

# Access and use of electronic information resources by scientists of National Physical Laboratory in India: A case study

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## **Abstract**

The paper aims to determine the usefulness of e-resources to the scientists of National Physical Laboratory, New Delhi, India and their skills in using various search methods and techniques to access and utilize these resources. The study further aims to investigate the level of satisfaction with the information accessed by the scientists through the available e-resources and various challenges faced by them in their field. The survey was conducted with the help of a questionnaire and personal interview. Questionnaire was distributed to a random sample of 75 scientists from different fields of physical sciences available at the time of study and the response rate was 80 per cent. The responses received from the available scientists are presented in tables and figures and data is analyzed by using simple calculation of percentage method. The findings reveal that access and use of e-information is an important component of research activities for scientists, also qualitative and quantitative developed e-collections overcome conventional resources with the characteristic of fast accessibility. Title field, simple search techniques and self-taught methods are used to access the e-information. E-journals are most preferred e-resources and scientists are very highly satisfied with the retrieved e-information. Also, research indicates that as the internet is most preferred medium of access, there is a need to provide high bandwidth to overcome poor network connectivity. Also there is a constructive suggestion for developing an automated library system and increased electronic resources with improved library services.

**Keywords:** E-resources, Search techniques, Search skills

## Introduction

The information and communication technology has enabled scientists in physical sciences to create, grasp and share the information explosion worldwide in electronic formats. Electronic information forms an integral part of libraries assisting the users in learning, teaching and research. So it's the responsibility of library to keep pace with technological developments and cope up with the users demand for e-information.

In the scientific environment it is very essential for librarians to know about the users demand for e-resources which forms an integral part of their information needs, users skills and problems faced in identifying, accessing, utilizing (Tahir, Mahmood and Shafique 2010) and handling those resources in comparison to conventional sources (Madhusudhan 2010). Depending upon the level of awareness, effective and efficient use of e-resources is found to a greater extent in higher education and research activities.

Scientists all over the world use various databases, journals and other e-resources to search and use the latest information in their respective fields and related ones. Based on the user information behavior and awareness (Deng 2010) towards access and use of e-resources, publishers try to produce and develop qualitative collections which are further collected and managed in better ways by librarians to substitute services and fulfill user (Zhang, Ye and Liu 2011) information requirements with improved satisfaction.

A framework for effective development of electronic information resources (EIRs) (Ani and Ahiauzu 2008) is developed which explores the levels of developing electronic information resources in university libraries and encourages local research information conversion for national and international access by users. There are many advantages of e-resources in enhancing and supporting research and education such as enabling users to save time and space, and providing instant easy improved access (Vakkari 2008) to useful information at minimum cost.

All these reasons have influence on the publication productivity (Wu and Chen 2010) and scholarly work. Also various studies reveal that frequency of access and use of web-based electronic databases helps in decision making (Oduwale and Oyewumi 2010) in the work flow of an individual.

There are many hindrances (Plum et al 2010) and challenges (Shuling 2007) faced by users in the utility and access of the e-resources which includes lack of awareness, lack of information literacy skills (Angello 2010) necessary to

search databases, lack of time, the challenge of locating “good citable stuff”, inability to use effectively the library, and poor skills in information searching due to which users at undergraduate (Baro, Endouware and Ubogu 2011) and postgraduate level (Ozoemelem 2009) rarely access and make use of e-resources. There is also a disciplinary difference (Talja and Maula 2003) in the use and non-use of e-resources such as e-journals, databases, and e-books etc. So there is a need to develop and improve ICT and information literacy skills for utilizing the enormous benefits available in electronic formats.

Further, libraries should develop their decision support systems for e-resource and must have library portals/gateways to link adequate resources and provide training and retraining to user groups. A preliminary review of literature reveals that no such study has been done so far and keeping in view the previous aspects, the present study is conducted with aimed at e-information resources provided by the library of National Physical Laboratory, New Delhi, India through CSIR consortium and various other online digital libraries.

These are accessed and used by scientists at National Physical Laboratory for research and related activities through Kariamanikkam Srinivasa Krishnan (KSK) Library (NPL 2011), which was developed in 1947. All the resources in the library are in printed versions and access is provided to vast amount of electronic resources through CSIR consortium and other online digital libraries. The KSK library is working and growing rapidly at a development stage, but is yet to be automated.

## **Purpose of the Study**

Exponential growth of electronic information in the physical sciences has proved to be more value added in nature and time saving for an individual. The access to, use of and awareness about the e-information resources are very essential for users as well as for libraries.

E-resources are quick to access, save time and keep up-to-date with the current happenings in the specific fields and related areas. Further, electronic information plays a pivotal role in enhancing the research& development activities and improving the productivity of an individual.

There are various search and retrieval techniques to access the required e-resources, so gaining knowledge of those is very important. No specific study having been conducted so far, and keeping in view all the prime aspects and current information trends, the following study focuses on the scientist’s perspectives about the e-resources which they prefer to access and use through

various modes and medium in support of their work requirement and related activities.

Study also indicates search fields and techniques used to locate and access e-information and the methods they adopt to learn about different types e-resources are studied. This paper also identifies several purposes of using and accessing the available e-resources.

In addition, the study shows which services are used and what is the impact of e-resources on scientists. The study also states various issues and challenges which scientists of National Physical Laboratory face related to electronic information resources. Library automation and the digitization of important collections are taken into consideration.

## **Objectives of the Study**

- To know the search techniques and common search fields used among scientists to access e-resources;
- To know the purpose of accessing and using e-resources among scientists;
- To determine the types of electronic information resources preferred in support of work;
- To know the methods adopted to learn and format to receive the training about e-resources;
- To identify the impact of e-resources and general information services preferred and
- To state the challenges faced and suggestions for effective use of e-information resources.

## **Methodology and Analysis**

A survey method of research using questionnaire was followed for data collection in the study. A total number of 75 questionnaires were distributed to the random sample of scientists working at various designations in different areas of physical sciences at NPL, out of which an 80% response rate was received.

Scientists were also personally assisted and interviewed in order to receive more clear, accurate and pin-pointed responses to the listed questions. The data gathered is organized in tabular form and simple calculations

(%percentage) are used to achieve the qualitative and quantitative results in the study.

Graphical representation of data is also done in the study. The problem of lack of time for responding to questions from scientists was faced. Also a few of scientists did not respond to all questions.

While all respondents were aware of the e-resources in physical sciences, most of them prefer to use and access the e-resources from their work place through the medium of the internet. Home was the least preferred place and CD-ROM was least used medium to access and utilize the e-resources in their respective fields of research.

During the one to one interaction, scientists have mentioned various reasons for using and accessing the e-resources such as time saving, access to current up-to-date information, easier and faster access to information, access to a less expensive, more pinpointed, useful and wider range of information.

## Level of satisfaction of electronic information accessed and used

In performing the process of searching and accessing the electronic information, the scientists evaluate the usefulness and quality of retrieved information as per their satisfaction level. Table I indicates the satisfaction level of accessing and using the required e-information where about 73.3 per cent of the scientists are very highly satisfied with the quality of e-information accessed and used, 16.7 per cent are highly satisfied, 10 per cent are somewhat satisfied.

**Table I: Level of satisfaction of electronic information**

Level of satisfaction	No. of Scientists	% of Scientists
Very highly satisfied	44	73.3
Highly satisfied	10	16.7
Somewhat satisfied	6	10
Least satisfied	0	0
Not at all satisfied	0	0

**Note:  $n=60$**

It is clear from the previous analysis that electronic information offered in the form of various services has direct impact on the research activities and satisfaction rate of scientists. So there is a need for libraries to put efforts into providing enhanced electronic collections to scientists for maximum utilization of e-information.

## **Common search and retrieval fields and techniques used to access electronic information resources**

E-information resources can be retrieved easily by searching through their author, title, full text of the articles, date range, journal category, and subject category (Bodomo et al. 2003). It is found from Table II that 90 per cent of scientists search the e-resources through title of the required information, followed by journal title (80 per cent) and author (85 per cent). Scientists prefer to search the resources by subject classification (50 per cent), followed by date/year of publication (40 per cent), and also by type of publication (30 per cent). Only 16.7 per cent of scientists use other common methods such as abstract/title, affiliation, abstract, keywords to search the resources.

**Table II: Common search and retrieval fields and techniques used to access e-information resources**

<b>Common search and retrieval fields</b>	<b>No. of scientists</b>	<b>% of scientist</b>
Author	48	80
Title	54	90
Journal Title	51	85
Date/ year of publication	24	40
Subject classification	30	50
Type of publication	18	30
Any other	10	16.7
<b>Common search and retrieval techniques</b>	<b>No. of scientists</b>	<b>% of scientists</b>
Wild cards	1	1.6
Selectable Truncation	4	6.7
Boolean operators	18	30
Proximity Functions	-	-
Simple search in fields	37	61.6

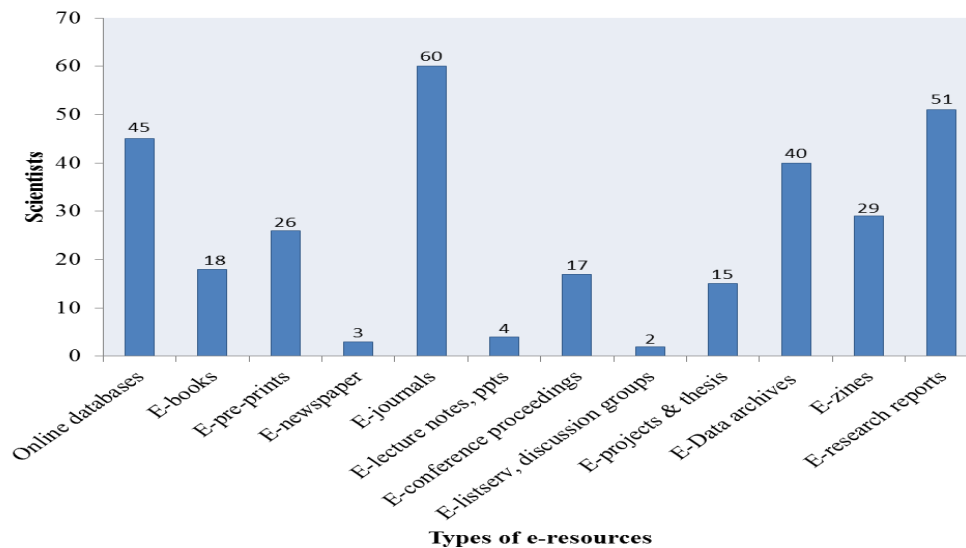
**Note: Per cent exceeds 100% as Scientists were allowed for multiple answers;  $n=60$**

Further, 61.6 per cent of scientists prefer simple search in fields technique, followed by Boolean operators (30 per cent) and selectable truncation (6.7 per cent). Only 1.6 per cent of scientists use wild cards to search the e- resources.

The study discloses that title as field is most preferred search field to reach the destination source of information as it is easy to navigate directly to the required resource. Simple search in fields is most preferred technique used by scientists in various databases, online sites and search engines to have excellent functionality in approach for searching and accessing the e-resources in the physical sciences and related fields made available through consortium by the KSK library.

## Types of electronic information resources

Electronic resources with their characteristics of flexibility, portability, searching facility, storage and access/dissemination (Watts and Ibegbulam 2005) are beneficial in terms of time and space. Figure 1 presents the use of different types of e-resources by the users of KSK library.



The figure indicates that 100 per cent of scientists use e-journals, followed by e-research reports (85 per cent), online databases (75 per cent), and e-data archives (66.7 per cent). 48.3 per cent of scientists have shown their preference for using e-zines and 43.3 per cent for e-pre-prints. Only 30 per cent uses e-books, followed by 28.3 per cent uses e-conference proceedings and 25 per cent prefer e-projects and thesis. E-lecture notes&ppts (6.7 per cent ), e- newspaper (5 per cent) and e-listserv &discussion groups (3.3 per cent) are least used resources.

This study reveals that scientists prefer to use e-journals in the physical sciences which have additional functionality to promote the searchability of accurate information and also more research developments are encapsulated in them, which encourages a high level of productivity and research output. Scientists also use various databases and e-books & reference sources including patents and standards in support of their work. These mentioned resources are accessed through the CSIR consortium and other accessed libraries.

## Methods and formats adopted to learn about the electronic information use

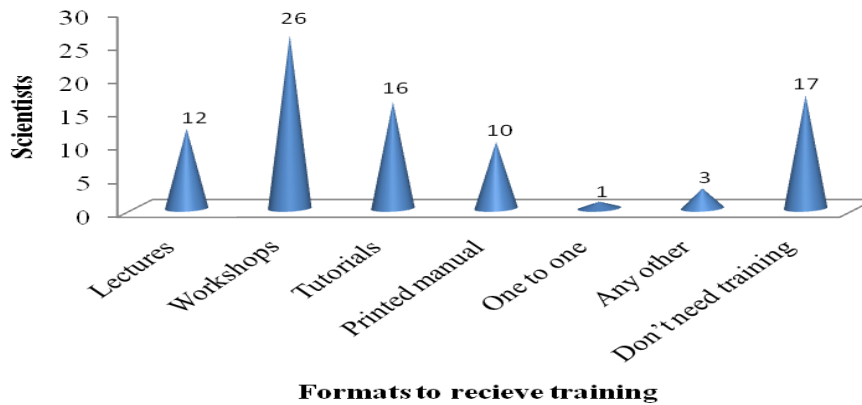
Scientists were further asked to indicate the methods and formats adopted to learn about the electronic information resources made available by the library through CSIR consortium and other complementary sources of vendors and publishers. From the indicated Table III, it is found that 61.6 per cent learned about electronic information through self-taught methods, followed by guidance from colleague (46.7 per cent), and trial and error (21.7). Of the total scientists 10 per cent have learnt the skills through guidance from the library staff, 1.6 per cent acquired the skills through external courses and courses from a parent organization.

**Table III: Methods adopted to learn about the electronic information use**

Different Methods	No. of scientists	% of scientists
External courses	1	1.6
Guidance from colleague	28	46.7
From library staff	6	10
Self taught	37	61.6
Courses from parent organization	1	1.6
Trial and error	13	21.7

**Note: Per cent exceeds 100% as Scientists were allowed for multiple answers; n=60**

Further, Figure 2 indicates the percentage of scientists who prefer different methods to know about the electronic information use.



**Figure 2: Formats to receive the training**

Note: Scientists were allowed for multiple answers;  $n=60$

26 per cent of the scientists prefer to attend the workshops to be trained about electronic resources, followed by tutorials (16 per cent) and lectures (12 per cent). Further, 10 per cent prefer printed manuals to receive training, followed by one to one (1.6 per cent) and also other methods (3 per cent) includes online training programme which can be accessed, viewed anywhere, at any time and also demonstrations, lab wise training should be imparted and short term training should be organized at conferences.

It is observed interestingly that the most adopted method to learn to use electronic information is self learning or self-teaching. Scientists encourage themselves to be more productive and perform qualitative research which reflects the knowledge propulsion about e-resources among them. More frequent workshops are preferred for grasping quality practical knowledge about the right and exact approaches for electronic information. The library staff are encouraging them to put their preferences and choices of training so that more effective & efficient utilization of e-resources can be achieved and used for all categories of professional and personal enrichment..

## Purpose of using electronic information resources

There are different purposes amongst users in using e-resources. Scientists were asked about their purpose to access and use the e-resources. In this question, many purposes were listed, out of which most important are detailed in the given Table IV. 85 per cent of the scientists use e-resources for research and development activities, followed by study and updates in subject information (71.7 per cent), and literature searching in subject specialized

(66.7%). Relevant information in related fields (58.3%) is another useful purpose, followed by purpose of electronic publishing (50 per cent) and teaching/lectures (35 per cent), which they deliver to their junior staff, fellow colleagues and scholars under them. Only 25 per cent of scientists stated their purpose was to fulfill their projects efficiently and 10 per cent have various other purposes such as creating and designing various online technical databases, graphical presentations.

**Table IV: Purpose to use electronic information resources**

Purpose to use e-information	No. of scientists	% of scientists
Literature searching in subject specialized	40	66.7
Relevant information in related fields	35	58.3
Study and updates in subject information	43	71.7
Research and development activities	51	85
Projects	15	25
Teaching/Lectures	21	35
Electronic Publishing	30	50
Any other	10	16.7

**Note: Per cent exceeds 100% as Scientists were allowed for multiple answers; n=60**

From the study it is found that scientists use e-resources for their research and development activities which are very important for the progress of an individual and also for parent organization NPL.

## General electronic information services used

In this technological era, libraries should have developed infrastructure and skilled staff so that they can provide general e-information services to their patrons for their proficiency. Libraries must hold a good electronic collection and should manage their electronic services.

When the scientists were asked about what general electronic services they use, they responded interestingly and data was tabulated. Table V clearly indicates that 86.7 per cent scientist's uses internet services in general, followed by the www (80 per cent) and search engines (65 per cent). 58.3 per cent of scientists use the web pages of professional organizations& associations, 50 per cent use mailing list services and then web pages of conference & congresses (20 per cent) are used by the scientists of NPL. Bibliographic/ online databases (18.3 per cent) are next used service, followed by Individual (personal) webpages

(16.7 per cent) and reference services (11.7 per cent). Listserv, Discussion groups (5per cent), Web conferencing (5 per cent) and Inter Library Loan (5 per cent) are equally used. Subject gateways (1.6 per cent) are least used by the scientists. And none of the scientists use in-house databases, library online catalogues and ask-a-librarian services, since the library is not yet automated so library staff cannot provide these services.

**Table V: General electronic information services used**

<b>General Services through Electronic Resources</b>	<b>No. of scientists</b>	<b>% of scientists</b>
Internet Services in general	52	86.7
World Wide Web	48	80
Listserv, Discussion groups	3	5
Search Engine	39	65
Library online catalogues	0	0
Ask-a Librarian	0	0
Bibliographic/ online databases	11	18.3
In-house databases	0	0
Inter Library Loan	3	5
Portals (Subject Specific)	5	8.3
Subject gateways	1	1.6
Reference service	7	11.7
Web conferencing	3	5
Individual (personal) webpage	10	16.7
Web pages of Professional organizations & associations	35	58.3
Web pages of conferences & congresses	12	20
Mailing Lists	30	50

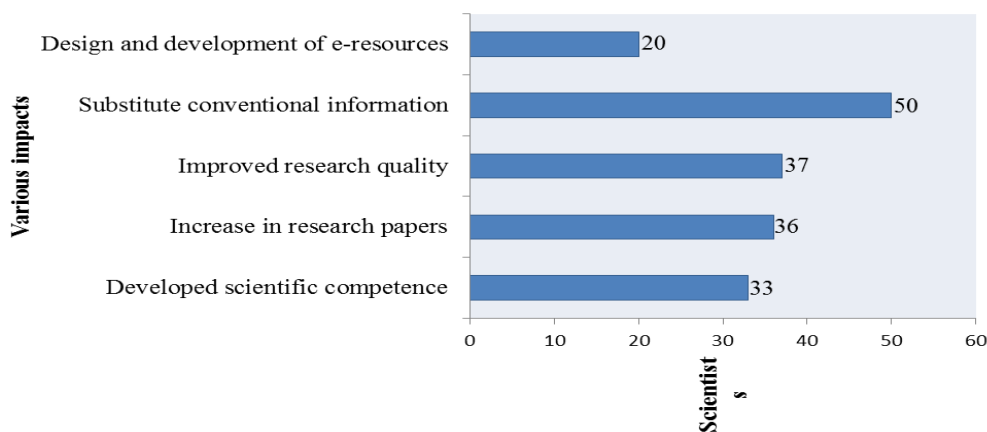
**Note: Per cent exceeds 100% as Scientists were allowed for multiple answers; n=60**

From the previous study it is inferred that the internet is most popularly used services by the majority of scientists, as it is easy to use and faster to access 24x7 from any location. There is really a need to develop an automated library system for such a national research organization, which is known worldwide for the quality of its performance.

## **Impact of using electronic information resources**

E-resources have impact on the competence level of an individual and improve the intellectual activity necessary for research. Electronic information allows scientists to directly access and use the materials which cannot be found otherwise.

The response of scientists regarding the impact of using e-information resources is depicted in the Figure 3. The figure 3 shows the impact of e-information in the research environment. 50 per cent of scientists responded that using e-information resources have been substituted for conventional resources, followed by 37 per cent have improved research quality and 36 per cent have impact on their e-publishing as they have an increase in the number of research papers produced. Further, 33 per cent of scientists have developed their scientific competence but only 20 per cent have developed various e-resources in the form of CD-ROMs and have uploaded various ppts and lectures.



**Figure 3: Impact of using electronic information resources**

**Note: Scientists were allowed for multiple answers;  $n=60$**

It has been found that electronic information have substituted the conventional resources, which has advantages for the scientists as well as for KSK library in terms of money, labor, space and time.

## Major challenges and issues

There are various problems to access and to use e-information for research & development activities. The scientists were requested to clearly provide details regarding the challenges and issues faced by them whenever and wherever they access and use the e-resources.

Table VI identifies various challenges faced by the scientists of NPL. It is shown in totality that the majority of users (81.7 per cent) face the common problem of poor network connectivity, followed by poor archive access (70 per cent) and slow downloading (58.3 per cent) of e-information. Of the

scientists, 55 per cent are facing problem of in-sufficient e-resources, 53.3 per cent with improper orientation & lack of awareness and 50 per cent detailed a lack of management of e-information. A total of 46.7 per cent state the problem of limited access to the paid resources which are very relevant and important for them, followed by the need for advanced search techniques (10 per cent) and incompatible user interfaces to the library website (1.6 per cent). 33.3 per cent of users don't have any problems regarding the access and use of electronic resources provided through CSIR consortium.

**Table VI: challenges and issues faced**

<b>Challenges and Issues related to e-resources</b>	<b>No. of scientists</b>	<b>% of Users</b>
In-sufficient electronic resources	33	55
Limited access	28	46.7
Advanced searching techniques	6	10
Poor network connectivity	49	81.7
Improper orientation & lack of awareness	32	53.3
Poor archive access	42	70
Lack of management of information	30	50
Incompatible user interface to library website	1	1.6
Slow downloading	35	58.3
No challenges	20	33.3

**Note: Per cent exceeds 100% as Scientists were allowed for multiple answers; n=60**

The study shows that poor network connectivity is the major problem faced by the scientists of NPL, which is a matter of concern for the KSK library, as it has direct influence on the entire work flow of its users in terms of scientific productivity and their contribution to the field of physical sciences. Measures should be taken to enhance the network connection for more qualitative results.

## **Discussion**

Electronic resources play an important role in the changing nature of information access and dissemination for the scientists. Accessibility and usability of electronic information is more valuable when it is readily available in the required electronic formats at the time of work. Electronic information

provides a wide range of options in highlighting the importance of libraries to their users.

In present trends of information needs, libraries should take the essential pre-requisite steps to keep pace with developed technological aspects. Libraries should be automated, digitized and self-sufficient to enhance the access approach of users towards electronic information. They should develop qualitative and quantitative electronic collections for their successful future.

The use of e-resources is expanding its boundaries to a greater extent to fulfill the research objectives of an individual. The scientists who responded in the survey were well aware of the e-resources. The majority of scientists as per their need for information, time feasibility and ease of use prefer to access the e-resources from their work place. This clearly shows that e-resources are essential component of the scientific and research community.

Many scientists access electronic information through the medium of internet which is very easy to learn and can be practically worked upon. So it is necessary for the library to provide high bandwidth internet connectivity.

The majority of scientists prefer to use title as a common field to search the required e-information resources and many uses the simple search in fields as a retrieval technique. This shows that scientists make use of very simple concepts in support of searching their e-documents.

The majorities of scientists access the multilingual feature in the user-interface to read learn and use e-resources. Large numbers of scientists are very highly satisfied with the retrieved information from e-resources. The majority of scientists prefer to use e-journals for updating of knowledge and to learn about the current literature published in their fields and also in support of their research work. Scientists use their own self-taught skills to access and use the e-resources. They state they would like to attend workshops to enrich their knowledge and skills about e-resources. So, it is necessary that the library should work actively to organize workshops and training programs to enhance the skills of scientists more efficiently.

Many scientists access and use the e-resources in support of their research and development activities and many access and use them because e-information is time saving, so that much time can be saved in their professional work. The internet in general is the most used service by the largest number of scientists. Also the scientists found greater impact of e-resources over conventional resources. Many scientists face the common problem of poor network connectivity. So, it is the responsibility of the library staff to personally visit the scientists to know their information requirements and resources in support

of their daily research activities and take necessary steps to build a strong network with various other research organizations to develop a wider range of e-resources and improve their quality of services to boost the productivity of the scientists.

The opinions and suggestions for developing an automated library system should be brought to reality by the KSK library, NPL; so that linking to more e-information can increase exponentially. An online catalogue which can be integrated into the library website should be created for quick and direct retrieval of e-resources. The library should improve the internet connection and should participate in a number of consortia. The library should work upon providing effective services to their users.

In conclusion, it is very important for any research library to develop itself with a high technological infrastructure and build a solid collection of e-resources to help its users and provide high quality services to the user's desktop. Libraries should organize various teaching and learning programs, either general training or subject specific training to impart and encourage education about all aspects of e-resources to its users. Libraries should develop their own subject gateways, portals and data archives to provide access to back volumes to know the past research done and to focus on present research trends in order to move towards a brighter future.

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