yahoo. In addition, AROW's categorisation of websites, among others, under international organisations, regional organisations and countries, made it easier to identify websites for possible inclusion in the survey. The AROW directory was, therefore, adopted as the sampling frame from which websites to be included in the survey were to be selected.



4.2.3 Sample populations

4.2.3.1 International agricultural organisations

The 29 websites of international agricultural organisations listed in the AROW directory at the time of the survey (Appendix 3) were all considered for inclusion in the survey. The internet links or Uniform Resource Locators (URLs) of all the sites were checked. URLs of the International Centre for Research in Agroforestry (ICRAF), which had changed its name to the World Agroforestry Centre, and the Centre for Living Aquatic Resources Management (ICLARM), which had also changed its name to the World Fish Centre, were broken. At that time, the change in names, which had also resulted in the change of domain names, had not been

updated in the AROW directory, and this was the major reason for the broken links. Correct URLs were obtained after a search in the Yahoo! Directory.

The website for Future Harvest was dropped from the list, leaving 28 sites for the survey. The 16 research centres under the CGIAR group created Future Harvest in 1998 as a charitable and educational organisation to advance debate and catalyse action for a world with less poverty, a healthier human family, and a better environment (Future Harvest 1999). The organisation strives to:

- Promote awareness and educate the general public and decision makers on the importance of food production and the role of agricultural science in meeting the human and environmental challenges of today and tomorrow.
- Build financial support for scientific research and charitable projects that bring the results of this research to rural communities, farmers, and their families in developing countries (Future Harvest 1999).

The decision to drop Future Harvest was based on the nature of its work and the fact that the websites of the 16 centres that created and support it were all to be included in the survey.

4.2.3.2 Regional agricultural organisations in Africa

As indicated above, AROW listed 12 regional agricultural organisations from Africa and others from outside Africa, but whose activities target Africa. After a preliminary check of the 12 websites, the sites of the following four organisations were excluded from the list for the reasons indicated below:

- Arab Organisation for Agricultural Development (AOAD) - the website was only available in the Arabic language. The researcher cannot read Arabic.

- Banana Research Network for Eastern and Southern Africa (BARNESA) and Musa pour l'Afrique centrale et occidentale (MUSACO) - the two websites form part of the website of the International Network for the Improvement of Banana and Plantain (INIBAP). The site was to be covered under the websites of international organisations.
- Southern African Centre for Co-operation in Agricultural and Natural Resources Research and Training (SACCAR) - the website consisted of one page with a logo, and no other information.

After excluding the above websites, the sites of the following remaining eight regional organisations were included in the survey:

- Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)
URL: <http://www.asareca.org/>
- Association of Agricultural Research Institutions in the Near East and North Africa (AARINENA)
URL: <http://www.aarinena.org/>
- Conférence de Responsables de Recherche Agronomique Africains (CORAF)
URL: <http://www.coraf.org/>
- Department for International Development (DFID) East Africa, Natural Resources Research and Development Co-ordination Office (NIDA)
URL: <http://www.nida.or.ug/index.htm>
- Institut du Sahel (INSAH)
URL: http://www.insah.org/start_insah.htm

- Special Program for African Agricultural Research (SPAAR)
URL: <http://www.worldbank.org/afr/aftsr/>
- The International Trypanotolerance Centre (ITC)
URL: <http://www.itc.gm/>
- Comité permanent Inter Etats de Lutte Contre la Sécheresse dans le Sahel (CILSS)
URL: <http://www.cilssnet.org/>

It should be noted that SPAAR, established in 1985 by a group of donors under the leadership of the World Bank, has ceased to exist. It has been replaced by the Forum for Agricultural Research in Africa (FARA) whose website was not available at the time of the survey.



4.2.3.3 Agricultural organisations in the SADC region

Although, at the time of the study, the Southern African Development Community (SADC) had 14 member states, for practical reasons only countries that have English as the official language or as one of the official languages were included in the survey. Therefore, Portuguese speaking Angola and Mozambique, and the French speaking Democratic Republic of Congo, were excluded from the survey.

The AROW directory categorised website entries for each country under *research institutions* (agricultural or related institutions involved in agricultural research), *universities* (institutes, faculties of agriculture or related areas, i.e. fisheries, forestry) and *others* (ministries of agriculture or related areas, i.e. fisheries, land, forestry). It was noted that in some cases AROW listed websites of affiliated institutions or departments/divisions under the parent organisation, even though these could be found under the same domain name and in most cases on the same web server. In all such cases only the website of the parent organisation or the

primary domain was counted for the purpose of this survey. Altogether, 58 entries of websites from the SADC member states were found in the AROW directory and these were distributed as follows:

Table 1: Distribution of websites

SADC member state	Total number of entries in AROW
Botswana	5
Lesotho	1
Malawi	2
Mauritius	10
Namibia	4
Seychelles	0
South Africa	22
Swaziland	0
Tanzania	8
Zambia	2
Zimbabwe	4

As the major interest of this research was the provision of digital-based information services to end-users involved in agricultural research, the researcher decided to include the following categories of websites from the SADC region in the survey:

- All websites under the *research institutions* category.
- Websites of research departments, institutes or divisions attached to ministries of agriculture and other related ministries (listed under the *others* category).
- Websites of universities that have schools or faculties of agriculture with a visible information service on the site targeting academic and research staff members of the school or faculty.

- Websites of colleges or institutes or universities of agriculture or related fields.

The 58 websites from the SADC region were all examined in order to select sites that qualified for the survey. Several websites were excluded from the survey for the following reasons:

- At the time of the survey, some websites in the AROW directory had broken links and could not be located by any other means, i.e. searching in the Yahoo! Directory, or other internet search engines, and through personal inquiries. This was the case with regard to the Tanzania Forestry Research Organisation (TAFORI), Malawi College of Forestry and Wildlife, Zambia Forestry College (ZFC), Ogongo Agricultural College in Namibia, and Bunda College of Agriculture in Malawi. In addition, the server for the Sokoine University of Agriculture in Tanzania appeared to be down during the entire period of the survey, and thus the site was excluded from the survey.
- Websites of some ministries of agriculture did not provide information or links to any affiliated agricultural research institutes or stations or centres. It was decided not to include them in the survey.
- Most websites of universities and related training institutions fell into what is called *brochureware*. That is, they consisted primarily of content originally designed for the university brochure and not adapted to the Web. They provided, for example, information about the curriculum of the faculties or departments of agriculture, and the contact details of the academic staff.

- The website of the Mlezu College of Agricultural (<http://zimlink.com/mlezu/>) in Zimbabwe was under construction and had only one page with the college's name to warrant inclusion on the survey.
- Several websites were found to be a little bit off the agricultural research track as defined in this survey. Examples include the Mauritius Institute of Education, University of Botswana - Faculty of Science, and Ministry of Minerals, Energy and Water Affairs of Botswana.

After excluding several websites for the reasons given above, the number of sites eligible for inclusion in the survey was reduced from 58 to 21 (Appendix 4). These sites were distributed as follows:

Botswana		2
Mauritius		5
Namibia		1
South Africa		8
Tanzania		3
Zambia		1
Zimbabwe		1

4.3 FINDINGS OF THE SURVEY

Table 2 below gives a summary of the presence or absence of the variables on the websites that were included in the survey.

Table 2: Summary results of websites survey

Variables	International Organisations		Regional Organisations		SADC Organisations	
	Present	Absent	Present	Absent	Present	Absent
Electronic publications	27 (96%)	1 (4%)	6 (75%)	2 (25%)	11 (52%)	10 (48%)
Online databases	25 (89%)	3 (11%)	3 (37.5%)	5 (62.5%)	7 (33%)	14 (67%)
Tools	9 (32%)	19 (68%)	0 (0%)	8 (100%)	1 (5%)	20 (95%)
Discussion forums	7 (25%)	21 (75%)	0 (0%)	8 (100%)	0 (0%)	21 (100%)
Info. retrieval facilities	28 (100%)	0 (0%)	3 (37.5%)	5 (62.5%)	11 (52%)	10 (48%)
Data sets	3 (11%)	25 (89%)	0 (0%)	8 (100%)	0 (0%)	21 (100%)
Online staff directory	7 (25%)	21 (75%)	0 (0%)	8 (100%)	2 (10%)	19 (90%)
Links to resources	28 (100%)	0 (0%)	7 (87.5%)	1 (12.5%)	14 (67%)	7 (33%)
News	28 (100%)	0 (0%)	4 (50%)	4 (50%)	8 (38%)	13 (62%)
Events	21 (75%)	7 (25%)	5 (62.5%)	3 (37.5%)	2 (10%)	19 (90%)
Journals	1 (4%)	27 (96%)	0 (0%)	8 (100%)	1 (5%)	20 (95%)
Newsletters	28 (100%)	0 (0%)	5 (62.5%)	3 (37.5)	4 (20%)	17 (80%)

4.3.1 Electronic publications

The use of the Internet and World Wide Web technologies is allowing organisations to provide their employees, clients and partners with access to full text documents in digital format via their websites. In the survey, 27 (96%) of the websites of international organisations provided access to a variety of full-text documents in digital formats, mainly in portable document format (PDF) and HTML formats. Examples of documents provided include:

- Annual reports by almost all the 27 organisations .
- Training modules, for example on scientific writing and presentation, research program formulation, strategic planning, by ISNAR

- Manuals and guides like the *Fertiliser Manual* and a *Guide to Fertiliser Products* by the International Fertiliser Development Centre (IFDC)
- Conference papers or proceedings by the International Food Policy Research Institute (IFPRI) and International Institute of Fisheries Economics and Trade (IIFET)
- Technical papers, articles and monographs by the Centre for International Forestry Research, ISNAR and INIBAP.

In addition to full-text digital documents, the websites of some organisations such as the CGIAR, International Centre for Tropical Agriculture (CIAT), International Crops Research Institute for Semi-arid Tropics (ICRISAT), and International Fund for Agricultural Development (IFAD), also provided access to photo albums or image galleries, and in some cases, video clips.

Regarding sub-Saharan Africa, the survey revealed that some regional-based organisations are also taking advantage of the Internet and the Web and are providing access to full-text documents in both PDF and html formats on their websites. Out of the eight websites surveyed, six (75%) provided access to full-text documents. These included:

- Annual reports by SPAAR
- Some copies of agricultural policies of member states by NIDA
- Strategic plans by ASARECA and CORAF
- Workshop reports by ASARECA
- Minutes of the organisation's meetings by AARINENA
- Annual statistical bulletins by CILSS.

It was generally observed that in most cases the number and variety of documents provided on websites was very limited. Some of the regional agricultural

organisations are involved in research activities and projects that are generating a lot of information and knowledge documents such as technical research reports, fact sheets, and how-to-do manuals. However, these types of documents were conspicuously missing on the websites.

Regarding SADC-based websites, 11 (52%) provided access to full-text documents, notably the following:

- Annual reports by the Food and Agriculture Research Council (FARC) of Mauritius.
- Strategic plans in MS-Word format by the Agricultural Research Council (ARC) of South Africa.
- Statistical information for food crops by the Agricultural Research and Extension Unit (AREU) of Mauritius.
- Articles and books on sugar by the Mauritius Chamber of Agriculture (MChA).
- Minutes of the Management Committee of the Faculty of Agriculture at the University of the Free State.

As in the case of regional organisations, it was also noticeable that the variety and number of full-text documents being provided on the sites were very limited. Agricultural research organisations in sub-Saharan Africa and the SADC region in particular should provide access to as much locally produced information content as possible via the Web as this is one of the ways that will draw attention to their contribution to agricultural research and development. Organisations should provide access to articles, technical guides, posters, models, and other relevant materials produced by the organisation and the researchers. By doing so, they will be

contributing to the development of useful content from sub-Saharan Africa on the information superhighway.

4.3.2 Online databases

The advent of the Internet, intranets and extranets has made it possible for organisations to provide access to electronic databases by using different proprietary software systems via a single user access interface, the web browser. In the survey, 25 (89%) international agricultural organisations provided access to various types of online databases on their websites. These include the following:

- Online Public Access Catalogues (OPACs) by the Centre for International Forestry Research (CIFOR); World Fish Centre, International Maize and Wheat Improvement Centre (CIMMYT), International Livestock Research Institute (ILRI);, and the International Water Management Institute (IWMI).
- Specialised databases like POLEX databases (Forest Policy Experts) by CIFOR; Agroforestry and Botanical Nomenclature databases by the World Agroforestry Centre (ICRAF); Plant Genetic Resource Database by the International Centre for Tropical Agriculture (CIAT); Rural Poverty Knowledge Base by IFAD; Rice Knowledge Bank by International Rice Research Institute (IRRI); and Experts Databases by IWMI.
- Databases of publications and catalogues by the International Institute of Tropical Agriculture (IITA), CIAT, INIBAP, ILRI and ICRAF.

Regarding regional organisations in Africa, provision of access to online databases was available on three (37.5%) of the websites surveyed. Databases provided were mainly directories and they included the directory of national agricultural research systems (NARS) by ASARECA, the directory of agricultural research institutions by AARINENA, and the directory of African agricultural research by SPAAR.

In the SADC region, out of the 21 organisations surveyed only seven (33%) provided access to databases via their websites. These included three universities - University of Natal (now the University of KwaZulu-Natal), Pietermaritzburg campus, University of the Free State, and the University of Zimbabwe - that provided web access to the OPACs of their libraries. The University of Zambia provided telnet access to its OPAC. Other databases accessed via the Web were:

- SADC Agribase - a database covering agriculture and related subjects, mainly relating to the Southern African region by the University of the Free State Library.
- A searchable glossary of terms of the Agricultural Geo-referenced Information system (AGIS). AGIS is a collaborative project between the South African National Department of Agriculture, Provincial Departments of Agriculture, and the Agricultural Research Council (ARC).
- GADI Projects - a database for current completed and/or archived projects by the Grootfontein Agricultural Development Institute (GADI).
- CSIR Publication Lists - a database of references of peer-reviewed journal articles published by South Africa's Council of Scientific and Industrial Research (CSIR) scientists from 1997.

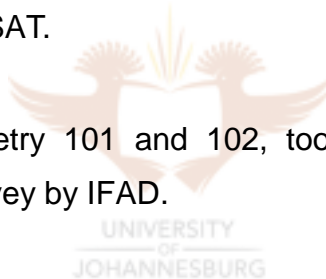
Taking into account the fact that most agricultural research organisations have libraries and documentation centres, some of which have developed various bibliographic databases, the number of institutions providing access to databases via the Web in the SADC region was far too low. Bibliographic databases serve as guides or pointers to the availability and location of information resources, and therefore access to such useful resources should be made available via the Web. In addition, databases that provide access to information on agricultural research

experts or scientists, research results, projects, and publications, should also be made accessible via the Web.

4.3.3 Software tools

Provision of access to various useful tools, models and software via the Web makes distribution very easy and ensures that the tools are accessed whenever they are needed. Out of 28 international websites surveyed, only 9 (32%) provided access to tools that could be downloaded from their websites. Examples included:


- CIFOR criteria and indicators template for sustainable forest management.
- ICRILEX: English to French Lexicon for translating agricultural resource terminology by ICRISAT.
- Practical anthropometry 101 and 102, tools and resources for nutritional assessment and survey by IFAD.
- DIVA-GIS, free GIS software by the International Potato Centre (CIP).
- PODIUM - the Policy Dialogue Model software that runs on a personal computer developed by IWMI. PODIUM maps the complex relationships between the numerous factors that affect water and food security, and displays information clearly, in both graphic and tabular formats.
- WinDisp, software package for the display and analysis of satellite images, maps and associated databases, with emphasis on early warning for food security, by the Food and Agricultural Organization (FAO).
- IRRISTAT, a computer program for data management and basic statistical analysis of experimental data; and WinBoot, designed to analyse DNA



fingerprints (restriction fragment length polymorphism [RFLP] banding patterns) of rice pathogens, both developed by IRRI.

- Identify and Classify Local Indicators of Soil Quality, a methodological tool developed by CIAT for use in Latin America and Africa to identify and classify local indicators of soil quality related to permanent and modifiable soil properties.
- INFORM-R - a management information system (MIS) developed by ISNAR.

In sharp contrast, none of the regional organisations provided access to tools and only one (5%) SADC-based organisation provided access to a couple of tools for downloading on its website. The tools were available on the website of the Grootfontein Agricultural Development Institute (GADI), and these were:

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- SM2000 - a Microsoft Excel-based simulation model for the calculation of profitability of different small stock enterprises at the gross margin level.
 - VIAPRO SG - a Microsoft Excel spreadsheet developed for viability projections of either sheep or goat farming enterprises from extensive agricultural grazing land. The projection is done for a 20-year period.

The absence of appropriate tools and software for downloading on the websites of regional and SADC-based agricultural organisations could be due to a number of reasons. Perhaps the organisations have not yet developed any tools that could be shared via the Web. It is also possible that they could have the tools, but there is not enough demand from the researchers for access to the tools via the Web.

4.3.4 Discussion forums

In spite of the opportunities presented by web-based discussion forums in sharing information and knowledge, the survey revealed that only a small number of international agricultural organisations have taken advantage of the facilities. Out of the 28 websites surveyed, only seven (25%) provided such facilities and these are sites of the FAO, CIFOR, the Global Forum on Agricultural Research (GFAR), International Society of Sugar Cane Technologists (ISSCT), International Soil Reference and Information Centre (ISRIC), and the International Food Policy Research Institute (IFPRI).

As for sub-Saharan Africa and SADC-based organisations, none of them provided access to web-based discussion forums. This is a regrettable situation taking into account the fact that all the regional-based organisations have their members located in different countries and the use of discussion forums could be a suitable way of involving members in their activities. Unlike electronic mail-based discussion forums, web-based discussion forums have the added advantage of providing access to the archives of the various contributions to the discussions.

4.3.5 Information retrieval tools

Information discovery on websites should be easier for end-users to enable them locate the various resources and services available on the site. This fact seems to have been noted by international agricultural organisations. The 28 (100%) websites of international organisations all provided some form of search facility or resource discovery tools on their websites, i.e. sitemaps, local search engines or categorisation of information resources for easy browsing. In sharp contrast, only three (27.5%) websites of regional organisations in Africa had implemented search facilities and 11 (52%) of the SADC websites provided such facilities.

One major reason why a good number of websites from sub-Saharan Africa and the SADC region are without search facilities could be that most of the sites are very small. The sites are made up of very few documents and resources for search facilities to make a difference.

4.3.6 Data sets

Only three (11%) of the websites of international organisations provided access to data sets, while none from the African region or the SADC-based organisations did so. This could be due to several reasons. Perhaps the organisations are not involved in activities that require sharing of data and/or they are not just willing to share data via the Web.

Agricultural research organisations in Africa should share research data. Sharing of research data will avoid duplication and unnecessary spending of funds on collecting data, which is already available for analysis. It will also allow researchers in the region to speed up the translation of research results into knowledge and procedures to improve agricultural production.

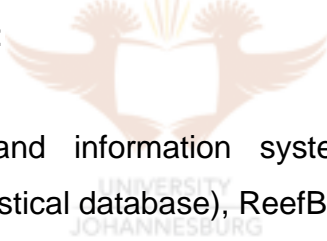
4.3.7 Online staff directories

The survey revealed that provision of access to "static" staff lists on websites is still continuing in most organisations. Around 13 (46%) of the international websites provided access to staff lists, seven (25%) provided searchable staff directories, and seven (29%) did not provide any staff information. As for the sub-Saharan Africa regional websites, only one (12.5%) provided a static list. The remaining seven (87.5%) did not do so. In the case of the SADC region, 10 (52%) provided "static" staff lists, two (10%) searchable directories and eight (38%) did not provide any information.

The low number of organisations providing searchable staff directories in the three cases may be attributed to the fact that most of them do not have large staff compliments to warrant a searchable directory. This could also explain why a large number of organisations provide access to static staff lists. It should also be noted that some organisations may have in place a policy not to provide staff contact information on their websites. In such cases, a general inquiry contact e-mail address is provided.

4.3.8 Links to useful external resources

The survey revealed that international organisations are taking full advantage of the free access to various information resources provided by the Web Publishing Model. The 28 (100%) websites that were surveyed all provided links to information resources hosted by other organisations. In general, external links were made to the following types of resources:

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- Online databases and information systems like AGRICOLA, AGRIS, FAOSTAT (FAO statistical database), ReefBase and many others.
 - Online publications in full-text, i.e. electronic journals, magazines, newsletters, conference reports and proceedings.
 - Websites of other organisations involved in similar or related activities.

Regarding sub-Saharan Africa and the SADC region, seven (87.5%) and 14 (67%) respectively provided links to other information resources available on the Web. Regional organisations mainly provided links to electronic publications available on the websites of international agricultural organisations. For example:

- AARINEBA linked to publications by International Centre for Agricultural Research in the Dry Areas (ICARDA), FAO, CGIAR, GFAR and ISNAR.

- INSAH provided links to publications by ISNAR.
- CILSS linked to publications by FAO, FewNet and Club du Sahel.

The International Trypanotolerance Centre (ITC) provided links to websites of international organisations and governments that are funding the Centre's research and development work. These included links to the websites of the European Union, FAO, the Belgian Government, African Development Bank, and the International Development Research Centre (IDRC) of Canada. SPAAR also linked to agricultural research organisations that, although based elsewhere, conduct their activities largely in Africa; while ASARECA also linked to two separate websites of its associated programmes and networks - FoodNet and the Eastern and Central Africa Programme for Agricultural Policy Analysis (ECAPAPA). The two sites provided access to several types of full-text documents and information including FoodNet annual reports, mid-term reports, and Uganda market prices information.

CORAF was the only organisation that did not provide links to other resources on the Web. However, it should be noted that its *Autres Sites* page, where the resources were to be listed, was under construction at the time of the survey.

The 14 SADC-based organisations provided links to different types of information resources. These included links to selected agricultural-based subject gateways on the sites. For example, the University of Zambia linked to *AGRIGATE* - an agricultural information gateway for Australian researchers - and the University of Natal linked to *Agri INFO* - a collection of technical publications related to beef, dairy and maple production. It was observed that the University of Natal provided links to several electronic journals and databases, including electronic journals such as *Acta Horticulture*, *Agricultural Economics*, *Agricultural and Water Management* and database services such as EBSCOHost and SwetWise. Access is available mainly to staff and registered university students through the University's intranet.

4.3.9 News

The 28 (100%) websites of international organisations all provided news or news facilities. These took different formats and titles like media coverage and media releases by CIFOR; online newsroom and newsroom by ICRAF and CIAT respectively; press releases by ICARDA, CIP and ICRISAT; and notice board by the International Union of Forestry Research Organisations (IUFRO).

Four (50%) regional organisations from Africa provided news items on their websites. The news included updates on various activities by CILSS; announcements of changes in management staff by ITC; highlights of activities and announcements of new appointments by AARINENA; and coverage on the launching of the Foundation for Sustainable Development of the Sahel by INSAH.

Among the SADC organisations, only 8 (38%) provided a link to news items on their websites. In most cases, these were in the form of *press releases* or *what is new?* There were cases in which the only news items provided on the site were outdated. For example, during the survey the news items available on the website of the Department of Agricultural Research in Botswana were for 1999. This raises questions about the frequency of updates of information on some of the websites that were surveyed in the SADC region.

4.3.10 Events

As in the case of news, the 28 (100%) international organisations were all found to be using the Web to announce various events to visitors to their sites. For example, some of the major events covered on the sites included workshops by ICRAF, meetings by CGIAR and IFAD and conferences by CIMMYT, EFRN, and IIAT.

Regarding Africa region and SADC-based organisations, the situation was different. Only four (50%) of the regional organisations provided information on events on their websites, while only two (10%) of the SADC organisations provided

information about events on their websites. Regional organisations largely provided announcements about workshops and conferences, for example, ASARECA, AARINENA and CORAF. In addition, AARINENA also linked to the event pages of the web sites of the FAO, CGIAR, ICARDA, ISNAR and GFAR. In the SADC region, under events, the Mauritius Sugar Industry Research Institute carried announcements for various activities including open days, workshops and seminars. The "Forthcoming events" page for the University of Natal - School of Agricultural Sciences and Agribusiness contained no items at the time of the survey.

4.3.11 Journals and newsletters

Only one (4%) out of the 28 international organisations provided access to several titles (full-text copies) of its journals, and this was the FAO. The journals available on the FAO website include:

- *AGRIPPA*, a peer-reviewed electronic journal for the electronic publishing of agricultural literature - reviews, scientific papers, short communications and extension materials.
- *Food, Nutrition and Agriculture* - covering topics such as community nutrition, food quality and safety, nutrition assessment, nutrient requirements, food security and rural development.
- *Unasyva* - an international journal of forestry and forest industries, produced quarterly in separate English, French and Spanish editions.

With regard to providing access to newsletters, 25 (89%) international organisations made their newsletters available on their websites, mostly as PDF files. Among the newsletters provided are *Aquaculture Newsletter* and *FIVIMS Newsletter* by FAO; *CIFOR Newsletter*, *CABI-E-News*; *CIAT Newsbulletin*, *Rice Today* by IRRI, *PGR*

Newsletter by IPGRI, *IFET Newsletter*, *Seed Info Newsletter* by ICARDA; and *ROCARIZ Newsletter* by WARDA.

Although none of the regional agricultural organisations in Africa provided access to journals, there were at least some that are making their newsletters available on the Web. This was the case in five (72.5%) of the organisations surveyed. Newsletter titles provided included *AgriForum* by ASARECA, *AARINENA Newsletter*, *CORAF Action*, *Flash CILSS* and *AGRHYMET Info* by CILSS, and *LINKS* by NIDA.

Regarding SADC organisations, only one (5%) provided access to its journal. This was GADI, which provided access to the *Grootfontein Agric Journal*. Access to newsletters was provided by four (20%) organisations and the titles provided included *Bio-e-News* by the CSIR; *PRAIS Outreach* by the Library and Information Services of the University of Orange Free State; *ICFR News*; and *GADI News*.

The negligible number of organisations that provide access to full-text copies of journals may be attributed to the fact that, generally, journals require payment of subscription and can, therefore, not be provided freely on the websites. However, in the case of newsletters, these are generally distributed at no cost. No wonder, then, that a large number of the international organisations (89%) and regional organisations (62.5%) that were surveyed are taking advantage of the Web for distributing their newsletters. Regarding the SADC region, the reason for the low number of organisations that provide access to newsletters may be that very few of them actually publish newsletters.

4.4 DISCUSSION OF THE TRENDS

The survey revealed a number of trends regarding the provision of access to digital information services and resources on agricultural-based websites. The major findings are discussed below.

4.4.1 International organisations

The survey showed that international agricultural organisations are way ahead of agricultural research organisations in sub-Saharan Africa, and the SADC region in particular, in the use of internet websites in providing access to information and the knowledge resources that they are generating in digital format. Provision of access to different types of digital documents, among them corporate documents, technical documents and newsletters, and updating visitors to the website with news and information regarding planned events and activities, is widespread among international agricultural organisations. The amount of information resources provided on most websites is huge and organisations are implementing various types of information discovery tools, such as search engines, site maps and taxonomies on their sites to make it easy for end-users to retrieve information on the site. International organisations are taking advantage of the availability of other information resources on the Web and are making systematic links to resources held on other servers. These include links to external databases, technical documents, corporate documents, electronic newsletters, posters, tools and many more.

Important as they may be, provision of access to useful tools (32%), online staff directories (25%), discussion forums (25%), data sets (11%) and journals (1%) seem not to be popular among international organisations. The reasons for this situation are wide and varied, and may include the following:

- Developing and maintaining software-based tools and models require resources such as staff, time and funding. In addition, this may not be a priority for many of the organisations. Some organisations may have developed the tools, but these are meant for internal use only and thus could be accessible via the intranet site but not on the publicly accessible website.

- Managing discussion forums sometimes requires time and staff in order to sustain the discussions. These also work well with organisations that are basically forums of other organisations, for example GFAR.
- Data sets are expensive to collect and build and as a result organisations may not be willing to share their data sets.
- The size of the staff of some organisations is too small to warrant an online staff directory. In some cases, organisations could have implemented policies that prohibit publishing staff information on the Web.
- Many journals require subscription and are, therefore, generally not distributed freely via the Web. This is opposed to newsletters, which are distributed to target audiences largely free of charge.

4.4.2 Regional organisations in Africa

Although regional-based agricultural organisations in sub-Saharan Africa (including those outside the continent but targeting Africa) are providing access to some digital information resources and services via their websites, in general the level and sophistication of the services is way below the standard set by international organisations. The survey revealed that the trend in most cases is to provide access to corporate type of documents, such as annual reports, strategic plans and minutes of meetings, than research reports and other types of documents. Admittedly, since most of the organisations are regional networks or forums and have members in various countries, provision of access to corporate documents to their members via the Web is a very good thing. However, these organisations should also use the Web to distribute documents such as technical reports, manuals and other types of documents being developed following their research activities.

The survey also revealed that regional organisations are making efforts to provide access to copies of their newsletters, although in some cases only old back issues,

instead of the latest issues, were available on their websites. The newsletters are either no longer published or the websites not regularly updated. This was also the case with the provision of news and events information. Some organisations had very old information or news on their sites, basically because they do not update their news pages on a regular basis. Too little news information was provided on the sites and this makes one wonder whether there is nothing worth reporting on in the organisations.

Unfortunately, none of the organisations provided access to tools, discussion forums, data sets and journals. While all the above are important, the absence of discussion forum facilities on the websites is a major concern. As almost all-regional organisations have members located in different countries, discussion forum facilities could facilitate the sharing of information and knowledge among members.

4.4.3 SADC organisations



Compared to the trends set up by international organisations, the survey revealed that agricultural organisations in the SADC region are also lag behind in the provision of access to digital information resources and services. For example, while almost all international organisations provided access to key information sources and facilities, such as full-text documents, access to electronic databases, links to external information resources, and access to newsletters, on average only 43% of the SADC organisations surveyed provided access to these facilities. There is a general need to improve the situation and encourage research organisations in the SADC region to adopt the use of the Internet and web technologies in the provision of wider access to their information and knowledge products. This will integrate the information and knowledge they are generating into the global information infrastructure.

4.5 SUMMARY

This chapter discussed the results of the survey of publicly accessible web sites of selected international agricultural organisations, regional agricultural organisations based in sub-Saharan Africa, and those that target Africa, and agricultural organisations from the SADC regions involved in agricultural research and agricultural information management. The survey was conducted to establish the global trends regarding the provision of digital information resources and services on websites of agricultural-based organisations, and to compare them with the trends in Africa, with special emphasis on countries in the SADC region. The survey concentrated on establishing information resources and services that could be incorporated into information portals that could be developed by agricultural research organisations.

The findings of the survey revealed that international agricultural organisations use the Internet and web-based tools to provide access to several types of information services and resources in digital formats. They use their websites to provide access to online databases, electronic publications, tools and software, discussion forums, information retrieval tools, data sets, online staff directories and links to various web resources. Unfortunately, the situation is not quite the same with regard to regional organisations in Africa and the SADC region.. Although efforts are being made, organisations in Africa and the SADC region are generally behind in implementing innovative use of the Web.

Based on the findings of the survey, it may be concluded that agricultural research organisations in sub-Saharan Africa and the SADC region in particular, need to be guided in the development and provision of digital information services using the Internet and web technologies. There is need to develop and provide models or systematic guidelines that could be used in the development of advanced websites or information portals by these organisations. However, it also important to establish whether it is necessary to provide agricultural information services and resources

via information portals in agricultural research organisations in the SADC region. The next chapter discusses the design of the survey and data collection on the necessity of providing information services via portals for agricultural research organisations in the SADC region.



CHAPTER 5

NEED FOR AGRICULTURAL RESEARCH INFORMATION VIA PORTALS: SURVEY DESIGN AND DATA COLLECTION

5.1 INTRODUCTION

The previous chapter discussed results of the study of the trends in the provision of information services via the Web by international agricultural research organisations, regional agricultural research organisations based or operating in Africa, and organisations based in the Southern African Development Community (SADC) sub-region. The results of the study indicated that international organisations were way ahead in the provision of access to web-based agricultural information resources and services. It was concluded that there was need to improve on the use of websites in the provision of access to agricultural research information services and resources in agricultural research organisations in sub-Saharan Africa in general, and the SADC region in particular. There is no doubt that the use of modern information and communication technologies (ICTs), especially information portals, could go a long way in enhancing the provision of targeted agricultural information services to researchers in the SADC region. However, the question is whether there is a real need for additional functionalities to be incorporated into websites that are being used to provide agricultural research information services to researchers in the SADC region.

The objective of this chapter is, therefore, to design a survey with the aim of establishing whether or not it is necessary to develop portals to provide access to information services and resources in agricultural research organisations in the SADC region to address the fourth research sub-problem, namely:

What is the state of the development of agricultural research websites, and is there a need for the use of portals, other than ordinary websites, in the provision of access to web-based, value-added information services and resources to researchers in agricultural research organisations in the SADC region?

The survey was conducted to obtain information from researchers, information professionals and information technology specialists on the existence, implicit or explicit, of the following factors, identified and discussed in Chapters 2 and 3, that could assist in establishing the need for the use of portals in agricultural research organisations in the SADC region:

- State of information overload and the need to reduce or control information overload among researchers as discussed by Telleen (1995), Kirsh (2000), Aneja, Rowan & Brooksby (2000), and Konicki (2000).
- Work activities relating to information management and communication that would require the use of intranets and portal applications as identified by several authors, including Bowen and Wong (1996); Nanfito (1996), Thomas and Plumley (1997:14-15), Wagner and Engelmann (1997), Hills (1998), Shepherd (1998), CIO Communications (1998a & 1998b), Bernard (1999), Irving and McWilliams (1998), and Telleen (1999).
- Availability and current state of technical infrastructure that could support the development and use of portals in the organisation, as identified by Hernandez (1999), Pedley (1999), and CIO Communications (2001a).

5.2 DEVELOPMENT OF RESEARCH VARIABLES

To establish the need for the provision of agricultural information services and resources via portals in the SADC region, the researcher, using the information

obtained from the sources cited above, identified the following areas of research concern on which data was to be collected from three different sources - researchers, information professionals and information technology specialists - within the target agricultural research organisations: (See Appendix 5 for details and outline of the broad variables on which data was to be collected.)

- Problems associated with accessing and using paper-based information resources
- Information resources being used by researchers
- Availability of websites/portals and resources being provided on the sites/portals
- Tools for accessing and manipulating digital information resources
- Digital tools and skills for developing information portals
- Frequency of need or use of services that could be provided via an information portal.

5.2.1 Paper-based information resources: problems

The objective of including this research variable was to enable the researcher to establish the nature of problems and trends associated with accessing and using paper-based information resources by researchers in agricultural research organisations. The existence of problems, if any, could indicate a need to use portals to facilitate access to digital agricultural information resources and services.

5.2.2 Information sources used by researchers

A study of the various information resources used by the researchers would determine what sources were being used by researchers to meet different the information needs relating to their research work. Absence or lack of access to sources that provide up-to-date information could point towards the need for a portal or a good website. The need to access information from disparate sources could also support the need to deploy portals that could aggregate information from various sources and thus facilitate easy integration and access to the information sources on the researchers' desktops.

5.2.3 Websites

The researcher needed to establish whether information services were already being provided to researchers via internal or public websites. The absence of websites and the need to access digital information resources from both within and outside an organisation would support the theory that portals are necessary. In cases where websites were available, a review of the services and resources already being provided on existing sites could probably reveal a need to develop improved websites or portals to better serve the information needs of the researchers.

5.2.4 ICT tools for accessing digital information

This research variable was included to establish whether researchers had access to various information and communication technologies (ICTs) that could be used to access digital information resources; and to see if there was already a culture of using ICT among researchers. Results would indicate whether researchers in agricultural research organisations were ready for the digital information environment within their organisations that could be centred on an information portal.

5.2.5 Digital tools and skills for developing portals

A review of the digital tools and skills for developing portals would establish whether agricultural organisations in the SADC region already had the ICT infrastructure and human skills to support the development and provision of digital information resources via portals. In the absence of suitable ICT facilities and skills a recommendation would be made with regard to appropriate ICT investment strategies, policies, and capacity building programmes.

5.2.6 Need for services that could be provided via a portal

The variable was to be used to establish among researchers the frequency of the need to access or use key information services and resources, and their participation in information communication and management activities that could be facilitated by the use of portals. High demand for the services/resources and active participation in activities relating to the management and communication of agricultural research information could justify the need for information portals in agricultural research organisations.

5.3 OBJECTIVES OF THE SURVEY

To establish the need for portals, the research had the following specific objectives, developed from the research variables discussed above (Section 5.2):

- Existence of problems associated with using paper-based information resources that could be solved through the use of portals
- Availability and access to tools for manipulating digital information resources
- Availability of websites and the use thereof by researchers

- Availability of tools and facilities for developing information portals in agricultural research organisations
- Types of information resources used by researchers for different types of information needs
- Frequency of use or need to use/access services or facilities or conduct activities that could be done via an information portal.

5.4 STUDY POPULATION AND SAMPLES

Part of the research design involved the identification of agricultural research organisations based in the SADC region from which sample populations were to be selected for inclusion in the survey as a sampling frame. Data for the study was to be obtained from researchers, information specialists and information technology specialists. It is important to note that there was no comprehensive directory or listing of agricultural research organisations in the SADC region. Therefore, the researcher used various sources, among them the Web, personal contacts via electronic mail and telephone, and direct inquiries to ministries of agriculture, to identify the target organisations. It must also be indicated that even in this case, not all potential agricultural research organisations could be contacted or identified for various reasons:

- In some cases, no replies were received to the e-mail inquiries, while in other cases the e-mail addresses that were used were apparently invalid and the messages could not be delivered. This was the case with the Seychelles, and as a result no agricultural research organisations from Seychelles could be included in the study.
- In some cases it was difficult to make telephone contact. For example, in Malawi the researcher used the phone numbers obtained from various

websites for almost a month without realising that Malawi Telecommunication Ltd had introduced area codes and the numbers being used were not valid as the area are codes were missing.

- Overall, the request for a list of organisations involved in agricultural research in a country implied that such lists exist. Unfortunately, not many people and organisations that were contacted were willing to compile such lists. The best they could do was to indicate the organisations they are associated with or affiliated to.

5.4.1 Agricultural research organisations

The process of identifying target organisations revealed that there are several agricultural research organisations operating in the SADC region. These include both national and regional-based research organisations. Overall, they can be grouped into the following six categories:

- Agricultural research councils (ARC)
- Agricultural research institutes
- Departments of research operating under the ministries of agriculture and related ministries
- Agricultural research centres and stations
- Agricultural universities and colleges
- Non-governmental organisations (NGOs).

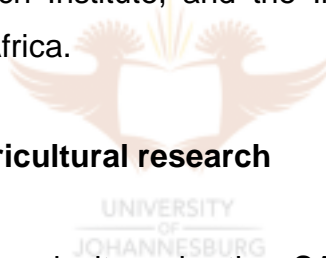
5.4.1.1 Agricultural research councils

In general, agricultural research councils are autonomous research organisations established by governments and in most cases they are the principal agricultural research organisations in the various countries. They are involved in policy making, conducting research, co-ordinating and funding agricultural research projects in the

country. Examples of ARCs identified from the SADC region are the Agricultural Research Council (ARC) of South Africa, the Agricultural Research Council of Zimbabwe and the Food and Agricultural Research Council (FARC) of Mauritius.

5.4.1.2 Agricultural research institutes

Agricultural research institutes include autonomous and semi-autonomous institutions established by the government, such as national agricultural research institutes, or by private or parastatal organisations involved in agricultural research. Some of the research institutes focus their research activities on one specific and sometimes specialised area, for example animal diseases, livestock production, cotton, tobacco, and many others. Examples of agricultural research institutes from the SADC region include the Mauritius Sugar Industry Research Institute (MSIRI), Tanzania Fisheries Research Institute, and the Institute for Commercial Forestry Research (ICFR) in South Africa.



5.4.1.3 Departments of agricultural research

Ministries responsible for agriculture in the SADC region have departments, divisions or directorates of agricultural research with various mandates. In most cases, the departments of agricultural research are responsible for the collection, evaluation, co-ordination and monitoring of research activities funded by the government in the country. Examples of the departments that were identified include the Department of Agricultural Research of the Ministry of Agriculture in Botswana, the Division of Research and Development in the Ministry of Agriculture and Food Security in Tanzania, and the Department of Agricultural Research and Extension (AREX) in Zimbabwe.

5.4.1.4 Agricultural research centres and stations

In general, government departments or divisions of agricultural research are located at the headquarters of the ministry responsible for agriculture, where not much of actual or applied research is carried out. As a result, these departments or divisions have established research centres, stations or institutes throughout the country where agricultural research is conducted. Examples of such centres from the SADC region include the Mount Makulu Research Station in Zambia, Sebele Agricultural Research Station in Botswana, Chitedze Agriculture Research Station in Malawi, Chiredzi Research Station in Zimbabwe, and Malkerns Research Station in Swaziland.

5.4.1.5 Departments of agriculture/agricultural universities

Although a large number of universities in the SADC region have schools or faculties of agriculture, some countries have established public universities or colleges that are responsible for agricultural research, education and extension education. Examples include the Sokoine University of Agriculture in Tanzania, Bunda College of Agriculture in Malawi and the Botswana College of Agriculture in Botswana.

5.4.1.6 Non-governmental organisations

There are several national and international non-government organisations, associations and networks operating in the SADC region that are involved in areas relating to agricultural research, or bringing together various agricultural research organisations. Examples from the region include the Zambia Association for Research and Development, the Forestry Association of Botswana, and the Southern Africa Root Crops Research Network (SARRNET) based in Lilongwe, Malawi.

5.4.2 Sample of agricultural research organisations

Admittedly, it was impossible to include all the institutions that were identified in the survey. Therefore, after careful examination of the various agricultural research organisations that were identified under the above six categories, a decision was made to include in the survey sample group only the *principal public agricultural research organisations*. Generally, these are organisations that have a government mandate to carry out agricultural research in the country. The decision to concentrate on principal public agricultural research organisations was based on the following reasons:

- For a number of reasons, it was impossible for the researcher to include all the organisations involved in agricultural research in the SADC region in the survey. These reasons included a lack of time, limited resources and logistical problems associated with getting in touch with organisations that are located in remote areas. It was assumed that several research organisations located in remote areas did not have telecommunication facilities.
- In view of their position, principal agricultural research organisations were assumed to have the following characteristics or features, and were thus expected to provide a representative sample for the survey:
 - Government mandate to conduct research in areas considered to be priority areas with regard to the country's agricultural needs. Providing researchers in these organisations with an effective and efficient agricultural research information management tool such as a portal, would greatly facilitate the implementation of the country's research priorities.

- Largest concentration of researchers among the organisations involved in agricultural research in the country.
- Several research units, divisions or stations involved in different types of agricultural research, for example research in livestock or crops would provide a good sample population of researchers with different information needs.

Through telephone and e-mail inquiries to the departments responsible for agricultural research in the ministries of agriculture (and related ministries), and in some cases individuals involved in agricultural research and agricultural research information management, the following were identified as the principal public agricultural research organisations in the SADC member countries:

- 
- Botswana - Department of Agricultural Research, Ministry of Agriculture
 - Lesotho - Agricultural Research Division, Ministry of Agriculture, Co-operatives, and Land Reclamation
 - Malawi - Department of Agricultural Research and Technical Services, Ministry of Agriculture and Irrigation
 - Mauritius - Food and Agricultural Research Council (FARC)
 - Namibia - Directorate of Research and Training, Ministry of Agriculture, Water and Rural Development (MAWRD)
 - South Africa – Agricultural Research Council (ARC)
 - Swaziland – Agricultural Research Division, Ministry of Agriculture and Co-operatives (MOAC)

- Tanzania – Division of Research and Development, Ministry of Agriculture and Food Security
- Zambia – Soils and Crops Research Branch, Ministry of Agriculture, Food and Fisheries
- Zimbabwe - Department of Agricultural Research and Extension (AREX), Ministry of Lands, Agriculture and Rural Resettlement.

It was, furthermore, established that almost all of the above agricultural research departments or organisations have several specialised research institutes, stations or centres located in different parts of the country where research is conducted. For example, the Agricultural Research Council of South Africa and the Division of Research and Development in Tanzania each have more than 10 research institutes located in various parts of the country. The Department of Agricultural Research Services in Malawi has five agricultural research stations, while the Soils and Crops Research Branch in Zambia has 11 stations located in different parts of the country. Because it was not practical to cover all the research institutes, centres or stations, a decision was made to limit the survey to the major agricultural research institutes, stations or centres in terms of their research outputs or number of researchers. This sample would provide the basic infrastructure and facilities to gain the information required to establish whether or not there was a need for agricultural information portals in the SADC region.

According to Ekurt (2001) it is impossible to come up with a single metric that adequately measures the research activities of an organisation. It is, however, possible to use multiple measures in an attempt to capture the different dimensions of research. Possible measures of research activity include:

- Papers published in peer-reviewed journals
- Research grants obtained through a competitive process

- Books and monographs published
- Conference presentations made
- Doctoral students supervised.

Taking into account the view that most people would agree that publications are an important outcome of scientific research (Phelan 2000), the identification of the major agricultural research institutes, centres or stations in the SADC region to be included in the survey was based on the number of research publications, including papers published in peer-reviewed journals, conference papers and research reports, produced in a five year period, starting from 1998 to 2002. It was assumed that data would be readily available in the management information systems or annual reports of the organisations involved. The researcher also noted Phelan's views that producing a lot of research is not the same as producing good research (Phelan 2000:39). However, since the survey was not going to measure the quality or impact of research outputs produced by the research organisations, it was felt that the number of research publications would serve to identify the major research organisations for the survey.

Inquiries via electronic mail were sent to the agricultural organisations identified above. The inquiry was designed to obtain information about the profile of the organisation and solicited information on the following:

- Mandate of the organisation
- Availability of an information management system (manual or computerised) for recording, managing and reporting on the organisation's research activities and outputs
- Major publications by the organisation

- List of research institutes, centres or stations of the organisation, and the number of researchers (scientists) at each institute
- The number of publications - journal articles, conference papers, books, technical reports, workshop reports, newspapers articles, web-based documents, and new technologies introduced from January 1998 to December 2002.

While the information regarding the number of research staff could easily be obtained, most of the research institutions contacted did not have in place a management information system that could provide information on research activities and outputs on demand. In some organisations, even annual reports from which vital information could be picked were missing or not up-to-date. In cases where the annual reports were available and up-to-date, information was scattered in several, often bulky reports that needed to be edited to make it usable. As this was tedious and time consuming, organisations refused to spend time compiling the information for the researcher.



As a result, and in the absence of quantitative data on research activities and outputs, consultations were conducted via e-mail with different individuals, including chief research officers, information management specialists and, in some cases, researchers in the target agricultural research departments or divisions, with a view to identifying the major research centres, stations or institutes to be included in the survey. This approach yielded results in all the countries except Zimbabwe where initial efforts to contact AREX via e-mail and telephone were futile. The following research organisations were consequently identified for inclusion in the survey:

- Botswana - Department of Agricultural Research
- Lesotho - Agricultural Research Division, Main Station, Maseru
- Malawi - Chitedze Agricultural Research Station
- Mauritius - Food and Agricultural Research Council (FARC)

- Namibia – National Botanical Research Institute
- South Africa – Agricultural Research Council's Animal Improvement Institute (ARC-AII) and the Animal Nutrition and Products Institute (ARC-ANPI) both located at ARC's Irene Campus
- Swaziland – Malkerns Research Station
- Tanzania – Selian Agricultural Research Institute
- Zambia – Mt. Makulu Research Station.

Regarding Zimbabwe, the Department of Agricultural Research and Extension (AREX) was provisionally included in the list with the hope that contacts would eventually be established and the required information obtained before the distribution of the questionnaires.

Before the above organisations were finally included in the survey, a request for permission to conduct the survey in the organisation was sent to each organisation via e-mail and by fax. It was felt that with authorisation from the organisation's top management, a good number of researchers would be compelled to participate in the survey. This worked well in all the organisations that were contacted, except for the Department of Agricultural Research and Extension (AREX) of Zimbabwe.

Department of Agricultural Research and Extension (AREX) of Zimbabwe

The reply from AREX indicated that under the national legislation, matters of research by foreign scientists or scholars wishing to conduct research in Zimbabwe are dealt with by the Research Council of Zimbabwe (RCZ), and the request had been forwarded to the Council. Later, communication from RCZ indicated that the researcher needed to pay a registration fee of US\$500.00 and be affiliated to an institution like the University of Zimbabwe which would then accept responsibility for the researcher and the research in Zimbabwe. Only then would AREX be instructed to allow the researcher to conduct research at the institution.

Although the matter was resolved two months later and permission obtained to proceed with the research, it proved to be difficult to obtain a list of the research institutions under AREX and the number of research scientists working at each institution. Such a list would facilitate the choice of the specific agricultural research institution at which research was to be conducted and determine the number of questionnaires to be sent to AREX for distribution. By that time, other organisations were already returning the completed questionnaires. Lack of time and the required information from AREX led to the decision to remove AREX from the list. As a result, Zimbabwe was not represented in the survey.

Food and Agricultural Research Council, Mauritius

Even though initial contact with FARC in Mauritius yielded positive results and the organisation had agreed to participate in the survey, arrangements for the distribution of the questionnaires at FARC could not be finalised. Although it had been agreed that questionnaires would be sent to the Director's office via e-mail, there was no response to the e-mail inquiries to finalise the arrangements. Therefore, FARC was replaced with the Mauritius Sugar Industry Research Institute (MSIRI).

Organisations from the Seychelles

Notably, no organisation from the Seychelles was included in the list as it was difficult to contact organisations in that country. The researcher obtained several e-mail addresses from the website of the *Ministry of Agriculture and Marine Resources* located at <http://www.agricta.org/partners/mamr/index.htm> and sent inquiries to various units at the Ministry, including author of the website. In some cases the messages bounced back, while in other cases no replies were received.

5.4.3 Researchers

This category was made up of individuals involved in agricultural research. They were included in the survey in their capacity as information end-users, information content generators or developers, and potential users of information services and resources that could be provided by via portals in their organisations. The major assumption with regard to researchers was that even though they might have certain views on services they would like to have available via an agricultural information portal, and preferences regarding the design features of such portals, most of them would find it difficult to express their views and preferences clearly. For this reason, a questionnaire was used to collect information from the researchers.

Since there were only nine target organisations, it was expected that the population of researchers was not going to be too large to warrant selecting a sample. Therefore, a census sampling method, in which the entire population was used as a sample, was adopted. However, individuals classified as technicians or research assistants were not included in the survey. Below is a table indicating the distribution of researchers in the target organisations at the time of the survey. Information on the number of researchers at each research organisation was obtained via e-mail and telephone inquiries to the target agricultural research organisations.

Table 3: Number of research scientists in target agricultural research organisations

Research organisation	Researchers
ARC – Irene Campus, South Africa	33
Agricultural Research Division, Central Station - Lesotho	28
Chitedze Agricultural Research Station, Malawi	26
Department of Agricultural Research, Botswana	20
Mauritius Sugar Industry Research Institute	35
Malkerns Research Station, Swaziland	07
Mt. Makulu Research Station, Zambia	38
National Botanical Research Institute, Namibia	09
Salien Agricultural Research Institute, Tanzania	26
Total	222

5.4.4 Information specialists

Information specialists such as information managers, subject specialists, librarians and documentalists are responsible for the provision of information services to information end-users in agricultural research organisations. In some organisations information specialists are also expected to implement the use and provision of information services using modern information communication technologies, such as information portals, in their organisations. Their input regarding the need for information portals is, therefore, very important. As these people are also a very good source of information regarding the information services and support being provided to researchers, they were included in the survey.

Since the questionnaires sent to information specialists were designed to obtain information regarding the overall provision of information services to support the work of researchers within the target organisations, only one questionnaire was distributed per organisation. The questionnaires were to be completed by the head of the library or documentation centre or information unit, or the person in charge of

the unit responsible for the provision of information services to researchers. A total of nine questionnaires were distributed.

5.4.4 Information technology specialists

It was considered necessary and important to include information technology specialists in the survey in their capacity as potential portal designers, developers or managers. It was assumed that agricultural research organisations in the SADC region have access to information and communication technologies and therefore they also have individuals that are responsible for the management of ICT facilities in the organisation. These are the people who are likely to be involved in the development and maintenance of information portals. As in the case of information specialists, the information required from this target group was about the overall ICT situation within the organisation, and therefore only one questionnaire was distributed per organisation. The questionnaires were to be completed by the individuals responsible for the ICT infrastructure within the various organisations.



5.5 QUESTIONNAIRES

Three sets of questionnaires, one for researchers (Appendix 6), information specialists (Appendix 7) and information technology specialists (Appendix 8) were developed, based on the structure, research variables and details developed in Appendix 5. The questionnaires requested respondents to provide information on the following:

- *Researchers' questionnaire:* Availability, access and use of ICTs by researchers; various sources of information used by researchers; problems experienced by researchers using paper-based information sources and systems; access to information resources and services provided via the organisation's websites or external websites, where applicable; and the

frequency of the need or participation or involvement in various activities that could be conducted via a portal.

- *IT specialists' questionnaire*: ICT facilities, human resources and skills available in the organisation that could be used in the development of portals; availability of an information plan or strategy; availability of the organisation's website or portal, the services and resources being provided.
- *Information specialist's questionnaire*: Information sources and services provided to researchers; problems associated with using paper-based information resources and manual systems; information services provided via the organisation's website or portal, where applicable; and the reasons for not providing information services via a website or portal, where applicable.

The questionnaires were structured in such way that almost all questions required the respondents to indicate their response(s) by making a selection from the various possible responses provided and indicating their choice(s) by marking an **X** in the spaces provided. Overall, the questionnaires were designed to collect information on the research variables briefly discussed in Section 5.2 above and presented in Appendix 5.

5.5.1 Instrument testing

Before their distribution to the target populations in the SADC region the three questionnaires were pre-tested to examine the content, clarity, validity and relevance of the questions.. Pre-testing was done at the following organisations:

- *Researchers' questionnaire*: The questionnaire was pre-tested at the Ethiopian Agricultural Research Organisation (EARO) in Addis Ababa, Ethiopia and at the Animal Research Institute of the Council for Scientific and Industrial Research (CSIR), in Accra, Ghana. Altogether 15 questionnaires

were distributed and 14 were returned. The respondents provided valuable comments on the content of the questionnaire. Based on their responses and comments, some of the questions were modified.

- *IT specialists' questionnaire*: IT specialists at AERO and the International Livestock Research Institute (ILRI) both in Addis Ababa, Ethiopia, completed the questionnaire and provided valuable comments.
- *Information specialist's questionnaire*: The individuals in charge of the University of Zambia, Veterinary and Agricultural Information Services in Lusaka, Zambia; Botswana College of Agricultural Library in Gaborone, Botswana; National Agricultural Research Institute's Documentation Centre, in Serekunda, Banjul, The Gambia; and the Animal Research Institute of the Council for Scientific and Industrial Research (CSIR) in Accra, Ghana completed the questionnaire and provided very useful comments on the questions.

5.5.2 Distribution of questionnaires

Arrangements were made with either the heads of the research organisations or the individuals they had designated, or as in the case of most organisations, with the information specialists, to assist with the distribution of the questionnaires. Questionnaires were sent to the organisations in either electronic or print format, depending on the preferred mode of distribution indicated by the researchers or the organisation. Questionnaires for researchers at ARC-Irene Campus, Namibia Botanical Research Institute (NBRI) and the Mauritius Sugar Industry Research Institute (MSIRI) were sent to the organisations via e-mail. MSIRI printed the questionnaires on site and handled the internal arrangements for the distribution of the copies to the researchers. The Namibian Botanical Research Institute provided the names and contact e-mail addresses of the staff in the organisation and questionnaires were sent directly to the researchers who completed them and

returned them via e-mail. At ARC-Irene Campus, questionnaires were sent to the contact person via e-mail for distribution within the organisation. All completed questionnaires, in digital format as MS Word documents, were sent back to the contact persons who forwarded them to the researcher. In all other cases, the questionnaires were sent to the organisations by private courier services.

5.6. SUMMARY

The objective of this chapter was to design a survey to establish whether or not there is a need to establish portals for use by researchers in agricultural research organisations in the SADC region. The chapter discussed and presented the design of the survey in which nine major agricultural research organisations, with a total population of around 222 researchers eligible for participation in the survey, were identified in the SADC region and included in the survey.

To achieve the objective of the survey, research variables and objectives were developed and data was obtained using a set of three structured questionnaires distributed to researchers, information management specialists and IT specialists. The questionnaires were pre-tested, modified and distributed either in electronic or print format. Arrangements were made with a private courier company to deliver and collect most of the questionnaires.

The next chapter provides an analysis and discussion of the results of the survey.

CHAPTER 6

NEED FOR AGRICULTURAL RESEARCH INFORMATION VIA PORTALS: RESULTS OF A SURVEY

6.1 INTRODUCTION

Based on the literature review of the features and use of intranets and extranets in organisations in Chapter 2, literature review and the study of the contents and features of selected, publicly accessed portals in Chapter 3, and the study of the trends in the provision of access to information resources via websites by agricultural-based organisations in Chapter 4, it was concluded that agriculture research organisations in Africa, and the SADC region in particular, could benefit a great deal from the use of web-based technologies such as portals in the provision of improved access to information resources and services to researchers. A content analysis in Chapter 4 of some websites of agriculture research organisations in the SADC region showed that the organisations in the region would need to be guided in the planning for the deployment and provision of digital information services via portals or improved websites. The organisations should have access to a model or a set of systematic guidelines that could be used to plan the deployment of information portals or improved websites capable of serving the information needs of researchers.

It was considered to establish, through a survey, whether there really was a need for the provision of information services and resources to researchers via improved websites or information portals in agriculture research organisations in the SADC region before any model or guidelines could be developed. Chapter 5 discussed the design and methodology of the survey that was conducted to establish whether or not there was a need for improved access to agricultural research information in the SADC region. The chapter also discussed the sample selection of the agricultural

research organisations and researchers that were included in the survey, the distribution of the questionnaires, and the limitations of the survey.

The objective of Chapter 6 is to analyse and discuss the findings of the survey that was conducted amongst agricultural research organisations in the SADC region.

6.2 RESPONSE RATES

6.2.1 Agricultural research organisations

Altogether nine agricultural research organisations from the SADC region were included in the survey:

- ARC – Irene Campus, South Africa
- Agricultural Research Division (ARD), Central Station – Lesotho
- Chitedze Agricultural Research Station (CARS), Malawi
- Department of Agricultural Research (DAR), Botswana
- Mauritius Sugar Industry Research Institute (MSIRI)
- Malkerns Research Station (MRS), Swaziland
- Mt. Makulu Research Station (MMRS), Zambia
- National Botanical Research Institute (NBRI), Namibia
- Salien Agricultural Research Institute (SARI), Tanzania.

Researchers to be included in the survey, and staff to complete the questionnaires regarding the availability of ICT facilities and provision of information services to researchers, were drawn from the above organisations.

6.2.2 Researchers

Altogether 222 researchers from the nine target agricultural research organisations were to be included in the survey. Table 4 shows the number of questionnaires that were actually distributed in each organisation, the number that were returned and the response rate from each organisation.

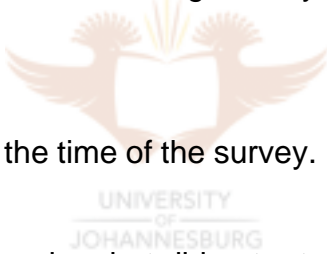
Table 4: Distribution of questionnaires and response rates

Research Organisation	Number of Researchers	Questionnaires		Response Rate
		Distributed	Returned	
Department of Agricultural Research - Botswana	20	15	10	66.6%
Agricultural Research Division, Main Station, Lesotho	28	10	8	80%
Chitedze Agricultural Research Station, Malawi	26	26	22	84.6%
Mauritius Sugar Industry Research Institute	35	35	25	71.4%
Namibia Botanical Research Institute	9	8	6	75%
Agricultural Research Council of South Africa – Irene Campus	33	33	11	33.3%
Malkerns Research Station – Swaziland	7	7	6	85.7%
Salien Agricultural Research Institute – Tanzania	26	21	19	90.47%
Mt Makulu Research Station – Zambia	38	30	17	65.5%
Total	222	185	124	67.02%

As can be seen from Table 4, except for the Irene Campus of the Agricultural Research Council of South Africa that recorded the lowest response rate of about 33.3%, the overall response rate from all the organisations was good. In five of the organisations the rate was equal to or above 75%, the highest coming from Salien Agricultural Research Institute of Tanzania that had a response rate of 90.46%.

Altogether 185 questionnaires, covering approximately 83% of the targeted 222 researchers, were distributed and 124 returned, representing an overall response rate of 67.02%. Although the quality of responses was very good, three questionnaires were disregarded owing to their poor quality or because they were incomplete. Thus 121 questionnaires were included in the data analysis and discussion, giving a response rate of 65.40%.

Many reasons were given by contacts in the organisations for not distributing the questionnaires to all the researchers available in the organisations and, in some cases, for the non-return of the questionnaires during the period of the survey. For example, at Salien Agricultural Research Institute the survey coincided with the new season during which some researchers were in the field conducting meetings with extension officers, farm clubs and associations. As a result, some questionnaires were not distributed. Other reasons given by organisations were that some researchers:

- 
- Were not available at the time of the survey.
 - Received the questionnaires but did not return them as they had left for short courses or other work engagements.
 - Did not agree to participate in the survey as they had other pressing work activities to attend to.

6.2.3 Information specialists and information technology specialists

In addition to the questionnaires to be completed by researchers, each organisation also received one questionnaire to be completed by the person (information specialist) in charge of the library or documentation centre, and another questionnaire to be completed by the person (information technology specialist) in

charge of the ICT infrastructure, or involved in the management of ICT within the organisation. Altogether, nine sets of each questionnaire were distributed. All nine questionnaires were received from information specialists and seven from information technology (IT) specialists, giving response rates of 100% and 77.7% respectively. The questionnaires completed by IT specialists came from the following organisations:

- Agricultural Research Council (ARC), South Africa
- Chitedze Agricultural Research Station (CARS), Malawi
- Department of Agricultural Research (DAR), Botswana
- Mauritius Sugar Industry Research Institute (MSIRI)
- Namibia Botanical Research Institute (NBRI)
- Salien Agricultural Research Institute (DRD), Tanzania
- Mt Makulu Research Station (MMRS), Zambia.

The areas of specialisation for the IT specialists who completed the questionnaires were as follows:

- | | | |
|-------------------------------|---|--------------|
| • Systems analysis and design | - | 1 specialist |
| • Software development | - | 2 |
| • Network administration | - | 1 |
| • Database administration | - | 1 |
| • Systems administration | - | 1 |
| • Website/portal development | - | 1 |

NBRI indicated that it did not have an IT specialist amongst its staff, and therefore the questionnaire was completed with the assistance of an IT specialist from the Division of Information Systems of the Ministry of Agriculture, Water and Rural Development, the parent Ministry for NBRI.

The Malkerns Research Station in Swaziland and the Agricultural Research Division in Lesotho indicated that they had no IT specialists in the organisation and therefore could not complete and return the questionnaires. However, this does not necessarily mean that the parent departments or ministries of agriculture of the two organisations did not have IT specialists who could have assisted in the completion of the questionnaires, as was the case at NBRI.

6.3 DATA CODING AND PROCESSING

Data from the questionnaires was coded and processed using SPSS for Windows, version 10.0. Descriptive statistics (frequencies and percentages) were generated and used in the analysis and description of the research variables. Cross tabulation was also used to show the relationships between responses made to some of the questions, for example lack of access to desktop computers and access to laptops at work places; lack of access to the Web and e-mail facilities at work; and lack of access to these facilities at home. In addition, a combination of content analysis and qualitative coding was used to interpret responses provided under “*Others*” and the comments of the respondents. The sections below present the findings, analysis and discussion of the data.

6.4 FINDINGS AND ANALYSIS OF THE RESULTS

The analysis of the data from the questionnaires that were completed by the researchers, information technology specialists and information specialists is arranged according to the following seven areas that were derived from the specific objectives of the survey developed in Chapter 5 and Appendix 5:

- ICT facilities in agricultural research organisations
- Access to ICT facilities at workplace and home
- Use of ICT facilities at workplace
- Sources of information and services used by researchers

- Use of paper-based information sources
- Resources on organisation's website
- Portal-based facilities and services.

6.4.1 ICT facilities in agricultural research organisations

Availability and access to appropriate ICT facilities in agriculture research organisations is vital if these organisations are to provide access to portal-based information services. Researchers working in these organisations should have access to ICTs appropriate for the development of content that could be shared via portals, in addition to accessing other portal-based information services and resources.

Data on the availability of ICT facilities in agriculture research organisations was obtained from information technology specialists and researchers. The questionnaire for IT specialists requested the respondents to indicate facilities available in their organisations that could be used in the development of information portals or websites, or to provide access to information resources provided via portals or websites. In addition, researchers were also asked to indicate the ICT facilities that they had access to at their work places. The responses provided by the two groups are shown in Tables 5 and 10 respectively.

Table 5: Availability of ICT facilities

N=7

ICT facilities	Number (%)
Personal computers	6 (85.7%)
Laptop computers	7 (100%)
Servers	7 (100%)
Local area network (LAN)	7 (100%)
Intranet	2 (28.6%)
Extranet	0 (0.0%)
Internet and World Wide Web access	7 (100%)
Electronic mail	7 (100%)
Mobile (Cellular) phone facilities	2 (28.6%)
Scanners	6 (85.7%)
Laser printers	6 (85.7%)
Other	2 (28.6%)

The results show that agricultural research organisations have access to various types of ICTs that could be used in the development and deployment of information portals. For example, computers servers, laptops, LANs, Internet and Web access, and electronic mail facilities were available in all seven organisations. However, only two (28.6%) organisations indicated that they have intranets in place and none (0.0%) of the organisations indicated access to extranets. The organisation that indicated *other types of ICT facilities* listed projectors, switches and routers.

6.4.1.1 Operating system

There are several system development tools that could be used in the development of information portals in agricultural organisations. In most cases, these operate either under the Microsoft Windows platform or the Open Source software platform. Each option has its benefits and drawbacks, the major one being the costs involved. In general, Windows-based systems must be purchased, while most Open Source systems can be obtained free of charge. Taking into consideration the poor level of funding for most agricultural research organisations in Africa, Open Source software should be more appealing.

The seven agricultural research organisations that completed the IT questionnaires were using mainly Windows-based operating systems (Table 6). They all had machines running Windows 95/98. Six (85.7%) had some machines running Windows XP, while five (71.4%) were running Windows 2000. Three (42.9%) organisations were running the Windows NT operating system.

Table 6: Availability of ICT facilities: operating systems **N=7**

Operating systems	Number (%)
Windows XP	6 (85.7%)
Windows 2000	5 (71.4%)
Windows NT	3 (42.9%)
Windows 95/98	7 (100%)
Novell Netware	1 (14.3%)
Solaris/Sun OS	1 (14.3%)
UNIX	1 (0.0%)
Linux	1 (14.3%)
MacOs	0 (0.0%)
Other	0 (0.0%)



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The widespread use of the Microsoft Windows operating system could be due largely to the fact that Windows is bundled with new PCs. It is also important to note that in spite of the growing advocacy for organisations in Africa to adopt the use Open Source software systems such as Linux, only one (14.3%) organisation indicated that it was using Open Source operating systems, such as UNIX and Linux.

6.4.1.2 Local area networks

The type of LAN installed in an organisation has an impact on the speed of data transfer and flow within the network. For example, fast, shared LAN technologies such as Fibre Distributed Data Interface (FDDI), 100 Carrier Sense Multiple Access

with Collision Detection Ethernet (100 CSMA/CD), and 100 Voice Grade AnyLAN (100VG AnyLAN), provides access to 100 Mbps of shared bandwidth.

The seven agricultural research organisations had LANs in place, and although some had installed more than one type of LAN, the main type implemented in all seven organisations was Ethernet-based LAN. Four (57.1%) organisations had installed ordinary Ethernet LANs, while two (28.6%) organisations indicated having Fast Ethernet LANs and one (14.3%) a Gigabit Ethernet LAN.

6.4.1.3 Quality of ICT facilities/support

Basically, all information systems require good ICT and support infrastructure, and portals are no different. In this regard, organisations were asked to rate how good or poor their ICT facilities and services for applying in advanced website or portal development were. The results of the ratings are shown in Table 7.

Table 7: Quality of ICT facilities and services

N=7

Facilities/Services	Number (%)			
	Very Poor	Poor	Good	Very Good
Computer hardware	0 (0.0%)	3 (42.9%)	2 (28.6%)	2 (28.6%)
Software	0 (0.0%)	1 (14.3%)	5 (71.4%)	1 (14.3%)
IT skills	0 (0.0%)	5 (71.4%)	2 (28.6%)	0 (0.0%)
Network infrastructure	1 (14.3%)	2 (28.6%)	2 (28.6%)	2 (28.6%)
Internet connectivity	1 (14.3%)	1 (14.3%)	3 (42.9%)	2 (28.6%)
Technical support	1 (14.3%)	1 (14.3%)	3 (42.9%)	2 (28.6%)

The degree of quality of ICT facilities and services differ from organisation to organisation, although on the average they appear to be *good*. However, one notable observation is that 5 (71.4%) organisations indicated that the IT skills available for website/portal development were poor. Although these skills could be sourced from outside, it is important that organisations have access to appropriate

website or portal development skills as these are also required for the regular maintenance of the site or portal.

6.4.1.4 Websites/portals

The data provided by both IT specialists and researchers showed that out of the nine organisations the following five had websites:

- Agricultural Research Council of South Africa
URL: <http://www.arc.ac.za>
- Chitedze Agricultural Research College
URL: <http://www.agricresearch.gov.mw>
- Department of Agricultural Research
URL: http://www.gov.bw/government/agric_research/mainpage.html/
- Mauritius Sugar Industry Research Institute
URL: <http://webmsiri.internet.mu>
- Salien Agricultural Research Institute
URL: <http://www.drd.mafs.go.tz>

Researchers at Chitedze in Malawi and Salien in Tanzania indicated that they accessed the websites of their parent departments, the Department of Agricultural Research and Technical Services, in the Ministry of Agriculture and Irrigation, and the Department of Research and Development in the Ministry of Agriculture, respectively.

The reasons for developing the websites, provided by the five organisations, are indicated below.

ARC – Irene Campus

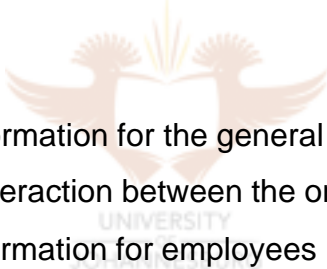
- To publish information for the general public and other organisations

- To facilitate interaction between the organisation and the public
- To facilitate interaction between the organisation's employees
- To publish information for employees
- To enable searching for information produced/created within the organisation
- To advertise the organisation
- To produce revenue by selling information.

Chitedze

- To increase the visibility of research results and reports
- To improve communication.

MSIRI

- 
- To publish information for the general public and other organisations
 - To facilitate interaction between the organisation and the public
 - To publish information for employees
 - To advertise the organisation.

Salien – DRD

- To publish information for the general public and other organisations
- To facilitate interaction between the organisation's employees
- To publish information for employees
- To enable searching for information produced/created within the organisation
- To provide links to other web resources for employees
- To advertise the organisation.

Department of Agricultural Research

- To publish information for the general public and other organisations
- To facilitate interaction between the organisation and the public
- To facilitate interaction between the organisation's employees
- To publish information for employees
- To reduce paper flow in routine administrative procedures
- To enable searching for information produced/created within the organisation
- To provide links to other web resources for employees
- To advertise the organisation.

From the above it can be seen that agricultural research organisations are trying to use the Web to provide information services targeting both their staff and the general public. The five websites in question were retrieved and examined by the researcher and the following were noted:

- The site for the Chitedze Agricultural Research Station was made up of a few pages located on the website of the parent organisation, the Department of Agricultural Research and Technical Services (DARTS).
- The websites of the ARC and MSIRI were quite well developed and provided access to various information resources and facilities.
- The website for the Department of Agriculture Research, Ministry of Agriculture in Botswana and Department of Research and Development, Ministry of Agriculture, in Tanzania were basically *brochurewares* and provided access to information such as the mandate or mission of the organisation, lists of the departments, staff information, description of services provided and, in some cases, a list of documents produced by the organisation.

6.4.1.5 Responsibility for publishing content

The survey also established that the primary responsibility for determining what content should be published on the websites of the five organisations rested with different individuals or units. At MSIRI and Department of Agricultural Research in Botswana, the management of the organisations decided what was to be published on their websites, while at DRD in Tanzania; the Webmaster determined what was to be published on the site. At Chitedze Agricultural Research Station there was a website committee that was charged with the responsibility of deciding what was to be published. In addition to Management, researchers at ARC-Irene Campus also participated in deciding on what content was to be published on the organisation's website.

Except for ARC – Irene Campus, the above arrangements may not be the best if these organisations are to use the Web to provide access to content generated by their researchers. There is need to involve and empower content generators, such as researchers, so that they can publish their output directly on the website. Information specialists such as librarians, documentalists, and information resource managers should also be involved in the organisation and management of web content. In this regard, agricultural research organisations need to have content management policies and content publishing guidelines in place.

6.4.1.6 Website/portal development technologies

Only four organisations provided information regarding the various ICT tools and software being used in the development of their internet websites. These are shown in Table 8.

Table 8: Website development tools/technologies

Tools	ARC – Irene Campus	DAR Botswana	DRD Tanzania	MSIRI Mauritius
Web server	Java Server	Microsoft Internet Information Server	MS Personal Web Server, WebSTAR, Netscape Enterprise	Microsoft Internet Information Server
Methodology	Ad hoc	Ad hoc	Ad hoc	Ad hoc
Mark-up standard	HTML 4	Not indicated	HTML 4, XML	HTML 3.2
Software (Editors)	Multi-edit	MS FrontPage	Dreamweaver	Dreamweaver
Server-side applications	JavaScript, PHP	None	VBScript, JavaScript	Active Server Pages
Database technology	MySQL, SQL	Microsoft Access	None	Microsoft Access

The use of server-side applications, database technologies and other technologies such as the Extensible Mark-up Language (XML) adds more functionality to the website or portal. The above institutions have adopted the use of some such technologies and tools to some degree. However, the major draw-back is their use of ad hoc methodologies in developing their websites. According to Pressman (2000: 18-19) the major problems associated with the continued use of ad hoc approaches to web development are that:

- Increasingly it will become very difficult to successfully develop, deploy and maintain websites over the long term.
- It might lead to what might be called a “tangled web” - which is a morass of poorly developed web-based applications that have a high probability of failure.

The adoption of formal website development methodologies could help to avoid the above problems.

6.4.1.7 ICT and information management skills

Availability of ICT and information management skills to support the development and maintenance of a portal-based information system within an organisation is vital.

The data in Table 9 below shows that agricultural research organisations have staff with various ICT skills relevant to the development and maintenance of websites or portals. In spite of this five (71.4%) of the seven organisations indicated that the IT skills available for website/portal development were poor (See Section 6.4.1.3 and Table 7.).

Table 9: Availability of ICT staff

N=7

Facilities/Services	Number (%)
Systems analysis and design	5 (71.4%)
Software development	5 (71.4%)
Network administration	5 (71.4%)
Database administration	7 (100%)
Systems administration	6 (85.7%)
Programming	6 (85.7%)
Hardware maintenance	5 (71.4%)
Website/portal development	6 (85.7%)

6.4.1.8 ICT strategy

An information technology strategy defines how IT is to be used across the organisation in the future. It describes how IT will support the organisation's missions, goals and strategies, thereby aligning IT with the organisation's overall direction (Raumer 2001). Therefore an IT strategy guides the development of a reliable IT infrastructure across the organisation. In agricultural research organisations a good ICT strategy could improve access to information resources

and services, communication, and facilitate collaboration among researchers both within and outside the organisation.

Among the seven organisations, four (57.1%) indicated that they had a written ICT strategy, two (28.6%) had ICT strategies but these were not in writing, and 1 (14.3%) had neither a formal nor an informal ICT strategy. Unfortunately, the researcher could not examine the formal ICT strategies of the four organisations since these were not available in electronic format and could not be made available for examination. The four (57.1%) organisations that had formal strategies indicated that their ICT strategies also encompassed issues relating to website development, while the two (28.6%) with informal strategies had separate strategies for the development and provision of access to digital information services. An ideal situation would be to develop an encompassing ICT strategic plan.

6.4.2 Access to ICT facilities at workplace and home

In the questionnaire for agricultural researchers, the respondents were asked a series of questions requesting them to indicate, from lists, the availability, access and use of information and communication technology (ICT) facilities in their organisations. The objective was to identify the ICT facilities available to researchers and how they are currently being used in research-related work. Responses would assist in establishing:

- The extent to which agricultural researchers have access to ICT facilities in their organisations, taking into account the fact that availability of access to ICT facilities could make it easier to provide information services to researchers via portals.
- Whether there was already a culture of using ICT facilities in research-related work among researchers, considering that some research-related activities could be conducted and supported via portals.

Table 10 gives the frequency and percentage scores regarding the number of researchers that indicated that they have access to each individual ICT facility that was included in the questionnaire.

Table 10: Access to ICT facilities

N=121

ICT facilities	Number (%)
Desktop computer	109 (90.1%)
Laptop computer	55 (45.5%)
Local area network	67 (55.4%)
Organisation's intranet	36 (29.8%)
Organisation's extranet	0 (0.0%)
Internet and WWW	114 (94.2%)
Electronic mail	116 (95.9%)
Telephone	114 (94.2%)
Mobile (cellular) phone	63 (52.1%)
Facsimile	96 (79.3%)
Video conferencing facilities	0 (0.0%)

6.4.2.1 Access to desktop computers and laptops

Desktop computers or personal computers are available in all the nine research organisations from which the sample population of researchers was drawn. This supports the information provided by IT specialists in the organisations that participated in the survey. However, not all researchers have access to the facilities. Of the 121 valid responses, 109 (90.1%) researchers indicated access to desktop computers, meaning that 12(9.9%) did not have access to desktops. Using cross tabulations, it was found that the 12 researchers who did not have access to desktops were part of the 55 (45.5%) who indicated that that they had access to laptops at their work place. Therefore, all the researchers that participated in the survey had access to either a desktop computer or a laptop. 43 researchers (35.5%) had access to both desktop and laptop computers.

6.4.2.2 Access to LANs

In addition to the availability of and access to computers, the other basic requirement for the provision of access to portal-based information services is a local area network (LAN), connecting client computers and servers. However, LANs have serious limitations and these have to do mainly with the information access and retrieval process (Bernard 1999). Generally, in most cases LAN users have to learn how to use the various application software systems needed to access different information resources.

As seen in Section 6.4.1.3, all seven organisations that returned IT questionnaires indicated that they had LANs in place. However, even though questionnaires from IT specialists were not received from Malkerns Research Station in Swaziland and the Agricultural Research Division in Lesotho, researchers from these two organisations indicated in their responses that they had no access to LAN facilities.

While it is expected that all respondents from the seven organisations that had LANs in place should have access to the facility, this was not the case in some organisations, for various reasons. For example, the LAN at Salien Agricultural Research Institute in Tanzania did not cover the entire organisation, and out of 19 respondents from the institution only 10 indicated access to the LAN. This was also the case at Chitedze Agricultural Research Station where only two respondents out of 22 indicated access to the LAN. At Mt. Makulu Research Station the LAN was in the process of being installed and some researchers had access while others did not. Overall, only 67 (55.4%) out of 121 researchers indicated that they had access to LAN facilities.

6.4.2.3 Access to intranets and extranets

As discussed in Section 2.1, LANs have various limitations that can be overcome by implementing intranets and extranets. In addition, resources on intranets and

extranets are generally accessed using universal client software, the web browser. Resources available on the intranet can also be provided to selected external organisations and individuals via extranets. The availability of intranets and extranets in organisations indicate that there is already a basic infrastructure that could be used to implement a portal-based information service.

Unfortunately, only two organisations, the Mauritius Sugar Industry Research Institute (MSIRI) and the Agricultural Research Council (ARC) of South Africa, Irene Campus indicated access to the intranet facilities, and none had extranets in place (See Section 6.4.1.). The 36 respondents from the two organisations, representing 29.8% of all the 121 valid responses, all indicated that they accessed and used the intranet facilities.

6.4.2.4 Access to the Web and electronic mail facilities

Portals can be implemented and accessed via intranets within organisations, and thus provide access to information resources generated within the organisation. To provide access to a variety of information resources available elsewhere, access to internet facilities is essential. Portals can, therefore, be used to integrate the information resources generated within the organisation and those from external source, especially the World Wide Web, into a single information system, that can be accessed by information end-users on their desktop computers.

The nine agricultural research organisations included in the survey all had access to the World Wide Web and electronic mail facilities, and a large number of the 121 researchers that participated in the survey had access to these facilities. Only seven (5.8%) researchers indicated that they did not have access to web facilities, while five (4.1%) researchers indicated that they did not have access to electronic mail. Using cross tabulation, only four (3.3%) researchers did not have access to both facilities at their work places. Unfortunately, the four did not have access to the facilities at their homes either.

One major observation regarding access to electronic mail was that in some organisations researchers shared a single, institutional e-mail account. This was the case at Malkerns Research Station (malkernsresearch@africaonline.co.za), Agricultural Research Division in Lesotho (agricres@lesoff.co.za), and Mt. Makulu Research Station (genetics@zamnet.zm) Chitedze Agricultural Research Station had several shared e-mail accounts, among them the following two addresses: groundnuts@malawi.net and genebank@malawi.net

While a shared e-mail account ensured that at least researchers had access to the facility, this arrangement, and sometimes the location of the computer on which e-mail access is available, places some limitations on how staff access and use the facility.

6.4.2.5 Access to telephone and mobile (cellular) phone facilities

On a limited scale, web-based information services could be provided via mobile phones. For example, mobile phones could be used to push or pull targeted information services, such as weather information, market information (prices of products), and announcements. Researchers working in the field can pull information from the server hosting the portal or push information to their headquarters or central station to be posted on the portal.

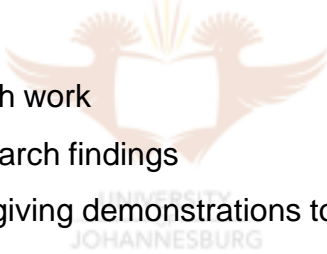
Results of the survey showed that 114 (94.2%) respondents had access to fixed telephone facilities, while 63 (51.9%) had access to mobile phone facilities at their work place. Using cross tabulations, the results revealed that out of 63 respondents who indicated access to mobile phones at work, 40 (63.5%) also had access to mobile phones at home. Taking into account the comments on some questionnaires that organisations did not provide access to mobile phone facilities, most of the researchers who owned personal mobile phones probably also used their phones for work related activities and therefore indicated access to the facility at work.

6.4.2.6 Access to facsimile facilities

Although the nine research organisations that were included in the survey all had facsimile facilities, only 97 (80.2%) respondents had access to and used the facilities. The lack of access by 24 (19.8%) could be because in some organisations, there was only one fax line available, and usually this was located in the office of the director or chief researcher, thus placing restrictions on how often and freely the facilities could be used.

6.4.2.7 Access to videoconference facilities

Videoconferencing facilities are among the modern information and communication facilities available to researchers around the world. In agricultural research organisations, these facilities could be used for:

- 
- Collaborative research work
 - Presentations of research findings
 - Communicating and giving demonstrations to farmers (extension services)
 - Communicating with organisations that fund agricultural research
 - Meetings
 - Giving lectures.

Unfortunately, none of the nine research organisations had videoconferencing facilities. The 121 (100%) respondents all confirmed this when they indicated that they had no access to videoconferencing facilities in their organisations. Useful and convenient as they may be, videoconferencing facilities are relatively expensive and most public institutions like agricultural research organisations in developing countries may not consider them as a priority.

6.4.2.8 Access to ICT facilities at home

Sometimes access to facilities such as computers, laptops, the Internet (World Wide Web and e-mail), and mobile phones at home could lead to requests by researchers for portal-based services that could also be accessed from home. In the survey, respondents were asked to indicate the ICT facilities they had access to at home. Table 11 gives the results of their responses.

Table 11: Access to ICT facilities at home

N=121

ICT Facilities	Number (%)
Desktop computer	48 (36.0%)
Laptop computer	19 (15.7%)
Internet and WWW	31 (25.6%)
Electronic mail	27 (23.3%)
Telephone	85 (70.2%)
Mobile (cellular) phone	66 (54.5%)
Facsimile	6 (05.0%)

Except for fixed line telephones and mobile phones, in all the cases less than half (50%) of the respondents had access to desktop computers, laptops, and internet and facsimile facilities. It should be noted that in most African countries computers are too expensive for most people to afford, and access to internet facilities in homes is still not widespread due to various factors, among them high monthly internet and telephone charges. In some cases, agricultural research organisations are located in towns or places that are far away from internet points-of-presence (POP). To establish internet access then may require long distance calls resulting in huge monthly telephone bills.

Noticeably, 15 respondents who did not have access to telephones at home had access to mobile phones, bringing the total number of researchers with access to either a phone or a mobile phone at home to 100. With the arrival of mobile

telephone communication systems, more and more people are getting connected, even though the prices for handsets are relatively high. Therefore, there is also some merit in providing access to some agricultural information services via mobile phones using WAP technology.

6.4.3 Using ICT facilities at workplace by researchers

Access to ICT facilities is one thing; using them is another. As portals are digital-based information systems, there is need to establish a culture of using digital technologies and information resources within the organisation for the staff to make effective use of portal-based resources. In this regard, a series of questions were asked to establish the various uses of the ICT facilities that researchers had access to at their work places. An analysis of the findings is set out below.

6.4.3.1 Using desktop computers and laptops

Table 10, above, indicates that 109 (90.1%) of the respondents had access to desktop computers, while 55 (45.5%) had access to laptops at their work place. Tables 12 and 13 show how these facilities were being used for research related work.

Table 12: Using desktop computers for research related work N=109

Activities	Number (%)
Processing and analysis of research data	99 (90.8%)
Preparation (word processing) of research reports	104 (95.4%)
Maintenance and storage of databases of research projects	69 (63.3%)
Maintenance and storage of research data/data sets	71 (65.1%)
Other uses	25 (22.9%)

The survey showed that a large number of agricultural researchers, 104 (95.5%) in the SADC region, were using desktop computers mainly for word processing their research reports. Computers were also being used to process and analyse research data, 99 (90.8%); maintain and store research data or data sets, 71 (65.1%); and maintain and store databases of research projects, 69 (63.3%). “Other uses” of desktop computers at work was 22.9%. These uses included the following:

- Preparing PowerPoint presentations
- Retrieval of data
- Internet access
- Downloading information from WorldSpace radio
- Production of extension materials
- Preparation of training materials such as presentations, seminars handouts, and many more
- Processing management reports and correspondence
- Preparation of research proposals.

The above pattern regarding the use of desktop computers was also reflected among the 55 researchers in their use of laptop computers, as shown in Table 13.

Table 13: Using laptops for research related work N=55

Activities	Number (%)
Processing and analysis of research data	48 (87.3%)
Preparation (word processing) of research reports	47 (85.5%)
Maintenance and storage of databases of research projects	31 (56.4%)
Maintenance and storage of research data/data sets	36 (65.4%)
Other uses	15 (27.3%)

The use of desktop and laptop computers by agricultural researchers is obviously resulting in the generation of information resources in digital format. These include

research reports, databases, data sets and research project documents. All these could be accessed and shared with colleagues within and outside the organisations via portals.

6.4.3.2 Using LANs and intranets

Local area networks (LANs) are used to share a variety of resources such as printers and other peripheral devices, data, application programs, and storage devices (Goldman 1998:148). This was confirmed by the results of the survey (Table 14). Among the 67 researchers that had access to LANs, 56 (83.6%) used the LAN to access or share printing facilities; 37 (55.2%) accessed databases/online catalogues; 36 (53.7%) used the LANs to transfer research data from their desktop computers or laptops to the server; and 8 (11.9%) used LANs for other activities such as accessing shared documents and shared directories on other PCs.



Table 14: Using local area networks

N=67

Activities	Number (%)
Access to software resources on the file server	29 (43.3%)
Access to shared printers	56 (83.6%)
Access to databases/online catalogues	37 (55.2%)
Transfer of research data/data	36 (53.7%)
Other uses	8 (11.9%)

Intranets and extranets provide access to a variety of resources and facilities in addition to facilitating collaboration and sharing of information and knowledge. Regarding using intranets in the organisations that were surveyed, Table 15 shows that management and monitoring of research projects (61%), and collaboration on research projects using intranets (52.8%) were most frequently mentioned by the 36 respondents that had access to intranets. The count for use of intranets to access

research funding information (13.9%), training resources (13.9%) *other uses* (11.1%) was very low, probably due to the fact these facilities are not readily provided on the intranets.

Table 15: Using intranets

N=36

Activities	Number (%)
Access to research funding information	5 (13.9%)
Management and monitoring of research projects	22 (61.1%)
Collaboration on research projects	19 (52.8%)
Access to training resources	5 (13.9%)
Other uses	4 (11.1%)

The relatively low use of intranet facilities may be ascribed to the fact that the facilities have not been fully adopted and integrated into the work culture of the researchers and the organisations.

6.4.3.3 Using the Internet/WWW and electronic mail

The Internet, especially the World Wide Web and electronic mail facilities, have had a very strong, positive impact on the conduct of research and distribution of research findings. As shown by the findings of the study of the global trends in the provision of access to agricultural information resources and services reported in Chapter 4, the Web provides access to a wide variety of information resources such as full-text journal articles, technical reports and conference papers that could be used as sources of information for research activities. Researchers using the Web also have access to facilities such as discussion forums and virtual laboratories that could also be used for sharing information and collaborating on research projects. The Web also offers an infrastructure for publishing and disseminating research findings to a wider international research community. Researchers can publish and disseminate their research findings on their personal websites or those of their organisations.

Electronic mail facilitates easy and speedy communication of information. Research results can be distributed via electronic mail to thousands of recipients within the shortest possible time. E-mail can also be used for soliciting inputs into research projects from colleagues working in other research organisations or located in other countries.

The survey also examined the use of the Web and e-mail facilities. All respondents are working in organisations that have these facilities in place, and 114 (94.2%) and 116 (95.2%) had access to the Web and electronic mail respectively. Tables 16 and 17 show how these facilities were being used.

Table 16: Using the Internet/WWW

N=114

Activities	Number (%)
Access to relevant information resources/documents	106 (93.0%)
Publishing of research reports/results on the Internet	31 (27.2%)
Access to web-based discussion forums	37 (32.5%)
Downloading of relevant information resources	99 (86.8%)
Other uses	6 (5.3%)

The Web was used mainly as a source of information and documents by 106 (93.0%) of the respondents, and for downloading of relevant information resources by 99 (86.8%). Cross tabulation revealed that 92 (80.7%) respondents accessed information and documents and also downloaded information resources from the Web.

Although the Web provides an opportunity for researchers to publish and share their research findings quite easily, only 31 (27.2%) indicated that they used it for publishing research reports and 37 (32.5%) that they used it to access web-based discussion forums. Six (5.3%) researchers indicated that they use the Web for *other activities*, including access to early warning information for livestock.

Regarding electronic mail, Table 17 shows that 112 (96.6%) of the 116 researchers that had access to e-mail were using the facility mainly for communicating with colleagues in other research organisations; 91 (78.4%) communicated with colleagues within the same organisation, 87 (75%) sent file attachments, and 73 (62.9%) got in touch with organisations that fund research projects. Less than half, 34 (29.3%) researchers to be exact, were using e-mail to participate in online discussion forums.

Table 17: Using electronic mail

N = 116

Activities	Number (%)
Communicating with colleagues within the organisation	91 (78.4%)
Communicating with colleagues in other research organisation	112 (96.6%)
Communicating with organisations that fund research projects	73 (62.9%)
Sending research reports/data as file attachments	87 (75.0%)
Participating in e-mail based discussion forums/groups	34 (29.3%)
Other uses	3 (2.6%)

Electronic mail is the most widely available and commonly used internet facility in the world today. In sharp contrast to postal-based communication, electronic mail is fast and reliable. As a result it has had a great impact on long distance communication. As was expected, the results of the study show that e-mail is providing a good opportunity for agricultural researchers in the SADC region to communicate with colleagues working in other research organisations located both within and outside their countries. In addition, the use of e-mail makes it easier for them to send documents in digital formats as file attachments. In this way, they can send research proposals to funding organisations, share research findings and reports with colleagues, all within the shortest possible time, and at low cost.

However, it appeared that not many researchers were using e-mail facilities for online discussion purposes. Only 34 (29.3%) indicated that they used the facility for this purpose. This figure is almost the same as the number that indicated that they access and use web-based discussion forums, namely 37 (32.5%). In fact,

altogether 20 respondents indicated that they use the Web for accessing web-based discussion forums and e-mail for online discussion forums.

The above figures show that agricultural researchers in the SADC region are not actively participating in online discussion forums. The reasons for this state of affairs include the following, which are supported by some researchers, as discussed in Section 6.4.7.2:

- In general, accessing and participating in online discussion groups, albeit via electronic mail or via the Web, is time-consuming. Probably, most of the researchers do not have time for online discussion activities.
- Many of the researchers may not be aware of the existence of such facilities or groups that they could join for discussions.
- There may not be many discussion groups that deal with subjects/fields of interest to agricultural researchers in the SADC region.

6.4.3.4 Using telephones and mobile (cellular) phones

Table 18 shows that 105 (92.1%) of the 114 agricultural researchers who had access to telephone facilities used the facilities mainly for communicating with colleagues within the organisation. 104 (91.2%) used the phone for communicating with colleagues in other research organisations, 93 (81.6%) for communicating with the general public and interested individuals, and 77 (67.5%) for getting in touch with organisations funding research projects. Six (5.3%) researchers indicated that they used telephone facilities for other activities, such as contacting government officials and industry, and for booking accommodation when proceeding to outstations on official assignments.

Table 18: Using telephone facilities

N=114

Activities	Number (%)
Communicating with colleagues within the organisation	105 (92.1%)
Communicating with colleagues in other research organisation	104 (91.2%)
Communicating with organisations that fund research projects	77 (67.5%)
Communicating with the general public	93 (81.6%)
Other uses	6 (5.3%)

The telephone infrastructure has been around in most organisations for quite some time now. That it is an already established tool for internal and external communication explains why such a large number of respondents indicated that they use telephones. The low count for respondents who communicate with organisations that fund agricultural research projects by telephone is probably due to the fact that most of these organisations are located in developed countries, and contacting them by phone means making expensive, long-distance international calls. Using cross tabulation, the findings showed that 62 respondents who used e-mail for getting in touch with research funding agencies also used telephone facilities for the same purposes. Although it may appear to be a waste of resources, people sometimes want confirm that their e-mail messages had reached the intended destinations, and a telephone call does just that.

Regarding the use of mobile phone facilities (Table 19), none of the 63 respondents that had access to mobile phones indicated that they use them to access web-based information services such as those that use the Wireless Application Protocol (WAP). The reason for this could be that there is no WAP-based information services that target researchers in the SADC region are being provided via the Web. Overall, the pattern regarding the use of mobile phones was similar to the pattern for the use of fixed telephone facilities. There was little difference in the number of researchers using mobile phones for communicating with colleagues within the organisation, 55 (87.3%), and communicating with colleagues in other organisations, 51 (81%). A further 53 (84.1%) used mobile phones for contacting the general public, and 31 (49.2%) for contacting organisations that fund research

projects. Six (9.5%) researchers indicated that they use the facility for *other activities*, among them getting in touch with the office while working in the fields, using mobile phone roaming facilities while outside their countries, and sending messages on the livestock early warning system to and from site monitors.

Table 19: Using mobile phone facilities

N=63

Activities	Number (%)
Accessing web-based information	0 (0.0%)
Communicating with colleagues within the organisation	55 (87.3%)
Communicating with colleagues in other research organisations	51 (81.0%)
Communicating with donors/potential donors of research projects	31 (49.2%)
Communicating with members of the general public	53 (84.1%)
Other uses	6 (9.5%)

Researchers were also using telephone facilities to communicate with the general public and individuals. Around 93 (81.6%) used telephones to get in touch with the general public and 53 (84.1%) used mobile phones for this purpose. However, the survey did not try to establish what information was communicated to the general public nor what the general public was requesting from the researchers.

JOHANNESBURG

6.4.3.5 Using facsimile facilities

Although the use of facsimile facilities for sending documents may sometimes be quite expensive, findings of the study shows that 64 (66.7%) of the 97 respondents who had access to facsimile facilities used them to send research reports, 57 (59.4%) sent research proposals, and 47 (49%) indicated *other* uses. The following are among the other uses of facsimile that were mentioned by respondents:

- Communication and transfer of research data/reports when e-mail facilities were not working
- Communicating with other research organisations

- General communication, such as sending letters and brief correspondence
- Communicating with other researchers inside and outside the organisation
- Communicating with colleagues in the extension services
- Sending inquiries to other research institutions and funding agencies
- Sending letters and notices to other research stations
- Transmitting trial requests from international organisations.

Research reports may sometimes be bulky and sending them by fax could be costly, especially if the destination is located outside the researcher's country of operation.

6.4.4 Sources of information and services

In reply to two questions respondents were asked to indicate how often they used various sources of information in their research work; and how often they needed information to meet certain defined information needs. The objective was to establish which information sources were used by researchers, for various defined information needs. These resources could possibly be accessed via an agricultural information portal. In addition to the above, information specialists in each organisation were also requested to indicate the various types of services available to researchers in their libraries or information centres.

6.4.4.1 Using information resources

The top five information sources, derived from Table 20, ranked according to the sources that were *always* used by researchers and scored more than 50% are the following:

- Colleagues 84 (69.4%)
- Journal articles 81 (66.9%)
- Technical reports 79 (65.3%)
- Conference proceedings 64 (52.9%)
- Workshop reports 62 (51.2%)

An information source that was rarely used was online discussion forums: only 10 (8.3%) respondents mentioned it. Other sources mentioned included working papers, annual reports and research progress reports.

Table 20: Frequency of use of information resources

N=121

Sources of Information	Number (%)		
	Never	Occasionally	Always
Colleagues	3 (2.5%)	34 (28.1%)	84 (69.4%)
Online Discussion Forums	64 (52.9%)	47 (38.8%)	10 (8.3%)
Websites	16 (13.2%)	68 (56.2%)	37 (30.6%)
Newspapers/Media	15 (12.4%)	66 (54.5%)	40 (33.1%)
Workshop reports	4 (3.3%)	55 (45.5%)	62 (51.2%)
Conference proceedings	5 (4.1%)	52 (43.0%)	64 (52.9%)
Technical Reports	2 (1.7%)	40 (33.1%)	79 (65.3%)
Monographs/Books	13 (10.7%)	48 (39.7%)	60 (49.6%)
Journal articles	1 (0.8%)	39 (32.2%)	81 (66.9%)
Online databases	44 (36.4%)	55 (45.5%)	22 (18.2%)
Other sources	5 (4.1%)	5 (4.1%)	3 (2.5%)

Using cumulative percentage scores for researchers who *occasionally* and those who *always* used the above sources of information, the ranking of the resources does not change much, as shown below:

- Journal articles 120 (99.1%)
- Technical reports 119 (98.4%)
- Colleagues 118 (97.5%)
- Workshop reports 117 (96.6%)
- Conference proceedings 116 (95.9%)

Noticeably, 108 (89.3%) researchers did not indicate whether they *never*, *occasionally* or *always* used *Other Sources* of information.

The by-products of agricultural research are information and knowledge. Researchers generally share information and knowledge with colleagues and other interested members of the public through various publications, forums and media, including journal articles, technical reports, conferences and workshops. This explains why most researchers indicated colleagues, journal articles, technical reports, workshop reports and conference reports as sources of information that were *always* used.

6.4.4.2 Need for information

The respondents were asked to indicate the frequency of their need to access the listed information resources. Table 21 shows that only two *information needs* scored above 50% in the *always* category. Altogether 74 (61.2%) researchers always needed to access the latest results of research work and 65 (53.7%) needed results of past research projects. 58 (47.9%) always needed to know about other researchers who could be working in their fields of specialisation or interest.

Table 21: Frequency of need for information

N=121

Information needs	Number (%)		
	Never	Occasionally	Always
Latest results of research work	3 (2.5%)	44 (36.4%)	74 (61.2%)
On-going/current research projects	8 (6.6%)	65 (53.7%)	48 (39.7%)
Past research projects and results	6 (5.0%)	50 (41.3%)	65 (53.7%)
Other researchers conducting research	6 (5.0%)	57 (47.1%)	58 (47.9%)
Information on forthcoming conferences, etc.	9 (7.4%)	84 (59.4%)	28 (23.1%)
Research project proposals	16 (13.2%)	70 (57.9%)	35 (28.9%)
Sources of funding for research projects	17 (14.0%)	81 (66.9%)	23 (19.0%)

A good number of researchers, above 50%, indicated that they *occasionally* needed information on various activities. These included 84 (69.4%) who need information on forthcoming conferences, workshops and seminars, 81 (66.9%) who need information on sources of funding for research projects, 70 (57.9%) who need information on research project proposals, and 65 (53.7%) who always needed information on on-going or current research projects.

Cross tabulations showed that 39 and 16 researchers, who *always* needed to collaborate with colleagues working in their organisations and in other agricultural research organisations respectively, were among those who also *always* needed information on other researchers who could be working in their field of interest. This showed consistency in their responses.

6.4.4.3 Services and resources provided by information specialists

The nine agricultural research organisations all had libraries or units responsible for providing library and information services to researchers. Information specialists managing the units completed a questionnaire that requested them to indicate the library and information services and resources provided to agricultural researchers.

The results of their responses are shown in Table 22.

Table 22: Information services and resources available from libraries N=9

Types of services/resources	Number (%)
<i>Information services</i>	
Reference services	8 (88.9%)
Current awareness services	9 (100%)
Selective dissemination of information (SDI)	8 (88.9%)
Other	3 (33.3%)
<i>Databases</i>	
In-house developed bibliographic databases	4 (44.4%)
In-house developed full-text databases	1 (11.1%)
CD-ROM bibliographic databases	6 (66.7%)
CD-ROM full-text databases	4 (44.4%)
Online databases, such as Dialog and SABINET	5 (55.6%)
Other	2 (22.2%)
<i>Information resources</i>	
Journal collections	9 (100%)
Research reports/papers collections	9 (100%)
Books and monograph collections	9 (100%)
Other	3 (33.3%)
<i>In-house information products</i>	
New acquisitions lists	8 (88.9%)
Subject bibliographies	3 (33.3%)
Information guides, leaflets, brochures and others	7 (77.8%)
Other	2 (22.2%)
<i>Training services</i>	
Information use (user) training	6 (66.7%)
Internet use training	4 (44.4%)
Evaluation of web resources	1 (11.1%)
Other	3 (33.3%)

Although overall the data in Table 22 shows that the nine (100%) libraries and documentation centres were providing access largely to traditional paper-based information resources and services such as print-based journal collections, books and monographs, reference services, research reports and new acquisitions lists, provision of access to digital-based information services and resources was also

available in some organisations. For example, one (11.1%) library indicated that it provided access to in-house developed, full-text databases, four (44.4%) libraries provide access to in-house developed bibliographic databases, six (66.7%) provide access to CD-ROM bibliographic databases, four (44.4.0%) to CD-ROM full-text databases, five (55.6%) to remote online databases such as Dialog, Southern African Bibliographic Information Network (SABINET Online). However, overall, there is a need to improve on the provision of access to digital-based information resources within organisations.

6.4.5 Using paper-based information sources

Using paper-based information resources has several associated problems, some of which could be addressed by implementing portals. These include the following:

- Spending too much time searching for documents, especially if they are misfiled or if there is no filing system.
- Having to browse through the documents to locate the specific information that is need.
- Filing system, if not properly designed, failing to handle the growing volume of information documents.
- Difficulty to update information that changes so often on a regular basis in the documents.
- Heavy and sometimes bulky documents and thus too difficult to carry around.
- Use of too much storage space. Sometimes organisations or individuals run out of storage space for documents.

- Overloading information end-users with too much information, some of which may not be relevant or useful, since in most cases the whole document has to be pushed to them.

Both researchers and information specialists were asked to indicate the frequency with which they experience each of the above problems. The objective was to establish problems or situations associated with accessing and using paper-based information resources that could possibly be addressed by the use of portals. Tables 23 and 24 below show the results of the responses to the questions.

Table 23: Problems associated with print documents: researchers N=121

Information needs	Number (%)		
	Never	Occasionally	Always
Spend too much time searching for a document	8 (6.6%)	82 (67.8%)	31 (25.6%)
Browse through the documents	6 (5.0%)	68 (56.2%)	47 (38.8%)
Inadequate current filing system	26 (21.5%)	48 (39.7%)	47 (38.8%)
Information not updated on a regular basis	19 (15.7%)	57 (47.1%)	45 (37.2%)
Information resources too bulky to carry	38 (31.4%)	43 (35.5%)	40 (33.1%)
Running out of storage space for documents	21 (17.4%)	49 (40.5%)	51 (42.1%)
Being overloaded with too much information	35 (28.9%)	59 (48.8%)	27 (22.3%)

Some agricultural researchers in the SADC region are experiencing problems associated with using paper-based information resources, although the degree of occurrence of such problems differs from individual to individual. For example, although only 27 (22.3%) indicated that they were *always* overloaded with too much information, 59 (48.8%) *occasionally* experienced the same problem. Overall, there were more researchers who *occasionally* experience various problems associated with accessing and using paper-based information resources and systems than those who *never* experienced any problems. Cross tabulation showed that some researchers in all the nine agricultural research organisations were experiencing all the above problems.

Regarding information specialists, seven (77.8%) felt that they were *always* running out of storage space for their documents, while five (55.6%) felt that their filing systems were inadequate. Eight (88.9%) and seven (77.8%) respectively *occasionally* experienced problems related to information not being updated on a regular basis and spending too much time searching for documents. Six (66.7%) had to repackage information for end-users, while another six (66.7%) needed to consult several other sources of information to provide responses to inquiries.

Table 24: Problems associated with print documents: libraries N=9

Information needs	Number (%)		
	Never	Occasionally	Always
Spend too much time searching for a document	1 (11.1%)	7 (77.8%)	1 (11.1%)
Repackage information	3 (33.3%)	6 (66.7%)	0 (0.0%)
Consult several sources of information	0 (0.0%)	6 (66.7%)	3 (33.3%)
Inadequate current filing system	1 (11.1%)	3 (33.3%)	5 (55.6%)
Information not being updated on a regular basis	0 (0.0%)	8 (88.9%)	1 (11.1%)
Information resources too bulky to carry	6 (66.7%)	3 (33.3%)	0 (0.0%)
Running out of storage space for documents	1 (11.1%)	1 (11.1%)	7 (77.8%)
Being overloaded with too much information	4 (44.4%)	4 (44.4%)	1 (11.1%)

6.4.6 Resources on organisation's websites

As seen in Chapter 4, some agricultural research organisations in the SADC region have websites and are providing access to some digital information resources. The survey included questions relating to the provision of access to information resources and services via websites. The objectives were:

- To establish the availability of websites in the nine agricultural research organisations that could be improved or upgraded to an information portal, where applicable.
- To establish the services and resources provided to researchers by the organisations via the website.

- To establish the services and resources accessed by researchers on the (external) websites of other organisations.

The data to be provided by the respondents was to be used to establish whether existing website infrastructures, if any, were adequate or could be improved and upgraded, if required, to a portal-based system. Access to information resources on the websites of other organisations could also indicate the need for the provision of certain information resources or facilities via the local portal.

6.4.6.1 Information services and resources provided via websites

Websites are implemented for various reasons. However, it is expected that sites for research organisation should provide access to various information resources and facilities, most of which were discussed in Chapter 4 during the review of the international trends in the provision of access to information resources via the websites of agricultural organisations.

Researchers whose organisations had websites were asked to indicate the types of web-based information resources and facilities provided to them by the organisations. Out of a total of 86 researchers in organisations that had websites, 76 (88.37%) provided information regarding the resources and services provided to them via their organisations' websites. Their responses are summarised in Table 25.

Table 25: Resources/facilities provided via the websites

N=76

Resources/facilities	Number (%)
Electronic publications	18 (23.7%)
Online databases (bibliographic or full-text)	6 (7.9%)
Tools	3 (3.9%)
Discussion forums	4 (5.3%)
Information retrieval facilities	38 (50.0%)
Data sets	4 (5.3%)
Online staff directories	60 (78.9%)
Links to useful resources	13 (17.1%)
News	34 (44.7%)
Events diaries	34 (44.7%)
Journals (full-text journals)	3 (3.9%)
Newsletters	5 (9.2%)
Other resources/facilities	26 (34.2%)

Overall, the above information shows that except for staff information (staff directories) indicated by 60 (78.9%) of the 76 respondents, information retrieval facilities by 38 (50%), news and events by 34 (44.7%) respondents each, organisations do not seem to be providing a variety of resources and services via the Web. This confirms the statement in Chapter 4 that not many information resources and services were being provided via the websites of agricultural research organisations in the SADC region. For example, only 18 (23.7%) researchers, all from two organisations, indicated that they only had access to electronic publications on their organisations' websites, 13 (17.1%) from the same two organisations had access to links to useful web resources on their websites, and 3 (3.9%) researchers from one organisation indicated access to full-text journals via their sites. Access to other information resources/facilities was mentioned by 26 (34.2%) researchers. The resources that were mentioned included an online herbarium; information on the organisation's current work or research projects of the technical/scientific departments; research project documents; publications lists, and technical recommendations; Director's Annual Talk; brochures; and copies of the organisation's annual reports.

One major observation from the results was that while all researchers from the same organisations were expected to have indicated access to the same resources available on their organisations' websites, this was not the case. For example, out of 11 respondents from ARC in South Africa, only three said that journal articles were available on their organisation's website. This was also the case with regard to many other resources in almost all the organisations. This could be ascribed to the fact that only those researchers who actively used their organisation's websites and resources were aware of what was actually available on the websites. In addition, researchers could have been indicating only the resources/facilities that they used regularly.

As websites are an ideal infrastructure for the provision of digital-based library and information services within the organisation, information specialists were also asked to indicate whether they were providing any library and information services via their organisation's website. In only three organisations out of the five that had websites information specialists indicated that they were providing access to some digital-based information sources and services via their websites. Table 26 shows the services and resources that were provided by the three organisations.

Table 26: Electronic services provided by the library N=5

Resources/facilities	Number (%)
Electronic books (e-Books)	0 (0.0%)
Electronic journals (e-journals)	1 (20.0%)
In-house database of full-text documents	1 (20.0%)
Web access to in-house bibliographic databases	1 (20.0%)
Web access to CD-ROM-based databases	1 (20.0%)
Web based Current Awareness Services	1 (20.0%)
Web based Selective Dissemination of Information (SDI)	1 (20.0%)
Access to online Virtual Reference Collections	0 (0.0%)
Online tutorials on how to use information services	0 (0.0%)
Electronic copies of acquisition lists	2 (40.0%)
Accessed to Subject-Based Information Gateways	1 (20.0%)
Others	2 (40.0%)

The above data, even though limited, shows that overall not much digital information service is being provided to agricultural researchers. This re-confirms the findings of Chapter 4. The reasons given by information specialists for not providing web-based information services included the following:

- Lack of funds to develop appropriate web content
- Lack of staff/skills to develop web-based services
- Slow internet connection
- Lack of time to develop web-based services
- Users have not yet requested the services.

6.4.6.2 Resources accessed on the websites of other organisations

In most organisations researchers make use of libraries or documentation centre facilities to obtain the information that they require. Where websites are available, these are also used. However, since an organisation cannot provide all the information resources needed by its staff via its website, researchers tend to rely on access to resources available via the websites of other organisations. As seen in Chapter 4, international agricultural research organisations are providing a variety of information resources and tools which are accessible via their websites to anyone who has access to the Internet.

Portals could, for example, be used to integrate information resources accessed via external websites into one single information system. This could save the researchers and the organisation time spent on locating information resources on the Internet. It was important to establish what researchers were accessing on the websites of other organisations help determine suitable information services that could be integrated into an organisation's portal. Table 27 shows the results of the findings regarding access to external information resources by the 114 researchers that had access to internet facilities.

Table 27: Resources/facilities accessed on the websites of other organisations

N=114

Resources/facilities	Number (%)
Electronic publications	73 (64.0%)
Online databases (bibliographic or full-text)	35 (30.7%)
Tools	18 (15.8%)
Discussion forums	22 (19.9%)
Information retrieval facilities	33 (28.9%)
Data sets	18 (15.5%)
Online staff directories	28 (24.6%)
Links to useful resources	54 (47.4%)
News	48 (42.1%)
Events diaries	40 (35.1%)
Journals (full-text journals)	48 (42.1%)
Newsletters	51 (44.7%)
Other resources/facilities	1 (0.9%)

A good number of agricultural researchers, 73 (64.0%) in all, were accessing electronic publications on the websites of other agricultural organisations. 54 (47.4%) were accessing links to useful resources, 51 (44.7%) were accessing newsletters, and 48 (42.1%) were accessing journal articles and news each.

Only 18 (15.8%) indicated that they also accessed software tools and models, and data sets. This number was quite low and could be attributed to the fact that there was not a wide variety of such tools available on the Web. As seen in Chapter 4, only 9 out the 27 international agricultural organisations provided access to software tools and models on their websites, and only 3 provided access to data sets.

6.4.7 Portal-based facilities and services

Chapter 2 and Chapter 3 stated that intranets and portals are used for various functions, the major ones being to facilitate:

- Collaboration
- Access to information resources
- Access to various tools and software for work
- Sharing of information and knowledge.

Involvement in the above activities by researchers could justify the implementation of portals, accessed via intranets and extranets, to facilitate and support their work. In this regard, the questionnaire for researchers also contained a series of questions designed to establish the frequency with which the researchers performed or would like to be involved in activities relating to collaborating on research projects with colleagues both within and outside their organisations; accessing information resources in order to meet their information needs; accessing various tools and software for use in their work; and sharing information and knowledge with colleagues and the public.



6.4.7.1 Collaboration

Regarding collaboration, 79 (65.53%) researchers *always* collaborated with colleagues within the organisation on research projects, while 33 (27.3%) *always* collaborated with colleagues from other research organisations. Notably, 83 (68.6%) indicated that they *occasionally* collaborated with colleagues from other organisations. One (0.8%) and five (4.1%) researchers respectively indicated that they *never* collaborated either with colleagues within the organisation or outside the organisation. Some of the reasons given for not being involved in any collaborative activities were the following:

- Collaborative research is carried out at a higher level.
- In some cases, the researchers were new in the organisation and had not yet established themselves.
- Owing to limited funding, some organisations are unable to involve everybody in joint research projects.

Using cross tabulation, the survey showed that only one (0.8%) respondent was neither *always* nor *occasionally* collaborating with colleagues within the organisation or in external research organisations. The remaining 120 (99.2%) were involved in various collaborative activities. For example, 79 (65.3%) researchers indicated that they *always* collaborated with colleagues within the organisation, and 33 (27.3%) collaborated with colleagues from other organisations. In fact, 23 researchers *always* collaborated with colleagues both within and outside their organisations. Around 83 (68.6%) occasionally collaborated with colleagues from other organisations.

As seen in Chapters 2 and Chapter 3, portals could be used to facilitate and enhance collaboration among agricultural researchers. This could be done, for example, by providing facilities such as access to information on research projects, project management and monitoring tools, and virtual work spaces.

6.4.7.2 Access to information resources

Researchers were asked to indicate how often they needed certain types of information or needed to have access to information resources. Their responses are presented in Table 28.

Table 28: Need to access information or resources

N=121

Information needs/resources	Number (%)		
	Never	Occasionally	Always
Information on on-going research	0 (0.0%)	35 (28.9%)	86 (71.1%)
Reports/results of past researches	3 (2.5%)	31 (25.6%)	87 (71.9%)
In-house databases	11 (9.1%)	73 (60.3%)	37 (30.6%)
External databases	12 (9.9%)	76 (62.8%)	33 (27.3%)
Journal articles	0 (0.0%)	32 (26.4%)	89 (76.3%)
Conference proceedings/papers	1 (0.8%)	47 (38.8%)	73 (60.3%)
Newsletters	4 (3.3%)	56 (46.3%)	61 (50.4%)
Data sets from past researches	10 (8.3%)	64 (52.9%)	47 (38.8%)
News from within the organisation	1 (0.8%)	51 (42.1%)	69 (57.0%)
Relevant news from other organisations	2 (1.7%)	64 (52.9%)	55 (45.5%)
Contact for other researchers	1 (0.8%)	52 (43.0%)	68 (56.2%)
Channelled information	16 (13.2%)	73 (60.3%)	32 (26.4%)
Website of other research organisations	7 (5.8%)	66 (54.5%)	48 (39.7%)
Relevant information resources on WWW	6 (5.0%)	67 (55.4%)	48 (39.7%)
Targeted information needs	5 (4.1%)	42 (34.7%)	74 (61.2%)
Discussion forums	26 (21.5%)	76 (62.8%)	19 (15.7%)

Overall, almost all agricultural researchers who participated in the survey either *always* or *occasionally* needed to access information on on-going research projects, journal articles, conference proceedings and papers, news from within and outside the organisation. Contact information on other researchers received the highest number of indications. The results show that 89 (76.3%) researchers *always* need to access journal articles, while 35 (28.9%) *occasionally* need access to the same information, bringing the total number to 121 (100%). The trend was almost the same with regard to other resources. About 87 (71.9%) *always* needed access to reports or results of past research and 31 (25.6%) *occasionally* needed to do so. Other notable results were that 86 (71.1%) needed access to information on on-going research, 74 (61.2%) need targeted information, 73 (60.3%) needed information on conference proceedings and papers, 69 (57.0%) needed news from within the organisation, 68 (56.2%) needed contact information for other researchers, and 61 (50.4%) needed to access newsletters. These resources and needs could all be addressed via a portal.

Notably, the largest number (25.1%) of respondents indicated that they *never* needed to access or use discussion forums. The following quotations from different questionnaires were among the reasons given for not needing to access or use discussion forums:

- I have never tried
- No discussion forums of relevance to my work
- I do not know how to participate in discussion forums and time is also limiting
- I am not a member of any online discussion group
- Not familiar with discussions forums
- I do not know about online discussions
- I have no interest in discussion forums as at now
- I consider it too time consuming, and time is my most limiting factor.

Other reasons given by some researchers for *never* needing some of the information resources or facilities included the following:

- Lack of interest in facilities such as internal news, access to websites, discussion forums, and so forth
- Absence of facilities or resources such as bibliographic and full-text databases
- Lack of facilities for accessing the required information
- Confidentiality limitations placed on some resources. For example, one researcher indicated that in his country data sets are classified as State property and regarded as highly confidential, and therefore not easily released for access.

6.4.7.3 Access to tools and software facilities

Portals and websites could be used to provide access to various tools, including software models for use by researchers in their work. In this regard, researchers were asked to indicate how often they needed to access the tools or facilities listed in Table 29.

While 98 (81.0%) of the respondents indicated that they *always* needed to access and use application software, 88 (72.7%) indicated that they *occasionally* needed to access user manuals for application software, 79 (65.3%) needed in-house training manuals and facilities, 75 (62.0%) needed to learn how to use different software, 74 (61.2%) accessed the information technology help desk, and 74 (61.2%) used different software systems. Cross tabulation revealed that 47 respondents out of the 52 that indicated that they *always* needed to use research project management tools/software also *always* needed to use application software, showing consistency in the completion of the questionnaires.

Table 29: Frequency of need to access tools and facilities

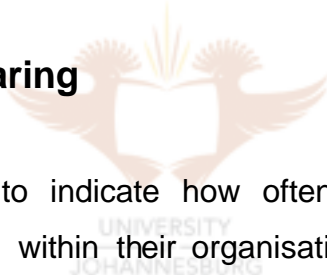
N=121

Tools/Facilities	Number (%)		
	Never	Occasionally	Always
Use research project management tools	13 (10.7%)	56 (46.3%)	52 (43.0%)
Use different software systems	7 (5.8%)	74 (61.2%)	40 (33.1%)
Learn how to use different software	13 (10.7%)	75 (62.0%)	33 (27.3%)
Consult user manuals for application software	18 (14.9%)	88 (72.7%)	15 (14.4%)
Access in-house training manuals/facilities	23 (19.0%)	79 (65.3%)	19 (15.7%)
Access the Information Technology help desk	28 (23.1%)	74 (61.2%)	19 (15.7%)
Use applications software	3 (2.5%)	20 (16.5%)	98 (81.0%)

The reasons given for some of the *never* responses included the following:

- *Help desk*: Absence of help desk services in the organisation; or individuals at the help desk are usually of little help, and difficult to get hold of when you are in a hurry and don't have the time to e-mail endlessly back and forth.
- *Manuals*: Users do not need manuals for the computer programs that are being used; lack of time to consult manuals; very few copies of the manuals are available and they are required by many users.
- *Software*: Some members of staff are not exposed to the software systems in use.

6.4.7.4 Information sharing



Researchers were asked to indicate how often they shared research-related information with colleagues within their organisations and colleagues from other research organisations. The results set out in Table 30 show that 84 (69.4%) researchers *always* shared information with colleagues within the organisation, while 36 (29.8%) *always* shared information with colleagues from other organisations.

Cross tabulation showed that 61 (77.2%) out of the 79 researchers that indicated that they *always* collaborated with colleagues also *always* shared information with colleagues within the organisation, while 15 (45.4%) of the 33 researchers that *always* collaborated with colleagues from other research organisations, also *always* shared information with colleagues from other organisations. Using cross tabulation, it was found that only one (0.8%) researcher *never* shared information with either colleagues from within the organisation or those from external organisations

Table 30: Information sharing

N=121

Sharing with	Never	Number (%)	
		Occasionally	Always
Colleagues within the organisation	0 (0.0%)	37 (30.6%)	84 (69.4%)
Colleagues from other organisations	1 (0.8%)	84 (69.4%)	36 (29.8%)
Donors/potential donors	5 (5.1%)	67 (55.4%)	49 (40.5%)
Interested individuals or the general public	0 (0.0%)	65 (53.7%)	56 (46.3%)

Noticeably, all researchers either *always* or *occasionally* shared information with the general public.

6.5 DISCUSSION OF SURVEY RESULTS

As stated in Chapter 5, the survey was conducted to establish whether or not there was a need for information portals amongst agricultural researchers in the SADC region. The survey had the following specific objectives, based on the research concepts that were developed in Appendix 5:


- To establish whether there are any problems associated with using paper-based information resources that could be solved through the use of portals
- To determine the availability of and access to tools for manipulating digital information resources
- To establish whether website are available how they are being used by researchers
- To determine the availability of tools and facilities for developing information portals in agricultural research organisations
- To determine the types of information resources used by researchers for different types of information needs

- To establish the frequency of use or need to use and access services or facilities or conduct activities via an information portal.

The discussion of the findings is based on the above six objectives, with a view to establishing whether the overall objective of the survey was achieved.

6.5.1 Problems associated with paper-based information resources

The findings of the survey established that, to some extent, problems associated with using paper-based information resources and manual-based information systems do exist in agricultural research organisations in the SADC region. For example, in all the nine organisations that were included in the survey some researchers either *always* or *occasionally*:

- 
- Spent too much time searching for information documents
 - Browsed through the documents to locate the information that they required
 - Felt that their filing systems had become inadequate and could not cope with the information resources that they had to file
 - Felt that information that required constant updating was not being updated on a regular basis, and thus they could be getting information that was out of date
 - Felt that information resources such as books and documents were sometimes too bulky or difficult to carry around
 - Felt that they were running out of storage space for their documents
 - Felt that they were being overloaded with too much information.

Although the extent of the above problems differed from organisation to organisation and from individual to individual, there is a definite need to put in place a mechanism that will ensure that the problems that individuals are currently experiencing are resolved. It is also important to rule out event problems that may affect researchers in the future.

6.5.2 Tools for manipulating digital information resources

The survey showed that a good number of agricultural researchers in the SADC region had access to ICT facilities, especially desktop computers, laptops, the Internet and electronic mail at their work place. These facilities are vital for generating and transmitting digital information resources. Some researchers also had access to computers and internet facilities at their homes, providing them with an opportunity to access digital information resources after office hours.

Unfortunately, there are still organisations with computers that are not connected to any electronic networks. This means that some researchers either have no access to networked information resources or have to share computer facilities with colleagues to access facilities such as web resources and electronic mail. In the long run, this arrangement is not conducive to working in a digital information environment, where information is accessed and shared, and collaborative activities are conducted via portals. Organisations would, therefore, be required to install local area networks, and develop intranets and extranets to facilitate access to digital information resources.

6.5.3 Websites and their use by researchers

Unfortunately, the provision of access to appropriate digital resources in agricultural research organisations in the SADC region was found to be behind international trends. Not many research organisations have developed their website to an acceptable level. Although five (55.5%) organisations out of the nine covered in the

survey had corporate websites, provision of access to digital-based information resources and services to researchers via these websites was inadequate. This fact was also discussed in Chapter 4.

Overall, the websites of agricultural research organisations in the SADC region were *brochurewares*. Admittedly, the sites were probably meant to target individuals interested in the activities of the organisation rather than to provide access to information resources such as research reports, technical reports, and data sets generated by the organisations. Most agricultural research organisations in the SADC region are public institutions and are expected to provide free information services to the general public. Using web-based technologies such as portals could help to ensure that free information services are provided to the public.

Although few information resources were being provided via the websites of the various organisations, it is important to note that researchers were accessing information resources and services from other external websites, probably the websites of international agricultural research organisations. As discussed in Chapter 4, international organisations are providing access to a variety of information resources, tools and services via the Web. The fact that researchers were accessing information resources via external websites is proof enough that organisations in the SADC region could do more to provide access to a variety of information resources and services via their own website. Guidelines on deploying advanced websites or on information portal development would help to improve the situation, particularly if they provide information on the type of content that could be provided on portals.

6.5.4 Tools and facilities for developing information portals

The deployment of portals in organisations requires various tools and facilities. These include ICT facilities such as computer hardware (server and client

equipment), operating systems software, application software, portal development tools and software, and skilled manpower.

The results of the study indicate that some research organisations in the SADC region do not have a well-established ICT infrastructure, especially network facilities that could be used to provide access to portals across the organisations. Other organisations, for example the Agricultural Research Division in Lesotho and Malkerns Research Station, also indicated that they did not have IT specialists in their establishments. Although the development and deployment of portals could be outsourced, daily maintenance and updating of information resources on the portal should be done within the organisation, and this would require the services of skilled IT staff within the organisation.

6.5.5 Information resources used by researchers

Agricultural researchers in the SADC region are using various information resources to meet their information needs. The findings show that researchers need information on the following:

- Latest results of research work
- On-going/current research projects
- Past research projects and results
- Other researchers conducting
- Information on forthcoming conferences
- Research project proposals
- Sources of funding for research projects.

No one single source of information or resource was used to meet the information needs mentioned above. Researchers used a combination of information sources and resources including journal articles by colleagues, technical reports, conference proceedings, workshop reports, and monographs.

The fact that colleagues were being used as a major source of information showed that researchers valued tacit knowledge. Well-designed portals could facilitate collaboration and the capturing and sharing of tacit knowledge within organisations, in addition to providing access to other information resources. Most public agricultural research organisations in the SADC region were linked to several research stations or institutes scattered around the country, thus portals could be the meeting point for researchers working at the research stations or institutes.

6.5.6 Frequency of use or need to use or access services or facilities

The surveys also showed that researchers in agricultural research organisations were involved in various activities requiring:

- Collaboration with colleagues on their research projects
- Access to certain information resources to meet their information needs
- Access to various tools and software
- Sharing of information and knowledge with others, including the public.

All the above activities could be facilitated or enhanced through the use of modern ICTs such as portals. There are many possibilities of collaborating, sharing information and other resources through e-collaboration, e-publishing and e-learning via portals. Taking into account that some research stations are located away from their headquarters where library and information facilities are offered. A portal accessed via intranet or internet could be an entry point to the organisation's information resources and knowledge.

6.6 SUMMARY

The objective of the survey, which was designed in Chapter 5, was to obtain information, implicit or explicit, that could assist in establishing the need for agricultural information portals in the SADC region. The findings, analysis and discussions presented in this chapter indicate that various problems could be addressed by the use of portals in agricultural research organisations in the SADC region. The extent of the problem differs from organisation to organisation, and the degree to which the factors are affecting individual researchers also differs from one individual to individual. However, the survey revealed that:

- Agricultural research organisations in the SADC region had access to ICT tools and facilities that could be used in developing information portals.
- Agricultural researchers in the SADC region have access to ICT facilities that could be used to access information services and resources provided via portals.
- Agricultural researchers and information specialists are, to a certain extent, being affected by problems associated with using paper-based information resources. Some of the problems could be minimised or eliminated through the use of portals.
- Most available websites of agricultural research organisations are brochurewares, and therefore they would need to be upgraded to advanced websites or portals.
- Researchers for different types of information needs are currently using a variety of information resources. Most of the information resources could be integrated into a portal.

- There is a need among agricultural researchers to use or access services or facilities or conduct activities via an information portal.

Taking the above factors into account, it is therefore concluded that there is a need to use portals or improved website to provide information services to researchers in agricultural research organisations in the SADC region. Overall, the environment for the development of a digital-based agricultural research information provision services is available in most research organisations. The use and integration of portals in the work of agricultural researchers will facilitate provision and make access to digital based information resources more efficient and affective.

Taking into account the quality of existing website and web-based information services that are available to researchers, it is important for agricultural research organisations to adopt the use of advanced website or information portals. In this regard, there is a need to provide these organisations with suitable guidelines for the planning of the deployment of information portals. The next chapter proposes guidelines for the deployment of portal facilities that could serve the needs of researchers involved in agricultural research in the SADC region.

CHAPTER 7

GUIDELINES FOR PLANNING THE DEPLOYMENT OF AGRICULTURAL INFORMATION PORTALS

7.1 INTRODUCTION

The results of the survey on the need for improved access to information in agricultural research organisations in the SADC region, discussed in Chapter 6:


- Confirmed and supported the need to use web-based technologies in the provision of access to agricultural research information.
- Showed that agricultural research organisations in the region are at different levels of development in terms of access to and use of web-based information systems. Therefore, if information services are to be provided via the Web, some organisations would have to start with a basic web infrastructure and later upgrade to portal infrastructure level.
- Showed that most of the available websites of agricultural organisations in the region are very basic, and are only providing access to information that is generally found in brochures of the organisations. Therefore, there is need to develop advanced websites or portals that could better serve the information needs of the researchers.
- Revealed that none of the organisations that had websites had used any formal web development methodologies. Therefore, if the organisations are to deploy advanced websites or portals, they would need to use formal website and portal development methodologies to avoid problems

associated with the non-use of formal system development methodologies discussed in Section 7.3.

The discussions of the findings also brought to the fore the view that a systematic set of guidelines that agricultural research organisations could use in planning the deployment of improved websites or sophisticated agricultural information portals, is of critical importance. Therefore, the overall objective of this chapter is to address the fifth research sub-problem, namely:

What is an agricultural information portal and are there any suitable models or guidelines (if any) that could be adopted (or developed) for the deployment of agricultural information portals in agricultural research organisations?

The chapter has the following specific objectives:

- 
- To define an agricultural information portal (AIP) and outline its major features or components
 - To give an overview of various information systems development methodologies that could possibly be used in the development of agricultural information portals
 - To propose guidelines for planning the deployment of agricultural information portals in agricultural research organisations

The definition of an AIP and the formulation of the guidelines for deploying AIPs in organisations are to take into account the findings of the literature review on intranets and extranets reported in Chapter 2; good features of portals discussed in Chapter 3; international trends in the provision of information resources and services on agricultural websites examined in Chapter 4; and the findings of the

survey on the need for improved access to agricultural information discussed in Chapter 6.

7.2 AGRICULTURAL INFORMATION PORTALS

It is important to first define an agricultural information portal and to outline its major features before proposing any guidelines for the development of such a portal. Based on the definition of a portal adopted from Morrison (2000) and further developed in Section 3.5, the term *agricultural information portal* (AIP), as used in this research, was defined as:

A web-based application accessed over the intranet or extranet that provides a personalised and adaptive interface enabling *agricultural researchers* to discover, track, and interact with colleagues and other people, software applications, information resources, services and tools relevant to their research interests and work.

An agricultural information portal is, therefore, a one-stop point access for researchers to agricultural information resources, services, tools and facilities such as virtual conferencing, instant messaging systems, virtual team workspace, discussion forums, document sharing, and electronic white boarding.

The use of agricultural information portals in the provision of access to digital information services in agricultural research organisations has several advantages. It can provide increased functionalities and improved access to information resources and services to researchers within the organisation. Agricultural information portals could also enable researchers, through a single user interface, to:

- Share information and knowledge with colleagues within and outside the organisation.

- Collaborate on research projects with colleagues within and outside the organisation.
- Manage and track the progress of various research projects being implemented by the organisation.
- Access various information resources such as bibliographic and full-text databases, images, and video clips generated within the organisation; services and tools relevant to agricultural research work; and information resources from external sources and organisations.

7.2.1 Components of an agricultural information portal

An agricultural information portal consists of the features outlined below and graphically illustrated in Figure 3. These are largely derived from the Intranet reference model discussed in Section 2.3.7.2, and the major characteristics of portals and features of good portals, discussed in Section 3.4. These are as follows:

- *Portal end-users*: These are the target users of the portal facilities and resources. In some cases, some end-users could also be content developers. In agricultural research organisations, researchers are expected to be the major users of AIPs.
- *Portal developers*: This group is mainly made up of information technology specialists or external firms and consultants involved in the development and maintenance of the portal.
- *Portal development tools*: Tools such as portal development software, standards and guidelines.

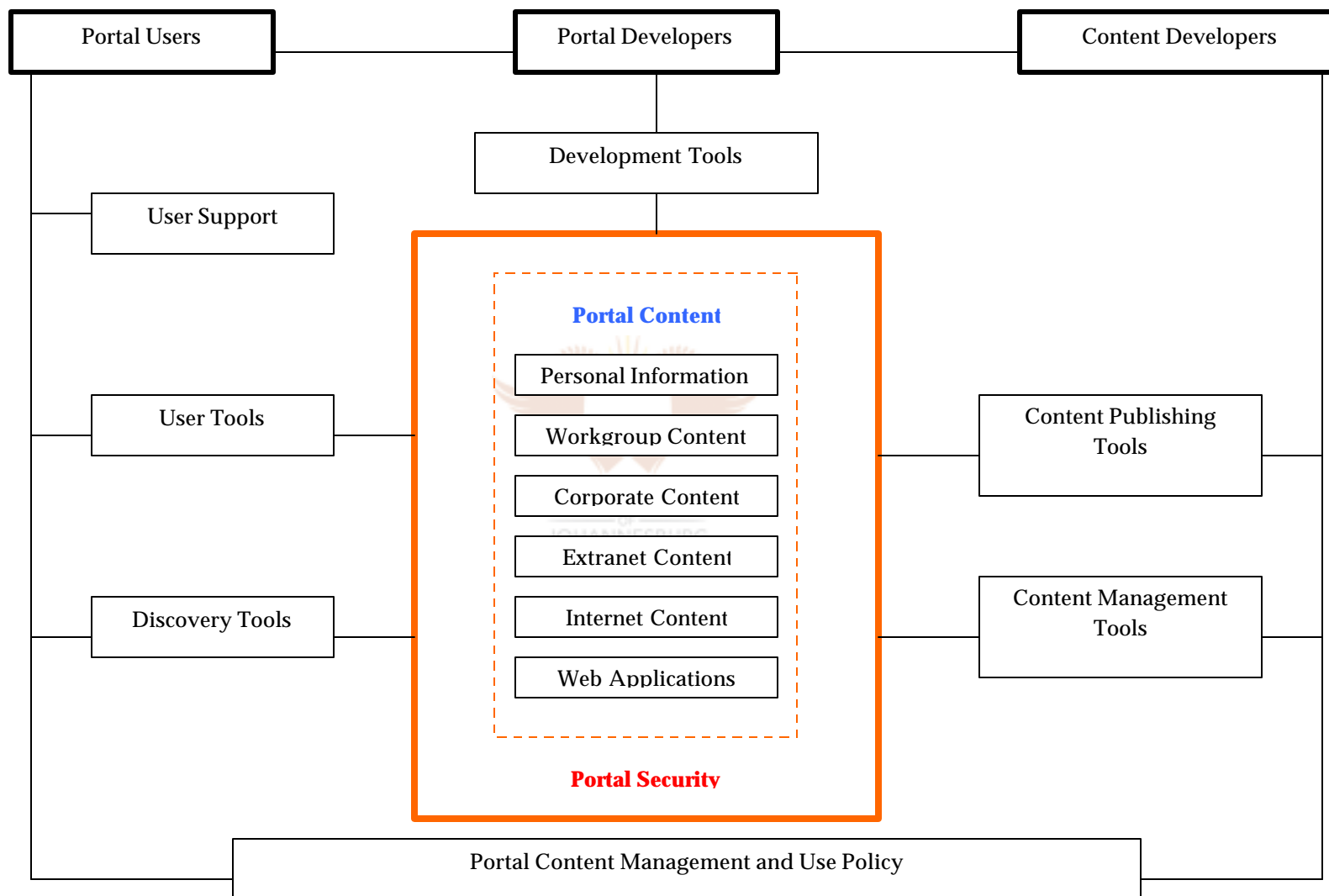
- *Portal content developers*: This group includes both internal and external content developers and providers. Therefore, external online database suppliers, publishers of electronic journals, and many others are also included in this category.
- *Portal security*: Features that allow or restrict access to the portal content, and control publishing (adding, modifying, and deleting) of content on the portal.
- *Portal content publishing and management tools*: Tools and software used to generate and publish content on the portal.
- *Content management and use policy*: Overall guidelines for publishing, managing and using content via the portal.
- *Portal discovery tools*: Various tools for retrieving content on the portal, including internal search engines, taxonomy and other such tools.
- *Portal user tools*: Such as web browsers, help applications, and hardware used to facilitate access to the portal resources.
- *Integration with the Internet*: As seen in Chapter 4, there are many international agricultural-based websites on the Internet. When developing an agricultural information portal, it is economical and efficient to not replicate content already available on other public websites. If appropriate content is available on other public websites which supports or fits into the goals and objectives of the AIP, links should be established to the content so that users of the of the AIP access the information without having to reproduce the content on the portal.



- *Portal user support:* Assistance given to users to enable them make affective use of the portal resources, including technical support and training.
- *Portal content:* Various contents and facilities available on the portal.



Figure 3: Major features of an agricultural information portal.



7.2.2 Portal content and facilities

Chapters 4 and 6 revealed that provision of access to appropriate digital-based information resources and services via websites in agricultural research organisations in the SADC region lagged behind international trends. In addition, not many research organisations had developed advanced or sophisticated corporate websites. Where websites were available, provision of access to digital-based information resources and services to researchers via the sites was found to be inadequate. In general, most agricultural research organisations were providing access to information, which is usually contained in their brochures.

Taking these findings into consideration, this research proposes possible contents of an agricultural information portal to assist agricultural research organisations when deploying their websites and portals. In the context of this research, an agricultural information portal should, possibly and where necessary, incorporate and provide access to the resources and facilities that have been discussed in Sections 3.4 and 4.2.1. The degree of integration into the portal of the proposed resources and facilities will vary from organisation to organisation and will largely depend on the identified needs of the target users (mainly researchers) and the purpose of the portal.

7.3 NEED FOR FORMAL PORTAL DEVELOPMENT APPROACHES

Portals are web-based information systems designed to achieve a set of defined objectives. The objectives are achieved through the interaction of different resources, including hardware, software, human skills, funds and information resources. To achieve optimal interaction of various resources, system development methodologies are used to develop and deploy information systems in organisations. Therefore, as in the case of all information systems, the development of agricultural information portals should be based on sound system development methodologies.

Unfortunately, as revealed by the results of the survey discussed in Section 6.4.1.6, agricultural research organisations in the SADC region are using ad hoc (in-house) methodologies in the development of their websites. Ad hoc web development methodologies are not adequate or suitable for the development of sophisticated web-based information systems, such as portals, since there are several problems associated with these approaches.

When using ad hoc approaches, most website and portal developers go directly into the implementation phase of the system, paying little or no attention to requirements acquisition and specification (Coda et. al. 1998). This makes it very difficult to successfully develop, deploy and maintain websites over the long term and the result is poorly developed web-based applications that have a high probability of failure (Pressman 2000: 18-19). Furthermore, if established methodologies are not used in web development, advanced web-based systems face a variety of problems regarding maintenance, scalability, real-time performance, integrity, configuration and content management, and other technical and non-technical issues (Murugesan & Deshpande 2000).

The non-use of formal website and portal development approaches also results in poor or inadequate management of web development projects, leading to a number of problems. For example, the results of a survey by the Cutter Consortium (2000) highlighted the following as being the major problems plaguing large web-based projects resulting from inadequate e-project management (any project that involves creating or changing the source code that is deployed on the Internet):

- Delivered systems do not meet business needs
- Schedule delays
- Projects exceeding the budget
- Delivered systems do not have the required functionality
- Deliverables are of poor quality.

Taking the above factors into account, and in order to deliver high quality and sophisticated agricultural information portals within limited time and budget, it is critical that agricultural research organisations in the SADC region and sub-Saharan Africa adopt the use of formal system development methodologies, when developing their advanced websites or information portals.

7.3.1 Formal approaches to website/portal development

There are several formal approaches that are currently being applied to website and portal design, development and implementation, and these include approaches based on:

- Traditional system development methodology
- Web development methodology
- Software engineering methodology
- Hypermedia methodology
- Web engineering methodology.

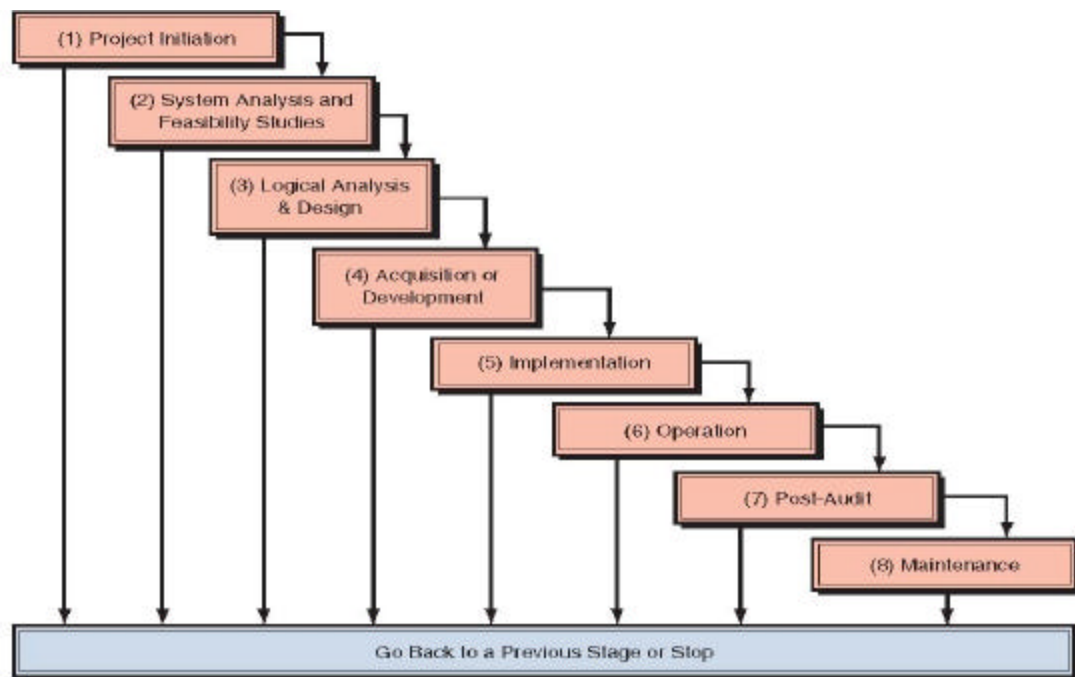
It would take a separate study to thoroughly review all the above development methodologies and their use in website and portal development. In addition, it is also not the intention of this research to examine the suitability of each methodology to website and portal development. However, since one of the objectives of this chapter is to propose guidelines that could be used in the planning of the deployment of AIPs, the sections below give brief descriptions of the above development methodologies, with a slight emphasis on the phases or stages involved in each approach. This will give potential developers of AIPs a general overview of the steps involved in various system development approaches that they may wish to adopt.

7.3.1.1 Traditional system development methodologies

There is a wide variety of system development methodologies that fall under the *traditional system development methodology* category. These include the code

and fix, waterfall, staged and phased development, transformational, spiral and iterative models (Wolak 2001). However, the most common traditional system development methodology is the System Development Life Cycle (SDLC), which is used to structure, plan and control the development of software applications within organisations.

Figure 4: SDLC: Formal and disciplined approach to systems development (Turban, McLean and Wetherbe 2004).



There is no universal, standardised version of the SDLC (Turban, McLean and Wetherbe 2004), and the number of stages in an SDLC varies according to different authors (Hunt and Swatman 1998). For example Turban, McLean and Wetherbe (2004) indicate that SDLC goes through eight stages, illustrated in the model in Figure 4 above and explained below:

- *Stage 1 – Project initiation:* The stage starts when the manager (or organisation) has a problem or sees an opportunity.
- *Stage 2 – Systems analysis and feasibility studies:* Conducted in two phases, and involves developing a thorough understanding of the

existing organisation, its operation, and the situation that is causing a problem; making decisions on introducing/building a new system or upgrading an old system; and determining the probability of success of the proposed solution.

- *Stage 3: Logical analysis and design:* Involves determining the logical requirements, from the user's point of view, of the proposed system; identifying information requirements and specifying operations such as input, output, processing and storage
- *Stage 4 – Development of acquisition:* Involves the actual development or acquisition of the system. The logical design developed in Stage 3 is converted into a technical system design.
- *Stage 5 – Implementation:* Involves bringing the proposed system to life and placing it in the organisation. This may involve writing/developing the program/code for the system, and development of manuals; installing the acquired system; and conversion from the previous system.
- *Stage 6 – Operation:* Postproduction environment
- *Stage 7 - Post-audit evaluation:* Reviews the stages and processes to determine best practice methods.
- *Stage 8 – Maintenance:* Providing constant monitoring of the system, fixing bugs in the software and regularly upgrading the system.

By contrast, Haag, Cummings and Dawkins (1998: 45-47) indicate that SDLC involves the following six steps:

- *Planning:* Establishing an IT plan to meet the strategic plans of the organisation

- *Scoping*: Defining the scope of the proposed system
- *Analysis*: Determining the logical requirements for the proposed system
- *Design*: Converting the logical requirements into a technical system design
- *Implementation*: Creating the new system
- *Support*: Providing ongoing support.

Further examples of the differences in the stages involved in SDLC are shown by Olle et al. (1988) who present four major steps: information systems planning, business analysis or requirements engineering, system design and construction. Teague and Pidgeon (1991) present eight stages of SDLC that include identification of user requirements; establishing user requirements; determining hardware and system software environment; system design; development of system acceptance criteria; construction of the system; integration with user organisation; and operation modification and system enhancement.

7.3.1.2 Web development methodologies

Web development methodologies emerged from informal (ad hoc) web development approaches. These have tempted to document ad hoc approaches and in the process introduce some formal approach, borrowed from other systems development methodologies, to web development. These methodologies have been proposed by different authors, and include approaches such as the *Information Development Methodology for the Web* (December 2002), a *Top-down Methodology for Building Corporate Web Applications* (Artz 1996) and the *People Approach to Produce Web Content (PAPWEC)* (Chivhanga 2001).

Like SDLC, existing web development methodologies do not have a standard number of phases or stages. Although, they are either based on the traditional system development life cycle (Chivhanga 2001), or contain many of the same elements as a traditional information development process (December 2002), each approach has its own stages or phases. For example, PAPWEC, which is

geared towards the design and production of web-based information resources that can be used to achieve development goals, is composed of the following four phases (Chivhanga 2001):

- *Phase 1 – Needs analysis*: Studying the socio-economic circumstances of the people (users), their culture, environment and development goals; identification of the needs of people; and analysis of existing sources of information
- *Phase 2 – Content architecture*: Matching information needs and development goals; and preparing content
- *Phase 3 – Authoring*: Designing and producing the website
- *Phase 4 – Implementation and evaluation*: Marketing the website; and analysing the impact of the website

Using the *Information Development Methodology for the Web*, the website developer will follow the following six processes (December 2001):

- *Planning*: Defining and gathering information about the website's audience, purpose, objectives, and policies for information development and use
- *Analysis*: Involves evaluating information consistency and correctness as well as checking the technical makeup of the website
- *Design*: Creating a map of the relationships among pages of the website and the look and feel of individual pages
- *Implementation*: Creating files of HTML (and associated software, such as Java applets)

- *Promotion*: Providing publicity releases for general website audiences, potential users, and current users
- *Innovation*: Continuously and creatively working for improvement in the website to meet user needs.

The top-down methodology for developing corporate web applications has seven stages (Artz 1996: 65-66):

- *Problem statement*: The problem statement should describe a problem to be solved or an opportunity to be exploited; the purpose of the application (website), the target audience, and the objectives and scope.
- *Constraining requirements*: These are facts about the application domain or the user environment that limit the design possibilities or force certain design decisions.
- *Conceptual design*: Describes at the conceptual level, what the application will do. It describes the major components of systems, relationships between them, and how the applications will be used. It takes the constraining requirements into account.
- *Derived requirements*: These are general statements of information on functional requirements derived from the problem statement and the conceptual model.
- *Detailed analysis*: Provides detailed specifications regarding information content, functionality, up-date cycles, and security for the webpages.
- *Detailed design*: Addresses the individual page layouts, traversals, and tailors the look and feel concept to a specific set of pages.

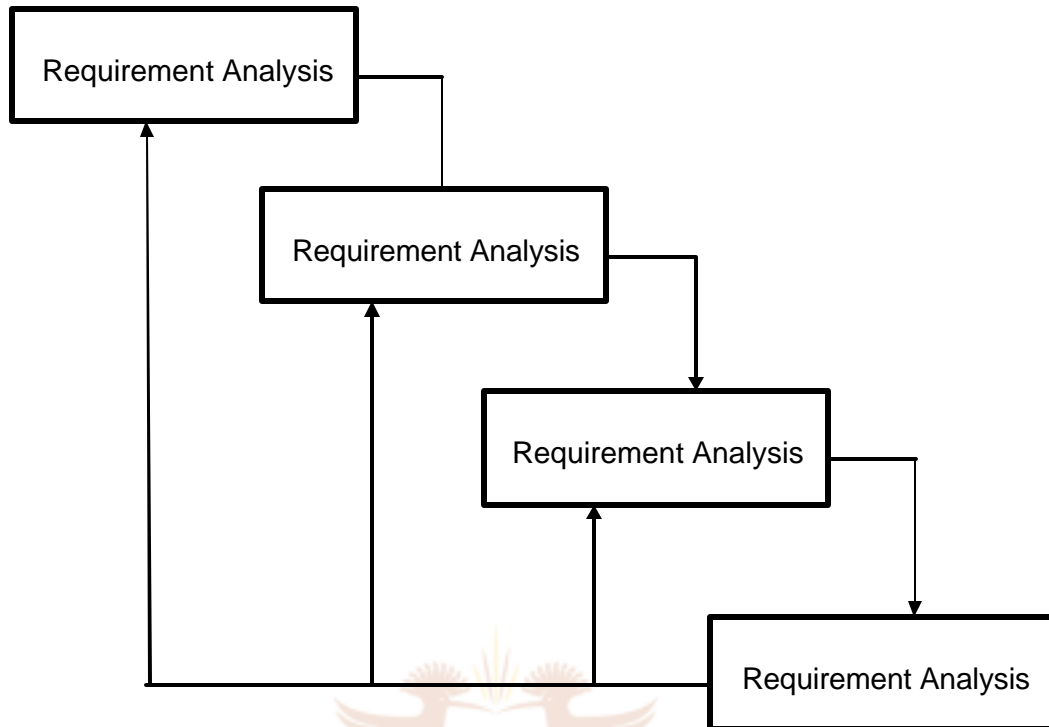
- *Development*: This involves implementing the application, coding the application using HTML and other scripts, loading the initial information set, and creating icons and images.

7.3.1.3 Software engineering methodologies

Software engineering is a computer science discipline concerned with developing large applications, and covers not only the technical aspects of building software systems, but also management issues, such as directing programming teams, scheduling, and budgeting (Webopedia 2003). Although there are various models of the software life cycle, the 'waterfall' model, developed by Royce (1970), in which activities cascade down from one phase to the next, outlined below and shown in Figure 5, is commonly used (Coxhead 2003):

- *Requirements definition*: Involves the definition of the problem to be solved, and the requirements of the system, independent of how these requirements will be accomplished.
- *Software design*: Defines the architecture, components, their interfaces, and behaviours of the system and maps the requirements of the system into the architecture.
- *Implementation and testing*: Involves building the components of the system either from scratch or by composition. The system to be built is based on the architecture document from the design phase and the requirement document from the analysis phase.
- *Operation and maintenance*: Involves operating and using the system and on-going maintenance.

Figure 5: Software engineering phases based on the Waterfall model (Coxhead 2003).



7.3.1.4 Hypermedia design models

Hypermedia design models evolved out of research into hypermedia applications, and in particular how hypermedia applications could be designed. As a result, these methodologies tend to have a strong focus on information modelling and design of effective navigation structure (Lowe 1999). Examples of hypermedia methods include the *Object Oriented Hypermedia Design Method (OOHDM)* (Schwabe and Rossi 1998), *Relationship Management Methodology (RMM)* (Isakowitz, Stohr and Balasubramanian 1995), *HyDev (hypermedia and development)* (Pauen, Voss and Six 1998), and many others. According to Lowe (1999), OOHDM is probably the most mature hypermedia methodology. Its phases are outlined below to illustrate the nature of the hypermedia approach.

OOHDM was developed for use in developing large hypermedia applications and it defines the following four-step development process (Schwabe and Rossi 1998):

- *Conceptual design*: Involves modelling the problem domain itself, providing a clear picture of the information that will underpin the website.
- *Navigational design*: Focuses on designing and representing the navigational structures that are layered onto the information.
- *Abstract interface design*: Involves the design of the interface appearance and behaviour.
- *Implementation*: Involves mapping the interface objects to an actual implementation, such as specific set of webpages, and Active Server Pages (ASP) documents, databases.

7.3.1.5 Web engineering

Web engineering (WebE) came up as a result of the need to use sound scientific, engineering and management principles in the successful building and deployment of web-based information systems and web applications. Alatalo and Oinas-Kukkonen (2000) define web information systems engineering as a collection of sound principles, methods and tools for developing web information systems, which differ from traditional information systems in their unique technological platform and design philosophy. Ginige (2000) defines web engineering as the application of scientific principles to design and create effective web-based information systems in an efficient manner, and further indicate that as opposed to some form of art, the web engineering process should be repeatable, measurable, predictable, and cost effective.

According to Ginige and Marugesen (2001:15), who are among the people who established web engineering as a new discipline (Ginige and Marugesen (2001:16), web engineering is multi-disciplinary and encompasses contributions from areas such as systems analysis and design; software engineering; hypermedia and hypertext engineering; requirements engineering; human-

computer interaction; user interface development; information engineering; information indexing and retrieval; testing, modelling, and simulation; project management; and graphic design and presentation.

Various specific approaches fall under the *web engineering* category. Examples include the approach proposed by Pressman (2000), *Agile Web Engineering (AWE) Process* (McDonald and Welland 2001a), *Web Engineering (WebE)* (Ginige 2000), *WebComposition* (Gellersen, Wicke & Gaedke 1997), *Web Modeling Language* (Ceri, Fraternali & Bongio 2000), *Web Object Oriented Model (WOOM)* (Coda et. al. 1998) and *Website Design Method (WSDM)* (De Troyer & Leune 1998).

Web engineering is a new approach and is still developing. Therefore, unlike traditional system development approaches that share almost the same development life cycle, under web engineering, almost each approach has its own specific processes or stages. For example, in their web engineering-based approaches, Pressman (2000) and McDonald and Welland (2001a), have proposed different processes.

Pressman's (2000) view of web engineering is based on the software engineering approach. He defines web engineering as an adaptable, incremental (evolutionary) process populated by a set of framework activities that occur for all business-critical WebApp (Internet-based Applications and e-Commerce Sites) projects, regardless of the size or complexity, and indicates that the following six activities, applied iteratively as a web-based system evolves, might be considered for web engineering work (Pressman 2000: 19-20):

- *Formulation*: Identifies the goals and objectives of the WebApp and establishes the scope for the first increment.
- *Planning*: Estimates overall project cost, evaluates risks, and defines a development schedule for the initial WebApp increment.

- *Analysis*: Establishes requirements for the WebApp and identifies the content items that will be incorporated.
- *Modelling*: Incorporates two parallel task sequences: content design and production, which results in the creation or acquisition of content within WebApp; architecture, navigation, and interface design, which establish the structure of the WebApp and the flow of user interaction.
- *Page generation and testing*: Constructing the WebApp.
- *Customer evaluation*: Involves reviewing each increment produced as part of the web engineering process. At this stage, users can also request for changes and these are integrated into the next path through the incremental process flow.

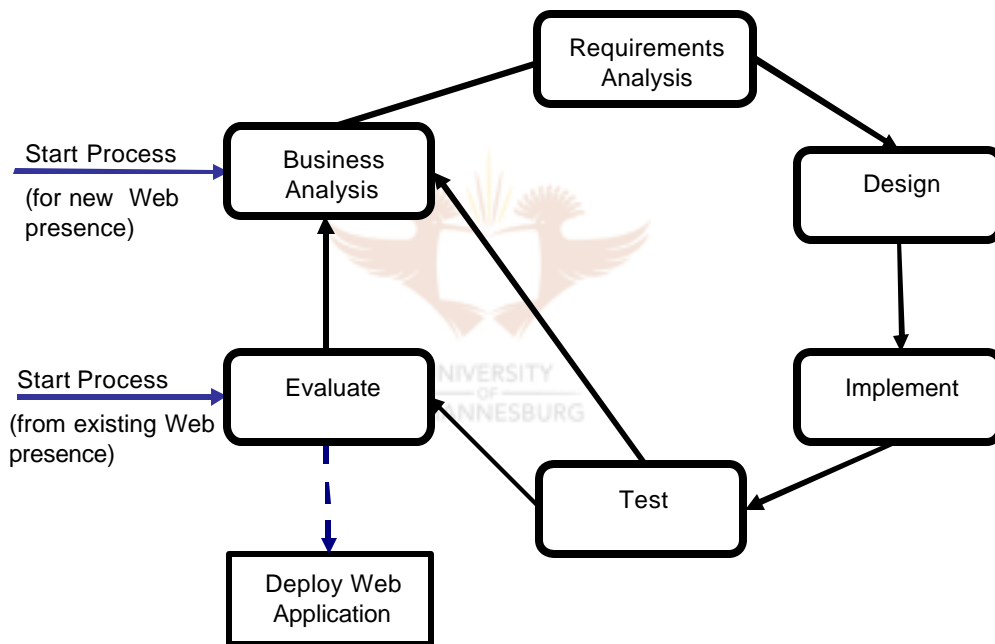
The *Agile Web Engineering (AWE) Process* life cycle proposed by McDonald and Welland (2001a) has the following phases, illustrated in Figure 6 and outlined below:

- *Business Analysis*: This phase is used to clearly understand the problems to be addressed by the proposed web application.
- *Requirements*: Defines what the proposed solution will do (functional requirements), and what constraints are to be placed upon the proposed solution (non-functional requirements).
- *Design*: Involves understanding, co-ordinating and communicating all the major issues, before implementation, of building a complex web application.
- *Implementation*: The phase involves programming the system.

- *Testing*: Involves assessing whether or not what has been built has satisfied the project's requirements.
- *Evaluation*: Finding out whether the developing team has built the right product.

According to McDonald and Welland (2001a) the only deliverable that the AWE Process is required to produce is the web application itself.

Figure 6: The Agile Web Engineering (AWE) Process Life-Cycle (McDonald and Welland 2001a).



7.4 PORTAL PLANNING GUIDELINES

Although planning, in general, is the first step in any system development process, regardless of who develops the system or how the system is developed (Haag, Cummings & Dawkins 1998), as seen above in Section 7.3.1, the portal development approaches that have been examined do not clearly outline the various activities that should be taken into account when planning the

deployment of information portals. In this regard, there is a need to develop clear guidelines to assist agricultural research organisations to plan the deployment of their information portals. It is the view of the researcher that the success of any agricultural information portal project will depend largely upon the effort, care and skill applied in its initial planning, thus the need for good planning guidelines, which could be used independent of the portal development approach that is adopted. Therefore, with a variety of approaches for website and portal development to choose from (as seen in Section 7.3.1), the guidelines for the deployment of agricultural information portals proposed in this thesis only address the planning phase of portal development.

7.4.1 Purpose of the guidelines

The purpose of the proposed guidelines is to assist agricultural research organisations in the SADC region in particular and sub-Saharan Africa in general, to conceptualise, plan and manage the deployment of agricultural information portals to serve the needs of agricultural researchers. In particular, the guidelines will assist agricultural research organisations in the region, as identified from the system development approaches discussed in Section 7.3.1, to:

- Manage the deployment of agricultural information portals (AIPs)
- Set realistic and achievable objectives for the development of AIPs
- Identify the target users for the AIP
- Identify the resources required for the development of AIPs
- Identify the resources, facilities, tools and services to be provided via the AIPs
- Understand the desirable features of AIPs
- Be aware of the various possible costs involved in deploying AIPs
- Be aware of the various technologies required for the deployment of AIPs
- Develop suitable AIPs implementation strategies
- Consider and adopt suitable AIPs development approaches.

7.4.2 Limitation of the Guidelines

The website and portal development guidelines proposed in Sections 7.4.3 and 7.4.4 are based on the premises that:

- Agricultural research organisations in the SADC region, and in sub-Saharan Africa in general, are at different levels of development regarding access to ICT and other resources such as funding and skilled IT specialists, and therefore there is need to provide guidelines that could be applicable to different types of agricultural research organisations.
- As seen above, there are several approaches and methodologies, for example web development methodologies, software engineering methodologies, web engineering methodologies, and others that agricultural research organisations could adopt and use in portal development.
- Different proprietary, commercial portal development tools (especially those used for developing Enterprise Information Portals) and Open Source tools are available in the market and these could be used in designing, developing and implementing agricultural information portals.

Thus, the guidelines do not attempt to restrict or limit organisations to one portal development approach or portal development tool, but rather provide a description of the various activities that should be taken into account when planning for a portal project. In addition, the guidelines do not cover or propose the actual design of the various features of the portal that could be subject to different preferences by different agricultural research organisations and individual researchers. Therefore, the guidelines are independent of specific portal design or development methodology, application domains, and techniques.

7.4.3 General Guidelines

The general guidelines include eight activities that should be conducted to ensure the successful deployment of AIPs. The activities, developed from the review of approaches to website and portal development (Section 7.3), study of intranets and extranets (Sections 2.3.2 and 2.4.2) and the study of portals (Sections 3.4 and 3.6) are as follows:

- Activity 1: Setting up the AIP project team
- Activity 2: Definition of AIP goals and objectives
- Activity 3: Inventory and analysis of AIP technical infrastructure
- Activity 4: Definition of the desirable AIP features
- Activity 5: Selection of AIP development approach
- Activity 6: Developing a strategy for AIP adoption
- Activity 7: Budgeting for AIP development costs
- Activity 8: Developing an AIP deployment schedule.

7.4.3.1 Activity 1: Setting up the AIP project team

The development of an agricultural information portal should involve various stakeholders from within and outside the organisation. In cases where the portal will also interact via an extranet with external users, such as partner agricultural research organisations and interested individuals, there is also a need to involve representatives or obtain the views of major partner organisations. Therefore, as soon as the idea of an AIP is mooted, among the first activities to be conducted should be the setting up of an AIP Project Team composed of members from among the various stakeholders. The main role of the AIP Project Team (AIP-PT) is to plan, document current practices, set-up priorities, and co-ordinate the deployment of the portal framework within the organisation. The Project Team should have a correct mix of information technology specialists, researchers, management staff, information and knowledge management specialists, all working together towards implementing a suitable portal strategy for the organisation. The main justification for including various stakeholders on the

Project Team is that each of the stakeholders brings special expertise and knowledge to the Team. This is briefly explained below:

- *Agricultural researchers:* They are expected to be the main users of the AIP and therefore they should be actively involved in the whole portal project from the onset. Researchers are also content developers and much of the information and knowledge they generate should be integrated into the portal framework. Because of their dual role, both as content users and content generators/owners, their participation and input in the portal development process is vital.
- *Information technology specialists:* An organisation's information technology staff (programmers, webmasters, database administrators, network administrators and many others) should be involved in the portal development process, regardless of what portal development strategy is adopted by the organisation. Among the members of the proposed portal development project team, information technology specialists are the only ones with the technical know-how regarding the various ICT facilities that could be used in the deployment of the portal in the organisation. Therefore, their input into the portal planning process is very useful.
- *Information and knowledge management specialists:* Agricultural science librarians, documentalists, information and knowledge managers and subject matter specialists should be part of the portal development project team. They possess useful experience, knowledge, information management and organisation skills, which are very relevant and important in the AIP environment.
- *Senior management:* Participation of representatives of the senior management staff of the research organisation would ensure that the deployment of the portal is within the overall objectives of the research organisation. In addition, if senior management buys into the idea of providing information services and facilities via a portal it would ensure

that the project is given favourable consideration when it comes to funding the project. A senior member of the management team should, preferably, chair the meetings of the AIP-PT.

- *Partner organisations and individuals:* In cases where the organisation works and collaborates with other external organisations and individuals (consultants or selected individuals from the general public), and the intention is to allow such organisations and individuals to have access to the portal facilities via an extranet, and also to integrate some of the resources and services provided by the partner organisations into the portal, it is important to include representatives of the major partner organisations into the AIP-PT. This would ensure that potential obstacles to information and resource sharing via the portal are addressed in good time.

Depending on the size of the organisation, in terms of staff and the number of agricultural research stations or institutes, it may also be necessary to establish special interest groups (SIG) or focus groups that would provide input into the activities of the AIP Project Team.

7.4.3.2 Activity 2: Definition of AIP goals and objectives

The AIP project should fit into the overall goals and objectives of the organisation, and therefore, one major activity that should be conducted by the AIP-PT is to define the goals and objectives of the portal. The goals and objectives of the portal will define what the organisation wishes to accomplish with the portal, and also set parameters on the development and accumulation of content on the portal.

The following is an example of what the goal of an agricultural information portal could be:

- To take advantage of the available portal technology solutions to provide access to appropriate information resources and services; facilitate collaboration and sharing of knowledge among researchers to enhance the generation, adaptation and transfer of agricultural technologies and knowledge for both subsistence and commercial farmers and other stakeholders for sustainable development of agriculture.

Examples of the objectives of an agricultural information portal could include the following:

- To gather/bring content and services from a variety of internal and external sources and aggregate them into a single point that can be accessed by researchers.
- To provide researchers with access to a variety of information resources and services to support their research work on their desktops, , through a single web-based interface.
- To support a single log-on to obtain authentication and authorisation to all information resources and applications .
- To allow researchers to personalise and customise the presentation of information and services they would like to access on the portal.
- To promote collaboration and sharing of data, information and knowledge among researchers.
- To improve productivity through quicker access to information resources and knowledge generated within and outside the organisation.

In the above context, the success of the portal could then be measured by asking whether it meets the above goal and objectives.

7.4.3.3 Activity 3: Inventory and analysis of AIP technical infrastructure

Implementing a portal requires various types of ICT facilities. It is, therefore, important to make an inventory and analysis of the available ICT facilities (technology audit) to determine whether the available facilities are adequate for the deployment of a portal environment in the organisation; what ICT facilities should be used, and, where applicable, to establish which facilities should be replaced or upgraded. Among other things, the inventory and analysis should examine the availability, state and status of the following ICT facilities in the organisation:

- *Personal computers or laptops*: For use by the portal end-users to access the portal resources, add and modify content on the portal, and for use by portal developers and content developers.
- *Servers*: Different types of servers, both hardware and software. Regarding software, this may include portal application server providing the development infrastructure for the portal; and web servers to work with the portal application server to provide the environment for managing client requests.
- *Application software*: Different types of software applications to be used by portal users and individuals involved in the development of the portal.
- *Database software*: Database systems implemented in the organisation, for example, Oracle, Microsoft Access, MySQL, and others. Portals require the use of a database system to keep track of information specific to the portal - such as users, personalisation settings, available portal services and security.
- *Network infrastructure*: Type of LAN available, and whether the organisation has a WAN or intranet and extranet in place; availability of internet connectivity and the type of connectivity available, for example,

dial-up, leased line connection, or VSAT (Very Small Aperture Terminal) connection.

- *ICT skills:* The inventory should also include an examination of the capacities available within the organisation, in terms of ICT skills, such as staff with computer programming skills, databases administration, and website design and development.

7.4.3.4 Activity 4: Definition of desirable AIP features

The AIP Project Team should also outline the features that the organisation would like to incorporate into the portal. Based on the needs of the major users, an agricultural information portal should incorporate the following features and characteristics of good portals that were identified and discussed in Section 3.4 :

- *Personalisation:* Researchers should be able to personalise the portal appearance, content and application interface to suit their individual needs, and also to avoid too much unwanted information.
- *Organisation of the user's desktop:* The portal should assist researchers to organise their desktops, to enable them to have access to the most important information content they need.
- *Division of resources:* The portal should have features that separate facilities into various layers for different categories of users. Portal users should have varying degrees of privileges ranging from researchers who could add and edit content on the portal to portal administrators who can modify the configuration of the portal itself. In addition, the portal should also be able to restrict access to selected content, when defined as such. For example, information resources intended for a particular individual or group should be accessed by that individual or group only.

- *Tracking of individual usage, interests and use behaviour:* The portal should be able to track individual usage, interests, and behaviour to make it easier for users to personalise the portal and so that the portal can present a personalised view of the information resources to the user.
- *Provision of access to multiple heterogeneous data resources:* Users should be provided with access to information from multiple heterogeneous data stores. These could include information from relational databases, multi-dimensional databases, document management systems, e-mail systems, web servers, news feeds and various file systems or servers.
- *Facilities for locating information and people:* It should be easy for users to locate colleagues and the information they need, both within and outside the organisation. There must be ways to both passively discover and actively locate experts, communities and content related to the areas of interests of the researchers.
- *User authentication:* Portal users should be requested to register and supply their username, password or Personal Identification Number (PIN), before a personalised view of the information resources available on the portal is provided to information end-users known to the portal. Users who have not logged on should only see content meant for the general public within the portal.
- *Taxonomy:* Content on the portal should be organised according to a well-defined classification scheme or taxonomy to facilitate information resource identification, searching and browsing by users.

The above features should be independent of any specific portal development approach (See Section 7.4.3.5). This means that even if the organisation opts to develop the portal using in-house resources (in-sourcing), or contracts an

external firm (out-sourcing), or acquires a turnkey portal solution, the above features should be part of the portal solution to be implemented.

7.4.3.5 Activity 5: Selection of AIP development approach

The organisation should decide which portal development approach is to be used or adopted. There are several options available, among them the following:

- *In-house development (In-sourcing):* The organisation may choose to build the portal using its IT staff and the many available free Open Source software and tools. However, this option requires technical expertise, especially programmers, and resources such as time and equipment, some of which are generally not available in most public funded agricultural research organisations in Africa. In addition, documentation for Open Source software is not always as good as commercial software, and if IT staff in the organisation have no experience with the Open Source software selected for the project, they may take longer to learn and master the software.
- *Commercial portal development software:* Purchase and use of commercial portal development software is another option available to agricultural research organisations. However, although there are several off the shelf portal development software that could be used (see examples in Section 7.4.4.5), most of them would require some customisation and this could result in additional costs. Available information resources within the organisation may also need to be migrated to the new software platform, resulting in additional costs.
- *Outsourcing portal development:* There are several firms involved in portal development that could be contracted to do the job. This approach could be cost effective and the final product could be delivered on time. However, use of an external firm may make the organisation dependent on the firm for maintenance and technical support, resulting in additional

costs. The consulting firm or individual may also bring into the organisation their preferences in terms of portal development approach and hardware and software that may not be compatible with the requirements of the organisation. In addition, dependence on external firms could result in the organisation not developing the required local capacities necessary for sustaining the portal.

In the final analysis, organisations should select a portal development approach that will deliver the required portal on time and within the organisation's budget, while incorporating the features outlined in Section 7.4.3.4.

7.4.3.6 Activity 6: Developing a strategy for adopting AIP

The success of the deployment of the portal within the organisation will depend on how far it is accepted and used by the stakeholders (senior management, portal project champions, content providers, researchers and other partners). Therefore, a strategy should be put in place, from the onset, to stimulate and encourage the support and adoption of the portal at all levels within the organisation or among the stakeholders. Senior management should be encouraged to buy into the idea of the portal, and provide strong support and advocacy for the adoption of the portal within the organisation. Without the involvement of senior management, adoption of the portal at departmental and user levels would be difficult. Major potential portal users should also be encouraged to integrate the portal into their work activities.

7.4.3.7 Activity 7: Budgeting for AIP development costs

Whether an organisation opts for the development of the portal in-house using internal expertise, or contracts a firm or individual consultant, or decides to purchase off-the-shelf portal development software, there are costs to be met. It is, therefore, important to include a budget for the development and deployment of the portal in the overall planning portal deployment strategy. The costs will vary depending on the scope of the portal project, the features to be

incorporated into the portal, and the portal development approach that is adopted. Overall, the costs may include the following:

- *Hardware costs:* Purchase, installation and maintenance of new or additional hardware, such as servers, to facilitate the development and implementation of the portal; and upgrading of existing hardware facilities, if required.
- *Software costs:* Purchase of portal development software, database software and annual software licence, maintenance and support, and upgrading existing software facilities, if required.
- *Networking and connectivity costs:* If the organisation does not have a local area network in place, this has to be installed and network administrators hired. In addition, the organisation should deploy an intranet, if it is not already in place and an extranet if required, and establish internet connectivity of this is not already available.
- *Costs for migrating content:* Old content and databases will possibly have to be migrated to the new portal environment.
- *Training costs:* Training of IT staff in the use of new technologies to be used in the development of the portal: individuals to be involved in the various aspects of managing the portal; individuals (data owners) who will be contributing content to the portal; and portal end-users (researchers) in the use of the portal.
- *Personnel costs:* These include costs for hiring new staff with skills that may be currently absent in the organisations but necessary for the successful deployment of the portal, hiring of external expertise (firms or individuals) to assist with portal development, content development, knowledge management and integration.

7.4.3.8 Activity 8: Development an AIP deployment schedule

The AIP Project Team should develop a schedule for the development and deployment of the portal within the organisation. During the interviews with a number of people within organisations in the United Kingdom who are involved in the development of web-based applications, McDonald and Welland (2001b) found that web applications have a very short development life-cycle. In general, this is no longer than six months, while the average development life-cycle time of a web application was observed to be just under three months. The AIP Project Team should take this into account when developing the schedule.

7.4.4 Specific Guidelines

Specific guidelines are derived from the components of the agricultural information portal illustrated in Figure 3 above. These include:

- End-users
- Content and services
- Developers
- Content developers and sources of content
- Development tools
- Content publishing and management tools
- Content management and use policy
- User training and support
- User tools
- Information discovery tools
- Security
- Integration with the internet.



7.4.4.1 Portal end-users

An agricultural information portal should be designed with the users in mind. It should be useful to the target users. It should be owned and managed by the

users. Therefore, all potential portal end-users in the organisation should be identified and categorised. They should be consulted and involved in the major decisions about the portal. Issues relating to the ownership and management of the portal should also be discussed with the portal users.

A decision should also be made as to whether the portal will cater for all categories of staff within the research organisation or only selected groups of staff, for example, researchers. In addition, the following factors that are likely to have an impact on the portal end-users' ability to use the portal-based resources and facilities should be addressed:

- Access to appropriate ICT facilities at the office and home
- Level of ICT skills.

If the target portal end-users do not have access to appropriate ICT facilities or their ICT use skills are very low, the adoption and acceptance of the portal in the organisation is likely to be affected. Access to ICT facilities at home, such as personal computers, laptops and the Internet, especially the Web, could also lead to users requesting to access the portal from their homes.

7.4.4.2 Portal content and services

An agricultural information portal is an aggregation of several different information resources, services, tools and facilities to be provided to the target user community. Therefore, the content for the AIP, where possible and necessary, should also include structured data sources such as relational databases and data warehouses, unstructured content sources such as news, documents generated inside the organisation, and external sources such as public or private websites, documents, and web-based services.

Resources, services and facilities to be provided via an AIP should be identified through an information audit that should establish the following:

- Information resources generated within the organisation and their structure
- Information resources and services obtained from outside the organisation
- Frequency of use of information within the organisation
- Users of information and the type of information used
- How the information is used
- Software and other software-based tools used in the organisation and their users
- Flow of information within, into and outside the organisation
- Areas for improvement regarding the generation and management of information content within the organisation.

The information audit activity should also identify the information resources, including documents, webpages, databases - both bibliographic and full-text, application software and tools that individual researchers and groups need to access via the portal to do their work (information needs assessment). It should also document the workflow within the organisation, and see how this could be implemented within a portal-based environment. Finally, the following categorisations, based on various factors such as the target end-users for the portal, should be made regarding the possible content to be provided via the portal:

- *Personal content*: Information, resources, tools and applications required by specific individual researchers.
- *Workgroup content*: Information, resources, tools and applications required by different groups of individuals, for example by departments and researchers collaborating on projects.
- *Intranet/corporate content*: Information, resources, tools and applications required by most portal end-users generated within the organisation, i.e.

information regarding research funding, and guidelines for research proposals.

- *Extranet content:* Information, resources, tools and applications required from other partner organisations or other research stations or institutes, to be provided to authorised external users.
- *External/Internet content:* Information, resources and tools such as websites, internet search engines and many more from the Internet.

The organisation of the portal contents, services and facilities should reflect the users' interests rather than the needs of the organisation.

7.4.4.3 Portal developers

Depending on the size and sophistication of the agricultural information portal, its development and deployment would require various types of technical skills, among them the following:

- Programming skills in various languages and scripts used in portal development, for example Perl, CGI, HTML, Visual Basic, Java, JavaScript, PHP, C++, XML
- Network administration, including TCP/IP administration
- Internet, intranet and extranet administration
- Database development and administration, for example MySQL and Oracle
- Operating systems, for example Linux, UNIX and Windows 2000
- Information management
- Project management
- Creative designing.

An organisation should make an effort to find staff with the correct mix of the above skills. Unfortunately, it is most unlikely that agricultural research

organisations will have staff with all of the above skills. In cases where the required skills are not available, it may be necessary to outsource the development of the portal, or some parts of the portal.

7.4.4.4 Portal content developers and sources of content

A portal should provide access to useful content, services and facilities. Therefore, all the potential sources of content, from both within and outside the organisation, should be identified. These may include the following:

- Individual researchers or departments within the organisation
- Partner research organisations
- Relevant government ministries and departments, for example the Ministry of Agriculture, and other related ministries, for example fisheries and rural development
- Academic institutions such as universities or colleges of agriculture, and their libraries
- International agricultural organisations, such as the ones listed in Appendix 3, that are involved in the generation and provision of access to agricultural information
- Organisations involved in funding agricultural research and related projects, for example the World Bank, and the Department for International Development (DFID) of the UK Government.

The identification of content developers and external sources of content should include identification of content that will be acquired free of charge and that which will be paid for. The cost of acquiring external content for the portal should also be included in the budget.

7.4.4.5 Portal development tools

Website and portal development require the use of different types of software-based tools. There are two main options available to organisations: use of proprietary software or Open Source software-based development tools.

Proprietary or commercial portal development tools/software (especially for Enterprise Information Portals) available on the market could be used to design, develop and implement an agricultural information portal. These include products as such as WebSphere Portal by IBM³, CleverPath Portal by Computer Associates International⁴, Microsoft SharePoint Portal Server 2003⁵, Oracle9i Application Server Portal by Oracle⁶, and many others. In addition, organisations could opt for Open Source portal technology solutions such as Jetspeed⁷ - an Open Source implementation of an Enterprise Information Portal; Metadot Portal Server⁸, and Zope⁹ - an Open Source application server and portal toolkit; and tools/software like MySQL¹⁰, Linux¹¹, PHP¹² (Hypertext preprocessor), Perl¹³ and many others.

Organisation should identify and list all the tools that would be required, find out which tools are already available within the organisations, and which ones will have to be acquired.

7.4.4.6 Portal content publishing and management tools and guidelines

Individuals and departments within the organisation involved in content development should be provided with various tools, especially content management software, to assist them in their work. Using content management

³ <http://www-306.ibm.com/software/info1/websphere/index.jsp>

⁴ <http://www3.ca.com/Solutions/Product.asp?ID=262>

⁵ <http://www.microsoft.com/office/sharepoint/prodinfo/default.msp>

⁶ <http://portalcenter.oracle.com/>

⁷ <http://jakarta.apache.org/jetspeed/site/>

⁸ <http://www.metadot.com/metadot/index.pl>

⁹ <http://www.zope.org/>

¹⁰ <http://www.mysql.com/>

¹¹ <http://www.linux.org/>

¹² <http://www.php.net/>

¹³ <http://www.perl.com/>

systems, they should easily be able to generate content, edit (proof read), and publish on the portal. The content management system should provide facilities and features to deal with documents in their original formats, such as Microsoft Word, Microsoft Excel, Portable Document Format (PDF) and others. It should also include web editing features such as page templates and wizards, HTML editors, and XML editors to allow content developers to author webpages.

It is also very important to develop content publishing guidelines and standards to assist content developers in creating and positing content on the portal. Content developers need to know what content should be published or not published on the portal, and when to update or remove the content.

7.4.4.7 Portal content management policy

The organisation should put in place a content management policy to support and facilitate the process of authoring, contributing, reviewing, modifying, approving, publishing, delivering, and maintaining digital content integrated with or accessed via the AIP. In addition, the content management policy should empower researchers and agricultural information specialists to manage the content on the portal, while the information technology specialists within the organisation should concentrate on managing the portal technical infrastructure. The portal content should preferably be hosted on the organisation's own computer servers. If hosted on an external server, the organisation should have the ability to change the content at will.

7.4.4.8 Portal user training and support

All categories of portal uses should be empowered through training so that they can access and use the portal facilities effectively. Training can take the form of workshops, seminars and online courses accessed via the portal. In addition to training, user support should be provided. This can be in the form of access to a physical help desk or an online help desk, online tutorials, telephone support, and access to lists of Frequently Asked Questions (FAQs). Training should be a continuous process.

7.4.4.9 Portal user tools

When planning the deployment of an agricultural information portal, decisions should be made regarding the types of tools to be used on the portal and these tools should be configured, packaged and tested together. According to CIO Communication (2001a), providing users with tested, packages, licensed tools will reduce the amount of time required for support. Support also simplifies the update process, reduces the amount of training and documentation, and makes it easier for new users to get up to speed on the intranet, and as in the case of this thesis, the portal.

Depending on the various requirements, the tools provided may include the following:

- *Web browsers:* Microsoft Internet Explorer, Navigator or Opera
- *Plug-ins:* Microsoft Media Player, Real Player, QuickTime Player, Adobe Acrobat Reader
- *Specialised software:* For example, Microsoft Office Suite and Lotus Smart Suite.

7.4.4.10 Portal information discovery tools

Portal users should have access to various information discovery tools. Provision of information discovery tools on the portal will ensure that the portal resources are visible and reduce the time users spend on searching for information. The tools may include a combination of the following:

- Consistent page navigation aids and local search engines
- Search directories
- Push technologies
- Information specialists.

7.4.4.11 Portal security

As more organisation content becomes accessible via the portal, and especially if external users are also allowed to access some of the content on the portal via an extranet or the Internet, security will become a critical issue. The organisation should, therefore, plan and integrate the portal's security services into its overall security infrastructure. Portal security should include both guarding against unauthorised access to the portal and against unauthorised access to portal resources and services once access to the portal is allowed. Decisions should be made regarding the following:

- Which individual users or user groups will have access to the portal?
- Which individual users or user groups will have privileges to add, modify or delete the content of the portal?
- Which individual users or user groups will have privileges to modify the appearance of the content area?
- What resources and services on the portal will be accessed by which user groups?

In addition, security regarding access to the rooms where the equipment hosting the portal server software and content are stored should also be implemented.

7.4.4.12 Portal integration with the Web

The Internet, especially the World Wide Web, is a major source of information in digital format. Organisations can pull various resources from the Web, using software tools and information specialists, and integrate them into the local resources. To take advantage of web resources, it is important that an agricultural information portal supporting research activities of the organisation is integrated with the Internet.

Portal integration with the Internet should also include integrating with the organisation's e-mail system. Agricultural research organisations should plan in advance how to manage and integrate the e-mail communication system into the portal environment. As more and more researchers adopt the use of e-mail for their communication and sharing of research results within the organisation, the system will become an important source of content for the portal. It is, therefore, necessary to save key and important e-mails messages in much the way organisations traditionally maintain paper files.

7.5 SUMMARY

The objective of this chapter was to address the fourth research sub-problem by defining an agricultural information portal (AIP) and outlining its major features or components. The chapter gives an overview of the various systems development methodologies that are being used for website development that could possibly be applied to the development of agricultural information portals, and proposes guidelines for planning the deployment of agricultural information portals in agricultural research organisations.

An AIP is defined as a web-based application accessed via the intranet or extranet that provides a personalised and adaptive interface enabling agricultural researchers to discover, track, and interact with colleagues and other people, software applications, information resources and services relevant to their research interests and work.

The chapter also reviewed the phases or stages involved in the following system development approaches that could be used in the development of agricultural information portals:

- Traditional system development methodology
- Web development methodology
- Software engineering methodology
- Hypermedia methodology
- Web engineering methodology.

With several potential portal development approaches to choose from, the chapter proposed general and specific guidelines for use by agricultural research organisations when planning the deployment of information portals.

The general guidelines included the following seven activities to be carried out during the planning phase for the portal:

- Activity 1: Setting up the AIP project team
- Activity 2: Definition of AIP goals and objectives
- Activity 3: Inventory and analysis of AIP technical infrastructure
- Activity 4: Definition of the desirable AIP features
- Activity 5: Selection of AIP development approach
- Activity 6: Developing a strategy for AIP adoption
- Activity 7: Budgeting for AIP development costs
- Activity 8: Developing an AIP deployment schedule.

Specific guidelines were based on the specific agricultural information portal components and facilities, and these include:

- End-users
- Content and services
- Developers
- Content developers and sources of content
- Development tools
- Content publishing and management tools
- Content management and use policy
- User training and support
- User tools
- Information discovery tools
- Security
- Integration with the Internet.

The development of the guidelines took into account the findings and discussions on intranets and extranets in Chapter 2, portals in Chapter 3, trends regarding the provision of content on agricultural websites in Chapter 4, and the findings on the need for agricultural information portals in the SADC region discussed in Chapter 6.

The next chapter provides overall conclusions of the thesis and recommendations on possible areas requiring future research.



CHAPTER 8

SUMMARY, RECOMMENDATIONS AND CONCLUSION

8.1 INTRODUCTION

The main focus of the research reported in this thesis was to address the following main research problem:

What is the nature and application possibility of agricultural information portals in the provision of web-based, value-added information services to researchers?

Arising from the above research problem and the main goal of the research, the following -research sub-problem statements were formulated:

First sub-problem statement What are intranets and extranets and how are they being used use in the provision of access to digital information resources and services to end-users in corporate organisations?

Second sub-problem statement. What are portals and how they are being used in the provision of digital information and services to end-users in corporate organisations?

Third sub-problem statement What are the international trends in the provision of access to digital agricultural information via websites, and what can be learnt from the trends regarding the resources and services that could be p rovided via an agricultural information portal?

Fourth sub-problem statement. What is the state of the development of agricultural research websites, and is there a need for the use of portals, other than ordinary websites, in the provision of access to

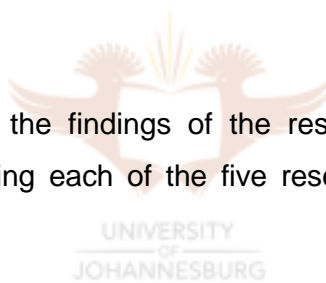
web-based, value-added information services and resources to researchers in agricultural research organisations in the SADC region?

Fifth sub-problem statement: What is an agricultural information portal, and are there any suitable models or guidelines (if any) that could be adopted (or developed) for the deployment of agricultural information portals in agricultural research organisations?

In concluding this study, this chapter pays attention to verifying that the above main research problem and research sub-problems have been addressed. This is done by summarising and highlighting the major findings of Chapters 2, 3, 4, 6 and 7 in which the five research sub -problems have been discussed.

8.2 SUMMARY

Below is a summary of the findings of the research and recommendations, where necessary, regarding each of the five research sub-problems that were addressed in this thesis.



First sub-problem statement: *What are intranets and extranets and how are they being used use in the provision of access to digital information resources and services to end-users in corporate organisations?*

The study of intranets and extranets, as reported in Chapter 2, was done with a view to addressing the first sub-problem. The major findings of the study show that:

- Intranets have several uses in the provision of information services to information end-users within organisations. These uses include the publication of corporate information, provision of online training, project management, online communication, distribution of information

resources, knowledge management and preservation.

- The major benefit of intranets is improved information communication (speed of information transfer and feedback) within the organisation. The use of intranets also results in a drastic reduction of the amount of file and shelf space required for storing print-based documents; better control of redundant and out-dated information through a single-point storage and access; and improved productivity through quicker access to information resources, knowledge and skills.
- Organisations are using extranets largely to conduct business activities (e-commerce), provide access to information resources and communicate with customers or clients, suppliers, and business partners located outside the intranet firewall. The use of extranets is resulting in quick communication between companies and their customers, partners, and suppliers; quick receipt of inputs and comments on product features from key customers before the product is put on the market; and quick transmission and processing of order requests, resulting in quick delivery of orders.



The above applications of intranets and extranets in corporate organisations can also be adapted and applied to agricultural research organisations. These organisations could, therefore, also enjoy the benefits associated with using these technologies.

The research also established the following features of good intranets and extranets:

- *Goal oriented*: Good intranets and extranets are designed and implemented to achieve and support well-focused goals, objectives or processes that benefit the organisation, its customers, partners and suppliers.

- *Based on employee centred design and user centred design:* A good intranet is designed with the employees in mind.
- *Platform independent:* Good intranets and extranets are not locked into proprietary software systems. They are based on an open systems platform.
- *Sustainable:* Good intranets and extranets must be sustainable.
- *Based on proven project management methodology:* Implementation of good intranets and extranets in organisations should be based on sound project management methods.
- *Have a content management policy:* A good intranet has an effective content management policy in place. The policy should empower non-technical staff and help them to contribute to the content of the intranet.
- *Provide relevant information content:* Good intranets and extranets should be properly organised for easy access and information retrieval, otherwise it could lead to information overload within the organisation.
- *Have Terms of Use (TOU) for external users:* A good extranet provides all users who access the facilities with an agreement (Terms of Use [TOU] agreement) that governs each party's use of the extranet and the information exchanged on the extranet.

The study of intranets and extranets also resulted in the researcher proposing the following definitions of the two facilities:

- *Intranet:* A private, internal and secure information management and communication network based on the Internet and World Wide Web technologies and protocols.

- *Extranet*: A private, secure information management and communication network based on the Internet and World Wide Web technologies and protocols, which is open for access to selected groups of external users.

Second sub-problem statement: *What are portals and how are they being used in the provision of digital information and services to end-users in corporate organisations?*

The second sub-problem is addressed in Chapter 3, which reports on the study of portals. Regarding portal applications, the findings show that:

- Various types of portals, among them web portals, vertical portals, affinity portals and enterprise information portals (EIPs), are being used to provide access to information services to various categories of users accessing information via the Web and those accessing information within corporate organisations.
- Enterprise information portals (EIPs) concentrate on harnessing internal corporate information resources and selected external information resources for the benefit of the organisation. Therefore, in general, EIPs provide access to information resources on the corporate intranet and to selected information resources available on the Internet.

The review and examination of the features of various types of portals showed that EIP could be adapted and deployed in agricultural research organisations. In addition, there are other features that could also be borrowed from different types of portals and incorporated into the design of agricultural information portals.

The following have been identified as the major features of good portals that should be incorporated into agricultural information portals:

- *Personalisation for end-users:* A portal should allow information end-users to personalise its appearance, content and application interface to suit their individual needs.
- *Organisation of the user's desktop:* A portal should help to organise end-users' desktops to enable users to have access to the important information content they need. This feature, together with personalisation, ensures that information end-users are able to reduce the state of information overload.
- *Division of resources for different categories of users:* Portals should have features that separate facilities into various layers for different categories of users.
- *Tracking of individuals' usage, interests and use behaviour:* Portals should track the individual usage, interests, and behaviour of users to enable the users to personalise the portal, and the portal to present a personalised view of the information resources to the user.
- *Provision of access to multiple heterogeneous data resources:* Portals should be able to provide users with access to information from multiple heterogeneous data stores.
- *Provision of facilities for locating information and people:* A portal must make it easy for users to locate people and the information they need.
- *User authentication:* A portal should provide user authentication and login facilities to facilitate the provision of content that is relevant and current to the user's needs.

- *Taxonomy*: The organisation of portal resources should be based on a well-defined categorisation system of content or subject.

In concluding the study on portals, the researcher, proposed the following definition of a portal:

A web-based application accessed over the Internet, intranet or extranet that provides a personalised and adaptive interface enabling users to discover, track, and interact with other people, applications, services and information relevant to their interests.

Third sub-problem statement: *What are the international trends in the provision of access to digital agricultural information via websites, and what can be learnt from the trends regarding the resources and services that could be provided via an agricultural information portal?*


The study of the global trends in the provision of access to digital agricultural information via websites, reported in Chapter 4, addressed the third research sub-problem. The findings show that:

- International agricultural organisations are way ahead of agricultural research organisations in Africa, and the SADC region in particular, in the use of internet websites in providing access to information and knowledge resources. These organisations are providing access to different types of digital documents, including corporate documents, technical documents and newsletters. Updating visitors to the website with news and information regarding planned events and activities in the organisation is also widespread among international agricultural organisations.
- The amount of information resources provided on most websites of international agricultural organisations is vast. Therefore, these organisations are implementing various types of information discovery tools, such as search engines, site maps and taxonomies on their sites to

make it easy for visitors (end-users) to the sites to retrieve information on the site.

- International agricultural organisations are also taking advantage of the availability of other information resources on the Web and are making systematic links to resources on websites of other organisations. These include links to external databases, technical documents, corporate documents, electronic newsletters, posters, tools and so forth.

There is nothing to prevent agricultural research organisations in the SADC region from conforming to the international trends when providing access to digital information resources and services via websites. Furthermore, the adoption and use of portals to provide access to various digital information resources and services will improve the provision of information services to researchers.



Fourth sub-problem statement *What is the state of the development of agricultural research websites, and is there a need for the use of portals, other than ordinary websites, in the provision of access to web-based, value-added information services and resources to researchers in agricultural research organisations in the SADC region?*

To address the above fourth sub-problem, a questionnaire survey was conducted on the existence of the need for the use of portals in the provision of information services via portals, other than ordinary websites to researchers in agricultural research organisations. The discussion and analysis of the findings are reported in Chapter 6, and these reveal that:

- Overall, agricultural research organisations in the SADC region have access to ICT tools and facilities that could be used in developing information portals.

- Most agricultural researchers in the SADC region have access to ICT facilities that could be used to access information services and resources provided via portals.
- Agricultural researchers, together with information management specialists, are to a certain extent, being affected by problems associated with using paper-based information resources. Some of the problems could be minimised or eliminated through the use of portals.
- Most available websites of agricultural research organisations are providing access to brochure type of information, and should, therefore, be improved, and in some cases, upgraded to a portal level.
- A variety of information resources are being used by researchers for different types of information needs. Most of the information resources could be integrated into an agricultural information portal.
- There is a need among agricultural researchers to use or access services or facilities or conduct communication activities via an agricultural information portal.

The study concluded that:

- There is a need for the use of portals or improved websites in the provision of information services to researchers in agricultural research organisations in the SADC region.
- Taking into account the quality of existing websites and web-based information services being provided to researchers, it is important to provide suitable guidelines for the planning of the deployment of portals in agricultural research organisations.

Fifth sub-problem statement: What is an agricultural information portal and are there any suitable models or guidelines (if any) that could be adopted (or developed) for the deployment of agricultural information portals in agricultural research organisations?

Chapter 7 addressed the fifth research sub-problem. Based on the definition of a portal proposed in Chapter 3, an agricultural information portal is defined as:

A web-based application accessed over the intranet or extranet that provides a personalised and adaptive interface enabling *agricultural researchers* to discover, track, and interact with colleagues and other people, software applications, information resources, services and tools relevant to their research interests and work.

The major features of an agricultural information portal are proposed and outlined. These are largely derived from the findings of the studies on intranets and extranets, discussed in Chapter 2, and portals in Chapter 3.

Regarding the application possibilities of agricultural information portals, the findings indicate that the use of AIPs could bring increased functionality and improved access to information resources and services to researchers in agricultural research organisations, and could also enable them, through a single user interface, to:

- Share information and knowledge with colleagues within and outside the organisation.
- Collaborate on research projects with colleagues within and outside the organisation.
- Manage and track the progress of various research projects being conducted by the organisation.

- Access various information resources such as bibliographic and full-text databases, images, video clips and many more generated within the organisation; services and tools relevant to agricultural research work; and information resources from external sources and organisations.

Furthermore, the study findings indicate that the following types of content could be provided via an agricultural information portal:

- *Personal content*: Information, resources, tools and applications required by specific individual researchers.
- *Workgroup content*: Information, resources, tools and applications required by different groups of individuals, for example by departments and researchers collaborating on projects.
- *Intranet/corporate content*: Information, resources, tools and applications required by most portal end-users generated within the organisation, for example information regarding research funding, and guidelines for research proposals.
- *Extranet content*: Information, resources, tools and applications required from other partner organisations or other research stations or institutes that could be provided to authorised external users.
- *External/Internet content*: Information, resources and tools such as websites, documents and search engines from the Internet.

Chapter 7 also shows that there are a variety of approaches to website and portal development to choose from, and proposes guidelines for the deployment of agricultural information portals, addressing the planning stage of the portal development process. The guidelines take into account the findings and discussions on intranets and extranets in Chapter 2, portals in Chapter 3, international trends regarding the provision of content on agricultural websites in

Chapter 4, and the findings on the need for agricultural information portals in the SADC region, discussed in Chapter 6.

The proposed general guidelines include the following seven activities to be carried out during the planning phase for the portal:

- Activity 1: Setting up the AIP project team
- Activity 2: Definition of AIP goals and objectives
- Activity 3: Inventory and analysis of AIP technical infrastructure
- Activity 4: Definition of the desirable AIP features
- Activity 5: Selection of AIP development approach
- Activity 6: Developing a strategy for AIP adoption
- Activity 7: Budgeting for AIP development costs
- Activity 8: Developing an AIP deployment schedule.

Specific guidelines take into account the specific agricultural information portal components and facilities, and these include:

- 
- End-users
 - Content and services
 - Developers
 - Content developers and sources
 - Development tools
 - Content publishing and management tools
 - Content management and use policy
 - User training and support
 - User tools
 - Information discovery tools
 - Security
 - Integration with the Internet.

8.3 RECOMMENDATIONS

Arising from the findings and discussions in the thesis, the following should be taken into account:

- Portals have several potential applications in agricultural research organisations in the SADC region.
- The variety and number of digital information resources and services being provided in the websites of agricultural research organisations in the SADC region were very limited.
- Agricultural research organisations in the SADC region were using ad hoc system development approaches to develop their websites.
- There was a need to deploy advanced websites or information portals in order to improve access to web-based, value-added information services and resources to researchers.

It is therefore recommended that agricultural research organisations in the SADC region should:

- Take advantage of the Internet and Web-based technologies and start deploying advanced websites or information portals to facilitate the provision of access to digital information resources and services to researchers. Use of advanced websites and portals would also enable the organisations to provide researchers with access to as much locally produced information content as possible, including research reports, articles, technical guides, posters, models, data sets and other relevant materials produced by the organisation and the researchers. At the same time organisations will also be able to integrate various types of relevant digital content and services from outside the organisation into the websites/portals.

- Adopt the use of formal system development methodologies in the development of advanced websites and information portals. Use of formal methodologies would ensure that agricultural research organisations avoid the various problems associated with the use of ad hoc approaches in website development. This will also ensure that the websites and portals that are developed are sustainable and fit into the organisations' overall information strategy.

8.4 CONCLUSION

As can be seen from the above, this research has addressed all five sub-problems identified. Therefore, it can be concluded that the main statement of the problem: *What is the nature and application possibility of agricultural information portals in the provision of web-based, value-added information services to researchers?* has been addressed. Specifically, this has been done by identifying, outlining and discussing the following in Chapter 7, all based on the study and findings of the five sub-problems:

- The definition of an agricultural information portal
- The potential application possibilities of an agricultural information portal, including content and services
- Major features of an agricultural information portal.

The research also indicates that there is a need to deploy advanced websites or information portals in agricultural research organisations in the SADC region and that as is the case with all information systems, the development of agricultural information portals should be based on sound system development methodologies. As a result, various systems development approaches that could be adopted for agricultural portal development were examined. To assist and facilitate the process of deploying information portals in agricultural research

organisations, guidelines for the deployment of agricultural information portals were suggested.

8.5 AREAS REQUIRING FURTHER RESEARCH

During the course of the study, the researcher observed that the following areas require further research:

- Although in most organisations in the SADC region development and deployment of websites is mainly the domain of information technology specialists, the researcher recognised the important role information specialists could play in the development, promotion and provision of access to digital information resources and services via advanced websites or portals in many organisations. However, there is need to investigate whether information specialists on the SADC region are playing any role whatsoever in the development and deployment of websites in their organisations, and whether they have the right mix of skills that would enable them participate fully in the development and deployment of advanced websites or information portals in their organisations.
- The research showed that advanced websites and portals are rarely set up or used in agricultural research organisations in the SADC region. There is a need to investigate whether this is also the trend in national corporate organisations. Corporate organisations in developed countries have been at the forefront in the use of portal technologies.
- Several system development approaches have been proposed for use in portal development by various authors. There is need to investigate the suitability of these methodologies in portal development with a view to identifying the approach that would work best with information portals.

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APPENDIX 1

THE WORLD WIDE WEB: TIMELINE

Year	Activity
1989	<ul style="list-style-type: none">• March, Tim Berners-Lee writes, <i>Information Management: a Proposal</i>, the first proposal for the Web and circulates the document for comments at CERN.• November 12, the revised proposal “WorldWideWeb: Proposal for a HyperText Project” by Tim Berners-Lee and Robert Cailliau is submitted to Tim’s boss.
1990	<ul style="list-style-type: none">• Mid November, Tim had developed (written the codes) for a client program – a point and click browser/editor which he called WorldWideWeb. By December the WorldWideWeb client program could work with the Hypertext Mark-up Language.• By December Tim had written the first web server running the Hypertext Transmission Protocol (HTTP). The server was formally known as nxoc01.cern.ch (NeXT,Online Controls,1) and Tim registered it with an alias infor.cern.ch, with the CERN computer systems staff.• By Christmas Day, the WorldWideWeb browser/editor was working on Tim’s and Robert’s computers (both NeXT machines) and communicating over the Internet with the infor.cern.ch server.

1991

- In May, there was a general release of WWW on central CERN machines.
- In August, WWW files were made available outside CERN on the Internet for downloading by FTP.
- In December, Tim and Robert presented a demonstration of the Web at Hypertext '91 in San Antonio, Texas (US).
- Paul Kunz installs the first web server outside of CERN and Europe, at Stanford Linear Accelerator (SLAC) in Palo Alto, US.

1992

- In January, the Line mode browser release 1.1 was available by anonymous FTP.
- In April, the Finnish "Erwise" GUI client (browser) for UNIX machines running X Windows System was released.
- In May, Pei Wei, a student at the University of California at Berkeley, released a test version of a web browser called VoilaWWW for UNIX machines running X Windows System.

1993

- By January, Midas (Tony Johnson, SLAC), Erwise (Helsinki University of Technology), and ViolaWWW (Pei Wei, O'Reilly Associates) browsers were available for X Windows System. Samba, although not complete, was also working for Mac computers.

- In February, NCSA released the first alpha version of Marc Andreessen's "Mosaic for X-Windows System". (Note: Mosaic was the first graphical Web browser).
- In March, Lou Montulli, a student at the University of Kansas, released Lynx 2.0 web browser, an adaptation of Lynx developed by the University.
- In March, Tom Bruce of the Legal Information Institute at Cornell University demonstrated an alpha release of Cello, a point-and-click browser for Windows, to the legal community in Chicago.
- On April 30, CERN's directors declared that WWW technology would be freely usable by anyone, with no fees being payable to CERN.
- In December, Robert Cailliau got the go-ahead from CERN management to organise the First International WWW Conference at CERN.



1994

- In January, Marc Andreessen and his colleagues leave NCSA to form "Mosaic Communications Corporation" (later changed the name to Netscape Communications Corporation).
- In February, Navisoft released a browser for the PC and Macintosh called Navipress. This was the first browser since Berners-Lee's WorldWideWeb browser that incorporated an editor, so that you could browse and edit content at the same time.
- April, Bill Gates of Microsoft indicates that the next version of Windows 95 would include software for accessing the Internet.

- The Opera browser is developed by a team of researchers at a telecommunication company called Telenor in Oslo, Norway.
- May 25-27, the First International WWW Conference, attended by around 400 participants, is held at CERN, Geneva.
- In July, an agreement to start the World Wide Web Consortium (W3C) by MIT and CERN is announced in Boston by Martin Bangemann, one of the European Commission's commissioners, who was charged with developing the EC's plan for a Global Information Society.
- The Second International WWW Conference: "Mosaic and the Web", is held in October, in Chicago. Attended by around 1300 participants.
- In October, Tim Berners-Lee, inventor of the Web, founded the World Wide Web Consortium (W3C) at the Massachusetts Institute of Technology, Laboratory for Computer Science (MIT/LCS) in collaboration with CERN, where the Web originated, with support from DARPA and the European Commission.
- October, Netscape released a first version (a beta or test version) of its browser called Mozilla, on the Net for users to try it and send suggestions and comments.
- December 14, the First World Wide Web Consortium Advisory Committee Meeting is held at MIT, Cambridge, USA.
- December 15, Netscape Communications Corporation released Netscape Navigator 1.0, a graphical web browser compatible with Microsoft Windows operating system, the X Windows system on

UNIX and Macintosh. (Note: The browser was released on the Internet and was free of charge.)

1995

- In February, the Web is the main reason for the theme of the G7 meeting hosted by the European Commission in the European Parliament buildings in Brussels, Belgium.
- March - CERN holds a two-day seminar for the European Media (press, radio, TV) attended by 250 reporters. WWW is demonstrated on 60 machines, with 30 pupils from the local International High School helping the reporters to "surf the Web".
- March - The "OCLC/NCSA Metadata Workshop" is held in Dublin, Ohio, US. More than 50 people discussed how a core set of semantics for web-based resources would be extremely useful for categorising the Web for easier search and retrieval. They dubbed the result "Dublin Core metadata", based on the location of the workshop.
- In April, the Third International World Wide Web Conference: "Tools and Applications", is hosted by the Fraunhofer Gesellschaft, in Darmstadt, Germany.
- In April, Netscape Navigator 1.1 is released
- In May, Sun Microsystems introduces Java, a new programming language that opened up a wide world of potential web applications.
- In August, Microsoft introduces Windows 95 Operating Systems that came with Internet Explorer 1.0, first shipped as an Internet

Jumpstart Kit in Microsoft Plus! for Windows 95. The web browser war: Microsoft Internet Explorer v. Netscape Navigator, begins.

- September, Netscape Navigator 2.0 is released, introducing support for HTML 3.0, JavaScript, Java support, RealAudio, frames, client side image maps, the tag and Netscape Composer.
- December, Bill Gates announced that Microsoft would distribute Internet Explorer for free.
- December, the 4th International World Wide Web Conference takes place in Boston, Massachusetts.

1996

- January, Shockwave, a web browser plug-in, developed through collaboration between Macromedia and Netscape, is released.
- January, the number of websites is estimated to be around 100,000.
- February, the W3C introduces PICS (Platform for Internet Content), a way for users to classify the content of websites themselves.
- May, the 5th World Wide Web International Conference takes place in Paris, France.
- June, the number of websites is estimated to be around 230,000.
- June, Microsoft Internet Explorer 3.0 is released. Includes support for Jscript, Cascading Style Sheets and ActiveX
- First WebTV boxes shipped by Sony and Phillips

- November, at the SGML '96 in Boston, the first draft for XML is introduced.
- December, Cascading Style Sheets (CSS) Level 1 are released.
- Real Audio technology, streaming sound on the Internet straight from a Real Audio server, is introduced.

1997

- January, the W3C publishes its recommendation for HTML 3.2.
- January, release of Futurewave's FutureSplash Animator – later acquired by Macromedia and repackaged as Flash.
- March, Sun Microsystems releases HotJava 1.0, a browser programmed in Java.
- April, the 6th International WWW Conference takes place in Santa Clara.
- July, the W3C introduces the first Draft for HTML 4.0. The specifications were approved in December.
- September, Microsoft Internet Explorer 4.0 is launched.
- By the end of the year, push, multicasting, and webcasting technologies, products and services like PointCast, IBM News Ticker, My Yahoo! News Ticker, and others are available to Web users.
- December, Microsoft buys Hotmail, a free web-based e-mail account provider.

1998

- January, Netscape releases the source code to their browser engine. The Mozilla project is born.
- February 10 – The World Wide Web Consortium (W3C) released the Extensible Mark-up Language (XML) 1.0 recommendation. XML is to be used for developing structured documents and data on the Web.
- February, the website for the XVIII Olympic Winter Games registers 650 million visits in 16 days.
- March, the W3C proposes Cascading Style Sheets 2 (CSS2) and the Resource Description Framework (RDF).
- April, the 7th World Wide Web International Conference takes place in Brisbane, Australia
- April, the W3C publishes the specifications for Mathematical Mark-up Language 1.0 (MathML) and Synchronized Multimedia Integration Language 1.0 (SMIL).
- April, Technical specifications for the Wireless Application Protocol (WAP) is published.
- By the first quarter of the year, there are 275 million websites according to Digital, 320 million according to NEC Corporation.
- June, Microsoft released Windows 98, with Internet Explorer well integrated into the Desktop.
- The browser war continued. In June, Netscape's market share stood at 41.5%, while the combined market share for Internet

Explorer and America Online (whose users got IE automatically) rose to 43.8%.

- June, after the Winter Olympics, the Soccer World Cup in France becomes the second largest sporting event on the Web.
- July - The number of webpages was estimated to be around 300 million.
- November – America Online (AOL) announced the acquisition of Netscape in a stock-for-stock transaction worth \$4.2 billion.

1999

- Implementation of Wireless Application Protocol (WAP) providing a standardised way of linking the Internet to mobile phones, thereby allowing WAP-enabled mobile phone users to access web content stored on WAP servers. (Note: Development of WAP was initiated in mid 1997 by Motorola, Nokia, Ericsson and the US software company Phone.com (formerly Unwired Planet])
- May - In the browser war, Microsoft's Internet Explorer surpasses Netscape's Navigator as the most popular browser among business users. In a new study, 59% use Microsoft as opposed to 41% for Netscape, according to Zona Research Inc., Redwood City, California
- May, the 8th International World Wide Web Conference is takes place in Toronto, Canada.
- By the end of 1999, the number of web servers was approaching 10,000,000 and still rising fast.

2000

- May, the 9th International World Wide Web Conference takes place in Amsterdam, the Netherlands.
- December – Opera Software released Opera 5.0 for Windows web browser and made available for downloading a free ad-sponsored version. Thus Opera entered the Browser War in full force as a third player besides AOL/Netscape and Microsoft's Internet Explorer.

2001

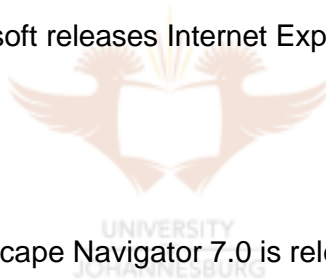
- May, the 10th International World Wide Web Conference takes place in Hong Kong.
- October, Microsoft releases Internet Explorer 6.0

2002

- In August, Netscape Navigator 7.0 is released.

2003

- January, Opera 7.0 is released.



APPENDIX 2

EXAMPLES OF WEB APPLICATIONS

Below are some examples of some of the applications of the World Wide Web in the world today.

Electronic commerce

Conducting business and banking using the Web has become a major activity in the world. A number of organisations are involved in the buying and/or selling of goods and services using “digital cash” via the Web. Examples of organisations using the Web for electronic commerce are:

- *Amazon.com* – involved in online sale of books, videos and audio CDs, software, electronics and many more. Amazon.com can be accessed at <http://www.amazon.com>.
- *Goodyear* (The Tire and Rubber Company) – involved in online sale of tyres, conveyer belts, casual wear and collectibles associated with Goodyear, and many more. Available at <http://estore.goodyear.com>.
- *Ican Online* – a South African based virtual place providing access to services such as shopping, banking, insurance, and investment and trading. Ican Online can be accessed at <http://www.icanonline.co.za>. Ican Online is a joint initiative of MWEB, an Internet Service Provider, and Nedbank, a financial institution.

Education

The Web is being used to offer online courses, especially to students registered on distance learning programmes. Some training institutions have also adopted

and integrated the use of web-based technologies and tools to supplement and enhance on-campus traditional courses. For example, a large number of institutions of learning around the world are using WebCT (<http://www.webct.com/>), a web-based set of course tools, to deliver online learning. The tool was originally developed by the University of British Columbia and is presently being used by universities and colleges all over the world in the production and management of online courses accessed via the Web. WebCT provides the following tools and features to support online learning:

- Conferencing system
- Online chat
- Student progress tracking
- Student self-evaluation
- Grade maintenance and distribution
- Access control
- Navigation tools
- Auto marked quizzes
- Electronic mail
- Course calendar
- Student homepages



Examples of academic institutions, also called WebCT Institutes (<http://www.webct.com/institutes/>), that offer web-based courses using WebCT, include the following:

- The University of Alberta, <http://www.ualberta.ca>, in Canada. The University adopted the use of WebCT in 1998 and since then a number of faculties have developed various online courses. The University's WebCT site is at <http://www.ualberta.ca/WEBCT/>.
- The University of Turku, <http://www.tkk.utu.fi>, in Finland. The University started using WebCT in 1997. The University's WebCT site is at <http://www.tkk.utu.fi/avoin/momu/>.

- George Mason University - <http://www.gmu.edu>, in the United States. The University started using WebCT in 1999. The University's WebCT site is at <http://www.irc.gmu.edu/WebCT/default.asp>.

Electronic publishing

The Web has changed the face of electronic publishing. Organisations are using the Web infrastructure as a medium for publishing and distribution of documents in digital format. Examples of publications, in digital format, available on the Web include:

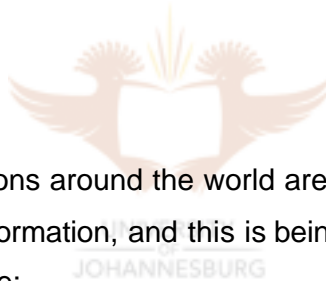
- Journals - *South African Journal of Information Management* accessed at <http://general.rau.ac.za/infosci/raujournal/> and *Nature: International Weekly Journal of Science* accessed at <http://www.nature.com/nature/>
- Encyclopedias – *Encyclopedia Britannica Online* accessed at <http://www.eb.com> and *Columbia Encyclopedia* accessed at <http://www.bartleby.com/65/>
- Newspapers – *The Daily Mail & Guardian* accessed at <http://www.mg.co.za>; and *The Sunday Times* accessed at <http://www.sundaytimes.co.za>
- Novels – *Pride and Prejudice* by Jane Austen accessed at <http://www.pemberley.com/janeinfo/pridprej.html>

Virtual and digital libraries

Information resources in electronic format available on the Internet are being organised into virtual and digital libraries. This is making it easier for information end-users to search and access information via the Web. Examples of virtual and digital libraries include the following:

- *The Social Science Information Gateway (SOSIG)*, a freely available internet service which aims to provide a trusted source of selected, high quality internet information for students, academics, researchers and practitioners in the social sciences, business and law (SOSIG 2000). SOSIG is – accessed at <http://www.sosig.ac.uk>
- *Edinburgh Engineering Virtual Library (EEVL)*, a free service providing access to engineering, mathematics, and computing information available on the Internet. EEVL is accessed at <http://www.eevl.ac.uk>
- *Project Runeberg*, an open and volunteer-driven initiative to publish Nordic literature on the Internet. The Project can be accessed at <http://www.lysator.liu.se/runeberg/>. The project is based at Linköping University in Sweden.

Broadcasting



Various media organisations around the world are using the Web to disseminate their programmes and information, and this is being done in print and multimedia formats. Examples include:

- The British Broadcasting Corporation (BBC) website, accessed at <http://www.bbc.co.uk/audiovideo/tvradio/>, provides access to various news stories, pictures, and audio and visual files. Visitors to the site, using the BBC Radio Player (radio on demand) that can be launched from the site, can listen to live programmes, or listen any time up to 7 days after programme broadcast.
- The Cable News Network (CNN), accessed at <http://www.cnn.com>, provides access to news stories, pictures, audio and video clips, news archives and facilities for delivering breaking news stories to subscribers via e-mail.

Entertainment

The entertainment industry is also making good use of the Web. A large number of musicians have websites on which sample clips of their music and lyrics can be downloaded. Examples include Lucky Dube at <http://www.luckydube.net>, Michael Jackson at <http://www.mjnet.com/>, and the Bellamy Brothers at <http://www.bellamybros.com/>. In addition to individual artists setting up websites, major entertainment events like the Oscars for the Film Industry (<http://oscar.com/>) and the Grammy Awards for the Music Industry (<http://grammy.com/>) have websites providing details about these events.

The film industry is has also adopted the use of the Web as a marketing and information distribution media. Almost each film produced in Hollywood has a website that provides information about the film, characters, and in most cases trailers can also be viewed by the visitors to the site. Visitors to websites for blockbuster movies like the Lord of the Rings (<http://www.lordoftherings.net/>, can view information about the Oscar awards and other awards received by the film, view film trailers, visit video and photo galleries, and download posters, electronic cards and screensavers.

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Sports

There is a large number of websites, like *CNN Sports Illustrated* at <http://cnnsi.com> and *Supersport Zone* at <http://www.supersport.co.za> that are providing access to sports related information. In addition, nowadays most major sports events or organisers of the events have websites. These include the Soccer World Cup (<http://www.fifa.com>), the Masters Tournament (golf) (<http://www.masters.org>), the Olympics (<http://www.olympics.com>), Wimbledon Tennis Tournament (<http://www.wimbledon.org>), and many others. These websites provide access to large amounts of information about the events, including results of the competitions, statistics, and archival information.

Communication

Web-based electronic mail systems are being used by a large number of people for communication. Examples of web-based e-mail systems include Hotmail at <http://www.hotmail.com> and Yahoo! mail at <http://mail.yahoo.com>. In addition, there are various websites that provide access to online chat facilities.

E-governance and politics

There is a growing interest among governments and politicians around the world to provide information access to their citizens via the Web. Examples of government and political related websites are many and include South Africa Government Online at <http://www.gov.za>; 10 Downing Street (<http://www.number-10.gov.uk>), the official residence of the British Prime Minister; and the White House (<http://www.whitehouse.gov>), the official residence of the U.S. president and the Vatican (<http://www.vatican.va>).



APPENDIX 3

WEBSITES OF INTERNATIONAL AGRICULTURAL ORGANISATIONS LISTED IN AROW

- Centre for International Forestry Research (CIFOR)
URL: <http://www.cifor.cgiar.org/>
- Centre for Agricultural and Biosciences International (CABI)
URL: <http://www.cabi.org/>
- International Maize and Wheat Improvement Centre (CIMMYT)
URL: <http://www.cimmyt.org/>
- Consultative Group on International Agricultural Research (CGIAR)
URL: <http://www.cgiar.org/>
- European Tropical Forest Research Network (ETFRN)
URL: <http://www.etfrn.org/etfrn/index.html>
- Food and Agricultural Organisation of the United Nations (FAO)
URL: <http://www.fao.org>
- Future Harvest
URL: <http://www.futureharvest.org/>
- Global Forum on Agricultural Research (GFAR)
URL: <http://www.egfar.org/home.shtml>
- International Centre for Agricultural Research in the Dry Areas (ICARDA)
URL: <http://www.icarda.cgiar.org/>
- International Centre for Tropical Agriculture (CIAT)
URL: <http://www.ciat.cgiar.org/>
- International Crops Research Institute for Semi-arid Tropics (ICRISAT)
URL: <http://www.icrisat.org/>
- International Fertiliser Development Centre (IFDC)
URL: <http://www.ifdc.org/>
- International Food Policy Research Institute (IFPRI)
URL: <http://www.ifpri.cgiar.org/>
- International Fund for Agricultural Development (IFAD)
URL: <http://www.ifad.org/>

- International Institute of Fisheries Economics and Trade (IIFET)
URL: <http://www.orst.edu/Dept/IIFET/>
- International Institute of Tropical Agriculture (IITA)
URL: <http://www.iita.org/>
- International Livestock Research Institute (ILRI)
URL: <http://www.cgiar.org/ilri/>
- International Network for the Improvement of Banana and Plantain (INIBAP)
URL: <http://www.inibap.org/>
- International Potato Centre (CIP)
URL: <http://www.cipotato.org/>
- International Rice Research Institute (IRRI)
URL: <http://www.irri.org/>
- International Service for National Agricultural Research (ISNAR)
URL: <http://www.isnar.cgiar.org/>
- International Society of Sugar Cane Technologists (ISSCT)
URL: <http://www.sugaronline.com/issct>
- International Soil Reference and Information Centre (ISRIC)
URL: <http://www.isric.nl/>
- International Union of Forestry Research Organisations (IUFRO)
URL: <http://iufro.boku.ac.at/>
- International Water and Irrigation Management Institute (IIMI)
URL: <http://www.cgiar.org/iwmi/>
- The International Plant Genetic Resources Institute (IPGRI)
URL: <http://www.ipgri.cgiar.org/>
- West Africa Rice Development Association (WARDA)
URL: <http://www.warda.cgiar.org/>
- World Agroforestry Centre (formerly International Centre for Research in Agroforestry (ICRAF)
URL: <http://www.worldagroforestrycentre.org/home.asp>
- World Fish Centre (formerly) Centre for Living Aquatic Resources Management (ICLARM)
URL: <http://www.worldfishcenter.org/>

APPENDIX 4

WEBSITES OF AGRICULTURAL RESEARCH ORGANISATIONS IN THE SADC REGION INCLUDED IN THE SURVEY

Botswana

- Botswana College of Agriculture
URL: <http://www.bca.bw/index.html>
- Department of Agricultural Research, Ministry of Agriculture
URL: <http://www.agricta.org/partners/dar/>

Mauritius

- Food and Agriculture Research Council (FARC)
URL: <http://farc.gov.mu/>
- Agricultural Research and Extension Unit (AREU)
URL: <http://ncb.intnet.mu/moa/areu/>
- Mauritius Sugar Industry Research Institute (MSIRI)
URL: <http://webmsiri.intnet.mu/>
- Mauritius Chamber of Agriculture (MChA)
URL: <http://www.prosi.net/directry/dirmca.htm>
- Albion Fisheries Research Centre (AFRC)
URL: <http://ncb.intnet.mu/fish/afrc.htm>

Namibia

- University of Namibia (UNAM) - Faculty of Agriculture and Natural Resources
URL: <http://www.unam.na/faculties/agriculture/index.html>

South Africa

- Agricultural Research Council (ARC)
URL: <http://www.arc.agric.za/>
- Food Science and Technology Programme, Division of Food Biological and Chemical Technologies (DFBCT) - Council for Scientific and Industrial Research (CSIR)
URL: <http://www.csir.co.za/biochemtek/index.html>
- Grootfontein Agricultural Development Institute (GADI)
URL: <http://gadi.agric.za/>
- Institute for Commercial Forestry Research (ICFR)
URL: <http://www.icfrnet.unp.ac.za/>
- University of Natal - School of Agricultural Sciences and Agribusiness
URL: <http://www.nu.ac.za/department/default.asp?dept=asaunp>
- University of the Free State - Faculty of Natural and Agricultural Sciences
URL: <http://www.uovs.ac.za/faculties/agrinat/>
- National Department of Agriculture (NDA) - Agricultural Information Service (AGIS)
URL:
http://www.agis.agric.za/agisweb/IDceb6f2301f10e8/?Mlval=agis_s.html
- South African Sugar Association Experiment Station (SASA)
URL: <http://www.sasa.org.za/>

Tanzania

- Department of R&D, Ministry of Agriculture and Food Security
URL: <http://www.drd.mafs.go.tz/>
- University of Dar-es-Salaam - Institute of Marine Sciences
URL: <http://www.udsm.ac.tz/marine/super.html>
- Tanzania Fisheries Research Institute (TAFIRI)
URL: <http://www.tanzaniafish.org/TAFIRI.htm>

Zambia

- University of Zambia - School of Agricultural Sciences
URL: <http://www.unza.zm/agric/agric.html>

Zimbabwe

- University of Zimbabwe - Faculty of Agriculture
URL: <http://www.uz.ac.zw/agriculture/>



APPENDIX 5

RESEARCH THEMES AND SOURCES OF INFORMATION

		Sources of Information		
		Information End-Users	Information Specialists	Information Technology Specialists
Concepts/Objectives	Elements			
1. Problems associated with paper-based information resources		X	X	
To establish the existence of problems associated with using paper-based information resources that could be solved through the use of portals	1.1 Difficult to personalise or customize the information content to suit specific individual users' needs	X	X	
	1.2 Easy to misplace/misfile documents resulting in difficulties in locating or retrieving documents	X	X	
	1.3 Require several copies (duplicate copies) for distribution	X	X	
	1.4 Difficult updating information that changes often	X	X	
	1.5 In most cases require large storage space	X	X	
	1.6 Documents can sometimes be bulky and difficult to carry around	X	X	
	1.7 Information overload as a result of lack of personalization and customization	X	X	

2. ICT/facilities for accessing and manipulating digital information by end-users				
To establish the availability of and access to tools for manipulating digital information resources	2.1 Personal Computer	X		
	2.2 Laptop	X		
	2.3 Local area network (LAN)	X		
	2.4 Intranet	X		
	2.5 Extranet	X		
	2.6 Internet and World Wide Web	X		
	2.7 Electronic mail	X		
	2.9 Mobile phone	X		
	2.10 Facsimile	X		
	2.11 Video conference	X		
	3. Website			
To establish the availability of websites and the uses being made by researchers	3.1 Availability of websites	X	X	
	3.2 Type: Internal or public	X	X	
	3.3 Resources and services provided to researchers via the website	X	X	
4. Tools/facilities for developing information portals				
To establish the availability of tools and facilities for developing information portals in agricultural research organisations	4.1 Hardware resources			X
	4.2 Web server software			X
	4.3 Web client software			X
	4.4 Portal development methodologies			X
	4.5 Content development software			X
	4.6 Hardware and software skills			X
	4.7 Networks and connectivity			X
	4.8 Digital information strategy/plan			X
	4.9 Content development guidelines			X
	4.10 Network operating software			X
	4.11 TCP Protocol			X

5. Information source being provided to be used by researchers				
To establish the types of information resources provided within the organisation for use by researchers for different types of information needs	5.1 Latest research results/findings		X	
	5.2 Other researchers in the same field		X	
	5.3 What has been published in the field		X	
	5.4 On-going research projects		X	
	5.5 Research project proposals		X	
	5.6 Sources of research funding			
	5.7 Information on forthcoming conferences, workshops, etc		X	
6. Portal-based information resources and services				
To establish the frequency of use or need to use/access services or facilities or conduct activities that could be done via an information portal	6.1 Research project management	X		
	6.2 IT help desk facilities	X		
	6.3 Software resources	X		
	6.4 Software manuals	X		
	6.5 Access training manuals	X		
	6.6 Collaborate on research projects	X		
	6.7 Information on on-going research	X		
	6.8 Reports/results of past researches	X		
	6.9 Full-text databases (internal)	X		
	6.10 Full-text databases (external)	X		
	6.11 Bibliographic databases	X		
	6.12 Journal articles	X		
	6.14 Conference proceedings	X		
	6.15 Newsletters	X		
	6.17 Data from past researches	X		
6.19 News from within the organisation	X			
6.20 Relevant news from other organisations	X			
6.21 Contact information for researchers working in similar fields of interest	X			
6.22 Channelled information i.e. weather information, news, etc	X			

	6.23 Websites of other research organisations working in similar areas of interest	X		
	6.24 Relevant information resources on the World Wide Web	X		
	6.25 Personalised/customised information	X		
	6.27 Search engines	X		
	6.28 Online discussion forums	X		
	6.29 Share research related information with colleagues	X		
	6.30 Share research results with the public, donors, etc	X		



APPENDIX 6

A SURVEY OF PORTAL REQUIREMENTS FOR AGRICULTURAL RESEARCH ORGANISATIONS IN THE SADC REGION

QUESTIONNAIRE FOR RESEARCHERS

INSTRUCTIONS

Please, read the instructions provided for each question. Most questions only require you to indicate your response(s) by marking an **X** in the boxes provided. In cases where you are required to write down your response(s) or comments, please, *be as brief and to the point as possible*. For any questions or clarifications regarding any aspect of the questionnaire, please send an e-mail to Justin Chisenga at **Chisenga_J@yahoo.co.uk** or **Justin.Chisenga@fao.org**. The questionnaire should be returned by **11 July 2003**.

PART 1: GENERAL INFORMATION

Name of your organisation: _____

Your title/position _____

Your major agricultural research interest/field (e.g. agronomy, livestock, etc):

E-mail address (Optional): _____

Country: _____

PART 2: ACCESS AND USE OF ICT FACILITIES

Question 1

Which of the following Information Communication Technology (ICT) facilities do you have access to at your **work place** and for what do you use them in your research-related work? (*Select only facilities available **at your work place** by marking with an **X** in the boxes provided.*)

1.1 [] Desktop computer

Used for:

1.1.1 [] Processing and analysis of research data

1.1.2 [] Preparation (word processing) of research reports

1.1.3 [] Maintenance and storage of databases of research projects

1.1.4 [] Maintenance and storage of research data/data sets

1.1.5 [] Other (Specify): _____

1.2[] Laptop computer

Used for

- 1.2.1 [] Processing and analysis of research data
- 1.2.2 [] Preparation (word processing) of research proposals and reports
- 1.2.3 [] Maintenance and storage of databases of research projects
- 1.2.4 [] Maintenance and storage of research data/data sets
- 1.2.5 [] Other (Specify): _____

1.3[] Local area network (LAN) (Note: *A LAN is a group of computers, printers or other hardware that are all connected in a reasonably small geographic location like an office or a building. A LAN makes it possible for the connected users to share files and applications that usually reside on a **server [central computer]** or some type of shared computer.*)

Used for:

- 1.3.1 [] Access to software resources (i.e. SPSS, MS-Word, etc.) on the organisation's file server
- 1.3.2 [] Access to shared printers for printing of research reports
- 1.3.3 [] Access to databases/online catalogues provided by the library
- 1.3.4 [] Transfer of research data/data sets from personal computer to the server
- 1.3.5 [] Others (Specify): _____

1.4[] Organisation's Intranet (Note: *An **intranet** is a private and secure information management and communication network based on the Internet and World Wide Web technologies and protocols*)

Used for:

- 1.4.1 [] Access to the organisation's researching funding information
- 1.4.2 [] Management and monitoring of agricultural research projects
- 1.4.3 [] Collaboration on research projects with colleagues within the organisation
- 1.4.4 [] Access to the organisation's training resources, i.e. online tutorials, online courses
- 1.4.5 [] Others (Specify): _____

1.5[] Organisation's Extranet (Note: *An **extranet** is a private and secure information management and communication network based on the Internet and World Wide Web technologies and protocols, **which is open for access to selected groups of external users.***)

Used for:

- 1.5.1 [] Collaboration on research projects with colleagues from other research organisations that have access to our extranet
- 1.5.2 [] Sharing of research reports/results with colleagues from other research organisations that have access to our extranet
- 1.5.3 [] Other (Specify): _____

1.6[] Internet and World Wide Web access

Use for:

1.6.1 [] Access to relevant information resources/documents (i.e. electronic journals)

1.6.2 [] Publishing of research reports/results on the Internet

1.6.3 [] Access to web-based discussion forums

1.6.4 [] Downloading of relevant information resources

1.6.5 [] Others (Specify): _____

1.7[] Electronic mail

Used for:

1.7.1 [] Communicating with colleagues within the organisation

1.7.2 [] Communicating with colleagues in other research organisations

1.7.3 [] Communicating with organisations that fund research projects

1.7.4 [] Sending of research reports/data as file attachments

1.7.5 [] Participating in e-mail based discussion forums/groups

1.7.6 [] Others (Specify): _____

1.8[] Telephone access, including voice mail

Used for:

1.8.1 [] Communicating with colleagues within the organisation

1.8.2 [] Communicating with colleagues in other research organisations

1.8.3 [] Communicating with organisations that fund research projects

1.8.4 [] Communicating with members of the general public interested in my research activities

1.8.5 [] Others (Specify): _____

1.9[] Mobile (cellular) phone facilities

Used for;

1.9.1 [] Accessing web-based information

1.9.2 [] Communicating with colleagues within the organisation

1.9.3 [] Communicating with colleagues in other research organisations

1.9.4 [] Communicating with donors/potential donors of research projects

1.9.5 [] Communicating with members of the general public interested in my research activities

1.9.6 [] Other (Specify): _____

1.10[] Facsimile facilities

Used for:

1.10.1 [] Transmitting research reports

1.10.2 [] Transmitting research proposals

1.10.3 [] Others (Specify): _____

1.11[] Video conference facilities

Used for:

1.11.1 [] Participating in research-related video conference discussions

1.11.2 [] Other (Specify): _____

Question 2

Which of the following Information Communication Technology (ICT) facilities do you have access to at **your home**? (Select all that apply by marking an **X** in the boxes provided.)

2.1[] Desktop computer

2.2[] Laptop computer

2.3[] Internet and World Wide Web access

2.4[] Electronic mail

2.5[] Telephone access

2.6[] Mobile (cellular) phone facilities (e.g. used for Web access)

2.7[] Facsimile facilities

PART 3: SOURCES OF INFORMATION

Question 3

How often do you use the following sources of information in your research-related work? (Select all that apply by marking an **X** in the appropriate boxes provided. Please, use the last row (3.11) on the **Information Sources** to add any other major source that you use and that you think should be included on the list.)

		Frequency		
		Never	Occasionally	Always
Information Sources				
3.1	Colleagues			
3.2	Online Discussion Forums			
3.3	Websites			
3.4	Newspapers/Media			
3.5	Workshop reports			
3.6	Conference proceedings			
3.7	Technical Reports			
3.8	Monographs/Books			
3.9	Journal articles			
3.10	Online databases			
3.11	Others (Specify)			

Comments or clarifications _____

Question 4

How often do you need information on the following? (Select all that apply by marking an **X** in the appropriate boxes provided.)

		Frequency		
		Never	Occasionally	Always
Information Needs				
4.1	Latest results of research work			
4.2	On-going/current research projects			
4.3	Past research projects and results			
4.4	Other researchers conducting research in your area of interest			
4.5	Information on forthcoming conferences, seminars and workshops			
4.6	Research project proposals			
4.7	Sources of funding for research projects			

Comments or clarifications _____

PART 4: USING PAPER-BASED INFORMATION SOURCES

Question 5

Regarding accessing and using paper-based information resources at your work place, i.e. books, journals, conference proceedings, etc., how often do you...? (Indicate your responses by marking an **X** in the appropriate boxes.)

	Problems/Situations	Frequency		
		Never	Occasionally	Always
5.1	Spend too much time searching for a document			
5.2	Have to browse through the documents in order to locate the specific information that you need			
5.3	Feel that the current filing system in your office/organisation is no longer able to handle the growing volume of information documents			
5.4	Feel that information that changes so often is not updated on a regular basis in the documents			
5.5	Fail to carry information resources such as books, conference proceedings, etc. because you feel that they are too bulky and difficult to carry around			
5.6	Feel that you are running out of storage space for documents			
5.7	Feel that you are being overloaded with too much information, some of which may not be relevant or useful to your work			

Comments or clarifications _____

PART 5: ORGANISATION'S WEBSITE

Question 6

Does your organisation have a website? (*Indicate your response by marking an X in the appropriate box.*)

6.1 [] Yes

6.2 [] No

*If YES, proceed with **Question 7** and the rest of the questions, and if NO, go to **Question 10** and continue completing the questionnaire.*

Question 7

Which of the following is true about your organisation's website? (*Indicate your response by marking an X in the appropriate box.*)

7.1 [] Access is restricted to employees within the organisation.

7.2 [] Access is open to anyone who has an Internet connection.

7.3 [] Not sure about restrictions or non-restriction on access.

If access is open to the public, please give the internet address of the website:
http://_____

Question 8

Which of the following services or resources are **provided by your organisation** (resources and facilities developed by your organisation) on the website? (Select all that apply by marking an **X** in the appropriate boxes provided).

- 8.1 [] Electronic publications, i.e. technical reports, manuals, posters, etc.
- 8.2 [] Online databases (bibliographic or full-text)
- 8.3 [] Tools, i.e. software-based models, specialised software tools, etc.
- 8.4 [] Discussion forums
- 8.5 [] Information retrieval facilities, i.e. internal search engines and site maps
- 8.6 [] Data sets
- 8.7 [] Online staff directories
- 8.8 [] Links to useful resources
- 8.9 [] News
- 8.10 [] Events diaries
- 8.11 [] Journals (full-text journals)
- 8.12 [] Newsletters
- 8.13 [] Other (specify): _____

Question 9

If you have access to the Internet, either at your organisation or other places, i.e. at home, Internet Café, telecentre, etc., which of the following services and resources do you access on **other organisations' websites**? (Select all that apply by marking an **X** in the appropriate boxes provided.)

- 9.1 [] Electronic publications, i.e. technical reports, manuals, posters, etc.
- 9.2 [] Online databases (bibliographic or full-text)
- 9.3 [] Tools, i.e. software based models, specialized software tools, etc.
- 9.4 [] Discussion forums
- 9.5 [] Information retrieval facilities, i.e. internal search engines and site maps
- 9.6 [] Data sets
- 9.7 [] Online staff directories
- 9.8 [] Links to useful resources
- 9.9 [] News
- 9.10 [] Events diaries
- 9.11 [] Journals (full-text journals)
- 9.12 [] Newsletters
- 9.13 [] Other (Specify) _____

PART 6: PORTAL-BASED FACILITIES/SERVICES

Question 10

How often do you...? (Indicate your responses by marking an **X** in the appropriate boxes.)

		Frequency		
		Never	Occasional	Always
	Type of Collaboration			
10.1	Work on research projects with colleagues within your organisation			
10.2	Work on research projects with colleagues from other organisations			

If answer to any of the above is **Never**, why is this so? _____

Question 11

How often do you need to access the following? (Indicate your responses by marking an **X** in the appropriate boxes.)

		Frequency		
		Never	Occasionally	Always
	Information Needs/Resources			
11.1	Information on on-going research			
11.2	Reports/results of past researches			
11.3	In-house databases of bibliographic records or full-text documents			
11.4	External databases of bibliographic records or full-text documents			
11.5	Journal articles			
11.6	Conference proceedings/papers			
11.7	Newsletters			
11.8	Data sets from past researches			
11.9	News from within the organisation			
11.10	Relevant news from other organisations			
11.11	Contact information for researchers working in your field of interest			

11.12	Channelled information, i.e. weather information, news, etc.			
11.13	Websites of other research organisations working in your area(s) of interest			
11.14	Other relevant information resources on the World Wide Web			
11.15	Information targeting your information needs			
11.16	Discussion forums			

If answer to any of the above is **Never**, why is this so? _____

Question 12

In your work organisation, how often do you need to...? (Indicate your responses by marking an **X** in the appropriate boxes.)

		Frequency		
		Never	Occasional	Always
Facilities/Services				
12.1	Use research project management tools/software			
12.2	Use different software systems to access information resources			
12.3	Learn how to use different software for accessing information resources			
12.4	Consult user manuals for application software			
12.5	Access in-house training manuals/facilities			
12.6	Access the Information Technology help desk			
12.7	Use applications software, such as MS-Word, Excel, PowerPoint, SPSS and others			

If answer to any of the above is **Never**, why is this so? _____

Question 13

How often do you...? (Indicate your responses by marking an **X** in the appropriate boxes.)

Frequency

		Never	Occasion	Always
	Information sharing			
13.1	Share research related-information with colleagues within your organisation			
13.2	Share research related-information with colleagues from other organisations			
13.3	Share research reports/results with donors/potential donors			
13.4	Share research reports/results with interested individuals or the general public			

If answer to any of the above is **Never**, why is this so? _____

Thank you for participating in the survey. Please, return the questionnaire by 11 July. 2003



APPENDIX 7

SURVEY OF PORTAL REQUIREMENTS FOR AGRICULTURAL RESEARCH ORGANISATIONS IN THE SADC REGION

QUESTIONNAIRE FOR INFORMATION TECHNOLOGY SPECIALISTS

INSTRUCTIONS

Please, read the instructions provided for each question. Most questions only require you to indicate your response(s) by marking an **X** in the boxes provided. In cases where you are required to write down your response(s) or comments, please, *be as brief and to the point as possible*. For any questions or clarifications regarding any aspect of the questionnaire, please send an e-mail to Justin Chisenga at **Chisenga_J@yahoo.com** or **Justin.Chisenga@fao.org**. The questionnaire should be returned by **11 July 2003**.

PART 1: GENERAL INFORMATION

Name of your organisation: _____

Your official title/position: _____

Highest academic/professional qualifications: _____

E-mail address: _____

Country: _____

Question 1

Which of the following best describes your main area of Information Technology specialisation? (*Select one*)

- 1.1[] Systems analysis and design
- 1.2[] Software development
- 1.3[] Network administration
- 1.4[] Database administration
- 1.5[] Systems administration
- 1.6[] Programming
- 1.7[] Hardware maintenance
- 1.8[] Website/portal development
- 1.9[] Other (specify): _____

Question 2

Altogether, how many members of staff in your organisation have experience/skills in the following IT areas? (Indicate the number of staff in the space provided on the table. Use the spaces provided below to provide any clarifications or explanations of the numbers, i.e. in cases where staff possess skills in more than one IT area.)

	IT Field	Number of Staff
2.1	Systems analysis and design	
2.2	Software development	
2.3	Network administration	
2.4	Database administration	
2.5	Systems administration	
2.6	Programming	
2.7	Hardware maintenance	
2.8	Website/portal development	
2.9	Other (specify):	

Explanation/comments:

Question 3

If applicable, how long have you been involved in activities relating to website/portal development? (Answer the question if you are involved in activities relating to website/portal development, even though it may not be your major area of specialisation indicated in Question 1, or your major job responsibility in the organisation.)

- 3.1[] Not applicable/I am not involved in web development activities
3.2[] Under 6 months
3.3[] 6 to 12 months
3.4[] 1 to 3 years
3.5[] Over 3 years

PART 2: INFORMATION PLAN/STRATEGY

Question 4

Which of the following does your organisation have in place?

- 4.1[] Formal (written) information plan/strategy
4.2[] Unwritten information plan/strategy
4.3[] None

If you answered **4.1** or **4.2**, go to **Question 5** and continue completing the questionnaire. If **None**, please indicate below why your organisation does not have an information plan/strategy and then go to **Question 7** and continue completing the questionnaire.

Question 5

Does the information plan/strategy also incorporate a web/portal development plan/strategy? (*Select one*)

- 5.1[] Yes
5.2[] No, but there is a separate web/portal development plan/strategy
5.3[] No, and there is no web/portal development plan/strategy

Question 6

Is the information or web development plan/strategy document available in electronic format? (*Select one*)

- 6.1[] Yes
6.2[] No

If **YES**, and if **possible**, please send a copy via e-mail to Chisenga_J@yahoo.co.uk or Justin.Chisenga@fao.org or if published on the Web give the URL. JOHANNESBURG
<http://>_____

PART 3: AVAILABILITY OF ICT IN THE ORGANISATION

Question 7

Which of the following Information Communication Technology facilities are available in your organisation that could be used in the development of information portals/websites or give access to information resources provided via portals/websites? (*Select all that apply.*)

- 7.1[] Personal computers
7.2[] Laptop computers
7.3[] Servers
7.4[] Local are network (LAN)
7.5[] Intranet
7.6[] Extranet
7.7[] Internet and World Wide Web access
7.8[] Electronic mail
7.9[] Mobile (Cellular) phone facilities

- 7.10[] Scanners
7.11[] Laser printers
7.12[] Other (*Specify*): _____

Question 8

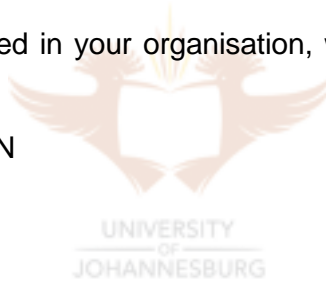
Which operating system(s) are used in your organisation to run client applications? (*Select all that apply.*)

- 8.1[] Windows XP
8.2[] Windows 2000
8.3[] Windows NT
8.4[] Windows 95/98
8.5[] Novell Netware
8.6[] Solaris/Sun OS
8.7[] Unix
8.8[] Linux
8.9[] MacOs
8.10[] Other (*Specify*): _____

Question 9

If you have a LAN installed in your organisation, what type of LAN is it? (*Select all that apply.*)

- 9.1[] Do not have a LAN
9.2[] Ethernet
9.3[] Fast Ethernet
9.4[] Gigabit Ethernet
9.5[] Token ring
9.6[] AppleTalk
9.7[] Other (*specify*): _____



Question 10

How would you describe the following ICT facilities/services in your organisation for applying in website/portal development? (*Mark your responses with an X in the appropriate box.*)

		State of Facilities			
ICT Facilities		Very Poor	Poor	Good	Very Good
10.1	Computer hardware (clients, servers, scanners, etc)				
10.2	Software (operating systems and applications)				
10.3	IT skills				
10.4	Network infrastructure				
10.5	Internet connectivity				
10.6	Technical support (for both software and hardware)				

PART 4: WEBSITES/PORTALS AND SERVICES

Question 11

Does your organisation have a website/portal? (*Select one.*)

11.1[] Yes

11.2[] No, but there concrete plans to establish a website/portal

11.3[] No, and there are no plans to establish a website/portal

*If your answer is **NO (11.2 or 11.3)**, please answer **Question 12** and **RETURN** the questionnaire. If the answer is **YES (10.1)**, proceed to **Question 13** and continue completing the questionnaire.*

Question 12

What are the major reasons for your organisation not having a website/portal? (*Select all that apply*)

12.1[] Do not have access to the Internet

12.2[] Lack of funds to pay for Internet access

12.3[] Lack of staff to develop and maintain the website/portal

12.4[] Lack of telecommunication facilities

12.5[] Do not have use for a website/portal

12.6[] Other (specify): _____

Question 13

Which of the following do you have in your organisation? (*Select one*)

- 13.1[] Website/portal (open to the public)
- 13.2[] Internal website/portal (closed to the public)
- 13.3[] Internal website/portal partly open to selected individuals and organisations and they need a password to access the resources
- 13.4[] Other (*Specify*): _____

If you have a website/portal that is open to the public, please, provide the URL of the site/portal: http://_____

Question 14

For what a purpose was your organisation's website/portal developed? (*Select all that apply.*)

- 14.1[] Publish information for the general public and other organisations
- 14.2[] Facilitate interaction between the organisation and the public
- 14.3[] Facilitate interaction between the organisation's employees
- 14.4[] Publish information for employees
- 14.5[] Reduce paper flow in routine administrative procedures
- 14.6[] Enable searching for information produced/created within the organisation
- 14.7[] Provide links to other web resources for employees
- 14.8[] Advertise the organisation
- 14.9[] Produce revenue by advertising for others
- 14.10[] Produce revenue by selling information
- 14.11[] Other (*specify*): _____

Question 15

Who is primarily responsible for determining the content that should be added to (or deleted from) the website/portal? (*Select one.*)

- 15.1[] Researchers
- 15.2[] Management
- 15.3[] Webmaster
- 15.4[] Website/portal committee
- 15.5[] External consultant
- 15.6[] Computer/information systems department
- 15.7[] Other (*Specify*): _____

PART 4: WEBSITE AND PORTAL DEVELOPMENT TECHNOLOGIES

Question 16

Which web server program(s) is/are used to run your website/portal? (*Select all that apply.*)

- 16.1[] Apache
- 16.2[] Savant
- 16.3[] Microsoft Internet Information Server (IIS)
- 16.4[] Microsoft Personal Web Sever
- 16.5[] Netscape Enterprise
- 16.6[] Zeus
- 16.7[] Lotus Domino
- 16.8[] WebSTAR
- 16.9[] Java Server
- 16.10[] Httpd
- 16.11[] iPlanet Enterprise
- 16.12[] Other (specify): _____

Question 17

Which methodology was/is used in the development of your organisation's website/portal? (*Select one*)

- 17.1[] Ad hoc (In-house developed methodology)
- 17.2[] SDLC
- 17.3[] Software engineering
- 17.4[] W3DT
- 17.5[] WebML
- 17.6[] OOHDM
- 17.7[] WDSM
- 17.8[] RRM
- 17.9[] Web Composition
- 17.10[] Other (Specify): _____
- 17.11[] None

Question 18

Why was/is the methodology indicated above (in **Question 17**) used by your organisation?

Question 19

Which of the following standards have been implemented on your website/portal? (*Select all that apply.*)

- 19.1[] HTML 4
- 19.2[] HTML 3.2
- 19.3[] SSIs
- 19.4[] DHTML
- 19.5[] XML
- 19.6[] XHTML
- 19.7[] VRML
- 19.8[] Other (Specify): _____

Question 20

Which software (web editor or code editor) is used to develop webpages on your website/portal? (*Select all that apply.*)

- 20.1[] Notepad/text editor
- 20.2[] Microsoft FrontPage
- 20.3[] Dreamweaver
- 20.4[] HomeSite
- 20.5[] CodeWright
- 20.6[] NetObjects Fusion
- 20.7[] PageMill
- 20.8[] BBEdit
- 20.9[] HoTMetaL Pro
- 20.10[] Adobe GoLive
- 20.11[] ColdFusion Studio
- 20.12[] Other (*specify*): _____
- 20.13[] None



Question 21

What types of dynamic server-side applications, if any, are used on your website/portal? (*Select all that apply.*)

- 21.1[] ASP
- 21.2[] ColdFusion
- 21.3[] JavaScript
- 21.4[] VBScript
- 21.5[] CGI
- 21.6[] Java Servlets
- 21.7[] Perl
- 21.8[] PHP
- 21.9[] JSP
- 21.10[] Other (*Specify*): _____
- 21.11[] None

Question 22

Which database technology, if any, is used for web applications and/or as a backend storage facility on your website/portal?

22.1[] Oracle

22.2[] MySQL

22.3[] MSSQL

22.4[] SQL

22.5[] Microsoft Access

22.6[] Other (*specify*): _____

22.7[] None

Thank you for participating in the survey. Please, return the questionnaire by **11 June 2003**.



APPENDIX 8

A SURVEY OF PORTAL REQUIREMENTS FOR AGRICULTURAL RESEARCH ORGANISATIONS IN THE SADC REGION

QUESTIONNAIRE FOR INFORMATION SPECIALISTS

INSTRUCTIONS

Please, read the instructions provided for each question. Most questions only require you to indicate your response(s) by marking an **X** in the boxes provided. In cases where you are required to write down your response(s) or comments, please, *be as brief and to the point as possible*. For any questions or clarifications regarding any aspect of the questionnaire, please send an e-mail to Justin Chisenga at **Chisenga_J@yahoo.co.uk** or **Justin.Chisenga@fao.org**. The questionnaire should be returned by **11 July 2003**.

PART 1: GENERAL INFORMATION

Name of your organisation: _____

Your official title (i.e. Information Manager, Librarian, Documentatlist, etc):

E-mail address: _____

Country: _____

Question 1

Within your organisation, your unit/department is known as a: (*Select one.*)

- 1.1[] Library
- 1.2[] Documentation centre
- 1.3[] Information centre
- 1.4[] Resource centre
- 1.5[] Other (Specify): _____

Question 2

What is your highest level of academic or professional information science/studies or information management-related qualification? (*Select one.*)

- 2.1[] Certificate level
- 2.2[] Diploma level
- 2.3[] B.A. /B.Sc. level
- 2.4[] Honours level

- 2.5[] Masters level
- 2.6[] Doctoral level
- 2.7[] None

Question 3

What is your highest level of academic or professional qualification relating to agriculture science? (*Select one.*)

- 3.1[] Certificate level
- 3.2[] Diploma level
- 3.3[] B.A. /B.Sc. level
- 3.4[] Honours level
- 3.5[] Masters level
- 3.6[] Doctoral level
- 3.7[] None

PART 2: INFORMATION SOURCES AND SERVICES

Question 4

Which information resources available in your library or documentation centre or within the organisation can researchers use to find information on the following: (Please, be specific and provide the exact title of at least ONE major information resource. This could be a database, i.e. AGRIS; a website, i.e. FAO website; document, i.e. Journal of Agriculture, etc. If none, indicate NONE.)

4.1 Latest results of research work: _____

4.2 On-going/current research projects: _____

4.3 Past research projects and results: _____

4.4 Other researchers conducting research in their areas of interest: _____

4.5 Forthcoming conferences, seminars and workshops in their areas of interest: _____

4.6 Research project proposals: _____

4.7 Sources of funding for research projects: _____

Question 5

Which of the following information services, resources and products are you currently providing to researchers? (Select all that apply.)

Information Services

- 5.1[] Reference services
- 5.2[] Current Awareness Services
- 5.3[] Selective Dissemination of Information (SDI)
- 5.4[] Other (Specify): _____

Databases

- 5.5[] In-house developed bibliographic databases
- 5.6[] In-house developed full-text databases
- 5.7[] CD-ROM bibliographic databases
- 5.8[] CD-ROM full-text databases
- 5.9[] Online databases (i.e. Dialog, Sabinet, etc)
- 5.10[] Other (Specify): _____

Information Resources

- 5.11[] Journal collections
- 5.12[] Research reports/papers collections
- 5.13[] Books and monograph collections
- 5.14[] Other (Specify): _____

In-house Information Products

- 5.15[] New acquisitions lists
- 5.16[] Subject bibliographies
- 5.17[] Information guides, leaflets, brochures, etc
- 5.18[] Other (Specify): _____

Training Services

- 5.19[] Information use (user) training
- 5.20[] Internet use training
- 5.22[] Evaluation of web resources
- 5.23[] Other (Specify): _____

PART 3: USING PAPER-BASED INFORMATION SOURCES

Question 6

Regarding providing access to paper-based information resources, i.e. books, journals, conference proceedings, in your library, documentation or information centre, etc, how often do you...? (Indicate your responses by marking an X in the appropriate boxes.)

	Problems/Situations	Frequency		
		Never	Occasionally	Always
6.1	Require more time to search for a document requested by the user			
6.2	Have to repackage information so that it meets the specific information needs of the user			
6.3	Feel that your current filing system or catalogue system is no longer able to handle the growing volume of information documents			
6.4	Feel that information that changes so often is not updated on a regular basis in the documents			
6.5	Your users fail to carry information resources such as books, conference proceedings, etc. because they feel that they are too bulky and difficult to carry around			
6.6	Feel that you are running out of storage space for documents			
6.7	Feel that your users have to consult several documents/sources to get the information they need			
6.8	Your users are overloaded with too much information, some of which may not be relevant or useful to their work			

PART 4: SERVICES VIA WEBSITES

Question 7

Do you provide access to information services, resources and products to researchers via a website? (Select one. If YES, and if the website is open to the public, indicate the web address of the site.)

7.1[] Yes [http://_____]

7.2[] No
If **YES**, answer Question 8, and if **NO**, go to **Question 9**.

Question 8

Which of the following do you provide via your website? (Select all that apply.)

8.1[] Electronic books (eBooks)

8.2[] Electronic journals (e-journals)

8.3[] In-house database of full-text documents i.e. research reports, newsletters, etc.

8.4[] Web access to in-house developed bibliographic databases/OPAC

8.5[] Web access to CD-ROM-based databases

8.6[] Web-based Current Awareness Services

8.7[] Web-based Selective Dissemination of Information (SDI)

- 8.8[] Access to online Virtual Reference Collections
- 8.9[] Online tutorials on how to use the information services
- 8.10[] Electronic copies of acquisition lists
- 8.11[] Accessed to Subject-Based Information Gateways
- 8.12[] Others (Specify): _____

Question 9

What are the main reasons for not providing information services via a website/portal? (Select all that apply.)

- 9.1[] Not applicable
- 9.2[] Do not have access to the Internet/web facilities
- 9.3[] Slow internet connection
- 9.4[] Lack of staff/skills to develop web-based services
- 9.5[] Lack of time to develop web-based services
- 9.6[] Lack of funds to develop content for the Web
- 9.7[] Inadequate computer facilities
- 9.8[] Researchers do not have access to internet/web facilities
- 9.9[] Provision of web-based services is not in the staff's job descriptions
- 9.10[] Users have not asked for services to be provided via a website/portal
- 9.11[] Users' needs for such type of services have not yet been established
- 9.12[] Other (Specify): _____

Thank you for participating in the survey. Please, return the questionnaire by **11 July 2003.**