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Access and Use of Electronic Information Resources by Technical Staff at Kenya Agricultural and Livestock Research Organization in Nairobi County

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Abstract: Purpose: This study investigated access and use of electronic information resources by technical staff at Kenya Agricultural and Livestock Research Organization (KALRO) in Nairobi County to enable KALRO management make informed decisions on current and future investment in electronic information products and services that meet the needs of technical staff.

Design/Methodology/Approach: A descriptive research design based on both qualitative and quantitative approaches was adopted with a survey as the main research method. Out of a population of 81, Simple random stratified sampling technique was used to sample 70 research scientists, information workers, ICT personnel, and other technical staff. A questionnaire was used as the primary instrument for data collection supplemented by interview. Quantitative data was analyzed by SPSS program to perform descriptive statistics.

Findings: Findings revealed all respondents were aware of electronic resources at KALRO and on the internet. Majority accessed these resources from office computers on a daily basis through the Internet and KALRO Local Area Network/Intranet. Whereas, they relied on multiple tools to discover and utilize digital information, majority used search engines and KALRO electronic repository. E-resources were used for research and publishing in scholarly journals. Respondents mainly patronised The Essential Electronic Agricultural Library (TEEAL) and Access to Global Online Research in Agriculture (AGORA) databases. Poor internet connectivity was identified as the main challenge in accessing e-resources.

Implication: This study has implications on current and future investment in electronic information products and services that meet the needs of technical staff at KALRO and similar research institutions in Africa.

Originality/Value: It was recommended KALRO formulates and implements a policy framework to guide digital information landscape; improves internet connectivity, enhances ICT infrastructures'; trains users and information workers on information retrieval skills and promotes available resources.

Keywords: Electronic resources, Kenya agricultural and livestock research organization, KALRO, Electronic information, Digital agricultural information, Electronic agriculture, E-resources, ICT resources.

I. Introduction

Access to and use of relevant information in whatever format acts as input for scientific and technological progress, and is therefore critical in economic development (Güvenen, 1998). Rapid growth of Information Communication Technology (ICT) has led to the exponential growth of electronically available information resources such as e-books, e-journals, web resources and e-databases for fulfilling the day-to-day teaching, learning, recreational and research requirements of users. Indeed, the Internet and high-speed networks have radically changed the way researchers work, educators teach, and students learn.

The opportunity brought about by electronic information resources has in recent years' exerted pressure on research organizations to provide the necessary infrastructure and actual access to these resources. Therefore, the traditional functions of information centres' and information professionals have tremendously changed in tandem with the ICT revolution.

From global perspective, advances in ICT has led to changes in the way information is acquired or created, organized, stored, accessed and used. Due to scientific and technological revolution, most information is now published and made available in electronic form on various platforms. Consequently, many organizations are moving towards e-resources which are found to be less expensive, efficient, more useful and easy to access (Devi, 2010).

Indeed, information technology facilities have turned the world into a global village and most information is now published, stored, retrieved and communicated electronically. Electronic publishing has promoted the development and growth of various information services that are invaluable research tools that complement print-based resources (Sharma, 2009). According to Okorie and Agboola (2012), e-resources enhance and support research by enabling users to save time and space by providing instant easy improved access. This view was shared by Narayana and Gouder (2005) who posited that print sources were increasingly giving way to digital resources.

The African region is also embracing digital technologies in creating, processing, storing and disseminating information. However, Africa still lags behind the rest of the world in access and usage of the Internet that stands at only 7% of the world total usage (Internet World Stats, 2012). However, fibre optic projects have the potential to transform internet access on the continent by delivering much greater bandwidth and improving connection speeds between Africa and the global economy. Eastern Africa Submarine Cable System (EASSy), for example, is a fibre optic cable system that connects countries in East Africa to other countries in the world. Thus, Eastern Africa no longer relies exclusively on satellite Internet access to carry voice/data services. Besides EASSy, other fibre optic cables include The East African Marine System (TEAMS) and African Cable System (SEACOM) that became operational in 2009.

KALRO was established through the Kenya Agricultural and Livestock Research Act 2013 with a mandate mainly to promote, streamline, co-ordinate and regulate research in crops, livestock, marine, fisheries, genetic resources and biotechnology in Kenya. The organization which was formally called Kenya Agricultural Research Institute (KARI) is also responsible for expediting equitable access to research information, technology and promotes the application of research findings and technology in the field of agriculture (GoK, 2013; KARI, 2010).

To fulfill its mandate KALRO staff relied on print and electronic information resources. However, print medium was increasingly giving way to digital content (Kiplang'at & Ocholla, 2005). The transition from print to electronic medium had resulted in the growth of e-resources that provided users with new tools and applications for information seeking and retrieval. The electronic environment had radically changed the way KALRO staff discovers information, as well as how they access and retrieve it.

II. Statement of the Problem

The information age and knowledge economy has led to the integration of ICT into organizational routines where many organizations are adopting the digital culture (Parthasarathy & Kavitha, 2014). KALRO had embraced this digital revolution and made significant investments in e-resources and accompanying infrastructure to ensure accessibility. These resources include e-journals, online databases, e-books on CD-ROMs, Content Management Systems and network technologies. The INASP project through its Programme for the Enhancement of Research Information (PERI) availed over 7,000 full-text journals to KALRO through AJOL, EBSCO Host and other databases (Kiplang'at & Ocholla, 2005).

Kenya Agricultural Research Database (KARD) contains over 50,000 records of abstracts and bibliographic citations containing all researches conducted since the establishment of the organization. This database was available at KALRO Secretariat in Nairobi and 18 research centres across Kenya (GoK, 2013; Maillu, 1997; KARI, 2010; KARI, 2009).

The effectiveness of e-resources in research and their material, human and financial cost is usually justified by optimum usage. However, there are indications KALRO e-resources were underutilized or not used at all due to a variety of factors that needed to be investigated (Kiplang'at & Ocholla, 2005; KARI, 2009). The causes of underutilization remained uncertain. If the problem of low usage or underutilization was not addressed KALRO's large investments (in form of money, human resources and time) in e-resources were likely to go to waste and negatively affect research activities in the agricultural sector. Previously no significant study has probed the issue of e-resources at agricultural research institutions in Kenya and KALRO in particular. It is this research gap that this study attempted to fill.

III. Objectives of the Study

A. The Objectives of This Study Were To:

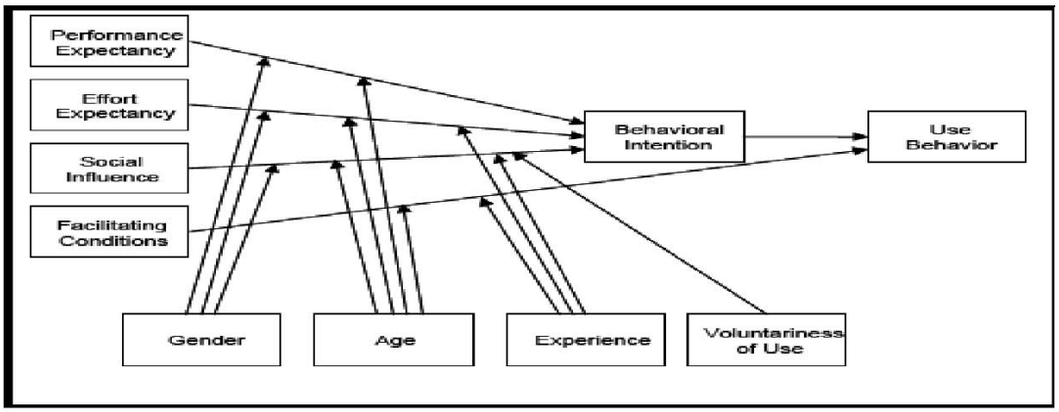
a. Determine patrons' awareness of electronic resources available at KALRO.
b. Determine when, how and why these e-resources were used.
c. Identify the barriers faced by users when accessing and using e-resources.
d. Establish the information needs of KALRO technical staff in the electronic environment.

B. Research Questions:

a. What is patrons' level of awareness of e-resources at KALRO?
b. When, how and for what purposes do technical staff use electronic information resources?
c. What challenges did patrons' face when accessing and using e-resources?
d. How are the electronic information resources at KALRO relevant to the needs of users'?

IV. Theoretical Framework

This study was guided by the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh and other researchers' in 2003 (Venkatesh et al. 2003) as illustrated in Figure 1.



Source: Venkatesh et al., 2003.

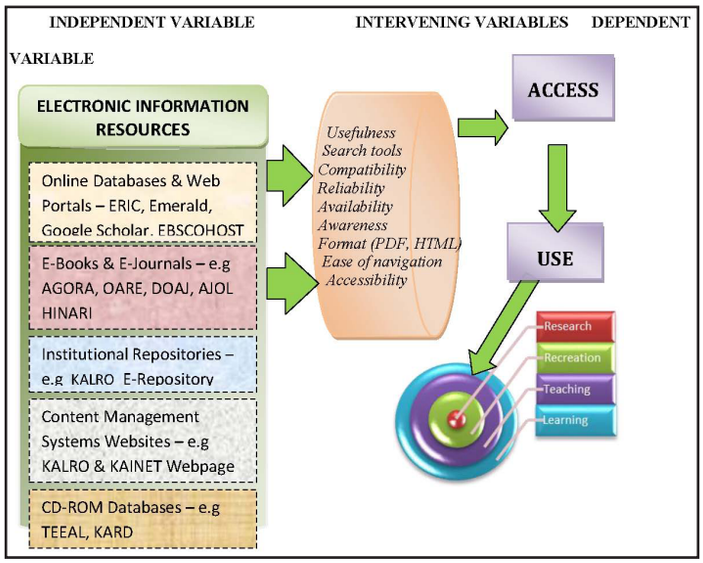
FIG. 1: UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

UTAUT attempts to explain user intentions to use an Information System (IS) and subsequent usage behaviour. The theory states that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behaviour (Venkatesh et al., 2003). Perceived improved job performance, ease of using the system, enhanced social status and perceived presence of technical infrastructure affects acceptance and use of technology. Perceived ease of use is tied to an individual's assessment of the effort involved in the process of using the technology. Gender, age, experience, and voluntariness of use are posited to moderate the impact of these four key constructs on usage intention and behaviour.

V. CONCEPTUAL FRAMEWORK

The study's conceptual framework is shown in Figure 2. The independent variable (IV) was "electronic information resources", and the dependent variable (DV) was "access and use" of e-resources. This conceptual framework indicates that electronic information resources at KALRO such as e-journals, e-books, e-databases, institutional repositories and web portals/ gateways (independent variable) can be accessed and used (dependent variable) by technical staff for research, recreation, teaching and learning purposes.

As an independent variable, electronic information resources are under-pinned by various determinants such as perceived usefulness, availability, compatibility, awareness, among others. These determinants may enhance or impede access and use; and can, therefore, be regarded as intervening variables because they come between the independent and dependent variables and may modify the relationship between them.



Source: Researcher 2015.

FIG. 2: CONCEPTUAL FRAMEWORK FOR ACCESS AND USE OF E-RESOURCES

VI. Review of Related Literature

According to Tsakonas and Papatheodorou (2006), electronic resources are information assets provided in digital form, and include e-books, e-journals, e-theses/dissertations, e-conference proceedings, e-technical reports, e-reference documents and online databases. Basically, e-resources that are accessible on the Internet are described as online or Internet resources. Offline resources on CD-ROM, DVD, magnetic tapes, and other computer–based electronic networks, also constitute electronic resources.

Computer networks such as Local Area Networks (LAN), the Intranet or the Internet typically promotes efficiency in accessibility and utilization of e-resources especially in overcoming barriers associated with geographical location. The Internet has played a very significant role in the transformation of traditional information environment to electronic environment, and its role in timely information access and use is unprecedented in the history of agricultural research (Thanuskodi, 2012).

A number of studies have explored the advantages of e-resources in the research, teaching and learning environments. In analyzing advantages of electronic resources, Dadzie (2007) as quoted by Okorie and Agboola (2012) stated that electronic resources were invaluable research tools that complemented print-based resources. According to Dadzie, the advantages included enabling users to remotely access current information and provision of extensive links to additional resources-related contents. Indeed, speedy publication and availability of e-resources on the desktop are the key advantages that attract research scholars.

In the academic world the major benefit of electronic resources besides ease of access to the needed information is that access can be done remotely without physical visit to information centres. Thus, electronic resources improve efficiency and effectiveness in disseminating information for research purposes (Thanuskodi, 2012).

Review of relevant literature, and interview of KALRO information/ICT staff revealed availability of online and offline electronic information resources. These wide array of e-resources included databases, books, journals and repositories that run on different platforms. KALRO was a beneficiary of free access to e-journals courtesy of INASP/PERI through which researchers were able to access over 600 African Journals Online (AJOL) and 5,500 full-text journals from the EBSCO Host with seven databases. The e-repository had links to various databases and full-text and could be accessed on LAN and the internet.

CD-ROM databases provided information in bibliographic, full-text and multi-media format. An example of a popular full-text CD-ROM database was The Essential Electronic Agricultural Library (TEEAL) which had a collection from 141 agricultural journals stored on 172 discs and holding images of 750,000 full text pages with illustrations and diagrams. This database was popular and provided a wide range of agricultural information relevant to the needs of researchers.

KALRO had also developed the Kenya Agricultural Research Database (KARD) with over 60,000 records that contained mainly metadata for all researches conducted since the establishment of the organization. There was a fully operational LAN with institutional email addresses to facilitate communication via the network and access to the Internet.

Aina (2014) carried out a study on awareness, accessibility and use of electronic databases among academic staff of Babcock University in Nigeria and found that information awareness on electronic resources among lecturers was inadequate and this affected their accessibility and use. He proposed the need to increase awareness to improve their usage. Aina's findings were collaborated by Kwafoa, Osman and Afful-Arthur (2014) research at the university of Cape Coast in Nigeria that showed that the usage of the library's online databases was very low largely because of lack of awareness. Likewise, Ehikhamenor's (2011) study findings on the use and impact of e-resources at the University of Lagos in Nigeria showed that 28.6% lecturers were not aware of the library electronic resources inspite of 69.8% of lecturers receiving prior training on the use of these e-resources.

Ahmad and Panda (2013) study on whether the faculty members of Indian institutes were aware of and fully utilized library databases and other e-resources within and outside the libraries revealed that majority of faculty members were aware of and used e-resources. The study confirmed some lack of knowledge and use of library specific resources such as theses, patents and CD-ROM databases. It was also found that all faculty members agreed that e-resources were useful and important to their work.

Agaba, Kigongo-Bukenya and Nyumba (2004) investigated the utilization of electronic information resources by academic staff of Makerere University in Uganda. The study examined the academic staff awareness of resources available at Makerere University Library and factors affecting their utilization. Findings revealed that most academic staff were aware of e-resources availability, but did not utilize them. It recommended enhancement of ICT Network, decentralization of service provision and increased marketing strategies.

In a similar study done in Uganda, Okello-Obura and Magara (2008) argued that learning basic computer skills and applications was necessary to function efficiently in modern workplace or to pursue personal interests in an electronic environment. Hussain and Ansari (2010) opine that information centres should take more initiatives for developing awareness about e-resources so that their full potential can be realized.

A study by Atakan, Atilgan, Bayram and Arlantekin (2008) examined the level of awareness and use of digital library resources by academics in Ankara University, Ankara, Turkey. Results of the survey showed that many academic staff were aware of available digital library resources and were using them in their research activities. The Web of Science, Science Direct

and EBSCO HOST were found to be the most used electronic databases among the respondents.

Kamar (2008) in her study on marketing of electronic information resources at Egerton University in Kenya, noted that information explosion and improved information communication infrastructure has enhanced access to global information. As a result, there was a need for libraries to identify e-resources that meet the information needs of their clients so as to avoid information overload, and save on time for both the clients and the staff. Kamar further defended purposeful marketing of e-resources because this ensures access to timely, accurate and reliable information resources; and create awareness of the availability of resources.

Jogan (2015) assessed access, awareness and use of electronic resources by postgraduate students at Gulbarga University, India and concluded that the respondents accessed e-resources more than once a week from campus computers mainly for academic research activity especially paper writing for publication. E-resources were preferred because of ease of access and choice of search tools.

Likewise, Sinha and Chnada (2014) study that focused on usage of e-resources at Assam University, Silchar, India revealed that research scientists accessed e-resources mainly from respective departments and the evening was the preferred time among the teachers, scholars and students.

Adeniran (2013) investigated the usage of electronic resources by undergraduates at Redeemer's University library, Mowe, Nigeria using a questionnaire as data collection instrument. The study showed that use of electronic resources had tremendous impact on the academic performances of the undergraduate students but it was recommended that they needed to acquire more skills in the use of e-resources.

Ansari and Zuberi (2010) analyzed the use of electronic resources using a sample of 70 academics at the University of Karachi and found that only 18% of respondents agreed to know much about electronic resources, while about 80% knew little about the same. Slightly over half of the respondents used both printed and electronic resources, while 42% used only printed sources. About one-third of the respondents used electronic resources for research, about one-quarter to one third used it to prepare lectures and gain subject knowledge.

Angello and Wema (2010) research focused on accessibility and use of e-resources by livestock researchers in Tanzania. The study findings showed that livestock research organizations in Tanzania did not have adequate e-resources for their researchers. It was concluded that most livestock researchers were not aware of most of the e-resources available and, therefore could not access and use them in doing research work.

A study to examine the effect information literacy had on the usage of electronic information resources in academic and research institutions in Uganda found that availability of information did not necessarily mean actual use (Kinengyere, 2007). The researcher identified nationally available e-resources in the Ugandan universities as EBSCO, HINARI, AGORA and Open Access Journals. Kinengyere posited that users were not aware of the availability of such resources; they did not know how to access them; or they did not know what the resources offered. Findings showed that effectiveness and efficiency in research process in the digital age rely on the level of information literacy of individual academic staff and on the nature of information available and accessible to them. The researcher's findings were supported by Bhat (2009) who said that one of the reasons for the slow uptake of e-resources was lack of awareness among users.

Madhusudhan (2010) examined the use of e-resources, users' skills in handling e-resources, and the purpose of their use by research scholars of Kurukshetra University, India. The findings showed that e-resources are critical to research scholars' information needs. The author concluded that electronic resources could be good substitute for conventional resources, if the access is fast, and more computer terminals are installed to enhance access.

A study by Parameshwar and Patil (2009) noted that the Internet is redefining how research is conducted in the universities. Their survey exploring the extent of use of the Internet by faculty and research scholars at Gulbarga University, India indicated that most respondents were accessing and using the Internet frequently in research. Recommendations were made on the need to increase user awareness of available electronic information resources as well as teaching information literacy skills to the researchers.

Still on internet usage, Ogunjobi and Fagbami (2012) investigated the use of the Internet by researchers in Agricultural Research Institutes in Ibadan, Oyo State, Nigeria and concluded that researchers used the Internet mostly for research purposes, communication, knowledge acquisitions, and news sourcing.

Mosha and Bea (2014) looked at the perceived barriers of using internet resources in higher learning institutions in Tanzania with a particular reference to Mzumbe University. The study identified major barriers of using internet resources for teaching and learning as: lack of skills on how to search internet resources; lack of consistent technical support; computer viruses which limit access to e-resources; inadequate PCs; lack of training on how to access and use e-resources; and unreliable internet connectivity.

Gakibayo, Ikoja-Odongo, and Okello-Obura (2013) in their study on electronic information resources utilization by students in Mbarara university library, Uganda, said that utilization was low mainly because students lacked awareness; had low computer and information retrieval skills; and slow Internet speed. In a similar study on Internet usage among students at the University of Nairobi, Kenya, Waithaka (2013) observed that students had good basic computer and internet skills but lacked more advanced skills and this negatively affected their use of internet resources.

Bhatt and Rana (2011) in their study identified challenges to e-resources utilization as low speed connectivity, lack

of awareness, technical problems (software/hardware), unavailability of sufficient e-resources, doubts in permanency, high purchase price and lack of legal provision.

Mugwisi, Ocholla and Mostert (2012) study examined the information needs and challenges of public sector agricultural researchers and extension workers in Zimbabwe. A questionnaire was used to collect data from from 16 institutes in 44 districts. Results indicated that the information seeking pattern of respondents was mainly determined by information sources availability, proximity and format. The study noted that most agricultural extension workers first visited departmental collections with a preference for printed sources. In contrast, most researchers consulted electronic sources. Respondents identified lack of requisite ICTs as the major constraint to accessing agricultural information especially e-journals and databases such as AGORA, OARE and TEEAL.

VII. Research Methodolohy

A descriptive research design based on both qualitative and quantitative approaches was used in the study because data collection instruments produced these two types of data. Numerical data on the scale, range, frequency of access and use of e-resources by technical staff at the KALRO Secretariat in Nairobi County was collected, analysed and presented.

Qualitative aspects of the study such as values, attitudes and perceptions of respondents on e-resources were also examined. Qualitative data are narrative in format and, therefore, subjective in nature. The purpose of qualitative data is to describe, not measure, the phenomenon of interest.

The study population (N) comprised 81 research scientists, information/knowledge workers, science editors, ICT managers and other technical personnel at KALRO Secretariat, Nairobi (KARI, 2010). These technical staff were organized administratively in six 'divisions' namely Crops systems; Livestock systems; Natural Resource Management; Planning, Resource Allocation & Quality Control; Partnerships & Business Development; and Knowledge Management & ICT. These 'divisions' are also called thematic areas or themes.

The study used stratified and simple random sampling methods. Stratified sampling ensures that particular categories of individuals are represented in the sampling process. Dane (2011) defined random sampling as a process by which every member of the population had an equal opportunity to be included in the sample. KALRO technical staff in six 'divisions' or thematic areas were sampled randomly using the table of random numbers to arrive at the sample size.

Determination of sample size for this study was based on Krejcie and Morgan Sample Size Determination Table for ±5% precision level and 95% confidence level (Krejcie & Morgan, 1970; Israel, 2013). According to this table a population of 80 corresponds to a sample size of not less than 66 respondents. Apart from the 66 respondents given questionnaires, four respondents were interviewed. This brought the total sample to 70 technical staff which constituted 86% of the target population.

Questionnaires were used to collect mainly quantitative data and partial qualitative information. Each questionnaire was divided into five sections grouping together related questions to make it easier for respondents to follow. The purpose was to collect data concerning access and use of electronic information resources and approaches used to retrieve required e-resources.

Two e-resources users and two information workers were interviewed. An outline of topics that guided the interview was divided into five sections, each of which grouped together related questions. The outline was left open for amendment should new themes and insights emerge by an interactive process during the interview. Interview involved use of pre-set, predetermined or standardized questions by the researcher to obtain data from the respondents. Results of qualitative research gave some indication as to the "why", "how", "when" and "how often" an activity occurred.

Raw data was checked for accuracy, completeness and usefulness. Data analysis was done by use of qualitative and quantitative methods. The Statistical Package for Social Sciences (SPSS) program performed descriptive statistics such as means, percentages and frequency tables. Closed questions were analysed using simple frequencies and percentages. Cross-tabulation was used to show relationships between variables. Tables, graphs, bar and pie charts were used in data analysis and presentation. Content analysis was applied to qualitative data from interviews and open-ended questions.

VIII. Data Analysis

A. Response Rate

As seen in Table 1, out of the 66 questionnaires that were distributed to the sample population, 58 were completed and returned representing 87.9% response rate.

Table I: Questionnaire Response Rate

Department	Issued	Returned	Percentage
Crops Systems	13	12	92.3
Livestock Systems	11	10	90.9
Natural Resource Management	11	10	90.9
Planning, Resource Allocation & Quality Control	9	7	77.7
Partnerships & Business Development	10	9	90
Knowledge Management & ICT	12	10	83.3
Total	66	58	87.9

Scheduled interviews with two information/knowledge workers and two e-resources users' were used to supplement responses from questionnaires. The high response rate was attributed to the distribution of questionnaires by KALRO library staff who gave respondents up to three weeks to return completed ones. Departmental variations in the response were due to the fact that the population size (hence sample size) was not of equal proportion.

B. Distribution of Respondents by Age

It was established that 22 (37.9%) respondents were aged between 36 and 45 years closely followed by 20 (34.5%) in the 46-55 years category (Table 2). The 26-35 age bracket was slightly higher than those above 56 years old. This indicated that the majority of technical staff were in their mid-thirties, forties and early fifties. The Government of Kenya embargo on recruitment of new professionals that became effective in the 1990's perhaps explains the low level of staff below 25 years.

Table II: Age Category Of Respondents

Age Category	Frequency	Percentage
Below 25	2	3.4
26-35	8	13.8
36-45	22	37.9
46-55	20	34.5
Above 56	6	10.3
Total	58	100

C. Distribution of Respondents by Gender

As indicated in Figure 3, 39 (68%) respondents were male while about one-third 19 (32%) were female. This could be attributed to the slow implementation of affirmative action by the Government of Kenya which aims at equal employment opportunities at public institutions in

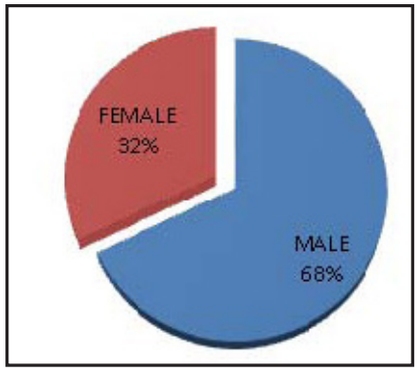


Fig. 3: Gender of Respondents

Kenya. This gender difference may also be due to low enrolment of female students at agricultural research training institutions.

D. Distribution of Respondents by Area of Specialization

The researcher attempted to find out the distribution of respondents by their area of specialization. Findings in Figure 4 show that the majority 30 (51.7%) were research scientists followed by information/knowledge workers 14 (24.1%). Under *'other'* 10 (17.2%) respondents listed their specializations as editors, computer programmers' and 'communication'. The majority of technical staff at KALRO were, therefore, information workers and researchers in crops, animals, natural resource management, business development, resource allocation and quality control.

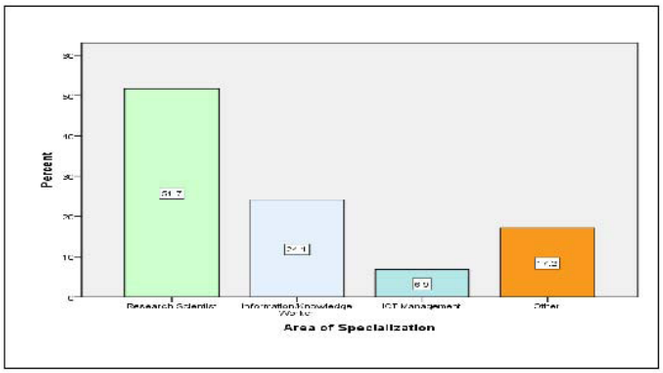


Fig. 4: Respondents Area of Specialization

E. Distribution of Respondents by Highest Level of Education

Analysis of results in respect of level of education of respondents is presented in Figure 5.

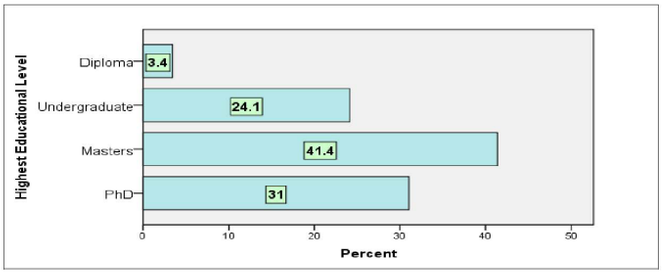


Fig. 5: Respondents Highest Level of Education

The majority, that is 24 (41.38%) of respondents had a Masters' degree as their highest educational qualification; followed by 18 (31%) PhD degree holders. About one-quarter of respondents 14 (24.1%) were undergraduates who were expected to obtain Masters and PhD degrees before being fully integrated into the KALRO research system. Diploma holders were a minority.

IX. Awareness of E-Resources

The first task of this study was to determine the level of awareness of electronic information resources available at KALRO

and the Internet. This was informed by the assumption that technical staff can only access and use electronic information resources they are aware of. Indeed, studies have shown that user awareness of a given service is the first step towards the appreciation or rejection of that service. The study was also to test the assumption that technical staff were motivated to seek e-resources to meet their research and learning needs, but faced constraints such as lack of awareness of what is available.

From the findings, 58 (100%) respondents were aware of e-resources available at KALRO and the internet. This was attributed to deliberate promotion programmes undertaken by KALRO information workers/ICT personnel who revealed during the interview that information on e-resources was disseminated to actual and potential users through various platforms such as library bulletins, KALRO webpage and social media. This finding was reinforced by the e-resources user interview that showed high level of awareness.

Respondents were further asked to indicate their awareness of specific categories of electronic resources and the results are shown in Table 3 where multi-response was allowed. The majority 54 (16.4%) knew about e-journals; 50 (15.2%) were aware of e-full-text articles; and 48 (14.5%) e-mail

Table III: Awareness of E-Resources (N=330) (Multiple Responses)

		Responses	
		N	Percentage
Awareness	E-Databases	40	12.1
	E-Journals	54	16.4
	E-Books	42	12.7
	E-Full-Text Articles	50	15.2
	E-Newsgroups/ magazines	24	7.3
	E-Theses/Dissertations	28	8.5
	Social Media	44	13.3
	E-mail	48	14.5
Total		330	100

Whereas, awareness about e-newsgroups and magazines was 24 (7.3%), almost one half 28 (8.5%) knew about e-theses/ dissertations. Indeed, all respondents were cognisant of more than five different types of e-resources.

A. Technical Staff Access to and Use of E-resources

The second broad objective of this study was to establish access and use of e-resources by technical staff. It sought to answer the following research questions:

(a) What electronic resources were accessed and used?

(b) How were these e-resources accessed and used?

(c) When were they accessed and used?

(d) Why were e-resources used?

B. Types of E-resources Accessed and Used

Respondents were asked to indicate specific types of e-resources they accessed and the results are shown in Table 4. A further question was whether access translated into actual use as indicated in Table 5. Multi-response was permitted.

Table IV: Access to E-Resources (N=288) (Multiple Responses)

		Responses	
		N	Percentage
Access	E-Databases	32	11.1
	E-Journals	52	18.1
	E-Books	36	12.5
	Full-Text Articles	38	13.2
	E-Newsgroups/magazines	28	9.7
	E-Theses/Dissertations	16	5.6
	E-mail	48	16.7
	Social Media	38	13.2
Total		288	100

Table V: Use of E-Resources (N=283) (Multiple Responses)

		Responses	
		N	Percentage
Use	E-Databases	36	12.7
	E-Journals	52	18.4
	E-Books	34	12
	Full-Text Articles	40	14.1
	E-Newsgroups/magazines	20	7.1
	E-Theses/Dissertations	22	7.8
	E-mail	48	17
	Social Media	31	11
Total		283	100

From these tables we note that there is some correlation between access to e-resources and actual use of the same. E-journals, for example, were the most accessed and used e-resource at 52 (18.1%). However, there was also some discrepancy between access to an e-resource and its utilization. For instance, 38 (13.2%) accessed the social media but only 31 (11%) used the same.

The above findings were affirmed by a scheduled interview of two information workers who when asked which user groups make most use of electronic services and why said scientists used e-journals and e-mails mainly for work-related research activities.

More than one-half of respondents accessed and used e-databases, e-books, full-text articles and the social media. As can be discerned from Tables 4 and 5 it was instructive that 13.2% of respondents said they accessed social media but only 11% used it, perhaps due to limited skills. This research finding corroborated Kinengyere (2007) study in Uganda which

revealed that availability of information did not necessarily mean actual use mainly due to low levels of information literacy.

Theses and dissertations recorded very low patronage perhaps because of restrictions by most academic institutions keen on protecting intellectual property rights. Another probable reason for low usage was limited availability of full-text theses due to fear of plagiarism. Most scholars only avail abstracts that may be of limited use by research scientists.

About one-half of those surveyed, that is 28 (9.7%) indicated they accessed newsgroups and online magazines but only a third used the same. This low utilization was most likely due to limited time since as noted earlier the majority of respondents were scientists engaged in agricultural research activities. Hence, they probably devoted more time and priority to work-related responsibilities.

C. Use of E-databases and E-journals

The researcher further investigated access and use of specific e-databases and e-journals and the results are shown in Figure 6 where multi-response was allowed.

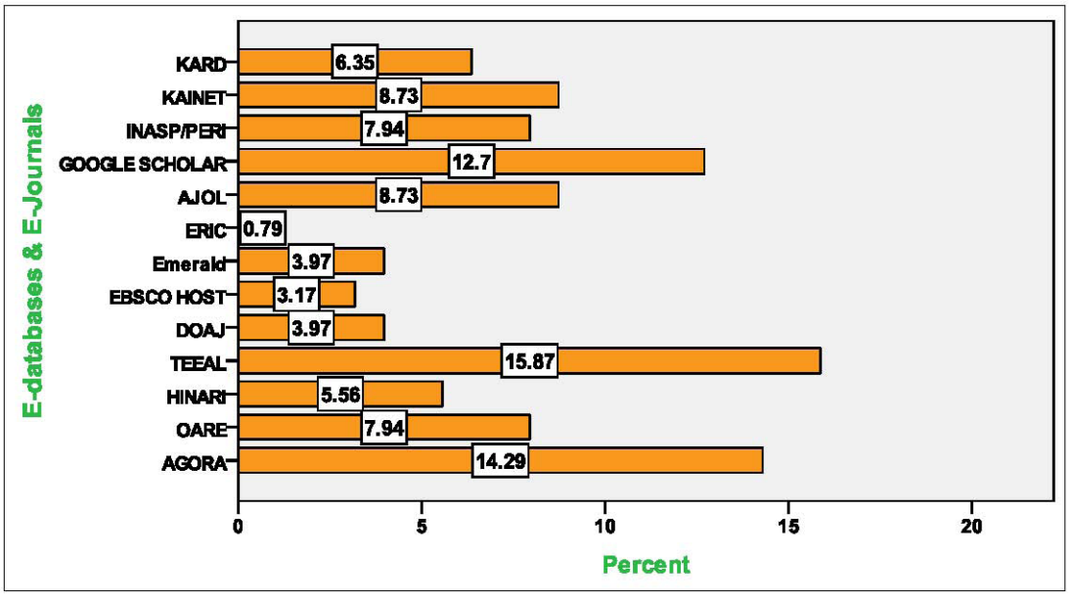


Fig. 6: E-databases & E-journals Used (n=252) (multiple responses)

Majority of respondents (15.87%) used The Essential Electronic Agricultural Library (TEEAL) database closely followed by Access to Global Online Research in Agriculture (AGORA) and Google Scholar in that order. The scheduled interview with two e-resources users also confirmed this. The interviewees said they used TEEAL and AGORA because this resources met most of their research information needs.

Whereas about one-third used journals offered under Online Access to Research in the Environment (OARE) and INASP/PERI initiatives, a quarter of respondents utilized HINARI and the in-house Kenya Agricultural Research Database (KARD). Kenya Agricultural Information Network (KAINET) and African Journals Online (AJOL) were moderately used. Emerald, EBSCO HOST, ERIC and the Directory of Open Access Journals (DOAJ) were the least used electronic information resources at KALRO. Education Resources Information Centre (ERIC) usage is statistically insignificant perhaps due to lack of awareness of what it offers.

This finding was in agreement with Madhusudhan (2010) study in India that indicated that 90% of research scholars use e-journals, followed by web sites (48%), search engines (38%), and online databases (30%). Atakan, Atilgan, Bayram and Arlantekin (2008) research at Ankara University also confirmed this study's results. The authors revealed that many academic staff were aware of available digital resources and were using them in their research activities.

D. Training on the Use of CD-ROM and E-resources

When asked if they had ever received any training on using CD-ROM service 44 (75.9%) respondents said they have never been trained (Figure 7). The researcher asked this question to find out if lack of training had hindered the effective utilization of CD-ROM based databases such as TEEAL and KARD.

Whereas TEEAL offered full-text the KARD CD-ROM databases were important tools for identifying metadata details of potentially useful documents and ensured easy access to large volumes of literature for research.

However, lack of training seemed to have no significant influence on the use of CD-ROM service because more than two-thirds indicated they used the service as will be revealed later when discussing how respondents access e-resources. Figure 8 reveals that 22 (37.9%) respondents had never been trained on the use of electronic information resources and 12 (20.7%)

expressed a wish to attend such training if given an opportunity. Willingness to be trained suggested that respondents required additional skills and competencies to enhance utilization of available e-resources. The interview elicited similar results.

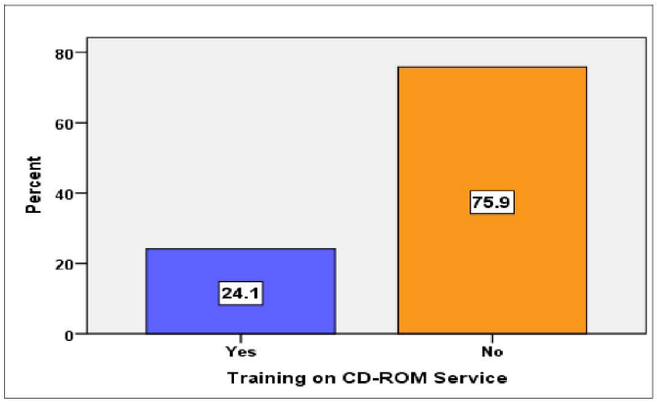


Fig. 7: Respondents Training on CD-ROM Service

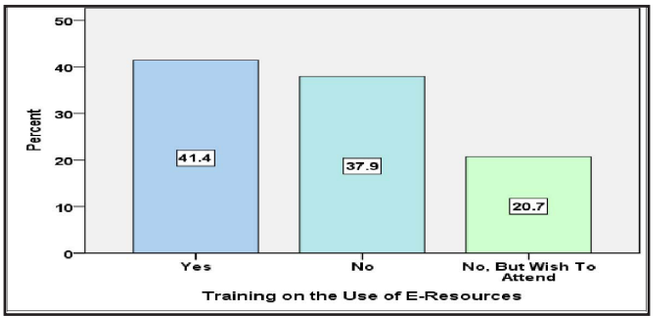


Fig. 8: Respondents Training on The Use of E-resources

E. How E-resources Were Accessed

Respondents were asked to indicate how they accessed various electronic information resources and the results are shown in Table 6. The majority accessed through the Internet followed by KALRO LAN/Intranet. Patronage of e-resources through CD-ROM was the least used most likely because the key KARD database contains bibliographic information as opposed to full-text.

Table VI: How Respondents Access E-Resources (N=98) (Multiple Responses)

		Responses	
		N	Percentage
Accessed through:	CD-ROM	12	12.2
	Internet	56	57.1
	KALRO LAN/Intranet	30	30.6
Total		98	100

The use of the internet as the preferred gateway to e-resources did not come as a surprise and corroborates results of earlier studies that regarded the internet as a versatile, agile and efficient medium of information storage and delivery. Waithaka (2013); Ogunjobi & Fagbami (2012); and Parameshwar & Patil (2009) posited that the Internet had revolutionized how researchers work, educators teach, and students learn using electronic information resources. This can be attributed to speed; efficiency; robustness; real-time content; remote access; and online collaboration associated with the Internet.

A. Access Point(s) to E-resources

An understanding of where users accessed e-resources from could assist KALRO management to develop relevant ICT strategies. The study indicated that respondents used more than one place to access e-resources. Figure 9 reveals that 54 (58.7%) accessed them from office computers at their place of work. This may be due to the fact that KALRO computers were connected to the internet

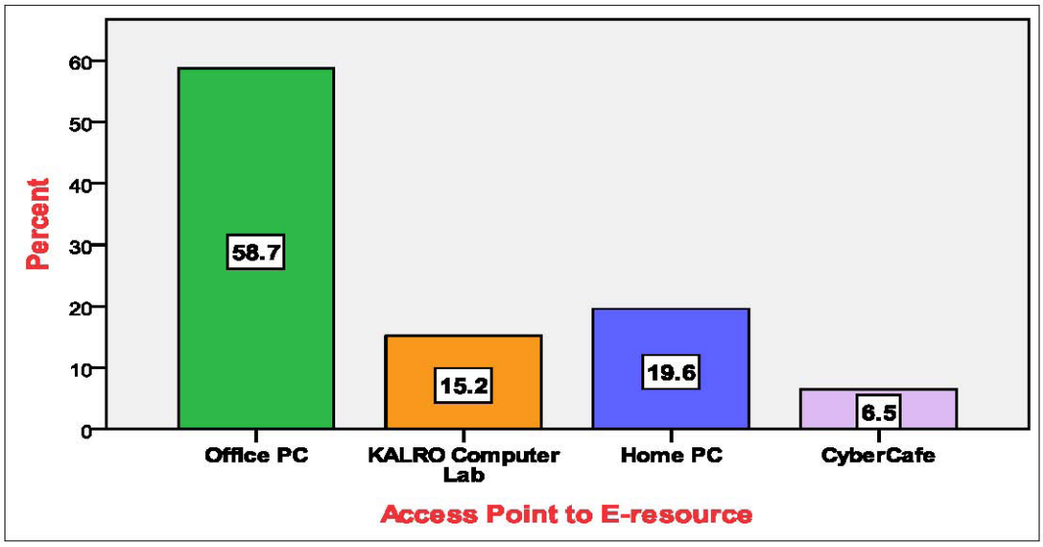


Fig. 9: Access Point(s) to E-resources (n=92) (Multiple Responses)

which we earlier noted was the main means of accessing e-resources. A further 18 (19.6%) relied on home PC's with KALRO Computer Lab accounting for only 14 (15.2%) of respondents' point of access. Cybercafés' were the least used 6 (6.5%) most likely because of the increasing affordability of the internet coupled with free accessibility extended by KALRO to its staff. Indeed it is now possible to access internet from anywhere at anytime due to improved ICT infrastructure especially the deployment of fibre optics such as EASSY, TEAMS and SEACOM.

G. Search Tools Used to Access E-resources

Respondents were asked to specify the tools used to locate e-resources and the results are depicted in Figure 10. Multiple answers were allowed. Findings indicated they relied on multiple tools to discover and utilize digital information. The majority that is 54 (39.7%) used search engines (such as Google, Bing and ASK) closely followed by 34 (25%) who relied on KALRO institutional e-repository. Subject directories were used by 22 (16.2%) respondents and online catalogues accounted for 16 (11.8%). Subject information gateways scored poorly (7.4%).

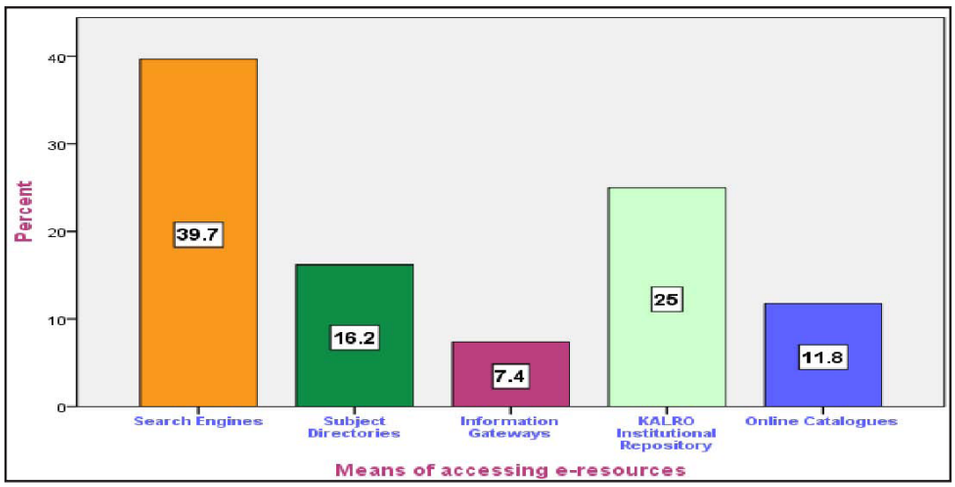


Fig. 10: Tools Used to Access E-resources (n=136) (Multiple Responses)

H. Importance of E-resources to Research Activities

In order to discern the prominence that respondents attached to e-resources two questions based on Likert-scale statements were designed to explore respondents' views. They were to state whether they *strongly agreed, agreed, disagreed, strongly disagreed or* remain *neutral.* These statements were:

- I prefer electronic to print resources, and
- Better research can be done using e-resources.

Table 7 shows respondents preference between electronic and print resources. The majority, 54 (93.1%) preferred and agreed that e-resources fulfilled their information needs more than print versions. This implied KALRO staff had embraced the digital revolution and were using electronic information for research, teaching, recreation and learning.

Table VII: Preference Of Electronic Over Print Resources (N=58)

I prefer e-resources more than print resources	Frequency	Percentage
Strongly Agree	26	44.8
Agree	28	48.3
Neutral	4	6.9
Total	58	100

When asked whether better research can be achieved using electronic information resources 54 (93%) of respondents agreed or strongly agreed (Figure 11). The study established that none of those surveyed disagreed with the notion that digital information enhances research activities.

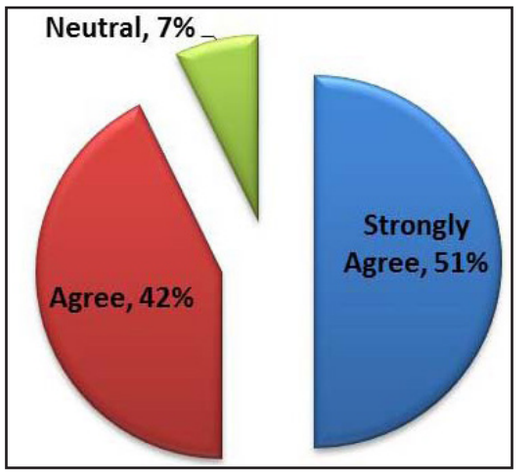


Fig. 11: Can E-Resources Improve Research? (n=58)

Usefulness can give an indication of how germane information resources or services are for a defined user group. Appropriate information resources or services should be able to provide relevant and organized information to meet the specific needs of enquiries for the advancement of research and learning.

The researcher was, therefore, interested in how KALRO technical staff rated e-resources in terms of usefulness. Figure 12 depicts how they were rated where the majority 56 (97%) regarded them as *quite useful* and *extremely useful* in helping to accomplish tasks. This suggested that e-resources were an integral part of KALRO research activities and were, therefore, highly valued.

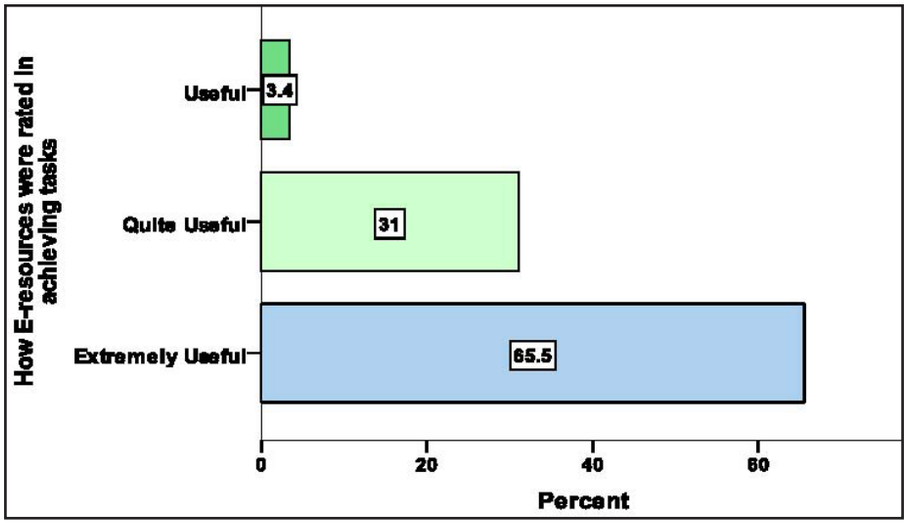


Fig. 12: How Respondents Rated E-resources in Achieving Tasks (n=58)

The study also revealed there was no correlation between respondents' rating of e-resources in achieving tasks and their highest educational qualifications. As depicted in Table 8, the same proportion (20.7%) of PhD, Masters' and Undergraduate degree holders said digital resources were extremely useful.

Table VIII: How E-Resources Were Rated in Achieving Tasks * Highest Educational Qualifications Cross-Tabulation (N=58)

How E-Resources were rated in achieving tasks		Highest Educational/Professional Qualifications				Total
		PhD	Masters	U/Graduate	Diploma	
Extremely Useful	N	12	12	12	2	38
	%	20.7%	20.7%	20.7%	3.4%	65.5%
Quite Useful	N	6	10	2	0	18
	%	10.3%	17.2%	3.4%	0%	31%
Useful	N	0	2	0	0	2
	%	0%	3.4%	0%	0%	3.4%
Total	N	18	24	14	2	58
	%	31.0%	41.4%	24.1%	3.4%	100%

1. Frequency of E-resources Access and Use

Respondents were asked about frequency of use on a 5-point Likert-scale: *daily, once a week, once a month, less than once a month and rarely*. Findings in Figure 13 showed that 40 (69%) of respondents used electronic resources on a daily basis with about one-third using them atleast once every week.

No respondent used them less than *once a month* or *rarely.* This suggested that utilization of digital information at KALRO was high. The interview also confirmed that respondents regularly and consistently used e-journals and e-databases in general and AGORA and TEEAL in particular.

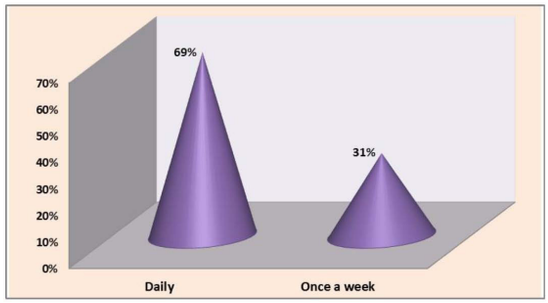


Fig. 13: Respondents Frequency of E-resources Access & Use (n=58)

The study further attempted to make a cross-tabulation of frequency of accessing e-resources and age category and the results are shown in Table 9.

Table IX: Frequency of Accessing E-Resources * Age Category Cross-Tabulation

Frequency of access to electronic resources		Age category of respondents (Yrs)					Total
		Below 25	26-35	36-45	46-55	Above 56	
Daily	N	2	4	14	16	4	40
	%	3.4%	6.9%	24.1%	27.6%	6.9%	69%
Once a week	N	0	4	8	4	2	18
	%	0%	6.9%	13.8%	6.9%	3.4%	31%
Total	N	2	8	22	20	6	58
	%	3.4%	13.8%	37.9%	34.5%	10.3%	100%

The results showed that 16 (27.6%) respondents who accessed e-resources on a daily basis were between 46 and 55 years closely followed by 36-45 years age category. This result was surprising because more than one-third of respondents (see Table 9) lay in the 36-45 age-group and were therefore expected to be leading users of e-resources.

The above finding contradicted Kinengyere (2007) who postulated that older generation of researchers use ICTs and e-resources less because most of them had low level IT literacy. Most users of digital resources at KALRO were above 46 years. This could be attributed to the fact that the majority of respondents over 46 years were information/knowledge workers and therefore expected to be ICT compliant with requisite information retrieval skills.

J. Purpose for Accessing and Using E-resources

The researcher sought to ascertain why electronic resources were used. Respondents were asked to indicate the main purpose of accessing and using e-resources and their response is outlined in Table 10. The question allowed multiple answers.

Table X: Purpose of Using E-Resources (N=144) (Multiple Responses)

Purpose of using e-resources	Responses	
	N	Percentage
Publish in Scholarly Journal	28	19.4
Undertake Research	42	29.2
Write a Thesis/Dissertation	20	13.9
Communicate/Collaborate	30	20.8
Perform Routine Task	24	16.7
Total	144	100

Majority of respondents 42 (29.2%) used e-resources mainly for research purposes; 30 (20.8%) for communicating and 28 (19.4%) for publishing in scholarly journals. The use of e-resources to perform routine tasks and write theses/ dissertations was the least cited.

This finding validates Ogunjobi and Fagbami (2012) research which showed that digital resources were mostly used for research purposes, communication, and knowledge acquisitions. This was also in tandem with Adeniran (2013) findings at Redeemer's University in Nigeria.

K. Challenges of Accessing and Using E-resources

The third objective of this research was to identify major challenges KALRO technical staff encountered when accessing and utilizing electronic information resources. Respondents were asked to select from a list of nine probable barriers to effective e-resources usage and allowed to give multiple answers.

There was a further open-ended question for respondents to state any other challenge(s) in their own words. A structured interview further elicited their views on personal and institutional challenges they faced when utilizing various digital assets.

As illustrated in Table 11 the majority, 56 (41.8%) highlighted slow internet connectivity as the main challenge. This was corroborated by open-ended responses and the interview where low bandwidth was specifically mentioned.

Table XI: Barriers to E-Resources Access & Use (N=134) (Multiple Responses)

Barriers to e-resources access & use	Responses	
	N	Percentage
Slow Internet Connectivity	56	41.8
Lack of Awareness	6	4.5
Inadequate Information Retrieval Skills	14	10.4
Information Overload	12	9
Difficulties in Finding Relevant Information	14	10.4
Unfriendly Interfaces	10	7.5
High Cost of Access	14	10.4
Lack of Time To Access E-Resources	8	6
Total	134	100

One respondent said the main challenge was *"ups and down of the internet to access the facility"*. Another mentioned *"slow browsing speed"* and *"difficulty in finding relevant information"*. This suggests that internet connectivity at KALRO was perceived as slow, erratic and unreliable and this adversely affected utilization of digital information.

Inadequate information retrieval skills, difficulties in finding relevant information and high cost of access were also prominently cited and collectively comprised about one-third of challenges reported. Respondents considered unfriendly interfaces, lack of awareness and time constraints as minor issues. It was instructive that none of those surveyed viewed lack of assistance by information centre staff as a problem.

To assess how long it took to find information for research, teaching and learning, respondents were asked whether they agreed or disagreed with the suggestion that it took too much time to find relevant e-resources. Results are shown in Figure 14.

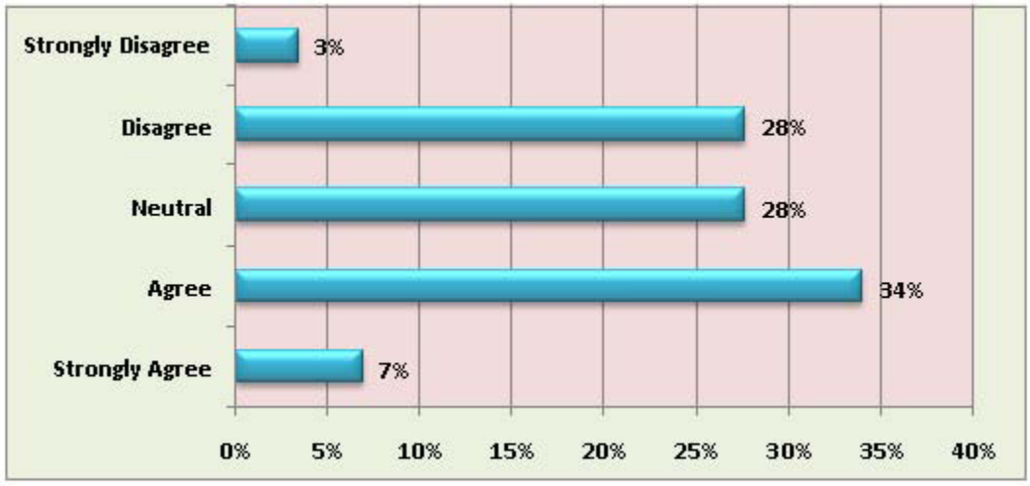


Fig. 14: Does it Take Much Time to Find Relevant E-resources? (n=58)

Whereas 16 (28%) disagreed that finding relevant information took too much of their time a similar number chose to remain neutral and thus non-committal. The study revealed that 20 (34%) respondents were of the opinion that searching and accessing pertinent e-resources was time consuming. This could be attributed to limited information retrieval skills and poor internet connectivity challenges that respondents had mentioned earlier.

X. Information Needs of Technical Staff In the Electronic Environment

The fourth and last objective of the study was to establish the information requirements of research scientists, information/ knowledge workers and other KALRO technical staff in the electronic age. This objective was based on the assumption that user information needs are dynamic in the advent of ICT revolution that has changed the way information is generated, organized, stored and delivered.

A qualitative approach was used where respondents were requested through interviews and an open-ended question to give suggestions on how to improve access and use of e-resources. Further critical analysis of responses to closed questions hinted at respondents' information needs. Their responses were organized into broad thematic areas namely, a) Access to current information, b) Improved internet connectivity, and c) Training on e-resources.

A. Access to Current Information

It was established that respondents preferred accessing current scientific and technical electronic information especially e-journals and at the same time expressed concern over the currency of KALRO repository. One respondent lamented that the e-repository was disseminating out-dated information by saying, *"the repository is not a reliable reference point for up-to-date information on generated knowledge"*.

It was suggested that KALRO should subscribe to more online journals and ensure instant access. Respondents also proposed the implementation of open access policies to enhance up-to-date research literature. It was discovered that besides AGORA and TEEAL resources which they were already using they needed free access to more full-text resources.

B. Improved Internet Connectivity

As already noted slow internet was cited as a major challenge that adversely affected patronage of digital assets. One respondent succinctly summed up the critical role played by the internet when he said: *"There is very slow internet at KALRO. This should be improved and everything else will fall in place"*.

Similar sentiments such as *"acquire more bandwidth"* and *"internet should be improved in terms of speed"* suggested that enhanced online connectivity was an essential factor in realizing the information needs of KALRO technical staff.

This was corroborated by reviewed literature. Singh and Satija (2007) study established that users utilized information sources that were easily accessible online. Dulle et al. (2002) recommended improving IT infrastructure and its use to enhance research productivity.

C. Training on E-resources

Provision of training on various facets of electronic information was a recurring theme in the study. Participants felt they needed training on information literacy; searching and retrieval skills to enable them appreciate and optimize e-resources usage. A respondent suggested that KALRO should *"train interested researchers and ICT staff in various centres/institutions"*. Training on user interfaces also came out during the interview where one respondent said the *"interface to databases is difficult* [sic]*"*.

In a nutshell, KALRO technical staff required technical skills and competencies necessary for faster, fair, ethical and productive utilization of electronic resources for research, recreation and educational purposes.

XI. Conclusion

Based on the findings, the study concluded that KALRO e-resources were mainly used by research scientists with postgraduate qualifications who were fully aware of various digital resources available. They used the internet to access e-databases, e-books, full-text articles and the social media on a daily basis. The study revealed that TEEAL and AGORA were the main databases used and were accessed mainly from office computers at KALRO. Technical staff relied on search engines, institutional e-repository and subject directories to discover and access e-resources for work-related research activities. Poor internet connectivity was a major constraint to effective and efficient utilization of digital resources. Other challenges included limited search skills that made it difficult for users to find relevant information. KALRO should subscribe to more e-journals and implement open access policies that could help in addressing problems associated with out-dated literature. Issues of low bandwidth and training required attention. Based on the finding that a quarter of respondents wished to attend training on e-resources, it was logical to conclude that additional information literacy skills were necessary for optimum utilization of e-resources.

XII. Recommendations

(a) Formulate and implement a policy framework to guide, promote and manage ICTs as drivers of electronic information access and utilization at KALRO. The policy document should integrate long-term strategic interests of the organization and rapid technological changes. It is recommended that such policy should incorporate Open Access initiatives which provide free online access to full-text research. It could also provide guidelines for the selection and acquisition of various e-resources and platforms on which to deploy them.

(b) Improve Internet connectivity through high speed broadband networks to facilitate faster and reliable online access to e-databases, e-journals, e-books, full-text and other electronic information resources. Increased bandwidth speeds up downloading of full-text especially graphics and animation incorporated in the publishers' resources. Users rely on the internet to accomplish work-related research activities that contribute to the mission of KALRO.

(c) Enhance ICT infrastructure as means of not only solving accessibility problem but improving on the overall electronic environment. More infrastructures such as external CD-ROM drives, laser printers, work-stations and projectors should be put in place to support access and utilization of digital assets. Moreover, wireless facilities should be enhanced to support staff that use tablets, laptops and other digital devices. The initial cost might be high but could potentially have a higher return on investment in the long run. It can be deduced, therefore, that improved infrastructure would lead to increased utilization of e-resources.

(d) Subscribe to more paid and free Open Access e-resources and make them freely available. Researchers' requirements and opinions should be given priority when subscribing. However, they need assistance from information workers and ICT personnel in identifying these resources since some may not be competent in doing so.

(e) Develop and implement a sustainable training programme for researchers and other technical staff on ICT skills necessary for handling digital information. A potentially valuable information resource is useless unless accessed by users. Limited network and digital information literacy skills usually frustrate users' access to invaluable digital assets. Unlike print sources electronic information is generated, organized, stored and transferred by means of technology which is ever changing. Providers and consumers of such information therefore have to train and retrain to remain relevant and competitive in this digital age.

Training curriculum should include advanced search strategies; CD-ROM technologies; Web 2.0 tools; use of various communication platforms; online information ethics and Web information evaluation. ICT-mediated communication requires skill and competency to be able to communicate proficiently. This training intervention should cover both the users and providers of e-resources.

(f) Create awareness and promote underutilized resources such as DOAJ, ERIC, EBSCO Host and Emerald. Study

findings revealed these were the least used e-resources. Web 2.0 tools such as blogs, RSS feeds, mashups, social bookmarking and wikis could be used to create awareness.

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