USABILITY ANALYSIS OF INDIAN INSTITUTES OF TECHNOLOGY AND INDIAN INSTITUTES OF MANAGEMENT LIBRARIES' WEBSITE: AN EVALUATIVE STUDY

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Submitted

in partial fulfillment of the requirement for the Degree of Doctor of Philosophy in Library and Information Science of Mizoram University, Aizawl

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I, **Nitesh Kumar Verma**, hereby declare that the subject matter of this thesis is the record of work done by me, and the contents of this thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/ Institute.

This is being submitted to the Mizoram University for the Degree of Doctor of Philosophy in Library and Information Science.

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C E R T I F I C A T E

This is to certify that the thesis entitled **"USABILITY ANALYSIS OF INDIAN INSTITUTES OF TECHNOLOGY AND INDIAN INSTITUTES OF MANAGEMENT LIBRARIES' WEBSITE: AN EVALUATIVE STUDY"** submitted by **NITESH KUMAR VERMA** for the award of the Degree of Doctor of Philosophy in Library & Information Science is carried out under my supervision and incorporates the students bona-fide research and this has not been submitted for award of any degree in this or any other university or institute of learning.

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Place: Aizawl (NITESH KUMAR VERMA)

Date:

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ABBREVIATIONS

Terms		Descriptions
ARPANET	:	Advanced Research Projects Agency Network
ASME	:	American Society of Mechanical Engineers
BHU	:	Banaras Hindu University
CCHS	:	Central Coast Health Service
CCTV	:	Closed-Circuit Television
CD-ROM	:	Compact Disk-Read Only Memory
CERN	:	Conseil Européen pour la Recherche Nucléaire
CSIR	:	Council of Scientific and Industrial Research
CSS	:	Cascading Style Sheets
DELCON	:	DBT eLibrary Consortium
DVD-ROM	:	Digital Versatile Disk- Read Only Memory
EBL	:	Evidence-Based Librarianship
FAQ	:	Frequently Asked Questions
FTP	:	File Transfer Protocol
HTML	:	Hyper Text Markup Language
IBM	:	International Business Machines
ICMR	:	Indian Council of Medical Research
ICSSR	:	Indian Council of Social Science Research
ICT	:	Information Communication Technology
IDR	:	Institutional Digital Repository
IEEE	:	Institute of Electrical and Electronics Engineers
IIM	:	Indian Institutes of Management
IIMB	:	Indian Institute of Management, Bangalore
IIMC	:	Indian Institute of Management Calcutta
IIMK	:	Indian Institute of Management Kozhikode
IIML	:	Indian Institute of Management Lucknow
IIT	:	Indian Institutes of Technology
IITB	:	Indian Institute of Technology-Bombay
IITD	:	Indian Institute of Technology Delhi

IITM	:	Indian Institute of Technology Madras
IIT-RPR	:	Indian Institute of Technology, Ropar
INDEST	:	Indian National Digital Library in Engineering Sciences and Technology
INFLIBNET	:	Information Library Network
IR	:	Information Retrieval
IRC	:	Internet Relay Chat
ISO	:	International Organization for Standardization
JBDC	:	Java Database Connectivity
JSTORE	:	Journal Storage
LIS	:	Library and Information Science
LRC	:	Learning Resource Ceter
LSP	:	Logical Scoring of Preferences
MHRD	:	Ministry of Human Resource and Development
MIM	:	Master of Information Management
MIT	:	Massachusetts Institute of Technology
MLSU	:	Mohanlal Sukhadia University
MSN	:	Microsoft Network
NNTP	:	Network News Transfer Protocol
NSF	:	National Science Foundation
NSFNET	:	National Science Foundation Network
OPAC	:	Online Public Access Catalogue
QUIM	:	Quality in Use Integrated Map
R&D	:	Research and Development
RFID	:	Radio Frequency Identification Device
S&T	:	Science and Technology
SC/ST	:	Schedule Caste/Schedule Tribe
SMTP	:	Simple Mail Transfer Protocol
TCP/IP	:	Transmission Control Protocol/Internet Protocol
TLD	:	Top Level Domain
U.S.	:	United States
U.S.A.	:	United States of America
UNESCO	:	United Nations Educational, Scientific and Cultural Organization

URI	:	Uniform Resource Identifier
URL	:	Uniform Resource Locator
VERONICA	:	Very Easy Rodent-Oriented Net-wide Index to Computer Archieved
VoIP	:	Voice over Internet Protocol
VSL	:	Vikram Sarabhai Library
VTLS	:	Visionary Technology in Library Solutions
WWW	:	World Wide Web

PREFACE

To cope-up the growing demand of users for information exchange, the easiest and effective way is websites. The term usability was mostly used in mid 1980's and there are multiple approaches to make a product or services serviceable and there is no any established definition of the term "usability". However, "usability is how easy an object is to use". The entity may be nearly anything, including tools, books, software, machines, websites, any items, or anything. We can say that anything that a user may intermingle and may be utilizable.

Academic institutions library website acts as a medium of access to its resources and offers a multiplicity of library services such as access to e-resource (e.g. e-journal, e-books, etc.), online public access catalogues (OPAC) and online e-reference services. The suitability of web based applications by their users severely relies on website usability. Usability is one of the major factors in the quality measurement of web based applications. So to cope the rapid increasing needs of users, libraries websites needs to evaluated in the terms of usability testing parameters so that their usability, accessibility, effectiveness may be evaluated and corrected.

The present study is confined to 16 Indian Institutes of Technology (IITs) and 13 Indian Institutes of Management (IIMs) libraries' websites established on or before May 5, 2015. In the case of IITs & IIMs libraries' websites, no usability study was conducted so far. So, the present study is an attempt to fill up the gap. Therefore, an attempt has been made to investigate the level of accomplishment of required characteristics such as usability, functionalability, reliability and their efficiency.

The study will also help to understand the present usability, efficiency and effectiveness of selected libraries' websites of IITs and IIMs. After the evaluation, the ranking of academic library websites based on usability scores will help to understand the level of their website usability and will prompt to take the right decision for improvement of library websites. The evaluation criteria developed for usability analysis will help to undertake further study in Indian environment and especially for libraries websites. The present study will also elaborate the basic usability attributes and errors of the selected IITs and IIMs libraries' websites.

The study is presented in five chapters:

Chapter 1: Introduction

Chapter 2: Website Usability Analysis: Concepts

Chapter 3: IITs & IIMs Libraries' Websites: An Overview

Chapter 4: Analysis of Data & Presentation of Findings

Chapter 5: Conclusion & Suggestions

Chapter 1: "Introduction" gives a preface to the study which deals with the significance, scope, review of literature and research design of the study.

Chapter 2: "Website Usability Analysis: Concepts" highlights about the World Wide Web, Services of Internet, Communication Services, Information Retrieval Services, Web services, Web browser, Web server, Websites, Usability analysis, Usability attributes, and Website usability analysis etc.

Chapter 3: "IITs & IIMs Libraries' Websites: An Overview" briefly elaborates the selected IITs and IIMs libraries, their evolution, growth, collection, etc.

Chapter 4: "Analysis of Data & Presentation of Findings" highligts the collected data and its descriptions in the form of tables, figures and graphs as well as findings of the study.

Chapter 5: "Conclusion & Suggestions" deals with the conclusion of the whole study and suggestions for improvement of selected IITs and IIMs libraries' websites usability features.

The bibliography and appendices are given at the end. Publication Manual of the American Psychological Association (6th ed.) is used for recording the references.

Chapter – 1: INTRODUCTION

1.1 Introduction

The World Wide Web (WWW) is used to access huge quantity of information available through Internet and become main source of information for academic and research activities. To cope-up the growing demand of users for information exchange, the easiest and effective way is websites. In the recent years, websites plays a key role through which information is disseminated effectively and efficiently.

A website is a rich collection of web pages and multimedia graphics like photos, videos or other digital materials which are interlinked through a common link known as Uniform Resource Locator (URL) and the website is hosted on web server machine reachable via any network such as Internet or local area network. The website services are getting significant thrust in both academia and industry in the recent years.

The website is playing significant role in the various application domains such as education, trade, industry and entertainment, etc which result, there are rising interest about the ways in which web-pages are designed and developed and the extent of quality delivered. Designing and developing a website should be conceded and passed through some design guidelines to ensure that the particular website can achieve their purposes and their originated goals proposed to be consummate. Furthermore, an educational institution's website is an entryway to its available products, information and available services. A website reflects the desires of their users where it serves. As well as, website development and design is repeatedly determined by organizational structure, technology and business objectives, relatively than by users needs. The

academic institutions Library websites are also selected regularly to obtain scholarly and educational resources in academia. Academic institutions library website plays a vital role of its expansion and amplification of conventional physical library resources, and also offers a multiplicity of library services such as access to e-resource (e.g. e-journal, e-books, etc.), online public access catalogues (OPAC) and online e-reference services. As libraries and information centres moving forward into the digital age, libraries and information centres online presence becomes gradually more important for coping the needs of their users. As the academic library website serves as a key gateway to library services, usability analysis and evaluation of library websites is very important. While there is much coverage of usability analysis and evaluation of academic library websites because library websites are taking more attention, primary sources of information for their users and for many services and sources many users depend on the library websites.

1.2 Significance of the Study

Present study has been confined to usability analysis of IITs and IIMs libraries' websites of India. Earlier, in the case of IITs & IIMs libraries' websites, no usability study has been conducted so far. So, the present study is an attempt to fill up the gap. Therefore, an attempt has been made to investigate the level of accomplishment of required characteristics such as usability, functionalability, reliability and their efficiency. Thus, the study has elaborated the current status of usability analysis of selected IITs and IIMs libraries websites. Library website's features and usability problems will help Library professionals and webmasters to improve their library website's usability and web significance among all academic library websites. The findings of the study have shown the present usability, efficiency and effectiveness of

selected library websites of IITs and IIMs. After the evaluation, the ranking of academic library websites based on usability scores will help to understand the level of their website usability and will prompt to take the right decision for improvement of library websites. The evaluation criteria developed for usability analysis will help to undertake further study in Indian environment and especially for libraries websites. The present study will also elaborate the basic usability attributes and errors of the selected IITs and IIMs libraries websites.

1.3 Scope of the study

The present study is confined to 16 Indian Institutes of Technology (IITs) and 13 Indian Institutes of Management (IIMs) libraries' websites established on or before May 5, 2015. Thus, there are 29 reputed libraries' websites which are covered under the present study. IITs are declared as "Institutes of National Importance" (https://mhrd.gov.in/institutions-national-importance) (Appendix - I) and IIMs as "Premier Management Institutions" (http://mhrd.gov.in/iim_hindi, presently URL not existing) by the Government of India.

1.3.1 Indian Institutes of Technology (IITs)

The Indian Institutes of Technology (IITs) are the autonomous government institutions covers higher education in India. All the Indian Institutes of Technology (IITs) of India are governed by the Institutes of Technology Act, 1961 which has declared them as "Institutions of National Importance", and lays down their powers, duties, framework for governance etc. The Institutes of Technology Act, 1961 lists sixteen institutes which are mentioned in Table 1.1.

Table 1.1: List of Indian Institutes of Technology

S.N.	Name of Indian Institutes of Technology
1.	Indian Institute of Technology Gandhinagar, Gujarat
2.	Indian Institute of Technology Bhubaneshwar, Odisha
3.	Indian Institute of Technology Chennai, Tamil Nadu
4.	Indian Institute of Technology Guwahati, Assam
5.	Indian Institute of Technology Indore, Madhya Pradesh
6.	Indian Institute of Technology Kanpur, Uttar Pradesh
7.	Indian Institute of Technology Jodhpur, Rajasthan
8.	Indian Institute of Technology Kharagpur, West Bengal
9.	Indian Institute of Technology Hyderabad, Telangana
10.	Indian Institute of Technology Mumbai, Maharashtra
11.	Indian Institute of Technology Patna, Bihar
12.	Indian Institute of Technology Delhi, New Delhi
13.	Indian Institute of Technology Ropar, Punjab
14.	Indian Institute of Technology Mandi, Himachal Pradesh
15.	Indian Institute of Technology Roorkee, Uttarakhand
16.	Indian Institute of Technology Varanasi, Uttar Pradesh

(Source: https://mhrd.gov.in/iits)

1.3.2 Indian Institutes of Management (IIMs)

The Indian Institutes of Management (IIMs) consists of thirteen public, autonomous institutes of management education and research in India. They mainly offer postgraduate, doctoral and executive education programmes in the management field. On the basis of recommendations of the Planning Commission, foundation of IIMs

was initiated by Jawaharlal Nehru, the first Prime Minister of India. Every IIM is autonomous body and exercises independent control over its day-to-day operations. However, the management of all IIMs and the overall policy making and administration of IIMs are overseen by the IIM council. The IIM Council is headed by India's Minister of Human Resource Development (MHRD) and consists of the chairpersons and directors of all IIMs and senior officials from the Ministry of Human Resource Development of the Government of India. The selected IIMs for the present study are listed in Table 1.2:

Table 1.2: List of Indian Institutes of Management

S.N.	Name of Indian Institutes of Management
1.	Indian Institute of Management Ahmedabad, Gujarat
2.	Indian Institute of Management Bangalore, Karnataka
3.	Indian Institute of Management Raipur, Chhattisgarh
4.	Indian Institute of Management Rohtak, Haryana
5.	Indian Institute of Management Ranchi, Jharkhand
6.	Indian Institute of Management Kozhikode, Kerala
7.	Indian Institute of Management Kolkata, West Bengal
8.	Indian Institute of Management Lucknow, Uttar Pradesh
9.	Indian Institute of Management Indore, Madhya Pradesh
10.	Indian Institute of Management Udaipur, Rajasthan
11.	Rajiv Gandhi Indian Institute of Management Shillong, Meghalaya
12.	Indian Institute of Management Tiruchirappalli, Tamil Nadu
13.	Indian Institute of Management Kashipur, Uttarakhand

(Source: https://mhrd.gov.in/iims)

1.4 Review of Literature

Due to information and communication technology (ICT) revolution, there are numerous amount of information available on the web, so for the present study only theme based literature has been reviewed, which will give more focus insight for the present study and enable to formulate the research problem. This would also facilitate in the identification of the gaps, if any, in the earlier works and the present study may help to fill them. For the present study, the review of related literature is categorized in two parts, i.e. part one related to literature on general websites usability analysis and part two includes usability analysis of academic libraries' websites.

a) General Websites Usability Analysis

Gullikson et al. (1999), in their assessment of information architecture on academic websites, stated that the viewers do not visit the websites for their "experience", they visit for their desired information. In their study, they examined the effect of the information structure of an academic website that in what way the information is categorized, labelled in the headings/sub-headings and in what style or format it is presented, and how users access it through navigation buttons or links and access the information. For data collection, twenty four participants from six faculties approached to answer these typical questions and they just answer just over half the questions successfully and in assessments, they gave the site a failing grade. They also included how the information structure of the website affected their ability to navigate the website. Baggio (2003) in their website analysis of European tourism organizations stated that all the European countries have incorporated several kinds of official tourism portal to encourage viewers on their websites. They evaluated these tourism websites and conducted end-user evaluations and mapping the website's

contents and services which were offered online to their users. The final outcome of their study revealed the common behavior of the European Internet users regarding the usage of the network as a tool to gather information and to acquire travel services. Zhou and DeSantis (2005) conducted a content analysis of fifty five city tourism websites including North America, Europe, Asia, Australia and Africa. They evaluated the distinctiveness of city tourism of each website and their target users. They generalized the existing literature and recognized the key factors which influence the city tourism. Their research focuses on usability problems detections and evaluates the cross cultural differences on city tourism websites. In their research, they included content analysis of website data and on the basis of their results they provide suggestions for making tourism websites more effective, efficient and easy-to-use. Cappel and Huang (2007), in their usability analysis of companies' websites, stated that websites should give importance to transparency, simplicity and consistency so website viewer can perform their desired operations effectively and efficiently. If any company websites lack these things then it may lead to loss of their potential customers. Most company websites follow good design practices rather than usefulness. In their study they evaluated INC. 500 company websites by using eleven parameters which were grouped into three categories. The results of their research revealed that only basic design was followed and a maximum of websites showed a high degree of variations in the terms of link appearance, navigation, search boxes and suggested that organizations should re-evaluate their websites from the usability point of view.

Buchanan and Salako (2009) conducted usability and usefulness study of a digital library in which they identified major usability and usefulness attributes and their

associated measures, collected integrated usability measurement framework, identified a methodological approach for creation of a framework and after that conducted a pilot study for the same. They found that effectiveness, efficiency, visual appearance, various terminologies, navigations and learnability are the key usability features. There are several other measurement attributes but each attribute are unique and play an important role. All these scattered usability attributes can be combined as part of a multi-method approach to system evaluation. Aziz et al. (2010), in their assessment of the accessibility of Malaysia Higher Education Website, shared the interest on creating awareness for the importance of ease of access and usability criteria by investigating the accessibility and usability level of Malaysia Higher Education Website. In their study, they investigated 120 samples of higher education institution websites which belong to the online portal of the Ministry of Higher Education. The investigation was conducted by using automatic evaluation to measure the various accessibility levels as per WCAG 1.0 guidelines. They included some parameters such as page size, speed and broken link, etc. Their study revealed accessibility and usability problems related to the websites of Malaysia Higher Education and recommended for further improvement of the website usability and accessibility.

Youngblood and Mackiewicz (2012), in their study of municipal government homepages websites of Alabama, found that in the municipal website there are several substantial problems such as usability, accessibility which battered the website credibility of municipalities. In their study they used government and corporate usability parameters to compare the selected websites; they developed correlations between usability scores and population of Alabama as per their per capita income

and found that there is no correlation between usability and municipality population. After removing the usability problems the municipal government website can attract more companies and that will create new jobs and leads to improvement of the local economy. Aharony (2012) attempted to describe and evaluate the academic library websites in the years 2000 and 2010. She conducted a content analysis of 31 academic libraries homepages and find that the content of the selected academic library websites in the years 2000 and 2010 has much changed over the ten years such as increasing use of e-resources and implementations of Web 2.0 applications and enhanced use of graphics in websites. In their study, they have explored the changes in the academic library websites over a decade. Gul and Saqib (2015) evaluated the usability analysis of educational websites of Saudi Arabia in which they used Heuristic evaluation and a questionnaire was also developed to accumulate the data. In their study, they found that that the selected libraries websites don't fit on the standards of design, content, user support and navigation and many heuristic rules violations were also detected. They recommended that their study will improve the usability of the King Abdul Aziz University website.

Kaur et al. (2016), in their study of website evaluation methods, stated that there are different ways through which website usability can be evaluated and there is a significant amount of methods to measure the usability of websites. The websites administrators need to know about usability and usability level of their websites. In their study they used two automated tools i.e. Site Analyzer (which measures the various parameters such as Content, Design, Performance, Search Engines Optimization, Page Analysis and Qualidator tool which also measure usability, website accessibility, SEO and quality and later evaluated educational Universities of

Punjab and accordingly ranked as per their evaluation criteria. Peker et al. (2016) explored the relationship between web usability and web presence of the selected universities in which they included five Turkish universities selected from Webometrics rankings. In their study, they included two measurement techniques such as to measure the user performance on the selected tasks and a questionnaire to assess the user satisfaction on the website use. They found some common usability problems. The study results also revealed that selected Turkish university websites have numerous usability problems. Fung et al. (2016) used ten heuristics usability developed by J. Nielsen in their study. Their findings show that the mobile website contains 5 heuristics usability errors, such as website unable to inform viewers the waiting time, information not in a reasonable way, uniformity problems in the arrangement of website contents, lack of advanced searching features and insufficient help or error messages. Though the design of the selected mobile libraries' websites are similar to their desktop view, so the study results are also useful for further improvements of the websites.

ChanLin & Hung (2016) evaluated the library mobile website in the university library. They aimed to prepare an approach to investigate user's responses for new mobile platform and usability of the same was also conducted. For their study, they developed an approach so that they can examine the mobile website and compare it with a full PC website. For that, a questionnaire survey was also conducted to know the student's responses in terms of learnability, control, presentation and website efficiency. The usability test was conducted before the mobile view resulted that students finished more search tasks and were more efficient in completing search tasks when they are using a PC website. The data from the collected questionnaires

represented that students' positive reactions to the developed mobile systems in four define facets. Ismailova (2017) studied usability, accessibility and security aspects of government websites of Kyrgyz Republic. He covered 55 web pages listed in the State Information Resources of the Kyrgyz Republic and five government web sites which were not included in their analysis. He used automatic evaluation tools which shows a usability error rate of 46.3 % and the accessibility error rate of 69.38 % and some security vulnerabilities in these web sites and recommended that the government websites of Kyrgyz Republic have not been reviewed and still need some efforts to improve accessibility, usability and security. Menzi-Cetin et al. (2017) evaluated university website's usability for visually impaired students in which six visually impaired students were interviewed for the said purpose. They have to access the websites with their assistive technologies what they use and for data collection, usability tests were conducted. They found that on the websites finding final exam dates and course schedule on any particular the academic calendar is major difficulties. Their test results also demanded the need for search engine on each page so that they can perform the search functions, rearrangement of the web link sequences with tabs and more information about visuals.

b) Academic Libraries' Websites Usability Analysis

Corry et al. (1997) conducted a usability evaluation of an existing Midwestern University website. An analysis was conducted to restructure the information contained in the current website; a prototype was developed and tested against the existing site. Usability was based on the ability of subjects (such as students, parents, and faculty) to quickly and accurately locates answers to asset of questions. While the study worked well, the metrics used to measure usability were limited to task

completion time and the number of user errors. Clausen (1999) examined the qualitative aspects of websites in general and concerning library websites in particular. A list of criteria is applied to 12 major Danish academic libraries. The findings include the panellists' scores and their verbal comments and it was concluded that the websites of the Danish academic libraries in question are above average compared with websites in general. They do not, however, come up to expectations as virtual expressions of the quality levels of the libraries. This situation can only be improved if the libraries allocate the necessary resources regarding updating and development of the websites. This should be done on the basis of regular user studies and comparative evaluations. Smith et al. (2001) conducted a case study on Website Usability Testing Centre at Wisconsin-Stout University to evaluate the usability of their University's website www.uwstout.edu. The researchers used qualitative testing criteria such as navigation times through subject evaluations to assess the usability of the site and they find that the website suffers from several problems including website specific jargon; unorganized link patterns, confusing search engines, and poorly emphasized information. Based on the results of the evaluation, the authors proposed a number of recommendations in order to improve and unify the university website.

Abdullah (2001) in his comparative study of eight academic library websites in Malaysia; found that most of the libraries are ready to give their services online to their users and to identify the quality criteria for evaluation of academic library website in Malaysia, examining has been done on selected parameters from local library websites and a few criteria from the project by University of Georgia. In his study, he found that most of libraries focus on their front page, few libraries do not update their broken links and less libraries gives frequency of their website updates

and many libraries have very poor responses due to server problems, leave, etc. And he suggests that librarian should have to consider their library websites as one of the important sources in getting information when doing a library instruction to the new students. It is not only to inform users of the services but also to guide them to proper information and know how to use facilities in the websites. McGillis & Toms (2001) measured the usability of an academic library website and to know how faculties and students complete typical tasks using one. After the evaluation they came to know that from the distributed questionnaire, 33 distinctive users effectively completed 75% of set typical tasks within two minutes and they were happy with the transparency and association of the website. In spite of their success in finishing the given tasks, the users experienced several problems such as where to start and website's information architecture. The result shows that library websites not succeed to take into account that how users access the information, their problems and frequently reflect conventional library structures.

Battleson et al. (2001) found that usability testing is an invaluable tool for evaluation the effectiveness and ease of use of academic library websites. The paper reviewed the major usability principles and explores the application of formal usability testing to an existing site at the University of Buffalo libraries. Nielsen (2001) in his analysis to academic websites, the research conducted by a group from the University of Maryland, performed a usability evaluation for the Master of Information Management (MIM) programme website to know whether their website meets the needs of its users. The methods focus of conducting user testing task and performed heuristics evaluation for these tasks. A set of recommendations were providing to guide future redesign of the website.

Ivory & Hearst (2002) presented an extensive survey of usability evaluation methods, organized according to a new taxonomy that emphasizes the role of automation. The survey analyzed existing techniques, identified different aspects of usability evaluation automation that are likely to be of use in future research and suggested new ways to expand existing approaches to better support usability evaluation. Ebenezer (2003) used content and design evaluation of selected comparable sites, focus groups, a questionnaire survey of library and Web development staff, heuristic evaluation, observation testing, card sorting/cluster analysis, and label intuitiveness/category membership testing. All test participants were staff of or providers of services to the trust. Demographic information was recorded for each participant and find that overall responses to the site were enthusiastic and favourable, indicating the scope and content of the site to be broadly appropriate to the user group. Testers made numerous suggestions for new content. Usability problems were discovered in two main areas: in the organization of the site and in the terminology used to refer to information services and sources. Based on test results, proposals for a revised menu structure, improved accessibility, and changes to the terminology used within the site are presented.

Chiew & Salim (2003) focused on developing a web-based tool (called WEBUSE) which consists of 24-questions for evaluating the usability of websites. The report generated by the tool indicates how good the website with respect to usability is. The researchers claim that WEBUSE is suitable for the evaluation of all types of websites and for any domain. The tool can assist webmasters to improve their websites based on the response provided by the visitors of the intended websites. Haak et al. (2004)

in their study described the three usability test approaches such as, retrospective think-aloud protocols, concurrent think aloud protocols and constructive interaction. These three methods of usability evaluation were compared by in their study by evaluation of an online public access library catalogue, in which they included four points of assessment: number and type of usability problems detected; relevance of the problems detected; overall task performance; and participant experiences. The outcomes of their study shows that there are merely few considerable differences between the usability test approaches, mainly with respect to method of problem detecting, task performance and participant experience.

Vande Creek (2005) conducted a study to describe the process and presented the findings of a usability assessment of the Northern Illinois University Libraries' website. Northern Illinois University Libraries conducted a usability analysis using a trilateral approach: usability testing, focus group sessions, and survey questionnaires after significant planning. Quantitative and qualitative data are presented and discussed. Quantitative data does not adequately reflect what the test moderators and recorders observed during test sessions. Thus, qualitative data prove to be more valuable. Results were used to redesign the library's website.

A case of website redevelopment of the Central Coast Health Service (CCHS) library in New South Wales, Australia is reported by Cotter et al. (2006) which uses usability checklist. The same was used to explore the practical application of Evidence-Based Librarianship (EBL). The usability index was increased to 98%. After a preliminary revision, the site achieved a usability index of 79% after application of the "Reward Library Usability Analysis Tool". Two areas of weakness viz. 'finding the

information' and 'supporting user tasks' were identified out of the study. Mustafa & Al-Zoua'bi (2008) evaluated the academic websites of Jordan's universities from the usability perspective. In their research, they have used two online automated analysis tools, namely: Web Page Analyzer and HTML Toolbox and also supported with a questionnaire directed towards users of Jordan's Universities websites. The online tools are used to calculate the selected website's inner attributes which normally cannot be professed by normal users, such as html page code error, download/upload time and size of html page, etc. The questionnaire were designed which was based on 23 usability parameters and further divided into 5 sub-categories. The results of their study showed that the overall usability level of the Jordan's universities websites is acceptable.

Vasanth Raju & Harinarayana (2008) examined thirty library websites of top science universities around the world for their design features with special reference to usability according to the guidelines suggested by National Cancer Institute and selected some of the parameters like optimizing the user experience; link back to home; colour link behaviour; navigability; and multimedia features, etc. And they found that only 53% of library websites provides frequently asked questions (FAQ's). The time out option has been neglected by all the websites except one. It is noticed that only 40% of the websites have provision for explicit home link as well as through logos. Persistent navigation feature is observed only on 50% of the websites. Only 8% of the websites use the de-facto link colour coding. Library websites are yet to exploit the advantages of multimedia (interactivity features) and only 30% of the websites contain video contents and none of the websites contained exclusive audio files.

Rogers & Preston (2009) conducted a usability analysis of Caribbean academic library websites. A combination of experiment and respondent research strategies were used to evaluate usability. These included survey questionnaires, focus groups, formal usability testing and card sort. Both usability heuristics and ISO guidelines were used to assess effectiveness, learnability, usefulness and user satisfaction. The findings identified the challenges in the site's information architecture and in the interface design. Ramesh Babu et al. (2009) studied and analyzed the various aspects of the usability and web credibility of university websites in Tamil Nadu. A total of 43 universities in Tamil Nadu were considered which include 17 affiliated and 21 private universities. The analysis of the data represented the extent and level of usability and credibility possessed by the university websites in Tamil Nadu. Srinivasa Ragavan et al. (2010) evaluated the library websites of all IITs in India on the World Wide Web. The purpose of this study was to assess the content management and usability of an academic library website. In this study, a brief examination of services provided on the websites in general and concerning library websites in particular had been assessed.

Hill et al. (2010) conducted an evaluation of secondary school physical education websites. There were 285 school websites in two southern California countries were assessed in the study using a website checklist. The features of the checklist were organized into categories of content, control (navigation), consistency (readability) and corroboration (accountability). The results showed that only 50 of the 258 identified schools had an active physical education department website. Most of the physical education websites were incomplete and lacks important design and content features. Kim (2011) analyzed and investigated the usage patterns of university library

websites having information sources with different academic roles. He surveyed through a questionnaire method. The same was created with previously validated items that were adapted for the technology acceptance, website design, and library quality service studies. The questionnaire was distributed in classroom settings that may have included a mixture of students of different disciplines. The first group of questions explored the extent to which different groups use websites and three different sources of information. Noticeably, and as expected, doctoral students and faculty members were the most frequent users of the university library website and relied on these websites for their research projects more than their two counterparts. While master's students mainly relied on printed materials, undergraduate students used commercial sources to a greater extent for their information needs, and doctoral students and faculty members highly dependent upon university library website resources. As observed from the findings, the usage of online resources appears to be low for all user groups. More specifically, although doctoral students and faculty members were heavy users of university library website resources, their usage level is proximate to 30–40%. The dataset shows that they also sought information from commercial websites outside of the university library website (around 40%).

Islam & Tsuji (2011) examined selected university websites of Bangladesh from the usability perspectives. There are two online automated tools were taken namely, HTML Toolbox and Web Page Analyser along with a questionnaire directed towards users of these websites. These tools were used to measure the websites' internal attributes which cannot be perceived by the users such as html code errors, download time, and size of the html pages. The questionnaire was developed and designed based on the 23 usability criteria divided into five categories. Each category deals with one

usability aspect. It was concluded that users are not satisfied by overall usability level of these websites and few of them are satisfied with the available features. However, there are some weaknesses in some aspects of the design, interface, and performances. Websites' internal features are identified and suggestions are provided in the study to enhance the usability of these websites. Shrivastava et al. (2012) specified that websites are domain intensive and that domains of website differ significantly and hence a common yardstick cannot be applied to measure quality of all websites. They have validated attributes, sub-attributes and metrics for measuring quality of websites of academic domain. Also the authors have measured quantifiable attributes of quality for six websites of academic domain. The usability, functionality, reliability, and efficiency aggregation have been carried out using logical scoring of preferences (LSP) method. Global aggregation of all four attributes is also carried out to rank six websites. The paper also describes a methodology for measuring external quality of websites. The authors emphasized that web user needs, evaluation goals and international guidelines for quality measurement should be used as a guiding force for deciding the characteristics, sub-characteristics and metrics to be used for measuring the quality.

Sarkar (2012) investigated how far the interactivity dimensions as proposed by Ha and James (1998) are empirically validated by using business websites which are applicable to library website. It also attempted to frame an online interactivity model, depicting the effect of interactivity dimensions on library website quality. The analysis reveals the way interactivity dimensions affect quality of website and the study suggests that the four interactivity dimensions - reciprocal communication, connectedness, information collection, and playfulness - have considerable impact on

the quality of library website. Believes that online interactivity model deduced from the study will help librarians to determine the relationships of four independent variables (dimensions of interactivity) with the dependent variable (website quality). The findings will also help researchers, librarians and web developers alike to measure qualitatively the effect of interactivity dimensions on library website quality which will guide in developing an interactive library website to attract users towards the library.

Pendell & Bowman (2012) identified how a newly developed library mobile website performed across a variety of devices; the researcher used a hybrid field and laboratory methodology to conduct a usability test of the website. Twelve student participants were selected according to phone type. It was revealed that a wide array of errors attributed to site design, wireless network connections, as well as phone hardware and software. This study provides an example methodology for testing library mobile websites, identifies issues associated with mobile websites, and provides recommendations for improving the user experience.

Aziz et al. (2013) in their study indicated that web evaluation has been used in decade to authenticate any website to check how it works. When evaluating a website, archetypal factors to be measured because they are the way to the information and check the information is ordered and accessible, and how to retrieve and disseminate the informative arrangement and planned an addition of the Quality in Use Integrated Map (QUIM) model as a basic model for usability model for a website so that, a set of guidelines to assist in determining design and usability. Mohamadesmaeil & Koohbanani (2013) conducted a study on Iran National Library website in which they used tools for data collection was an explanatory checklist, developed by the

researchers and desired website was measured by it and found that the web usability evaluation of Iran National Library website is having 594 points out of 663 overall assessment points. While the design of National Library website should be completely based on functions that support National Library's major aims, especially in information retrieving as well as rendering public information services.

Walia & Gupta (2013) analyzed selected national libraries websites in the terms of their general features, URL, window title, date and tile, navigations features, their contents, searching features, graphics and animations. For evaluation, they developed a set of checklist-based on guidelines given by Neilson and NIC (National Informative Centre) and clubbed into eight criteria. In their study, they found that the national library of Japan scored the first rank among the 23 national libraries of Asia and national library of Maldives stands at the bottom. They also compared all the selected libraries in the terms of usability features, which will enable national libraries themselves as a means for quality checking and self-improvement. Yusuf (2014), in his study, finds that the main aim of university library websites is to providing resources, up-to-date information and services to students, lecturers, administrators and other users in efficient ways. Unfortunately, website design is often driven by technology, organizational structure, or business objectives, rather than by its usability from the perspective of students in university website designers' end up developing websites which do not meet the needs of the primary users (students). He evaluated the usability of the university website from the perspective of 75 university students and investigated whether area of specialization, age & gender and students category has significant impacts on these usability factors. This aim is achieved by using a survey approach based on the three factors of usability defined ISO 9241-11

(1998) effectiveness, efficiency and satisfaction. The results identifies the usability factors that need to be given more consideration when designing an educational website and shows that different perspectives derived from area of specialization, age & gender and category gives different evaluation.

Verma & Shukla (2017), in the study of usability analysis of Central Universities Libraries Websites of North-East India, suggested that to maintain the standard, design and layout of selected libraries websites, regular assessment of library web portals is required to increase their usability and accessibility. The purpose of their evaluation is to analyze the usability, efficiency, and effectiveness of selected Central Universities libraries websites of North East India and on the basis of their study, they found that most of selected Central Universities libraries websites of North-Eastern region of India were ignoring their usability features and there is plentiful scope of further improvement in terms of applications of Web 2.0 tools, web searching features, library committee, website update, website map, website multilingual option, etc. Okhovati et al. (2017) find out the usability of Medical Sciences University's Central Libraries in Iran. Their study was a cross-sectional and descriptive study in which they have used Nielsen's heuristic websites evaluation method to analysis the 12 selected libraries websites and 668 usability problems was found the highest number of problems related to 'aesthetic' and 'minimalist design' (27.1%) and the 'help and documentation' heuristic (1%) were the lowest. Verma & Shukla (2018), in their observation method based study, used online automated tools and checklist based methods for usability evaluation of IIMs libraries websites. In their study, they found that IIMs' libraries websites have good looking websites but ignored some basic usability features and thus seem to be in a primitive stage of website

development. In their study they revealed that most of the selected IIMs' library websites have very basic and common usability features in terms of general information related to library, content writings, searching features, Web 2.0 applications, page size, page loading time etc and suggested that there is enormous scope for improvement and recommended that the webmasters check website usability of their websites on a timely basis to increase usability scores based on online usability tools.

1.5 Research Design

1.5.1 Statement of the Problem

Websites are most important for information dissemination in the web based environment. The academic institution's website not only disseminates the information pertinent to the organization but also to their related resources and services and one of the most important factors for the success of any organization in web based environment is its website. A good and well designed academic website is not only an excellent media for publicizing their activities and services but also helps to bring into the notice of their users about all the significant information which they must know at one place. Library websites disseminate knowledge and information among users and attract potential users by showing richness of collection/resources, variety of services and number of facilities etc. in their study, teaching and research.

The library websites of Indian Institutes of Technology (IITs) and Indian Institutes of Management (IIMs) provide information for the students, faculty, research scholars etc. While some of them are found to function and update properly, others are not which can cause serious problems for the users of their websites. Therefore, the study

may help users and librarians to understand the current position of academic libraries websites of India in terms of usability perspective.

The main aim of the academic library website's usability study is to evaluate the level of accomplishment of required characteristics such as usability, functional ability, reliability and their efficiency. The ISO standard defines three views of quality of websites such as users view, developers view and manager's view. There are number of researches conducted based on usability analysis of academic websites. From the LIS perspective, there have been few researches so far, based on usability analysis of websites of Libraries and Information Centres of ICMR, CSIR & ICSSR (Kalra, 2014) and university websites of Tamil Nadu (Ramesh Babu et al., 2009). There is still lack of research in usability analysis of library websites of Indian Institutes of Technology (IITs), and Indian Institutes of Management (IIMs). From the LIS perspective, it would thus be interesting to investigate usability analysis of Indian academic library websites. Further students, faculties, institutions and public in general are interested in comparison of academic and research institutions. So, rankings of them will actually reflect the status and standing of such organization in terms of usability of their library websites. Now almost all the academic institutions' have websites for their libraries. So there is need to investigate as to how the library websites are being used in order to disseminate information to their users. The present work is concerned with the evaluation of academic library websites based on usability analysis to know their usability, functional ability, reliability and their efficiency.

1.5.2 Objectives of the Study

The objective of the study is to evaluate the usability analysis of selected academic libraries' websites of India. The specific objectives for the present study are:

1) To develop evaluation criteria for assessing the usability of the selected academic libraries' websites.
2) To know how usable, efficient and effective the selected academic libraries' websites are?
3) To discover the selected academic library website's features and usability problems.
4) To analyse the usability of selected academic libraries' websites.
5) To rank the selected academic libraries' websites based on their usability analysis score.
6) To suggest the ways for improving the usability and recommendations for improvement of academic libraries' websites.

1.5.3 Research Methodology

There is less number of advanced statistical techniques available in website evaluation as well as general criteria for website evaluation. There are differences between museum websites, e-government websites and e-commerce websites; and website evaluation frameworks should take these differences into account. There are relatively rich sets of usability assessment frameworks and tools for evaluating websites but lacks single practical framework for evaluating quality of educational library websites. The study is exploratory in nature and thus does not qualify for having research hypotheses.

The present study has been designed to evaluate the usability of the academic library websites of India and rank them according to their usability scores. Therefore, the survey and observation methods of research have been used to undertake the study. For the usability studies, different types of automated data collection/evaluation tools have been utilized. These tools are: Online Software Programs, HTML tool box, Web Page Analyser, Usability Grade Tables etc. There are some parameters/checklist usability evaluation and analysis criteria available, which assess the accuracy, currency, authenticity, contents and usability of websites.

1.5.3.1 Online Automatic Evaluation Tools

The online automatic evaluation tools specially examine the source code of web pages of the particular website to conclude the compatibility of web pages with their own specific guidelines or defined by the respective users or researchers. The said guidelines may cover unanimously accepted rules or guidelines accepted in specific society. However there are some drawbacks to such methods. These include the following:

a) The result of automatic evaluation tools may contain enormously precious data but can be lengthy and comprehensive, which makes them complicated to infer, particularly to amateur.
b) Automatic evaluation tools cannot reveal all problems in a website, and needs extra manual examination for appendage results. For example only a human can decide whether a text alternative for a graphic contains the equivalent information of the graphic.
c) Automatic testing tools are able to detect only features related to internal attributes; they cannot determine external attributes.

To cope up with the above limitations of online automated tools in the present study and for proper analysis of the usability of selected academic library websites, parameter/checklist based evaluation criteria (Annexure-II) has been used and for proper evaluation, online automated tools have been used for usability analysis and interpretation. The data obtained was tabulated and analysed according to their effectiveness by the use of suitable statistical package.

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Chapter – 2: WEBSITE USABILITY ANALYSIS: CONCEPTS

2.1 Introduction

Tim Berners-Lee, whose first ever website and browser began the Internet revolution, paved way for further expansion of WWW. Gradually, installation and use of web servers and website browsers extended, and it was by 1993, when the Mosaic website browser was introduced, after that the technology truly achieved severe momentum. After the World Wide Web was available to public use, users could avail themselves of an Internet connection and with the help of that they can publish information on World Wide Web, or simultaneously they can access the information published by other users via website browser. The World Wide Web has enabled the partaking of information feasible in ways which were not possible earlier. The availability of information without spatial or temporal constraints made World Wide Web enormously popular with an increasing quantity of information supplemented to or tailored constantly.

With the introduction of the WWW, the availability and accessibility of information on the databases in these electronic forms in libraries and another type of information centres has been made even easier due to web's graphics and interactive capacity. These capacities enables users to explore databases, retrieve, store and view full-text articles including videos and images, tables, e-mail etc. which result every organization or institutions are perceiving the importance of the World Wide Web as a instrument, not only for attaining access to online information but also acts as a medium of disseminating information about their products, actions and services. However, even a high-quality library may have a low-quality website that may turn

users off. Different libraries have a wide range of target groups, level of service, resources, etc.

> *"Some organizations and institutions are designing and developing their own library websites. It has been observed that despite the effort made by the in house expert or outside agency, most of the library websites are not updated regularly. At the same time, the contents and information available on the library websites are also not up to the mark"* (Bhattacharjee et al., 2006).

Nielsen & Tahir (2001) in their research highlighted that web links acts as windows of house in which every single window is also a door which shows path to their users. According to Lee (2001), the designing and development of an academic library website is a developmental and continues process. As "good" design of website is persists to evolve, so academic library websites and website analysis should be included into general web management principles. Ward and Mervar (2003) described that an academic library's websites is a powerful medium that can offer information to users but often users use Google or other search engines, still academic library websites provides more genuine, dependable and structured information than Internet sources. The website design and architecture plays a significant role in the usability of the website. Most of the organizations tend to create and display variety of content as a way of maximizing their information communication potential with their stakeholders. However, if this is not done properly, it makes browsing through such website more complex than it should be.

2.2 Major Services of Internet

An Internet network service allows users to access and disseminate enormous amount of information such as graphics, text, audio, videos and other software over the Internet. The major services of Internet were categorized into four different categories of Internet Services which are as follows:

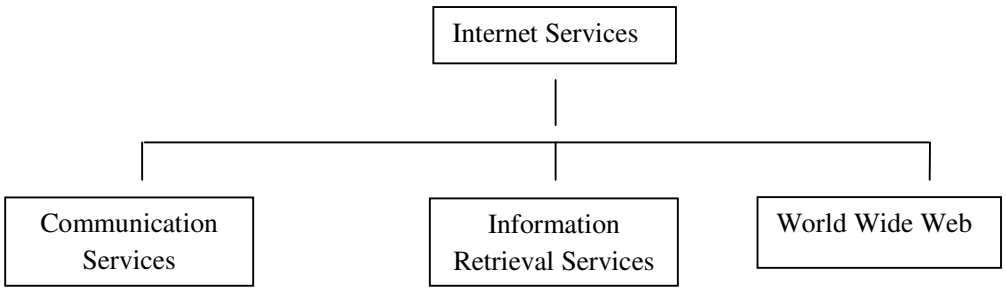

Fig. 2.1: Internet Services

2.2.1 Communication Services

There are various communication services of the Internet which offer interchange of information among individuals or groups. These are:

a) *Electronic Mail or e-Mail*: This service is used to send and receive an electronic message over the Internet.

b) *Telnet*: It is a Transmission Control Protocol (TCP) used to provide bi-directional interactive file sharing facility using a virtual terminal connection over the Internet.

c) *Newsgroup*: It acts as online group forum where people to discuss topics of common interests.

d) *Internet Relay Chat (IRC)*: It facilitates users from all over the world to communicate in real time. The communication process is called 'chat' and works on a client/server networking model.

e) *Mailing Lists*: The mailing list is a systematic arrangement of name and addresses used by an individual or group to share common information through e-mail.

f) *Internet Telephony (VoIP)*: Voice over Internet Protocol also called IP Telephony is a communication methodology or group of methodology for providing voice communications and multimedia sessions over the Internet Protocols which enables the Internet users to talk across the Internet.

g) *Instant Messaging*: It is a type of online real-time communication called 'chat' that offers real-time transmission of information between individuals and group of people over the Internet. Example: Yahoo messenger and MSN messenger.

2.2.2 Information Retrieval Services

Information Retrieval (IR) is the activity of collecting relevant data from various sources and resources. The information retrieval system is a mechanism of searching, storage, retrieval and dissemination of information from a database or library or web based resources. The information retrieval services offering easy access to the available information present on the database or on the Internet. Following are the IRs examples available over Internet:

a) *File Transfer Protocol (FTP)*: File Transfer Protocol (FTP) is a standard network protocol which is used for the transfer of various files between one

client or server on a computer networks. It enables the users to transfer files from one client to various nodes over the Internet network.

b) *Archive*: Archive is a collection of historical records. It contains sources of information that have collected over the course of an individual or organization's lifetime. It's updated over the database comes under any public File Transfer Protocol sites and any other medium.

c) *Gopher*: Gopher is a Transfer Cap Protocol or Internet Protocol application layer protocol developed for searching, distributing and retrieving documents over the network. Gopher protocol was developed for Internet document design and offered a substitute for World Wide Web in its premature stages, but finally Hyper-text Transfer Protocol (HTTP) became the foremost protocol for Internet. It was basically designed for searching, retrieving and display of information on remote sites.

d) *Very Easy Rodent-Oriented Net-wide Index to Computer Achieved (VERONICA)*: Veronica was a search engine scheme designed for the Gopher protocol; it was initially released in November 1992 by Steven Foster and Fred Barrie at the University of Nevada, Reno. It allows any users to access the information sources stored on gopher's computer servers.

2.2.3 World Wide Web (WWW)

The World Wide Web, commonly known as the WEB or WWW, is an online space where any data and information are addressed by Uniform Resource Locators (URL) and it may be interlinked by hypertext or any other web language and are accessible over the Internet. It enables access to various e-resources extended over many

computer servers over the Internet and hyperlinked to each others. These hyperlinks allow the users to navigate between one website to another website.

2.2.3.1 Introduction of World Wide Web

The WEB is the most well-liked and used Internet service after the e-mail services. WEB accesses massive quantity and bigger assortment of information on comparison to any other service available on the Internet. The WWW is an Internet based universal information exchange mechanism. It enables the transfer of available multimedia data from over 4(+) million computers or electronic devices around the globe. It offers audio, video and other interactive multimedia resources such as text-based or image-based and also stream live audio or video transmission.

2.2.3.2 Evolution of the World Wide Web (WWW)

In the 1969, U.S. Government started a project called the ARPANET (Advanced Research Projects Agency Network), which was an early packet-switching network and the first network to implement the TCP/IP Protocol suite. Both technologies became the technical foundation of the Internet. Later ARPANET extended this service to research laboratories, universities, and some military labs. The National Science Foundation (NSF) of U.S. in late 1980s funded the expansion of a network and later named National Science Foundation Network (NSFNET). The main aim of this programme is to promote advanced research and education networking in the U.S. which later connected the supercomputer centres in the United States. At that time many university colleges were encouraged to connect to that network. Finally due to

collective efforts of ARPANET and NSFNET, the number of websites increased rapidly. In 1987, there were more than 10,000 sites and in 1989 it increases to more than 100,000 while, these kinds of activities was not taking place in other countries on a large scale. This huge universal anthology of networks and computer network systems communication with same protocols has come to existence which was called the “Internet”. ARPANET was dismantled in 1990s, and the public Internet network in the U.S. was handed over to NSFNET. In the early 1990s, industrial Internet networks with their own Internet network exchanges or gateways were allowed to conduct trade over the Internet, and in late 1993 the NSFNET created the Inter Network Information Center to provide Internet Services.

The WWW is a mega collection of hypertext or other markup language based pages on the Internet. The evolution idea of WWW was developed in Switzerland at the European Particle Research Centre known as CERN, in the year 1989 by Tim Berners-Lee. The foremost text-based model of WWW was functional in the month of December 1991. The open exhibition was given at Hypertext 91st conference which was held at San Antonio, Texas, United States of America. The foremost graphical interface software package for WWW called Mosaic was released in 1993.

The following diagram briefly defines the growth of the World Wide Web:

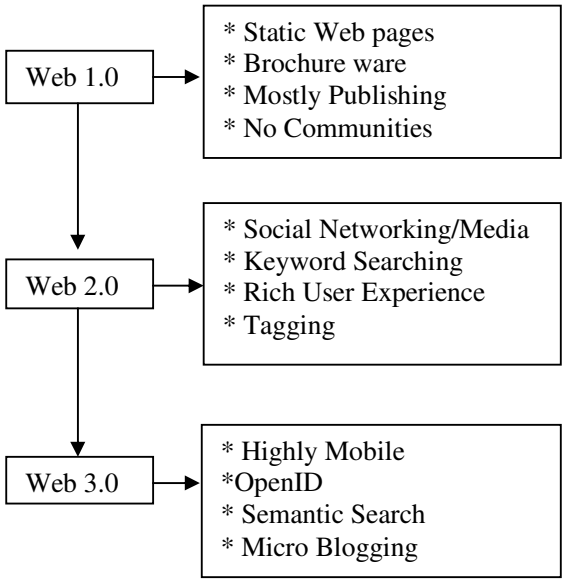

Fig. 2.2: Growth of Web

2.2.3.3 The World Wide Web: Hyper-text Transfer Protocol (HTTP)

The HTTP is the fundamental protocol used for World Wide Web. HTTP regulates how the information is created and about the outcome of data structure. It also controls the transmission or flow of data, actions of web servers and how the browser responds accordingly after each and every command. It is an application-level protocol basically used for information distribution, collaboration, and management of hypermedia information system. HTTP is also used as a standard Internet Protocol as a communication among different user and various Internet based proxies/gateways to other Internet network based systems. It is also supported by the Simple Mail Transfer Protocol (SMTP), Network News Transfer Protocol (NNTP), File Transfer Protocol (FTP), Gopher protocols etc.

2.2.3.4 The World Wide Web: Uniform Resource Locators (URL)

A Uniform Resource Locator (URL) termed as a website address of any particular website. It is a location of any web resource which implicates its location over the Internet or any network. It also acts as a mechanism for retrieving any particular website. It also acts as a Uniform Resource Identifier (URI) for any Internet based resources. The URLs are mostly used to refer any particular web pages and were also used for File Transfer (FTP), e-mail (as mailto), for Database Access (JDBC), and also for many other network based applications. Most web browsers display the URL of a web page above the page in an address bar. A typical URL could have the form http://www.xyz.com/index.html which indicates the standard protocol i.e. (HTTP), a hostname (www.xyz.com), and a file name (index.html).

Example: http://www.xyz.com/products/health/soaps.html

http://	-	Protocol
www.xyz.com	-	Host indicator
products/	-	Directory Name
health/	-	Sub-directory Name
soaps.html	-	Resource Name

2.2.3.5 The World Wide Web: Tools

Hyper-text Transfer Protocol (HTTP) is the unique Internet based inter-communication protocol which wires the bridge between Internet based Web server and its users through the TCP/IP layer. For proper communication through server-client, web browser and web servers were needed.

2.3 Web Browser

A web browser is a software programme used for accessing web resources. On the WWW each and every entity of images, web pages, video or any other resources are recognized by a separate Uniform Resource Locator (URL) which enables the web browsers to regain these online resources from Internet based web server and after regaining display on the out screen of the users. In 1990, the first web browser, called "World Wide Web", which was invented by Tim Berners-Lee came out. In the year 1993, Mosaic web browser was released which become the world's first popular web browser. Its pioneering interface enables the WWW system easy and more accessible to average person. Some of the most popular web browsers are Google Chrome, Mozilla Firefox, Apple's Safari, Microsoft Internet Explorer, and Microsoft Edge.

2.4 Web Server

A web server is a computer hardware dedicated for running the software and variety of resources uploaded in these servers using web browsers. The server follows client/server protocol for web based resources. A web server analyses and processes the incoming client requests over the any Internet based protocol. The main purpose of a web server is to acquire, analyse and disseminate the requests of clients through web browser. The exchange of data between server and users takes place through the Hypertext Transfer Protocol (HTTP). In 1989, Tim Berners-Lee proposed a new project, with the objective of providing speedy exchange of data between scientists or scientific institutions located in the various regions of USA by a hypertext system which enabled Berners-Lee for writing two programs i.e. a web browser called "World Wide Web" and world's first web server named as "CERN".

A web server plays a very important role in the exchange of information on the web, as per the request of clients the web server finds the requested data and the same transmitted through the web browser. The World Wide Web project parallels the techniques of Internet based network information system and hypertext to build an easy but effective worldwide information system. Presently, most advanced and complex network based information system deployed on the Internet. The web server hosts the different standard protocol based web pages which were accessible through URL or any Internet Protocol based web addresses. Now-a-days web servers also host the databases which were called database web server. The web servers can be found in many embedded electronic devices such as network routers, printers, webcams or any other. It may also be used as system for monitoring or administration.

2.5 Website

Website is a collection of many web pages categorised at a place, which also includes media rich contents such as texts, images, audios, and videos etc. The websites are recognized by its universal domain name and hosted on at least one web server. It may be reachable via any public Internet Protocol (IP) network or any Domain Name, such as 127.0.0.1 or www.xyz.com. All the openly available websites collectively comprise the World Wide Web.

The websites may be created and maintained by any group or any individual. The web pages are the building blocks for any websites. Websites may include any rudiments from other websites through web links. Different websites may have different functions and may be used for various purposes such as a fashion website for fashion related information; an e-commerce website for selling of their goods online, etc. The

websites were designed on specific topic or for purpose, ranging from e-commerce website to social networking, from news to online education programmes etc. The websites may be categorized on the basis of their top level domain (TLDs) name, for example:

Govt. websites	= .gov
Educational institutions websites	= .edu or .ac
Non-profit organizations websites	= .org
Commercial websites	= .com
Information sites	= .info

Besides these, many TLDs are based on country name viz. in, .uk, .ca, .au. .jp, etc.

2.6 Academic Websites

In the early 1990s, several academic institutions have initiated for the creation of websites for their institutions as well as for libraries. The information related to scholarly literature existing on the academic library was disseminated through library websites. Previous studies usually determined on the design features of the websites, while library websites simply provided the information on their collection and services available in their institution's library. In the late 1990s, the technical developments initiated with digitization efforts which opened new opportunities for websites and websites administrators to maintain the availability of e-journals, databases, e-books, and virtual reference services for the users. The availability and accessibility of new information and services on library websites increases the research efforts of a researcher. Further, research on academic library websites generated several literatures which suggest libraries to use web based techniques and online resources to serve their user community. The research also suggests that

libraries and information centres should consider the effective website design guidelines for the development of their websites to maximize their usage of available contents.

This is the need for higher education institutions in the present era to have a dependable, efficient and attractive web existence. In the ICT scenario, website is flattering as significant element of the enlightening process. The higher education institution plays an imperative role in the growth and development of society whereas the higher education websites have many purposes to fulfil the need of the society. The Internet is the major medium for communication and dissemination of information in the modern era. Every organization wants to advertise their products to make aware of its users. The website is one of the medium to disseminate the information. Universities and its libraries also want to provide their services to the academicians, researcher and students. Websites are playing the role of mediator between users and information providers. A university website is increasingly used for the variety of purposes like attracting new students, information regarding courses, syllabus, job vacancies, the library catalog, acts as center place for university news and announcements. The academic library websites have to serve a diverse category of students and researchers who are looking for reliable, relevant and quality information.

Students need information for their study purpose and doing assignments. Researchers need information for their research and to get new information or knowledge. Since, web portals are an integral part of the institutions it also provides direct access to the library and their digital resources. The availability of information in electronic

formats in libraries and information centers has made easier to access the electronic content by the user; and due to increasing web graphics and interactive website capabilities allow users to search databases, view full-text articles which include texts, images, and tables etc.

The web-based data comes in a mixture formats and is mostly amorphous, so analysis is to be undertaken. Therefore conducting content analysis certainly benefits the university website in general and library websites in particular to develop sturdy and strong websites, which cater the information need of net users. Therefore, the educational library websites should structure and organize quality content and information. On the other hand, the quality and diversity of information and many other factors affecting information seeking on academic library websites. If a good library may have an outdated website that turns a user off. Different types of libraries have different target groups, different types of services, resources, etc. which basically depends upon their host institution. The efforts should be made by in-house experts or any outside agency for proper updating of library website; most of the websites are not regularly updated.

2.7 Usability Analysis

The term usability was mostly used in mid 1980's and there are multiple approaches to make a product or services serviceable and there is no any established definition of the term "usability". However, "usability is how easy an object is to use". The entity may be nearly anything, including tools, books, software, machines, websites, any items, or anything. We can say that anything that a user may intermingle and may be utilizable. In the terms of computer programmes and websites, usability has been

defined as the effortlessness at which any average user can use their product either it may be a software programme or any website to achieve their desired goals. Basically usability is comprised of "learnability", "memorability", "efficiency", "satisfaction", and "errors" (Nielsen (1993). Learnability states for how simple it is for any new person to complete their desired task when first time they visit to any website. Memorability states for how simple it is for anyone to revert back after using any website they haven't visited it for a long period of time. Efficiency states for how quickly any person can complete their desired work on any website after they are known with its use and functions. Satisfaction is whether any users enjoying the design or content of any website and errors refers to the number of hurdles or problems any users get when they visit any website.

For website quality, careful planning and considering several key design elements are required. Visual and aesthetic look, even though important, is only the key aspect of website design and development. The utility of the website e.g. how fine it works and its usability e.g. how effectively and efficiently any users can navigate it are also key factors. Nielsen (2000) determines that "people do not come to the Web for an experience, they come for information. This is especially true for users of library websites, where finding reliable information quickly and easily is important."

The website usability analysis is a method which refers to steps for improving ease-of-use during the design process (Nielsen, 2003). The International Organization for Standardization (ISO) defines usability of a product as

"the extent to which the product can be used by specific users to achieve specified goals with 'effectiveness', 'efficiency' and 'satisfaction' in a specified context of use."

According to Nielsen (1999) *"with the swift development and increasing use of the World Wide Web as both information-seeking and an electronic commerce tool, web user interface studies grow in significance. Poor interface functionality is one potential cause for web usability meltdown."*

There are still set of many different ways for making a product more usable. There are mainly three views related to how usability should be measured:

a) *The consumer - oriented view*: Usability can be measured in terms of the mental satisfaction and their effort to get the desired item and also the attitude of the user towards the products.
b) *The user performance view*: Usability may also be measured by investigating how the user interacts with their desired product or services, with special importance on either ease-of-use or satisfactoriness in the real world.
c) *The item-oriented view*: Usability can be measured in terms of the ergonomic attributes of the product that depends upon its demands, alternative products, etc.

2.8 Basic Usability Attributes

"Usability is a quantitative and qualitative measurement of the design of a user interface, grouped into five key factors based on Nielson's (1993) five attributes". These are discussed as follows:

a. *Learnability*: Learnability has to do with how quickly and easily users can begin to do productive work with a system, which is new for them. Ease of learning is another wording for this usability attribute, as it is mentioned by most of the sources (Nielsen, 1993; Shneiderman, 1998; Dix et al., 2010). Learnability is how quickly and easily users can reach a level of proficiency in using the system (website).

b. *Efficiency*: Nielsen (1993) defines effectiveness refers to an expert user's steady-state level of performance at the time when the learning curve flattens out. Dix et al., (2010) and Wixon & Wilson (1997) specified efficiency as long-term performance, therefore associating it somehow with expert users as well. Efficiency is the number of tasks per unit of time that the user can perform using the system.

c. *Memorability*: This refers to the ease of identification the way a system must be operated. Nielsen (1993) describes this as the characteristic of a system that allows the user to return to the system after some period of not having used it, without having to learn everything all over again.

d. *Error rate*: This refers to the errors made during the use of the system and how easy it is to recover from them (Nielsen, 1993). According to Shneiderman (1998) and Nielsen (1993), errors can have an impact on efficiency, by slowing down performance.

e. *Satisfaction*: It is the subjective opinion that users form about the system (or about some parts of it). It is the most elusive usability attribute, as it is completely dependent on the subjective opinion of users.

2.9 Website Usability Analysis

There are numerous things to be considered for designing and building a new website. The website needs to be good-looking sufficient so that people want to look at it and visit it. Website also needs to contain all the desired information that any user want and share with other users in order to help them to achieve the purpose for which they came to a particular website. The basic and very important aspect of designing a website is testing it for usability. Users visit websites and immediately return back to earlier visited websites if they easily find useful and their desired information, which were structured and accessible according to a well-structured layout. The suitability of web based applications by their users severely relies on website usability. Usability is one of the major factors in the quality measurement of web based applications.

Although, a body of literature pertaining to the systematic study of websites' content and structure are still developing, it seems that studies of the content of Library and Information Centers websites are not explored much particularly in research & development (R&D) and Science & Technology (S&T) institutions. Since the web itself is still developing and websites are in a constant state of development, current literature on what makes a website useful is lacking. Many guidelines and recommendations on what makes a good or useful website now abound especially on the web, e.g. Web guidelines by Yale University (Lynch & Horton, 1999); Research-

based web usability guidelines given by National Cancer Institute (U.S. Department of Health and Human Services, 2006); IBM web accessibility checklist (IBM Human Ability and Accessibility Center, 2008); and Web content accessibility guidelines 2.0 (Web Accessibility Initiative, 2008). However, no concrete guidelines/ standards for library websites have been set yet.

Therefore, if usability of any website is more than the quality of that website, it's application and use will be more as compared to less usability websites. In recent times, website usability testing and evaluation has been gaining huge attention and being acknowledged as basic elements for the success of any web applications. There are many methods for ensuring usability; therefore, it is one of the current goals of the website's research as well as more attention on usability is currently paid by industry by which it is receiving the significance of adopting usability methods for verifying the usability of web applications before and after their deployment. Academic libraries websites have accepted the potential use of WWW by initiating innovative ways to cope their users' demands and in a digital educational civilization, by essentially designing user-friendly websites (Tobin & Kesselman, 2000).

2.10 Why Website Usability is Important?

The growing number of websites and the quantum of information available through the web have gone beyond one's imagination. But organizing information for easy retrieval purpose has not been explored much. Over the years, information architecture and usability studies have become a major focus of research. As expected, every kind of organization has made an attempt to set up a website through which the virtual worldwide community may access information about their

organization, its sources, resources, and services. Not to be left behind, many libraries have created websites to serve their patrons and the general information community. Each library has so to speak its own website quality. From the literature survey, it seems that various criteria have been applied to evaluate the websites; however, the two main quality aspects with regard to “Usability” and “Usefulness” seems to be appropriate for library websites.

The main cause that makes usability so significant is that there are enormous related websites that public will access and if they want they may go to the next site if the first one they visit is not utilizable. Anyone may have the most attractive website in the globe, but people will go away instantly if they are not capable to figure out how to navigate this site easily. As stated in the article "*Why Web Site Usability is Important for an Organization*", on the web, "*organizations entirely rely on their web presence in order to achieve their online goals. Similarly, a user of an organizations website will formulate a judgment about that organization that is strongly correlated with the way they perceive its website*". In addition to that, usable websites boost user satisfaction whereas there are many websites which disobey the usability features baffle their users and result in a loss of their customers or users and which directly implicate on their income for the organization behind them. Therefore, convalescing usability of websites is great way to hearten the users to visit any website instead of the websites that belong to any other ones and is often an approach that keeps anyone’s users coming back to website repeatedly. Undeniably, high-quality or high performing websites that are easy to use bring in users and give a particular site a competitive edge over the competition.

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Chapter – 3: IITs & IIMs LIBRARIES' WEBSITES: AN OVERVIEW

3.1 History and Establishment of IITs

After the end of the 2nd World War and before India got independence, Sir Ardeshir Dalal from the Viceroy's Executive Council predicted that the future wealth of India would depend on Information Communication Technology. Keeping in view of further future needs of India, he conceptualized academic institutions that would instruct such work forces in the country itself. Later, it is considered to be the first conceptualization and origin of the Indian Institutes of Technology.

Dr. Humayun Kabir (was a Bengali poet, novelist, educationist and politician) played a key role in establishing IITs in India. He encouraged Dr. B. C. Roy, the Chief Minister of West Bengal to work on Sir Ardeshir's proposal for an Indian Institute of Technology. Later, in 1945, Dr. Humayun Kabir along with Sir Jogendra Singh of the Viceroy's Executive set up a twenty two member committee to plan a proposal, and made Sir Nalini Ranjan Sarkar (was an Indian businessman, industrialist, economist, public leader, and was greatly involved in the political and economic regeneration of Bengal. He was Finance Minister of West Bengal Government in 1948) as the chairman. The Sarkar Committee recommended in 1945 that at least four Higher Technical Institutes in the lines of famous Massachusetts Institute of Technology, U.S.A. be established in the Eastern, Western, Northern and Southern regions of the country.

After Indian Independence, it was Pt. Jawaharlal Nehru, who evolved in establishing of the Indian Institutes of Technology to offer skilled technical people of international

class of knowledge and skills to the nation who would act as leaders in technology for the newly born independent India. Pt. Nehru visualize that the IIT structure would over time give scientists and technologists of the highest talent who would employ in research, design and development to help building the nation towards self-sufficiency in their technological needs.

In May 1950, the first in the series, IITs was established in Kharagpur at the location of the Hijli Imprisonment Camp, where the British had imprisoned political prisoners; the institution was named the "Indian Institute of Technology" before its formal investiture on August 18, 1951. Within a decade of the launch of the first IIT, four more were proposed to set up i.e. IIT Bombay in 1958, IIT Madras in 1959, IIT Kanpur in 1959, and IIT Delhi in 1961. Later, next sixth IIT was proposed to be established in Guwahati (1994).

India's first technical academic institute was set up in 1847 which was known as "Thomson College of Engineering" and afterward the "University of Roorkee", was ordained as the seventh IIT in September 2001. In the year 2008, six new IITs were started at IIT Bhubaneswar, IIT Gandhinagar, IIT Hyderabad, IIT Patna, IIT Rajasthan, and IIT Ropar. This was followed by two more IITs in 2009: IIT Indore and IIT Mandi. Later, IITs have created world class educational platforms and vigorously continued through globally documented research based on brilliant infrastructural amenities. Both in India and abroad, the faculty and alumni of IITs have made huge impact in all sectors of society and the institutes were internationally acknowledged as centers of academic excellence (Council of Indian Institute of Technology, 2018).

Table 3.1: IITs in India

SN.	Name of Institute	Year of Estd.
1.	Indian Institute of Technology Kharagpur	1951
2.	Indian Institute of Technology Mumbai	1958
3.	Indian Institute of Technology Madras	1959
4.	Indian Institute of Technology Kanpur	1959
5.	Indian Institute of Technology Delhi	1963
6.	Indian Institute of Technology Guwahati	1994
7.	Indian Institute of Technology Roorkee	2001
8.	Indian Institute of Technology Gandhinagar	2008
9.	Indian Institute of Technology Bhubaneshwar	2008
10.	Indian Institute of Technology Jodhpur	2008
11.	Indian Institute of Technology Hyderabad	2008
12.	Indian Institute of Technology Patna	2008
13.	Indian Institute of Technology Ropar	2008
14.	Indian Institute of Technology Indore	2009
15.	Indian Institute of Technology Mandi	2009
16.	Indian Institute of Technology Varanasi	2012
17.	Indian Institute of Technology Palakkad	2015
18.	Indian Institute of Technology Tirupati	2015
19.	Indian Institute of Technology Dhanbad	2016
20.	Indian Institute of Technology Bhilai	2016
21.	Indian Institute of Technology Goa	2016
22.	Indian Institute of Technology Jammu	2016
23.	Indian Institute of Technology Dharwad	2016

(Source: https://mhrd.gov.in/iits)

3.2 History and Establishment of IIMs

The Indian Institutes of Management (IIMs) are a group of 20 autonomous institutes of management education and research in India come under Ministry of Human Resource Development, Government of India. They principally offer professional

postgraduate, doctoral and executive education programs. The concept of establishment of IIMs was initiated by Pt. Jawaharlal Nehru, the first Prime Minister of India on the basis of the recommendations of the Planning Commission of India.

After India became independent in 1947, as Government of India established some public sectors organizations and framed many new policies. To manage all these, there was lack of suitable managers in the large numbers of public undertaking sectors. The Planning Commission was endow to supervise and direct the growth and development of the nation. To overcome all these problems, in 1959, the Planning Commission invited Professor George Robbins from University of California, Los Angeles to assist in setting up an All India Institute of Management Studies.

Later, based on his suggestions and recommendations, the Indian government resolved to set up two management institutes and named as "Indian Institute of Management". At first time two cities from India were selected for establishment of new IIMs i.e. Calcutta and Ahmedabad.

On 13 November 1961, institute at Calcutta was established first and named "Indian Institute of Management Calcutta" or "IIM Calcutta". It was set up in association with the MIT Sloan School of Management, Cambridge, Government of West Bengal, Ford Foundation, and Indian industry. Later in the following month, the next IIM was also established in Ahmedabad and named as "Institute of Management Ahmedabad". Harvard Business School played key role at the initial stages of growth and development of IIM Ahmedabad. After success of two IIMs, in 1972, a committee headed by Ravi J. Matthai (Ravi John Matthai was a management, educationist and

administrator) advised for the creation of two more IIMs. Later, based on the committee's recommendation, new IIM at Bangalore was established and named "Indian Institute of Management Bangalore" or "IIM Bangalore" in the next year.

In 1981, the first IIM Review Committee was constituted to inspect the growth and development of three existing IIMs i.e. IIM Calcutta, IIM Ahmedabad, and IIM Bangalore and to make further recommendations in this regard. Later the committee recommended that the three IIMs are producing approximately 400 Post Graduate professionals annually and they had reached their optimum. Then they proposed the establishment of two more IIMs to cope the increasing demands for management professionals. Later on the committee further recommended for the establishment of fourth Indian Institute of Management then IIM Lucknow, was established.

In 1996, two more IIMs were established at Kozhikode and Indore. In 2005, IIM Shillong was established and as per the decision by the Government of India, its foundation stone was laid in 2007. Later fourteen new IIMs have been set up, bringing to the total number of IIMs to 20. On 24 January 2017, the Union Cabinet of India approved the bill that became the Indian Institutes of Management Act, 2017 which declares IIMs as "Institutes of National Importance". In July 2017, the IIM bill was passed by the Lok Sabha and subsequently by the Rajya Sabha on 19th December, 2017 and after receiving the presidential concurs, the IIM bill became an Act on 31st December 2017 (Government of India, Ministry of Human Resource Development, Department of Higher Education, 2008).

Table 3.2: IIMs in India

SN.	Name of Institute	Year of Establishment
1.	Indian Institute of Management Calcutta	1961
2.	Indian Institute of Management Ahmedabad	1961
3.	Indian Institute of Management Bangalore	1973
4.	Indian Institute of Management Lucknow	1984
5.	Indian Institute of Management Kozhikode	1996
6.	Indian Institute of Management Indore	1996
7.	Indian Institute of Management Shillong	2007
8.	Indian Institute of Management Rohtak	2010
9.	Indian Institute of Management Ranchi	2010
10.	Indian Institute of Management Raipur	2010
11.	Indian Institute of Management Tiruchirappalli	2011
12.	Indian Institute of Management Kashipur	2011
13.	Indian Institute of Management Udaipur	2011
14.	Indian Institute of Management Nagpur	2015
15.	Indian Institute of Management Amritsar	2015
16.	Indian Institute of Management Bodh Gaya	2015
17.	Indian Institute of Management Sirmaur	2015
18.	Indian Institute of Management Visakhapatnam	2015
19.	Indian Institute of Management Sambalpur	2015
20.	Indian Institute of Management Jammu	2016

(Source: https://mhrd.gov.in/iims)

3.3 Brief Profile of Libraries Websites

3.3.1 Libraries' Websites of Indian Institutes of Technology

3.3.1.1 Central Library, Indian Institute of Technology Kharagpur

The Central Library of IIT Kharagpur started in the year 1951 and in 1956, moved to its present building. There is no overstatement that the Central Library of IIT Kharagpur is one of the biggest and premium technical libraries in Asia. The institute

library is well equipped with all the modern services and both electronic as well as print resources. The institute has also developed its own full-fledged Digital Library and Institutional Digital Repository. The Library is having a collection of more than 3.5 Lakh documents, subscribing about 100+ print journals, and providing access to over 26,000+ online full- text journals and some abstracting databases. Besides, there are 135,000+ e-books. The Library has two buildings, the Main Building, and the Annex Building. Books, Theses and Standards are kept in the Main Building whereas Current Periodicals, Bound Journals, CD-ROM/DVD-ROM Databases and lecture of various video courses are kept in the Annexe Building.

Screenshot 1: Website of Central Library, IIT Kharagpur

(Source: http://www.library.iitkgp.ac.in/)

Contact Details

Name of the Institute	Indian Institute of Technology Kharagpur
Address of the Library	Central Library, Indian Institute of Technology Jodhpur, NH 65 Nagaur Road, Karwar 342037, Jodhpur District, India
Establishment year	1956
Name of the Library	Central Library of Indian Institute of Technology Kharagpur
Name of the Librarian/ Library In-charge	Dr. B. Sutradhar
Contact No.:	+91 03222 - 282432
E-mail:	bsutra@library.iitkgp.ac.in

3.3.1.2 Central Library, Indian Institute of Technology Bombay

The Indian Institute of Technology Bombay (IIT) was established in 1958, often shortened to IITB. The funds from UNESCO came as Roubles from the then Soviet Union. In year 1961, the Indian Parliament decreed the IITs as 'Institutes of National Importance'. Since then, IITB has developed from strength to strength to emerge as one of the top technical universities in the world. The institutes' library has always benefited from the IITB and it is a pioneer in adopting latest technology. Central Library of the institute manages all its knowledge, both in print and electronic formats, ensures flawless discovery and easy access to subscribed scholarly resources. Central library provides high-quality environment for both thoughtful and mutual work and study. Library collection of about 4.40 lakh items which is used by more than 11000 members and others. Presently IITB library has 240101 Books, Theses, CDs & Videos, 12084 TLL & BC (Book Bank) Collection, 118925 Bound Volumes of Journals, 67677 Reports, Pamphlets, Standards, 4417 Photocopies, 40000(+). Journals (Print, Online).

Screenshot 2: Website of Central Library, IIT Bombay

(Source: http://www.library.iitb.ac.in/)

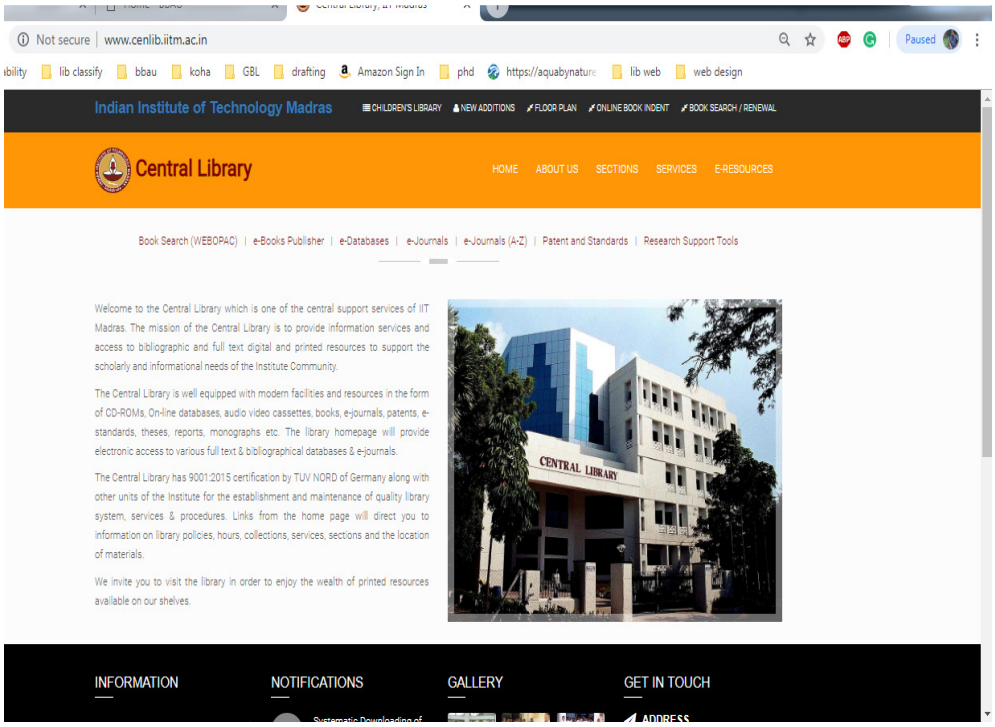
Contact Details

Name of the Institute	Indian Institute of Technology Bombay
Address of the Library	Chief Library Officer, Central Library, IIT Bombay, Powai (MH), 400076 (India)
Establishment year	1958
Name of the Library	Central Library of Indian Institute of Technology Bombay
Name of the Librarian/ Library In-charge	Dr. Manju Naika
Contact No.:	25768920, Extn: 8920
E-mail:	librarian@iitb.ac.in, manjunaik@iitb.ac.in

3.3.1.3 Central Library, Indian Institute of Technology Madras

The Indian Institute of Technology Madras (IITM) was established in 1959 by the Government of India as an "Institute of National Importance". The Central Library was started functioning in the year 1959 at the Department of Civil Engineering and

in 1965 the Central Library shifted to independent building in front of Institute's Main Guest House. In view of the latest progress and future needs, the Institute decided to build Millennium Library Building in front of the Administrative Building. The Central Library has implemented Integrated RFID Technology, Contactless Smart Card Enabled Access Control System, Smart Card, ISO-9001:2015 Standards, Electronic Book Drop System, Auto Check-in and Check-out Systems, Virtual Reference Desk, Web Portal, Research Carrels, Media Resource Center with 220 seating capacity, Students Conversation Hall, Automatic Bindery etc.



Screenshot 3: Website of Central Library, IIT Madras

(Source: http://www.cenlib.iitm.ac.in/)

Contact Details

Name of the Institute	Indian Institute of Technology, Madras
Address of the Library	Central Library, Indian Institute of Technology Madras, Chennai - 600036, India
Establishment year	1959
Name of the Library	Central Library of Indian Institute of Technology, Madras
Name of the Librarian/ Library In-charge	Dr. Mahendra N. Jadhav
Contact No.:	+91-44-22574951
E-mail:	librarian@iitm.ac.in

3.3.1.4 P. K. Kelkar Library, Indian Institute of Technology Kanpur

Indian Institute of Technology, Kanpur was established in 1959 and it is one of the most premier institutions established by the Government of India. The aim of the Institute is to provide momentous education, to carry out original research of the highest standard and to provide direction in technological innovation. The P. K. Kelkar Library (formerly Central Library) of the Indian Institute of Technology Kanpur is equipped with all the up to date facilities and services. It is situated in three-storied building covering total area of 5730 square meters. The mission of the library is to provide information services and access to bibliographic, full-text both in digital and printed resources to support the scholarly and information needs of all students, faculty members, and staff.

Screenshot 4: Website of P. K. Kelkar Library, IIT Kanpur

(Source: http://pkklib.iitk.ac.in)

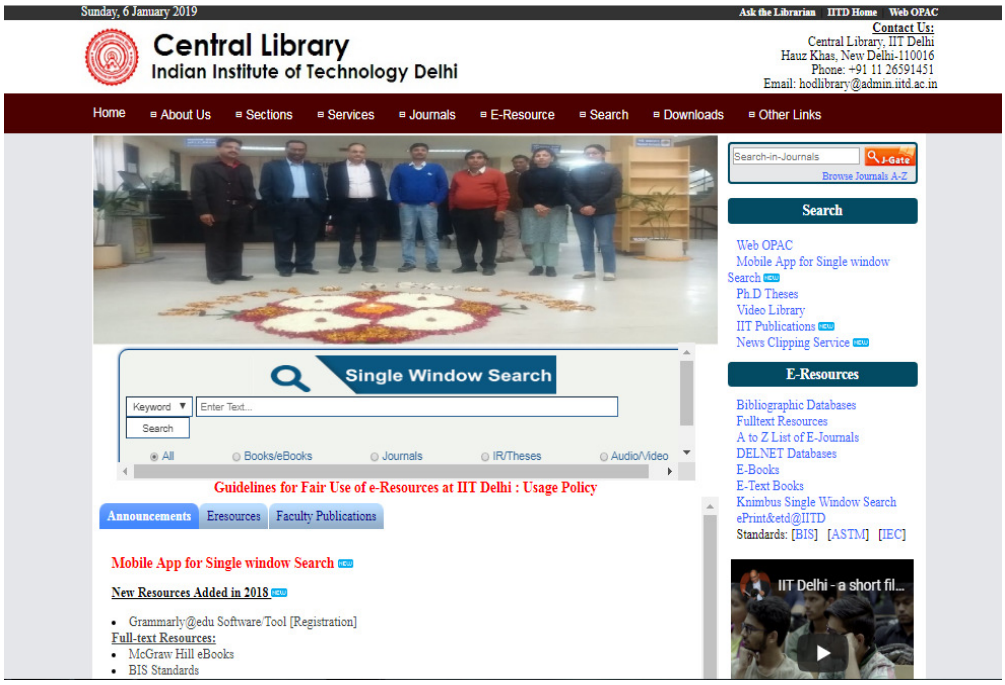
Contact Details

Name of the Institute	Indian Institute of Technology Kanpur
Address of the Library	Purushottam Kashinath Kelkar Library, Academic Area, Fourth Avenue, Hall 3, IIT Kanpur, Kalyanpur, Kanpur, Uttar Pradesh 208016
Establishment year	1959
Name of the Library	Purushottam Kashinath Kelkar Library of Indian Institute of Technology Kanpur
Name of the Librarian/Library In-charge	Prof. R. Gurunath
Contact No.:	0512-2597698
E-mail:	librarian@iitk.ac.in

3.3.1.5 Central Library, Indian Institute of Technology Delhi

The Indian Institute of Technology Delhi (abbreviated as IIT Delhi or IITD) located in Hauz Khas, Delhi, India. Established in 1961 and inaugurated in August 1961 by Prof. Humayun Kabir, Minister of Scientific Research & Cultural Affairs. The IIT Delhi Library System consists of a Central Library and eighteen departmental libraries that jointly support the teaching, research and extension programmes of the Institute. The Central Library of the institute consists of collection of over three lakhs documents comprising of books, journals, theses, dissertations, video cassettes and compact discs. All in-house functions of the library are fully automated using the LibSys software package which also provides web-based access to their online catalog of library.

The "Indian National Digital Library in Engineering Sciences and Technology (INDEST) Consortium" was set-up in 2003 by the Ministry of Human Resource Development (MHRD) under the institute. Presently library has 194471 Books, 103942 Bound Volumes of Journals, 26923 Standards, 2261 Microfilms, 4322 Theses, 13430 Technical Reports, 1800 Video Cassettes, 5550 Compact Discs, 22128 Books in Text Book & Book Bank, 10000 Online Electronic Journals, 6 Online Databases, and 2 CD-ROM Databases.



Screenshot 5: Website of Central Library, IIT Delhi

(Source: http://library.iitd.ac.in/)

Contact Details

Name of the Institute	Indian Institute of Technology Delhi
Address of the Library	Central Library, IIT Delhi, Hauz Khas, New Delhi-110016
Establishment year	1961
Name of the Library	Central Library of Indian Institute of Technology Delhi
Name of the Librarian/ Library In-charge	Dr. Nabi Hasan
Contact No.:	011-26591451, 9560978667
E-mail:	hasan@library.iitd.ac.in, nabihasan@gmail.com

3.3.1.6 Lakshminath Bezbaroa Central Library, Indian Institute of Technology Guwahati

The Indian Institute of Technology, Guwahati is the sixth member of the IITs fraternity, was established in 1994 and the academic programme of IIT Guwahati was started in 1995. Lakshminath Bezbaroa Central Library of the Institute was named after the well-known and much revered literary figure Sahityarathi Lakshminath Bezbaroa on 5th December 2014. The Lakshminath Bezbaroa Central Library is housed on a four-storeyed building having a floor area of about 7500 sq. meter. The library currently has 154564 printed volumes and 2291 subscribed current journals, several e-books, and online full-text as well as abstract databases across all domain of academic pursuit accessible through the campus network. Being a member of e-Shodh Sindhu and DBT eLibrary Consortium (DeLCON), the library provides access to 12835 e-journals to its users. The library catalogue is accessible through Web-OPAC.

Screenshot 6: Website of Lakshminath Bezbaroa Central Library, IIT Guwahati

(Source: http://www.iitg.ac.in/lib/)

Contact Details

Name of the Institute	Indian Institute of Technology Guwahati
Address of the Library	Lakshminath Bezbaroa Central Library, Indian Institute of Technology Guwahati, Guwahati- 39, Assam (India)
Establishment year	1995
Name of the Library	Lakshminath Bezbaroa Central Library of Indian Institute of Technology Guwahati
Name of the Librarian/ Library In-charge	Dr. Tamal Kumar Guha
Contact No.:	+91-361-258-2112
E-mail:	librarian@iitg.ac.in

3.3.1.7 M. G. Central Library, Indian Institute of Technology Roorkee

The Indian Institute of Technology, Roorkee lines among the oldest engineering education in the world. It was established in the year 1847 as Roorkee College of Civil Engineering primarily to instruct resident engineer for the constant Ganges Canal and in 1854, in the memory of its founder James Thomason, it was renamed as Thomason College of Civil Engineering and in 1945 it was again inverted to Thomason College of Engineering and at that time the Department of Electrical Engineering and Mechanical Engineering was added in the institute. In 1947, after the independence a wider role for the Thomason College was envisaged that Pt. Nehru, the first Prime Minister, converted Thomason College of Engineering into University of Roorkee on 25th November 1949.

In 2001, after the creation of new Uttarakhand state, Parliament of the country gave it the status of "Institute of National Importance" and later converted it to Indian Institute of Technology Roorkee. The Mahatma Gandhi Central Library of the

institute has a very integral part in the institute. It is an combination of the traditional and the modern library system and one of the oldest academic libraries in the country. It is housed in 80,000 sq. ft. ultra-modern fully air-conditioned building, outfitted with all latest IT amenities extended over on four floors. The library uses RFID technology for providing human involvement free service to its users. It also provides flawless Wi-Fi access connectivity throughout the building and have wired connectivity for more than 200 computer terminals for accessing e-resources. Its well-resourced imaging center uses two Minolta Planetary Scanners for scanning and digitization of print documents for their Institutional Repositories named "Bhagirathi" and "Shodh-Bhagirathi" containing Institute's archival materials, theses, dissertations, and other valuable publications. After 21st September 2001, when institute declared as Indian Institute of Technology, it was felt that the existing building needs necessary expansion, therefore keeping in view of future requirements, a new state of the art building was planned. The foundation stone of the present library building was laid on 19th June 2004 and it was finished in June 2007. On first International Day of Non-Violence i.e. 2nd October 2009, the Central Library was renamed as Mahatma Gandhi Central Library (MGCL). The present library building is a state-of-art structure which provides the pre-eminent possible atmosphere and facilities to the students and faculties of the institution. It covers a total area of 90000 sq.ft. which is fully air-conditioned.

Screenshot 7: Website of Mahatma Gandhi Central Library, IIT Roorkee

(Source: http://mgcl.iitr.ac.in)

Contact Details

Name of the Institute	Indian Institute of Technology Roorkee
Address of the Library	Mahatama Gandhi Central Library, Indian Institute of Technology, Roorkee-247667
Establishment year	1847
Name of the Library	Mahatma Gandhi Central Library Indian Institute of Technology Roorkee
Name of the Librarian/ Library In-charge	Dr. C. Jayakumar
Contact No.:	01332-285939, 285239
E-mail:	library@iitr.ac.in, jay.mcl2016@iitr.ac.in

3.3.1.8 Central Library, Indian Institute of Technology Gandhinagar

The Central Library of Indian Institute of Technology Gandhinagar is an integral part of its parent institution. The main objective of the institute is to become a world-class academic organization in Engineering, Sciences, Humanities & Social Sciences. It's

Central Library has a wealthy collection of books on relating subjects which includes reference books, textbooks, CDs, Theses and Dissertations and e-resources. The institute library is constantly in a process of increasing their collection of books further and they also started subscribing to e-resources as well as printed formats. Their subscribed e-journals includes various reputed online scholarly databases such as American Chemical Society, SpringerLink, American Physical Society, Science-Direct, JSTOR, American Mathematical Society, IEEE, Annual Reviews, ASME, MathSciNet, Nature, etc.

Screenshot 8: Website of Central Library, IIT Gandhinagar

(Source: http://library.iima.ac.in/)

Contact Details

Name of the Institute	Indian Institute of Technology Gandhinagar
Address of the Library	Central Library, Indian Institute of Technology, Gandhinagar, Palaj, Gandhinagar - 382355, India
Establishment year	2008

Name of the Library	Central Library of IIT-Gandhinagar
Name of the Librarian/ Library In-charge	Dr. T. S. Kumbar
Contact No.:	+91-079-2395 2431
E-mail:	tskumbar@iitgn.ac.in

3.3.1.9 Central Library, Indian Institute of Technology Bhubaneshwar

The Central Library of IIT Bhubaneswar plays a very important role for the academic and research mission of IIT Bhubaneswar and also facilitates the formation and propagation of scholarly knowledge. The variety of services offered by the Central Library is as good as to any modern libraries in India and which of international standard. Soon after the formal manifestation of the Central Library in the year 2009, the instant importance was given for a good collection development on Text Books and Reference Books. Presently Library is holding an admirable print collection of over 14000+ volumes of books, and has various other resources like magazines, journals, theses, reports, e-books, e-journals and online databases in various disciplines. Library also has EZ Proxy for remote access to its e-resources.

Screenshot 9: Website of Central Library, IIT Bhubaneswar

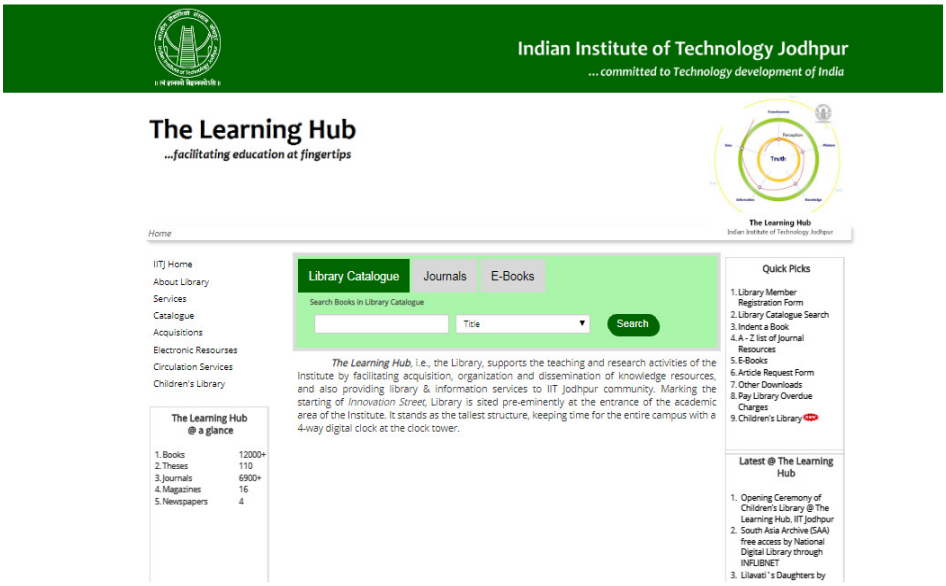
(Source: http://library.iitbbs.ac.in/)

Contact Details

Name of the Institute	Indian Institute of Technology Bhubaneswar
Address of the Library	Central Library, Indian Institute of Technology Bhubaneswar, Argul, Khurda - 752050, Odisha, India
Establishment year	2009
Name of the Library	Central Library of Indian Institute of Technology Bhubaneswar
Name of the Librarian/ Library In-charge	Dr. Bibhuti Bhusan Sahoo
Contact No.:	+91-674-7138755
E-mail:	bibhutisahoo@iitbbs.ac.in

3.3.1.10 Library, Indian Institute of Technology Jodhpur

Indian Institute of Technology Jodhpur was established in 2008 and functions from its sprawling residential permanent campus of 852 acres on National Highway 65, North-West of Jodhpur towards Nagpur. This campus is meticulously planned and envisioned to stand as a symbol of academics – simple, but deep. The library supports the teaching and research activities of the institute by facilitating acquisition, organization, and dissemination of knowledge resources, and also providing Library & Information services to IIT Jodhpur community. Marking the starting of Innovation Street, Library is sited pre-eminently at the entrance of the academic area of the institute. It stands as the tallest structure, keeping time for the entire campus with a 4-way digital clock at the clock tower. The library has 12000+ Books, 110+ Theses, presently subscribing 6900+ Journals, 16 Magazines, and 4 Newspapers.



Screenshot 10: Website of Library, IIT Jodhpur

(Source: http://library.iitj.ac.in/)

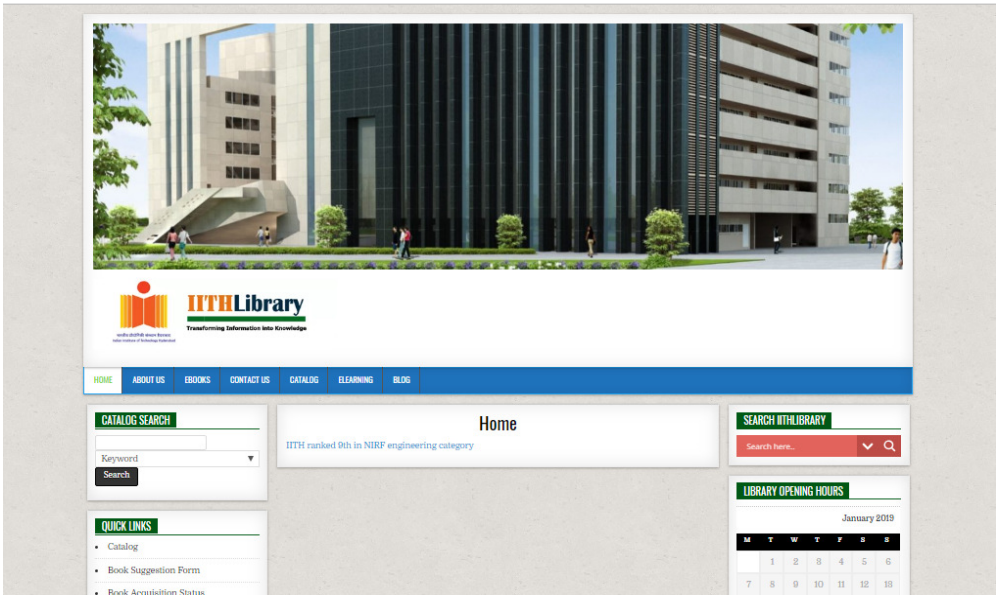
Contact Details

Name of the Institute	Indian Institute of Technology Jodhpur
Address of the Library	Library, Indian Institute of Technology Jodhpur, NH 65 Nagaur Road, Karwar-342037, Jodhpur, Rajasthan, India
Establishment year	2008
Name of the Library	Library of Indian Institute of Technology Jodhpur
Name of the Librarian/ Library In-charge	Kirankumar R. Hiremath
Contact No.:	+91-291-2449038
E-mail:	library@iitj.ac.in

3.3.1.11 Library, Indian Institute of Technology Hyderabad

The Indian Institute of Technology Hyderabad is an engineering and research institution located in Sangareddy district, Telangana, India. It was set up in technical and financial assistance from the Government of Japan. IIT Hyderabad began

functioning on 18th August 2008 from a temporary campus in Ordnance Factory. In July 2015, it moved to its 576-acre permanent campus at Kandi, Sangareddy. Institute has approx 285 Undergraduate, 395 Masters and 474 Ph.D. students with 181 full-time faculty members. In 2018, as per the survey of National Institutional Ranking Framework, IIT Hyderabad was ranked 9th among engineering institutes in India and 22nd in overall. The IIT Hyderabad library has more than 20,000 books and 10,000 periodicals in their collection.



Screenshot 11: Website of Library, IIT Hyderabad

(Source: https://library.iith.ac.in/)

Contact Details

Name of the Institute	Indian Institute of Technology Hyderabad
Address of the Library	Library, Indian Institute of Technology Hyderabad, Ordnance Factory (ODF), Yeddumailaram, Medak – 502 205, Telangana, India
Establishment year	2008
Name of the Library	Library of Indian Institute of Technology Hyderabad

Name of the Librarian/ Library In-charge	Dr. Mallikarjuna C.
Contact No.:	040-23016025
E-mail:	library@iith.ac.in

3.3.1.12 Central Library, Indian Institute of Technology Patna

The Central Library of Indian Institute of Technology Patna (IIT Patna) is one of the superior libraries in terms of its resource collection and services. Central Library of the institute caters all the information needs of their faculty members, students, research scholars as well as the staff of the institute. The Central Library was started in December 2008 with approximately 1000 books and one online resource and during very short duration of time, the library has acquired a good number of books and e-resources including e-books and e-journals. This library is equipped with library automation system with Online Public Access Catalogue (OPAC), Self Check-In and Shelf Check-Out system using RFID technology. The Library also has 50 computers for and remains open from 8.30 AM to 10.00 PM, all seven days throughout the year except National holidays.

Screenshot 12: Website of Central Library, IIT Patna

(Source: http://library.iitp.ac.in/index.php/index.html)

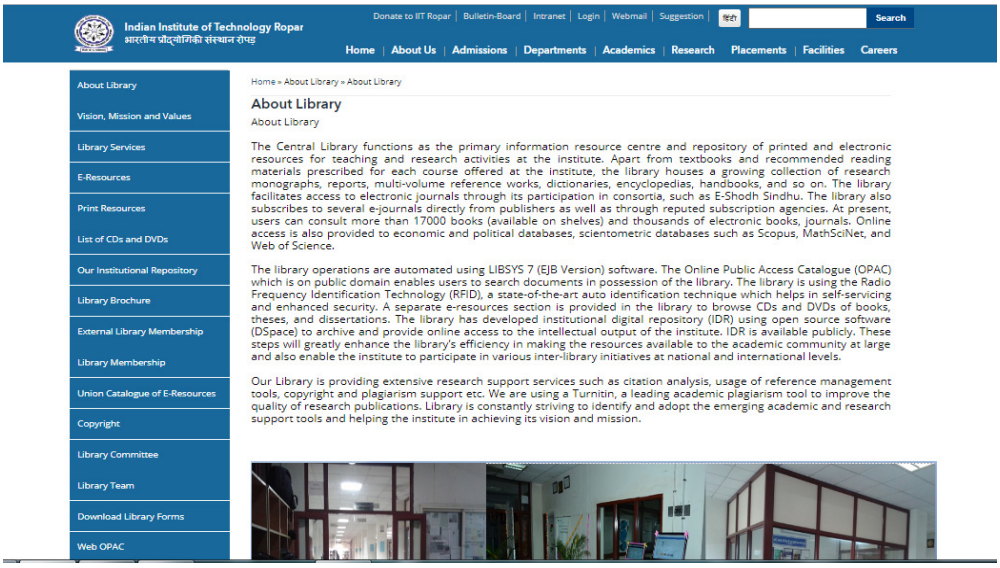
Contact Details

Name of the Institute	Indian Institute of Technology Patna
Address of the Library	Central Library, IIT Patna, Bihta, Patna – 801 106, Bihar, India
Establishment year	2008
Name of the Library	Central Library, Indian Institute of Technology Patna
Name of the Librarian/ Library In-charge	Dr. Manas Kumar Sarangi
Contact No.:	0612-302-8617
E-mail:	mksarangi@iitp.ac.in

3.3.1.13 Central Library, Indian Institute of Technology Ropar

The Indian Institute of Technology, Ropar (IIT Ropar) or IIT-RPR situated in Rupnagar, Punjab, India and it is one of the eight newer Indian Institutes of Technology (IITs) established by the Ministry of Human Resource Development (MHRD), Government of India under The Institutes of Technology (Amendment) Act, 2011. The library of the institutes facilitates access to subscribed electronic resources by participation in consortia, such as E-Shodh Sindhu of INFLIBNET. The library also subscribes to some e-journals and at present library users can access more than 17,000 books, thousands of e-books and e-journals, numerous databases such as Economic and Political databases, Scientometric databases such as Scopus, MathSciNet, and Web of Science. The library in-house operations are computerized using LibSys7. Currently the library is using the Radio Frequency Identification Technology (RFID), for auto recognition technique which helps in self-servicing and improved security. In a library, a separate e-resources access section is provided to the users to browse CDs and DVDs of procured books, theses, and dissertations. The

library has also developed Institutional Digital Repository (IDR) to archive and provide online access to the scholarly output of the institute.



Screenshot 13: Website of Central Library, IIT Ropar

(Source: http://www.iitrpr.ac.in/about-library)

Contact Details

Name of the Institute	Indian Institute of Technology Ropar
Address of the Library	Central Library, Indian Institute of Technology Ropar, Nangal Road, Rupnagar, Punjab, India 140001
Establishment year	2008
Name of the Library	Central Library, Indian Institute of Technology Ropar
Name of the Librarian/ Library In-charge	Dr. Dinesh K. S.
Contact No.:	+91-01881-242134
E-mail:	dinesh@iitrpr.ac.in

3.3.1.14 Central Library, Indian Institute of Technology Indore

The Central Library provides essential support for teaching programmes and research at IIT Indore. The library is speedily raising its collection of books, reference books, periodicals, and electronic resources and at present, the library has a collection of over 34492 books, which includes textbooks and reference books, the Periodicals and Newspaper Section consists of popular Magazines and Newspapers both in English and Hindi. The library provides access to more than 7600 e-journals, access to bibliographic databases such as SciFinder Scholar, and MathSciNet. The Reading Hall for the users acts as a peaceful atmosphere helpful to study.

Screenshot 14: Website of Central Library, IIT Indore

(Source: http://library.iiti.ac.in/)

Contact Details

Name of the Institute	Indian Institute of Technology Indore
Address of the Library	Deputy Librarian, Central Library, Helium (School Building), 1st Floor, R.No. 201, Indian Institute of Technology Indore, Khandwa Road, SIMROL, Indore – 453 552, Madhya Pradesh, India

Establishment year	2009
Name of the Library	Central Library of Indian Institute of Technology Indore
Name of the Librarian/ Library In-charge	Ms. Anjali Bandiwadekar
Contact No.:	0731-2438713
E-mail:	anjali@iiti.ac.in

3.3.1.15 Central Library, Indian Institute of Technology Mandi

The Indian Institute of Technology Mandi (IIT Mandi) is situated in Mandi, Himachal Pradesh. It is one of the eight new Indian Institutes of Technology (IITs) established by the Ministry of Human Resource Development, Government of India under The Institutes of Technology (Amendment) Act, 2011. IIT Mandi Library has a very special place in its campus because of its rich collection of books and journals in the various field of Engineering, Science & Technology. The institute's library stands as a exclusive knowledge resource centre that offers access to vital and dedicated information resources and services to gather the growing information needs of the institute. IIT Mandi Library in-house operations are computerized by using KOHA integrated library management software. The library currently has over 18,200 print books and 15,171 e-books and also provides access to more than 10,000 e-journals. Library objective is to augment and enable discovery through the effective utilization of information resources and services.

Screenshot 15: Website of Central Library, IIT Mandi

(Sources: http://library.iitmandi.ac.in/)

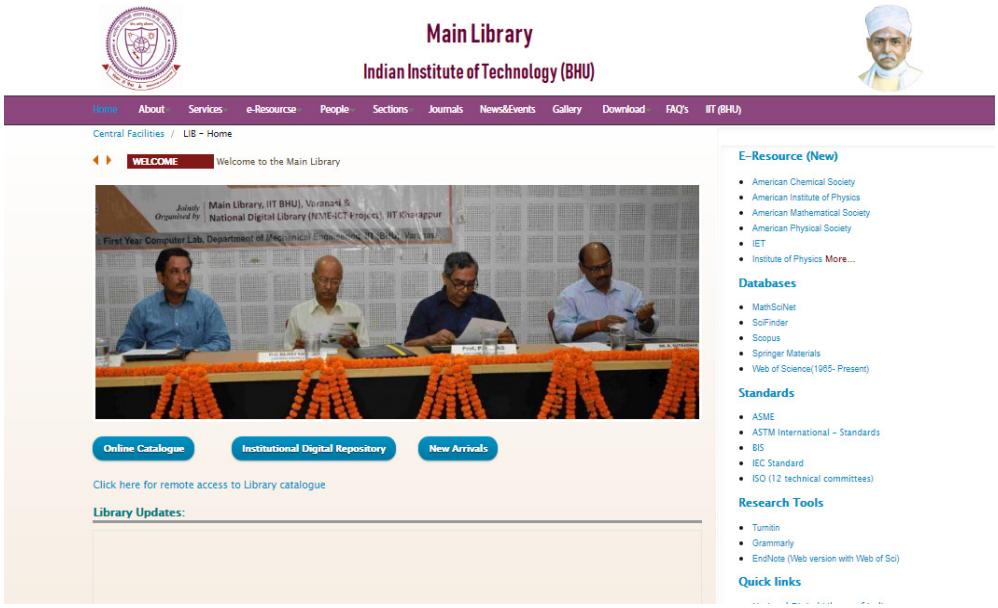
Contact Details

Name of the Institute	Indian Institute of Technology Mandi
Address of the Library	Library, Indian Institute of Technology Mandi, Mandi - 175 001, Himachal Pradesh, India
Establishment year	2009
Name of the Library	Central Library, Indian Institute of Technology Mandi
Name of the Librarian/ Library In-charge	Mr. Naresh Singh Bhandari
Contact No.:	01905-267059, 9816016376
E-mail:	nsbhandari@iitmandi.ac.in

3.3.1.16 Main Library, Indian Institute of Technology Varanasi

The Indian Institute of Technology, Banaras Hindu University, Varanasi or IIT BHU library has a wealthy collection of books on various subjects which includes

Engineering, Science & Technology, Humanities and Social Sciences. The library also has good and rare collection of the bound volume (since 1918), periodicals, standards, codes, electronic resources & online books etc. The total collection of the library is 90231 Books (Reference, General), 22049 Text Books, 8740 SC/ST Book Bank, 17738 Bound Volume of Journals, 445 Theses, 1065 Compact Discs.



Screenshot 16: Website of Main Library, IIT (BHU) Varanasi

(Source: https://www.iitbhu.ac.in/cf/lib)

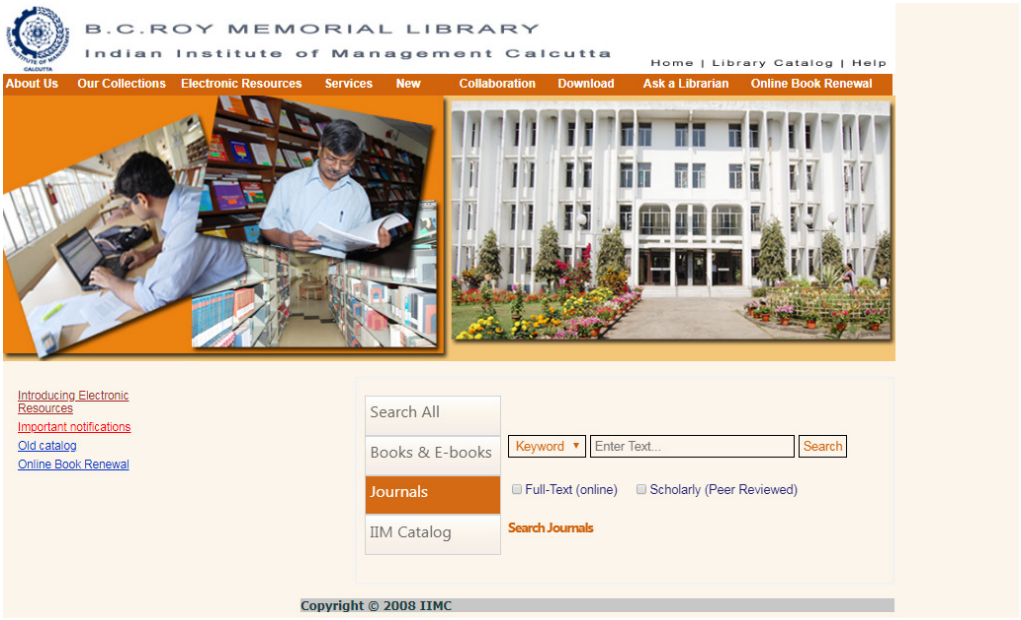
Contact Details

Name of the Institute	Indian Institute of Technology, Banaras Hindu University, Varanasi
Address of the Library	Main Library, Indian Institute of Technology (BHU), Varanasi – 221 005, Uttar Pradesh, India
Establishment year	1918
Name of the Library	Main Library, IIT Banaras Hindu University, Varanasi
Name of the Librarian/	Prof. Santosh Kumar
Contact No.:	+91 542 -2307016 (39)
E-mail:	nupadhyay.lib@iitbhu.ac.in

3.3.2 Libraries' Websites of Indian Institutes of Management

3.3.2.1 B. C. Roy Memorial Library, Indian Institute of Management Calcutta

In the November 1961, the Indian Institute of Management Calcutta (IIMC) was established as the first national institute for Post-Graduate studies and research in Management by the Government of India, in collaboration with MIT Sloan School of Management, Cambridge, the Government of West Bengal, Ford Foundation and Indian industry. The library of IIMC was set up in March 1962 and named as "B. C. Roy Memorial Library" in the memory of Dr. Bidhan Chandra Roy, the first chairman of the institute. The library of the institute is situated in a separate building having carpet area of approximately 30000 sq.ft. spread over three floors. Library acts as a knowledge resource center and occupies an inimitable position in the research and academic activities of the institute. Library in-house operations are automated with library automation software. It provides recent, precise and trustworthy information from print and electronic resources using its state-of-the-art technology.



Screenshot 17: Website of B. C. Roy Memorial Library, IIM Calcutta

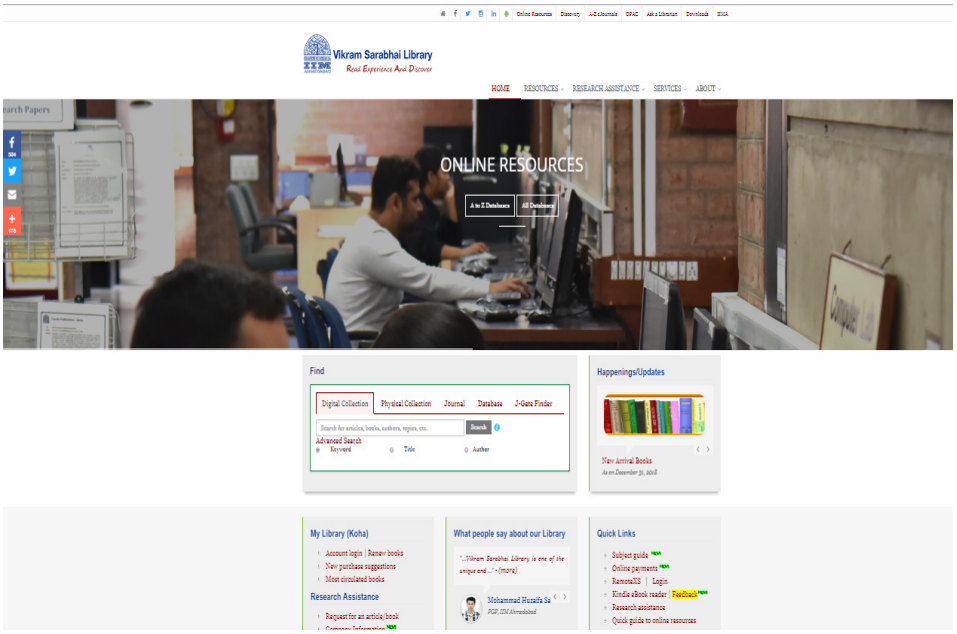
(Source: http://library.iimcal.ac.in/)

Contact Details

Name of the Institute	Indian Institute of Management Calcutta
Address of the Library	B. C. Roy Memorial Library of Indian Institute of Management Calcutta, Diamond Harbour Rd, Joka, Kolkata, West Bengal 700104
Establishment year	1962
Name of the Library	B. C. Roy Memorial Library of Indian Institute of Management Calcutta
Name of the Librarian/ Library In-charge	Mr. Saha Biswajit
Contact No.:	033-24678300/6, Ext.4423, 09231675070(M)
E-mail:	biswajit@iimcal.ac.in, librarian@iimcal.ac.in

3.3.2.2 Vikram Sarabhai Library, Indian Institute of Management Ahmedabad

The Vikram Sarabhai Library (VSL) is named after world-renowned Physicist and founding Director of Indian Institute of Management, Ahmedabad (IIMA) i.e. Dr. Vikram Sarabhai. It was established in 1962 and counted in one of the best management libraries in Asia. Library mission is to aid expedient and user-friendly access to existing, worldwide and pertinent information by identifying, procuring, organizing and retrieving information in available in various formats (print & non-print) and to serve the information requirements for the fraternity of IIMA to cope their research, teaching and training, consulting, and learning necessities. The library has 100+ online databases available via any networked devices within the campus. The library also provides dedicated online tools like EBSCO Discovery, journal title search, remote access facility (restricted to internal users) and Institutional Digital Repository and recently the library has introduced Kindle e-Book reader's service.



Screenshot 18: Website of Vikram Sarabhai Library, IIM Ahmedabad

(Source: http://library.iima.ac.in)

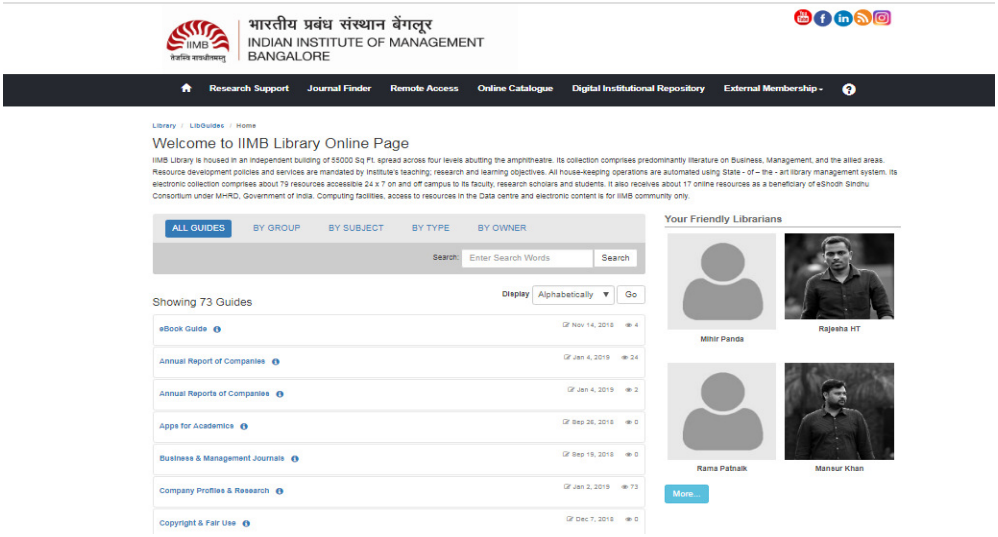
Contact Details

Name of the Institute	Indian Institute of Management, Ahmedabad
Address of the Library	Vikram Sarabhai Library, IIM Ahmedabad, Vastrapur, Ahmedabad - 380015
Establishment year	1962
Name of the Library	Vikram Sarabhai Library Indian Institute of Management, Ahmedabad
Name of the Librarian/ Library In-charge	Dr. H. Anil Kumar
Contact No.:	+91 79 6632 4987/4975
E-mail:	anilkumar@iima.ac.in

3.3.2.3 Library, Indian Institute of Management Bangalore

The Indian Institute of Management, Bangalore (IIMB) is an academic management institute and under the IIM Act of 2017. IIMB is an “Institute of National Importance”

located in Bangalore, Karnataka, India. IIMB Library has an independent building of 55,000 sq. ft. extended across four levels adjoining the amphi-theater. Library collection comprises of chiefly literature on management, business and other allied areas. All the library house-keeping functions are computerized using library management system. Library electronic collection consists of about 79 resources accessible for its faculty, research scholars and students. Library also receives about 17 online resources from e-Shodh Sindhu Consortium under MHRD, Government of India.



Screenshot 19: Website of Library, IIM Bangalore

(Sources: http://library.iimb.ac.in/library)

Contact Details

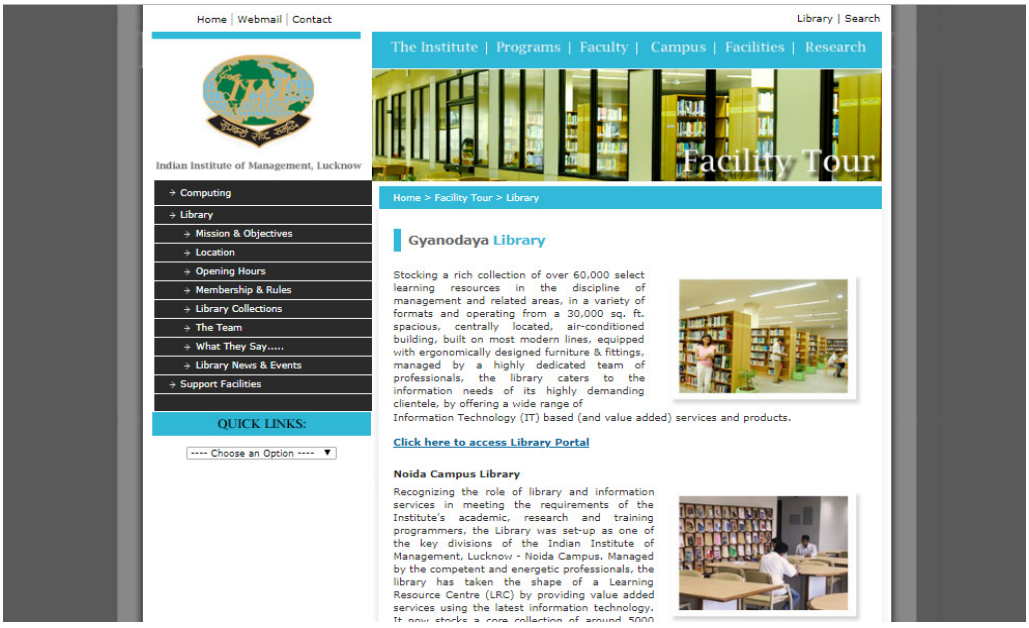
Name of the Institute	Institute of Management Bangalore
Address of the Library	IIMB Library, Indian Institute of Management Bangalore, Bannerghatta Road, Bengaluru, India - 560 076
Establishment year	1973
Name of the Library	Library of Indian Institute of Management Bangalore
Name of the Librarian/	Dr. K. Rama Patnaik

Library In-charge	
Contact No.:	+91-80-26993016
E-mail:	rama.patnaik@iimb.ac.in

3.3.2.4 Gyanodaya Library, Indian Institute of Management Lucknow

The Indian Institute of Management Lucknow (IIML) was established by the first prime minister of India Pt. Jawaharlal Nehru. It is fourth in the prominent IIM family of management schools to be established in India. For library, a self-effacing start was made in May 1985, when the library started operating from a small room in the rented premises of the Giri Institute of Development Studies, Lucknow. Library has an approx. collection of 60,000 learning resources in the various subjects of management and also in variety of formats.

The library operating from a 30,000 sq. ft. with air-conditioned building, built on most modern lines, outfitted with ergonomically premeditated furniture & fittings, managed by a extremely devoted team of professionals, the institute library caters the information desires of its extremely challenging patrons, by offering a extensive variety of Information Technology (IT) based services and resources. Presently library has collection of 45480 Books, 414 Periodicals, 2800 E-Journals, 21750 Back Files in Bound Volumes, 11875 Micro Films & Fiches and 66 electronic Databases.



Screenshot 20: Website of Gyanodaya Library, IIM Lucknow

(Source: http://www.iiml.ac.in/facilities/library)

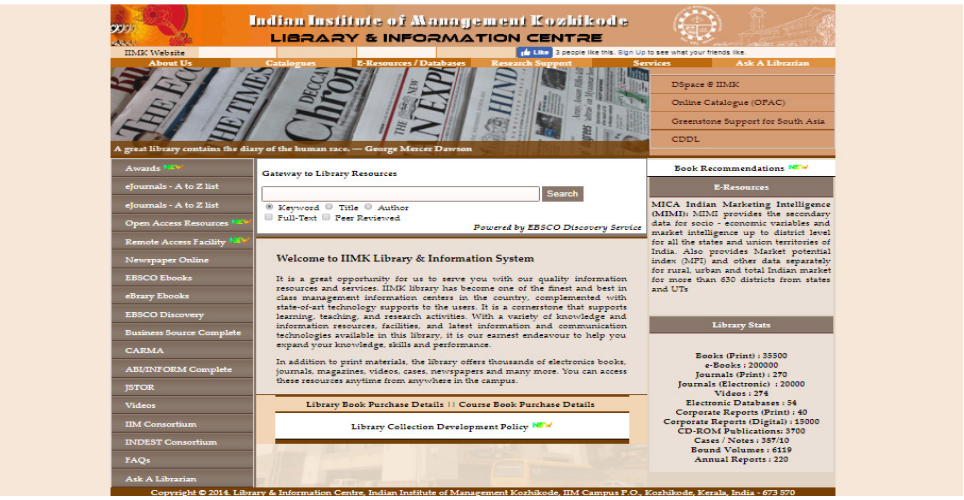
Contact Details

Name of the Institute	Indian Institute of Management Lucknow
Address of the Library	Gyanodaya Library, Indian Institute of Management Lucknow, Prabandh Nagar, IIM Road, Lucknow – 226 013
Establishment year	1985
Name of the Library	Gyanodaya Library of Indian Institute of Management Lucknow
Name of the Librarian/ Library In-charge	Mr. Mahendra Kumar Singh
Contact No.:	0522-2736965
E-mail:	librarian@iiml.ac.in

3.3.2.5 Library and Information Centre, Indian Institute of Management Kozhikode

The Indian Institute of Management Kozhikode (IIMK) is management school situated in Calicut (Kozhikode), Kerala. In 1996, the institute was initiated by the Government of India in association with the State Government of Kerala. The institute runs a complete range of management academic activities including training, research, teaching, consulting.

The institute focuses on the expansion of analytical skills. The institute library has one of the premium and best in class management knowledge centers in the India along with state-of-art technology to supports teaching and learning. Library has variety of latest information resources and facilities. Presently IIMK library consists of 35500 Books, 200000 e-Books, 270 Print Journals, 20000 e-Journals, 274 Videos, 54 Electronic Databases, 40 Corporate Reports, 15000 Corporate Reports (electronic), 3700 CD-ROM Publications, 387/10 Cases/Notes, 6119 Bound Volumes, and 220 Annual Reports.



Screenshot 21: Website of Library and Information Centre, IIM Kozhikode

(Source: http://www.iimk.ac.in/libportal)

Contact Details

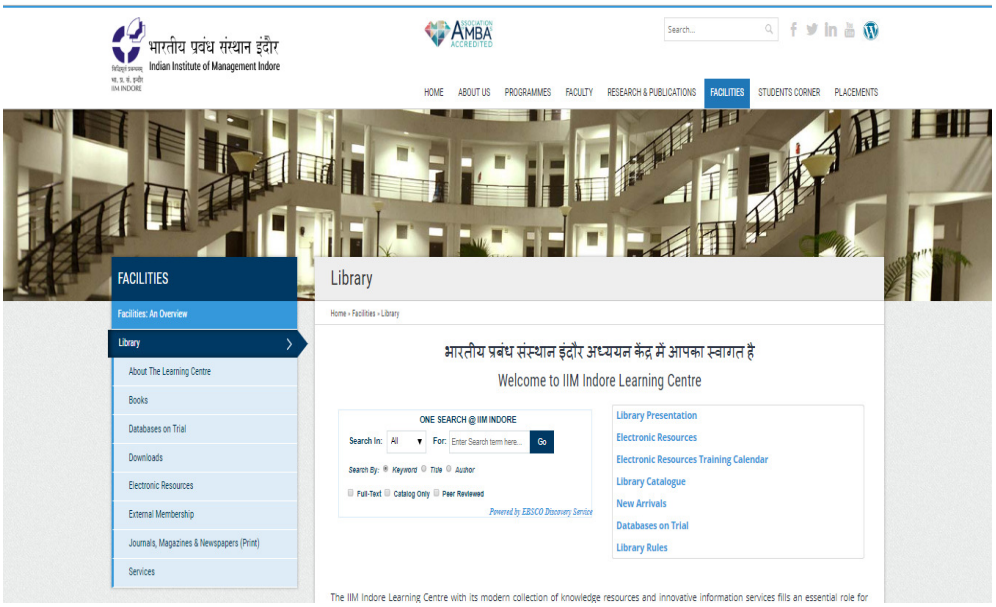
Name of the Institute	Indian Institute of Management Kozhikode
Address of the Library	Library & Information Centre, Indian Institute of Management Kozhikode, IIM Campus P.O., Kozhikode, Kerala, India - 673 570
Establishment year	1996
Name of the Library	Library and Information Centre of Indian Institute of Management Kozhikode
Name of the Librarian/ Library In-charge	Dr. M.G. Sreekumar
Contact No.:	clio@iimk.ac.in; mgsree@iimk.ac.in
E-mail:	0495-2809140

3.3.2.6 Learning Centre, Indian Institute of Management Indore

The Indian Institute of Management Indore (IIM Indore) was established in 1996. This institute is promoted and nurtured by the Ministry of Human Resource Development, Government of India and comes under "Institute of National Importance" under the Indian Institutes of Management Act 2017. The Learning Centre is having wide range of collection consists of various information sources and pioneering information services, through which it provides a vital obligatory in the academic pursuits for various studying students, faculties and the surrounding community of the institute.

The entire library collection consists of print journals, books, magazines and newspapers alongside wide variety of e-resources including e-books, e-journals, online databases, CD-ROM collection etc., which are available through the Institute's intranet. Library building has a rambling space about 27,000 sq. ft., equipped with

central air-conditioning. Library has approx. 64 Databases, 10000+ e-Journals, 250000 e-Books, 33000 Print Books, 6913 Bound Journals, 64 Print Journals & Magazines and 17 Newspapers.



Screenshot 22: Website of Learning Centre, IIM Indore

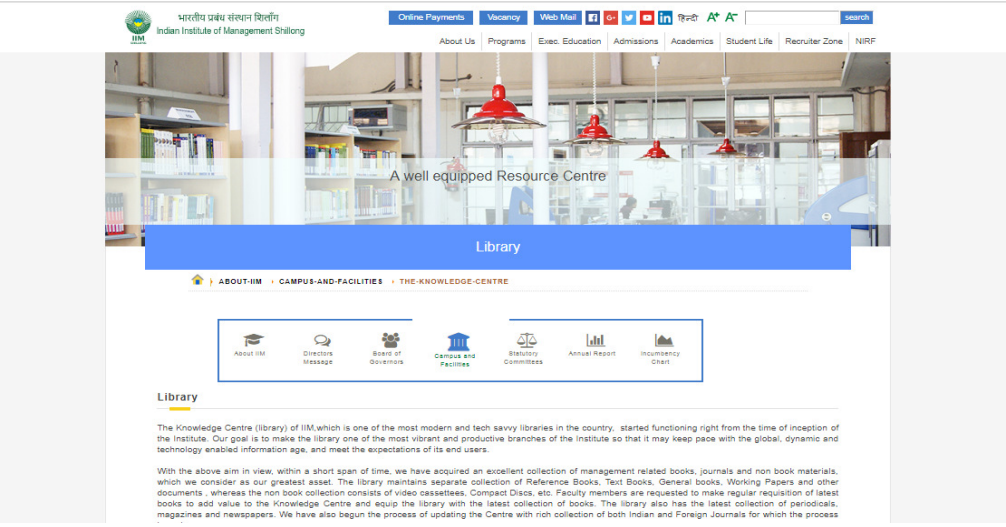
(Source: https://www.iimidr.ac.in/facilities/library/)

Contact Details

Name of the Institute	Indian Institute of Management Indore
Address of the Library	Learning Centre, Indian Institute of Management Indore, Prabandh Shikhar, Rau - Pithampur Road, Indore - 453556, Madhya Pradesh, India
Establishment year	1996
Name of the Library	Indian Institute of Management, Indore Learning Centre
Name of the Librarian/ Library In-charge	Appasaheb B. Naikal
Contact No.:	+91-731-2439626
E-mail:	appasahebn@iimidr.ac.in

3.3.2.7 Knowledge Centre, Indian Institute of Management Shillong

The Indian Institute of Management, Shillong (IIM Shillong) is located in the green contours of North-Eastern part of the India, started in 2008. The Knowledge Centre maintains various collections of Text Books, Reference Books, General books, Working Papers and other resources, whereas the digital collection consists of CDs, DVDs, video cassettes, CDs etc. Library also has access to current e-Resources like e-Books, e-Journals, and some Databases such as CMIE–Prowess, ISI-Emerging Markets, ProQuest, and EBSCO – Business Source Complete. Library has automated its in-house operations with VTLS software with RFID Library Management System.



Screenshot 23: Website of Knowledge Centre, IIM Shillong

(Source: https://www.iimshillong.ac.in/about-iim/campus-and-facilities/the-knowledge-centre)

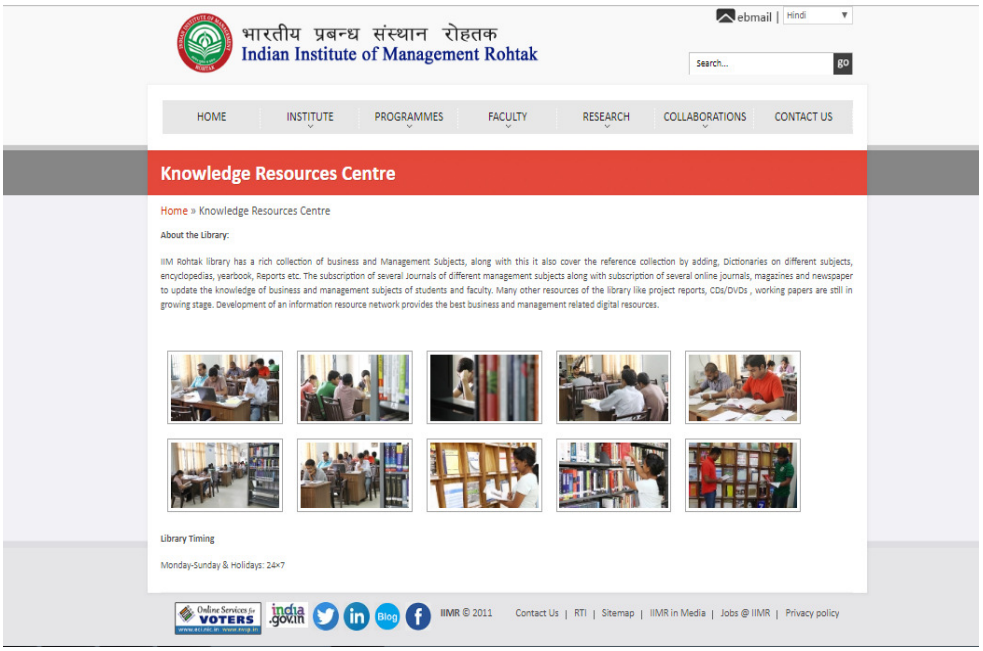
Contact Details

Name of the Institute	Indian Institute of Management Shillong
Address of the Library	Knowledge Centre, Rajiv Gandhi Indian Institute of Management, Shillong, Mayurbhanj Complex, Nongthymmai, East Khasi Hills District, Shillong, Meghalaya, Pin: 793014
Establishment year	2008
Name of the Library	Knowledge Centre, IIM Shillong

Name of the Librarian/ Library In-charge	Dr. Sudhir Kumar Jena
Contact No.:	0364-2308007, 9774514002
E-mail:	skj@iimshillong.in, drsudhirkumarjena@gmail.com

3.3.2.8 Library, Indian Institute of Management Rohtak

The Indian Institute of Management Rohtak (IIM Rohtak or IIM-R) is located in Rohtak, Haryana, India and established in 2009. IIM Rohtak library has an affluent collection on management and business subjects in the form of text books, encyclopedias, dictionaries on different subjects, reports, yearbook, etc. The library also subscribes several print and online journals from different management subjects along with newspapers and magazines. Several other resources of the library like project reports, CDs/DVDs, working papers are still in the emergent stage.



Screenshot 24: Website of Library, IIM Rohtak

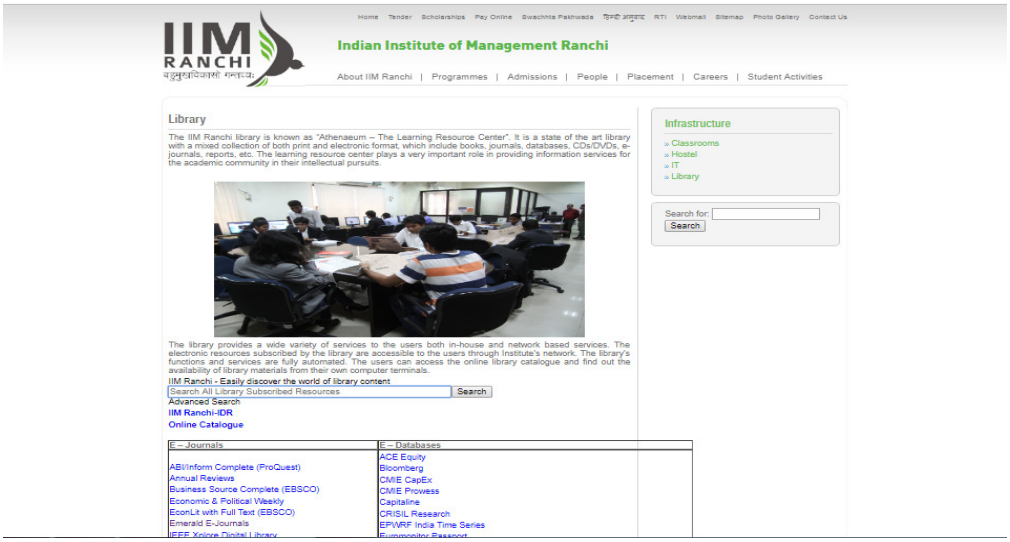
(Source: http://www.iimrohtak.ac.in/facilities/knowledge-resources-centre.htm)

Contact Details

Name of the Institute	Indian Institute of Management, Rohtak
Address of the Library	Library, Indian Institute of Management, Management City NH-10 Southern Bypass, Sunaria, Rohtak - 124010 Haryana, India
Establishment year	2009
Name of the Library	Library of Indian Institute of Management, Rohtak
Name of the Librarian/ Library In-charge	Sh. Kamal K. Joshi
Contact No.:	01262-228509
E-mail:	kamal.joshi@iimrohtak.ac.in, library@iimrohtak.ac.in

3.3.2.9 Athenaeum – The Learning Resource Center, Indian Institute of Management Ranchi

In 2010, the 9th Indian Institute of Management was established named Indian Institute of Management Ranchi or IIM Ranchi. This was made feasible with the extensive support of the Indian Institute of Management, Calcutta and the Government of Jharkhand. The name of IIM Ranchi library is "Athenaeum – The Learning Resource Center". Library has collection in both print and electronic format, such as journals, databases, books, CDs/DVDs, e-journals, e-books, reports etc. The Learning Resource Center of the institute plays a very vital role in providing resources and various services for the academic fraternity. The e-resources subscribed by the library are accessible through the Institute's network. The library's in-house functions and its services are fully automated.



Screenshot 25: Website of Athenaeum – The Learning Resource Center, IIM Ranchi

(Source: https://www.iimranchi.ac.in/?page_id=195)

Contact Details

Name of the Institute	Indian Institute of Management, Ranchi
Address of the Library	Library, Indian Institute of Management Ranchi, Suchana Bhawan, 5th Floor, Audrey House Campus, Meur's Road, Ranchi – 834 008
Establishment year	2010
Name of the Library	Athenaeum – The Learning Resource Centre of Indian Institute of Management, Ranchi
Name of the Librarian/ Library In-charge	Dr. Jayanta Kumar Tripathy
Contact No.:	9661080835
E-mail:	jayanta@iimranchi.ac.in

3.3.2.10 Library, Indian Institute of Management Raipur

In 2010, the Indian Institute of Management (IIM) has been set up by the Government of India, Ministry of Human Resource Development at Raipur, Chhattisgarh. The IIM Raipur has become an obligatory learning resource center for its researchers, students

and faculty members. The library has good collection of journals, books, magazines, newspapers and many other resources. Library offers to its user's handy access to the most excellent subject related digital resources through its subscription to various e-journals, e-databases and e-journals and other scholarly resources round the clock. For that remote access facility to access e-resources is also available on request.

Screenshot 26: Website of Library, IIM Raipur

(Sources: http://www.iimraipur.ac.in/index.php/home-lib)

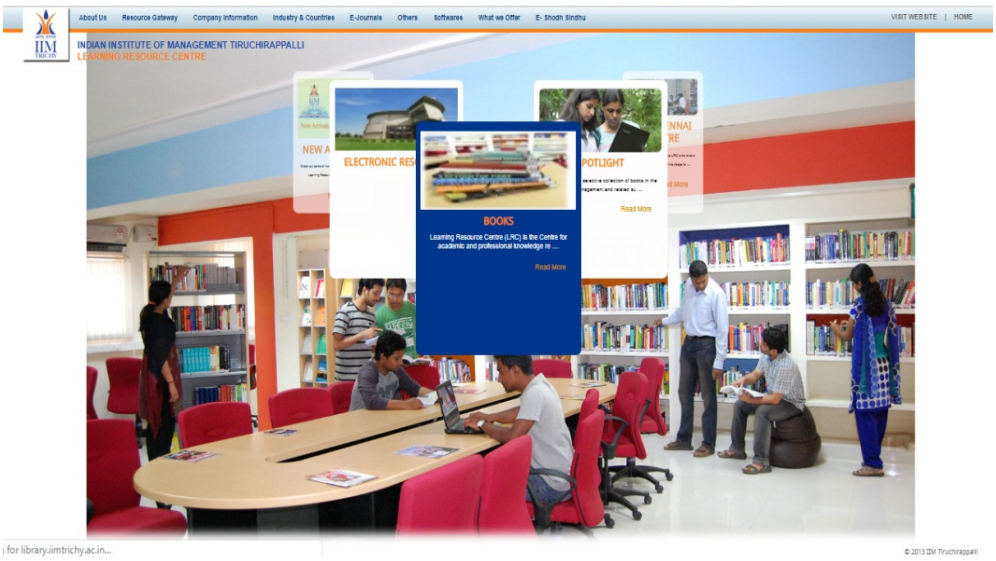
Contact Details

Name of the Institute	Indian Institute of Management, Raipur
Address of the Library	The Librarian, Indian Institute of Management Raipur, Atal Nagar, P. O. - Kurru (Abhanpur), Raipur – 493 661, Chhattisgarh, India
Establishment year	2010
Name of the Library	Library of Indian Institute of Management, Raipur
Name of the Librarian/ Library In-charge	Dr. C. K. Swain

Contact No.:	+91 771 2474639
E-mail:	librarian@iimraipur.ac.in

3.3.2.11 Learning Resource Centre, Indian Institute of Management Tiruchirappallli

The Indian Institute of Management Tiruchirappalli (IIM Tiruchirappalli) was established in 2011. The Library of the institute is called as Learning Resource Centre and principally premeditated to gather the necessities of the Institute's fraternities. The LRC enables their users for knowledge creation through its resources and services via electronic search platform and access to variety of resources on and off campus. LRC have automated its in-house activities with the help of RFID technology which enable easy circulation of documents and also provides ease and flexibility of access to the students. The LRC houses a notable collection of books and journals, which enables students to access variety of full-text scholarly articles in the field of Management Science and other related fields.



Screenshot 27: Website of Learning Resource Centre, IIM Tiruchirappalli

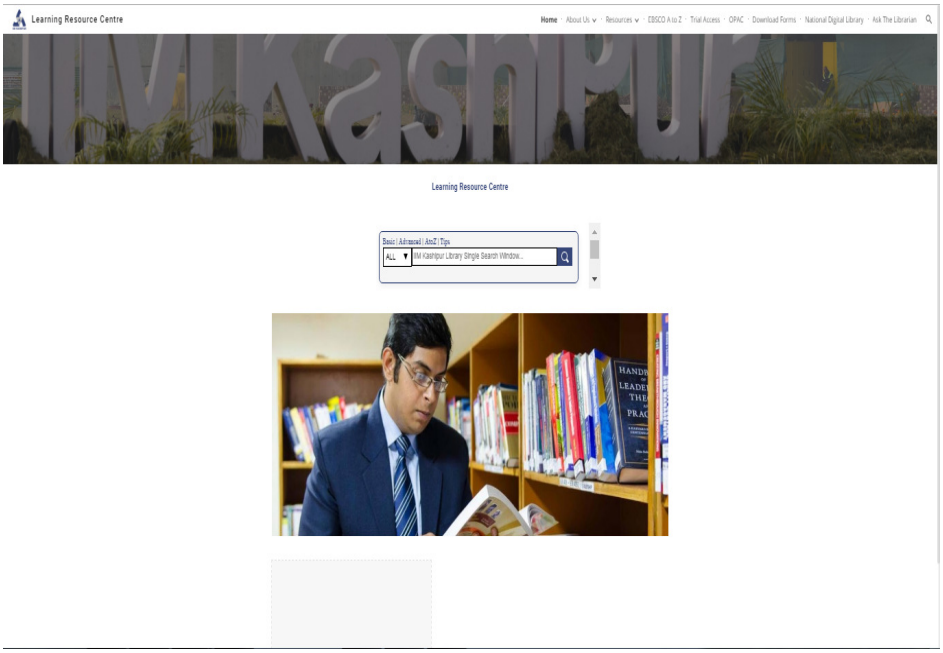
(Source: http://library.iimtrichy.ac.in)

Contact Details

Name of the Institute	Indian Institute of Management Tiruchirappalli
Address of the Library	Learning Resource Centre, Indian Institute of Management Tiruchirappalli, Pudukottai Main Road, Chinna Sooriyur Village, Tiruchirappalli, Tamil Nadu, PIN: 620024
Establishment year	2011
Name of the Library	Learning Resource Centre
Name of the Librarian/ Library In-charge	Dr. K. Elavazhagan
Contact No.:	0431-2505045
E-mail:	ela@iimtrichy.ac.in

3.3.2.12 Learning Resource Centre, Indian Institute of Management Kashipur

The Indian Institute of Management Kashipur (IIM Kashipur) established in July 2011 under the mentorship of IIM Lucknow. The LRC consists of around 5000 books, numerous e-resources of related to management and other related. The non-print collection includes CD/DVDs, audio/video cassettes and various e-resources such as e-journals of Springer Link, EBSCO Host, Emerald, ABI/INFORM etc. The LRC is a member of e-ShodhSindhu. The LRC is housed in separate air-conditioned building and connected with high-speed Internet and Intranet of IIM Kashipur network. All the in-house activities of LRC are automated, including Smart ID cards for their users, On-line Public Access Catalogue (OPAC) terminals for LRC catalogue search and also have an integrated electromagnetic security system with RFID for the safety of LRC materials.



Screenshot 28: Website of Learning Resource Centre, IIM Kashipur

(Source: https://sites.google.com/iimkashipur.ac.in/library)

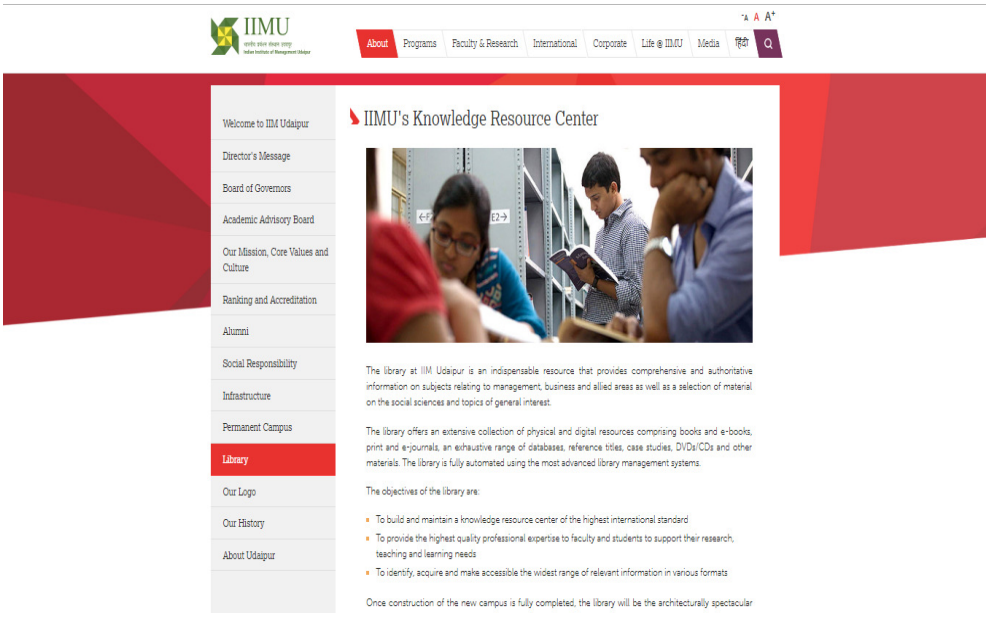
Contact Details

Name of the Institute	Indian Institute of Management Kashipur
Address of the Library	Learning Resource Centre, Indian Institute of Management Kashipur, Kundeshwari, Kashipur, Uttarakhand, Pin: 244713
Establishment year	2011
Name of the Library	Learning Resource Centre
Name of the Librarian/ Library In-charge	Mr. Sanjeev K. Jha
Contact No.:	+91-9720164423
E-mail:	sanjeev.jha@iimkashipur.ac.in

3.3.2.13 Knowledge Resource Center, Indian Institute Management, Udaipur

The Indian Institute of Management, Udaipur (IIM Udaipur) was inaugurated on 30th July 2011 by C. P. Joshi, Minister of Road Transport and Highways. Its temporary campus was located at the Polymer Science Building of the Mohanlal Sukhadia

University (MLSU), Udaipur. The library of IIM Udaipur is an essential resource center that provides inclusive and dependable information on disciplines relating to business, management and other associated. The library have an widespread collection of print as well as digital resources consists of books and e-books, print and e-journals, a complete variety of online databases, case studies, reference titles, DVDs/CDs and other materials. The library automated its in-house functions using the most advanced library management systems.



Screenshot 29: Website of Knowledge Resource Center, IIM Udaipur

(Source: https://www.iimu.ac.in/about/library)

Contact Details

Name of the Institute	Indian Institute of Management Udaipur
Address of the Library	Knowledge Resource Center, Indian Institute of Management Udaipur, Balicha, Udaipur-313001, Rajasthan, India
Establishment year	2011
Name of the Library	Knowledge Resource Centre
Name of the Librarian/ Library In-charge	Dr. Arvind Sharma

Contact No.:	0294-2477139
E-mail:	arvind.sharma@iimu.ac.in

REFERENCES:

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Institutions, Government of India. (2018). IIM. Accessed on 10 June 2018, From https://mhrd.gov.in/iims

IIT Gandhinagar. (2017). Central Library. Accessed on 10 June 2018, From https://www.iitgn.ac.in/library.htm

IIT Bhubaneshwar. (2017). Central Library. Accessed on 10 June 2018, From http://library.iitbbs.ac.in/

IIT Madras. (2017). Central Library. Accessed on 10 June 2018, From http://www.cenlib.iitm.ac.in/

IIT Guwahati. (2017). Lakshminath Bezbaroa Central Library. Accessed on 10 June 2018, From http://www.iitg.ac.in/lib/

IIT Indore. (2017). Central Library. Accessed on 10 June 2018, From http://library.iiti.ac.in/

IIT Kanpur. (2017). Purushottam Kashinath Kelkar Library. Accessed on 10 June 2018, From http://pkklib.iitk.ac.in/

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IIT Kharagpur. (2017). Central Library. Accessed on 10 June 2018, From http://www.library.iitkgp.ac.in/

IIT Hyderabad. (2017). Library. Accessed on 10 June 2018, From https://library.iith.ac.in/

IIT Mumbai. (2017). Central Library. Accessed on 10 June 2018, From http://www.library.iitb.ac.in/

IIT Patna. (2017). Central Library. Accessed on 10 June 2018, From http://library.iitp.ac.in/index.php/index.html

IIT Delhi. (2017). Central Library. Accessed on 10 June 2018, From http://library.iitd.ac.in/

IIT Ropar. (2017). Central Library. Accessed on 10 June 2018, From http://www.iitrpr.ac.in/about-library

IIT Mandi. (2017). Central Library. Accessed on 10 June 2018, From http://library.iitmandi.ac.in/

IIT Roorkee. (2017). Mahatma Gandhi Central Library. Accessed on 10 June 2018, From http://mgcl.iitr.ac.in/

IIT Varanasi. (2017). Main Library. Accessed on 10 June 2018, From https://www.iitbhu.ac.in/cf/lib

IIM Ahmedabad. (2017). Vikram Sarabhai Library Accessed on 10 June 2018, From http://library.iima.ac.in/

IIM Bangalore. (2017). Library. Accessed on 10 June 2018, From http://library.iimb.ac.in/library

IIM Raipur. (2017). Library. Accessed on 10 June 2018, From http://www.iimraipur.ac.in/index.php/home-lib

IIM Rohtak. (2017). Library Accessed on 10 June 2018, From http://www.iimrohtak.ac.in/facilities/knowledge-resources-centre.html

IIM Ranchi. (2017). Athenaeum – The Learning Resource Center. Accessed on 10 June 2018, From https://www.iimranchi.ac.in/?page_id=195

IIM Kozhikode. (2017). Library and Information Centre Accessed on 10 June 2018, From http://www.iimk.ac.in/libportal/

IIM Kolkata. (2017). B. C. Roy Memorial Library Accessed on 10 June 2018, From http://library.iimcal.ac.in/

IIM Lucknow. (2017). Gyanodaya Library Accessed on 10 June 2018, From http://www.iiml.ac.in/facilities/library

IIM Indore (2017). Learning Centre Accessed on 10 June 2018, From https://www.iimidr.ac.in/facilities/library/

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IIM Tiruchirappalli. (2017). Learning Resource Centre Accessed on 10 June 2018, From http://library.iimtrichy.ac.in

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Chapter – 4: ANALYSIS OF DATA & PRESENTATION OF FINDINGS

4.1 Introduction

Data analysis and interpretation is an integral method of assigning meaning to the primary collected data and on the basis of that, determining the conclusions, significance and implications of the findings. It is a significant and exciting step in the process of research. In all research studies, analysis follows data collection. According to C. R. Kothari (1989), "The term analysis refers to the computation of measures along with searching for patterns of relationship that exist among data-groups". Methodology is the main part in of any research work.

The success of the research depends upon the methodology applied in the study. So, methodology should be very systematic in the research. It shows the pathway from the very beginning to the end of research. The nature of present research was exploratory; and applied qualitative research methods with the elements of quantitative analysis also. Maxwell (2005) stated that, the ability to elucidate local processes, meanings, and contextual influences in particular settings or cases are the main strength of qualitative research. Strauss & Corbin (1998) stated that qualitative research appeals to non-mathematical process of interpretation, carried out for the purpose of discovering concepts and relationships in raw data and then organizing these into a theoretical explanatory scheme.

The procedures which were followed in the study are described as follows:

a) Literature search for collection of parameters
b) Details of the tools employed

c) Scope of the study

d) Phases of data collection

e) Procedure of data collection

f) Pilot study

g) Final data collection

4.2 Literature Search

To carry out literature search, various e-resources such as Springer, Taylor & Francis, Emerald, Google Scholar, Shodhganga, Shodhgangotri and other Web based resources regarding the research topic have been consulted. Besides these, many primary sources such as books, journals, theses and conference proceedings etc. related to the research topic have been consulted also.

4.3 Details of the Tools Employed

There is no standard parameter available to analyze the usability of the library websites. In this study, the researcher has adopted the necessary elements from the following standards, guidelines, and theses to analyze the usability of selected IITs and IIMs libraries' website:

a) Homepage Usability, 50 Websites Deconstructed (Nielsen & Tahir, 2001).

b) Usability Analysis of Websites of Libraries and Information Centres of ICMR, CSIR & ICSSR (Kalra, 2014).

c) Credibility of University Websites in Tamil Nadu. *DESIDOC Journal of Library & Information Technology* (Ramesh Babu, B., Narendra Kumar, A.M. & Gopalkrishnan, S., 2009).

d) A Comparative Study of Academic Libraries' Websites in Malaysia (Abdullah, A., 2001).

e) Usability of the Academic Websites of Jordan's Universities: An Evaluative Study. *The International Arab Conference on Information Technology* (Mustafa, S. & Al-Zoua'bi, L., 2008).

f) *Webometric Studies and Libraries*. Ess Ess Publications (Shukla, A., & Tripathi, A., 2015).

g) Establishing Content Awareness Evaluation Criteria for Library Websites: A Case Study of Indian Academic Library Websites. *Annals of Library and Information Studies* (Shukla, Akhandanand & Tripathi, Aditya., 2010).

4.4 Scope of the Study

The study was limited to 29 libraries' websites of India which includes 16 Indian Institutes of Technology (IITs) and 13 Indian Institutes of Management (IIMs). Thus, there are 29 reputed academic library websites which have been covered under the present study are as follows:

Table 4.1: List of Indian Institutes of Technology (IITs)

SN	Name of Indian Institutes of Technology
1.	Indian Institute of Technology, Kharagpur
2.	Indian Institute of Technology, Mumbai
3.	Indian Institute of Technology, Madras
4.	Indian Institute of Technology, Kanpur
5.	Indian Institute of Technology, Delhi
6.	Indian Institute of Technology, Guwahati
7.	Indian Institute of Technology, Roorkee
8.	Indian Institute of Technology, Gandhinagar

9.	Indian Institute of Technology, Bhubaneshwar
10.	Indian Institute of Technology, Jodhpur
11.	Indian Institute of Technology, Hyderabad
12.	Indian Institute of Technology, Patna
13.	Indian Institute of Technology, Ropar
14.	Indian Institute of Technology, Indore
15.	Indian Institute of Technology, Mandi
16.	Indian Institute of Technology, Varanasi

(Source: http://mhrd.gov.in/print/iits)

Table 4.2: List of Indian Institutes of Management (IIMs)

SN	**Name of Indian Institutes of Management**
1.	Indian Institute of Management, Calcutta
2.	Indian Institute of Management, Ahmedabad
3.	Indian Institute of Management, Bangalore
4.	Indian Institute of Management, Lucknow
5.	Indian Institute of Management, Kozhikode
6.	Indian Institute of Management, Indore
7.	Indian Institute of Management, Shillong
8.	Indian Institute of Management, Rohtak
9.	Indian Institute of Management, Ranchi
10.	Indian Institute of Management, Raipur
11.	Indian Institute of Management, Tiruchirappalli
12.	Indian Institute of Management, Kashipur
13.	Indian Institute of Management, Udaipur

(Source: http://mhrd.gov.in/print/iims)

4.5 Phases of Data Collection

The data have been collected in three phases with definite time lag between each phase. The details of the three phases of data collection have been given in Table 4.3.

Table 4.3: Three Phases of Data Collection

SN	Institutes / Phases	IITs Libraries' website	IIMs Libraries' website
1	Pilot study based on draft parameters	5th August, 2017 – 30th October, 2017	5th August, 2017 – 30th October, 2017
2	1st Phase of data collection	10th December, 2017 – 20th February, 2018	10th December, 2017 – 20th February, 2018
3	2nd Phase of data collection	5th May, 2018 – 10th July, 2018	5th May, 2018 – 10th July, 2018
4	Changes (if any) during 1st to 2nd Phase of data collection	No major changes in the terms of usability were found. Some minor changes like increase in the numbers of books, journals, magazines, newspapers and e-resource collections have been observed.	No major changes in the terms of usability were found. Some minor changes like increase in the numbers of books, journals, magazines, newspapers and e-resource collections have been observed.
5	3rd Phase of data collection	2nd September, 2018 – 10th November, 2018	2nd September, 2018 – 10th November, 2018
6	Changes (if any) during 2nd to 3rd Phase of data collection	No major changes in the terms of usability were found. Some minor changes like increase in the numbers of books, journals, magazines, newspapers and e-resource collections have been observed.	No major changes in the terms of usability were found. Some minor changes like increase in the numbers of books, journals, magazines, newspapers and e-resource collections have been observed.

4.6 Procedure of Data Collection

For this purpose, the survey and observation methods were employed to collect primary data from the library websites of IITs and IIMs. The quantitative rating system (1 and 0) was designed to determine the evaluation checklist. The "1" is used for 'Yes' i.e. the terms or parameters are present on the selected library websites and "0" is used for 'No' i.e. the terms/parameters are not available on the selected library websites. The system of using "1" and "0" makes the data analysis easy and converts qualitative data into quantitative data for easy evaluation. The collected data were arranged into simple tabular form in Microsoft Excel Worksheet. There were several tables made for the collection of huge amount of data. These data were collected institute wise i.e. for IITs & IIMs.

Further, data has been collected under 12 main heads/categories which consist of 102 parameters (Annexure-II). The twelve main heads are as follows:

i) *About Library Website*

As per the prepared checklist, under this heading maximum data/information were collected related to the library website such as separate website, page title with informative words, the home page of the site has a memorable URL, site load-time is reasonable, website map, multi-lingual options, browser related information e.g. browser support, resolution, etc., visitor counter, webmaster e-mail, website update information etc.

ii) *About Library Home Page*

As per the prepared checklist, under this heading maximum data/information were collected related to the library homepage such as the items on the home page are clearly focused on users' key tasks, product categories are provided and clearly visible on the homepage, show the library name or logo in reasonable and noticeable location, archiving and accessing past events, related information with appropriate heading, emphasize the highest priority etc.

iii) *General Information & Services on the Library Website*

As per the prepared checklist, the above stated head covers all the data/ information related to library and its services offered to its users such as Library Opening Hours, Library Staff, Library Rules & Regulations, Library News & Updates, About Library, Library Committee, ICT Infrastructure, Links to (working) Web-OPAC, Link to Institutional Repository, Link to Plagiarism, "Contact Us" link on Library Homepage, Physical address such as e-mail, Maps, FAQ/Help, Web forms etc.

iv) *Date and Time*

The date and time head covers the date and time data/ information available on the Libraries' Websites.

v) *Content Writing*

The content writings include the visibility and availability of all the contents on the library websites and includes the following sub-heads such as adequate text-to-background contrast, font size/spacing is easy to read, flash & add-ons are used carefully, images have appropriate ALT tags, site has custom not-found/404 page,

major headings are clear & descriptive, critical content is above the "fold", styles & colors are consistent, emphasis (bold, etc.) is used carefully, ads & pop-ups are unobtrusive, main copy is concise & explanatory, URLs are meaningful & user-friendly, page titles are explanatory, the site is free of typographic errors and spelling mistakes, the library website has appropriate help functions, user friendly language, avoid redundant contents, spell out abbreviations & acronyms.

vi) *Graphics and Animations*

The graphics and animations include the media files available on the library websites and its' layout. Its sub-heads are alternate tags for images & links, avoid watermark graphics, and control on scrolling and blinking contents.

vii) *Navigation Features*

The navigation features of any website plays a very important role. It navigates the users to their desired information. Its sub-heads are: main navigation is easily identifiable, navigation labels are clear & concise, number of buttons/links is reasonable, library logo is linked to home-page, links are consistent & easy to identify, active link for homepage, path information for each pages, links with informative words, links colors etc.

viii) *Searching Features*

Website searching is very important for any website; it enables it's users to get their desired information from single window. Its sub-heads are: search box at homepage, search box should be wide & clearly visible, site search is easy to access etc.

ix) *Identity & Credibility*

The identity and credibility of websites is determined by its hosting institution, its sub-heads are: library logo is prominently placed, tagline makes institutes purpose clear, the content is up-to-date, authoritative and trustworthy, clear path to library information, clear path to contact information, copyright information is clearly mentioned, library use, privacy & disclaimer statement properly stated etc.

x) *Web 2.0 Applications*

Nowadays Web 2.0 tools are very common and effective way to reach users; its sub-heads are: Blogs, Wikis, Bookmarking and Tagging, Social Networking Sites, Calendaring and Podcast/Vodcast etc.

xi) *URL of the Homepage*

URL of any website acts as address for webpage. Its sub-heads are: recall value of the website, responsiveness with both **www.** & **domain name**.

xii) *Online Evaluation Tools*

In the present study, online evaluation tools were used to assess the usability of the selected library websites such as, Global Rank, Rank in India, Google Page Rank, Mobile friendly test, Page load time @ 56K Connection rate in sec., Total objects, Images, CSS, Page Size, Script, HTML size, Image Size, Script Size, CSS Size, Internal Links, and External Links etc.

4.7 Pilot Study

A pilot study was conducted at the very beginning of the research work to check the feasibility of the tools employed for study. The pilot study was conducted on five IITs and five IIMs libraries' websites. Based on the pilot study results, categorization of usability features at suitable places has been done.

4.8 Final Data Collection

Based on the results of pilot study, usability parameters have been categorized and finalized for three phases of data collections. There were three months time lag has been maintained between each phase of data collection. To observe the significant changes in the usability of libraries' website, time lag has been given. The data have been collected and stored in MS-Excel for easy calculation and analysis.

4.9 Data Analysis

In the present study, the collected data from the selected IITs and IIMs libraries' website were tabulated and analyzed. The study includes 16 IITs and 13 IIMs Libraries' Websites of India. There are total of 29 selected institute's libraries' website, which were taken under the study.

4.9.1 IITs Libraries' Websites

By the prepared checklist, data were collected for 16 IITs libraries' websites as well as organized and tabulated. The qualitative and quantitative outcomes of the IITs libraries' website were recorded in the following tables.

4.9.1.1 About Library Website

Table 4.4 reflects that all the selected IITs libraries have their own library website and their website have suitable titles and with a memorable title. From the selected sixteen IITs Libraries' Websites, majority (94%) of the IITs Libraries' Websites have reasonable load time while rest 6% takes more time to load. There were 44% Libraries' Websites have webmasters e-mail while majority of the libraries (56%) does not have such information. Webmasters e-mail or webmasters contact information helps users to contact the website administrators during problem they faced in accessing of websites. There were 31% Libraries' Websites which have mentioned about website update date on their website while majority (69%) of the libraries does not. Website update date or time stamp is very important aspect which shows the frequency and time of update of the website. Some of the Libraries' Websites (19%) have mentioned browser-related information on their website while rests (81%) does not. Browser related information enables users to know the supported web browsers for easy accessing of the particular website. There were 13% IITs libraries which have given websites map while a big group (87%) of IITs libraries does not feel importance of website map. Multi-lingual options and website visitor counters were also neglected by the majority (87%) of IITs Libraries' Websites while 13% IITs have mentioned such information on their library website.

Table 4.4: About Library Website

S. No.	Parameters \ Institutes	IIT Gandhinagar	IIT Bhubaneshwar	IIT Madras	IIT Guwahati	IIT Indore	IIT Kanpur	IIT Jodhpur	IIT Kharagpur	IIT Hyderabad	IIT Mumbai	IIT Patna	IIT Delhi	IIT Ropar	IIT Mandi	IIT Roorkee	IIT Varanasi	**Total**	**Percentage**
1	Separate website	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
2	Page title with informative words	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
3	The home page of the site has a memorable URL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
4	Site load-time is reasonable	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	**15**	**94**
5	Webmaster e-mail	1	1	1	1	0	0	1	0	0	0	1	0	1	0	0	0	**7**	**44**
6	Website update date	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	1	**5**	**31**
7	Browser related information	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	**3**	**19**
8	Website map	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**2**	**13**
9	Multi-Lingual Options	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	**2**	**13**
10	Visitor Counter	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	**2**	**13**
Total Points		**6**	**5**	**4**	**6**	**4**	**4**	**5**	**5**	**5**	**4**	**9**	**4**	**9**	**4**	**5**	**5**		
Percentage		**60**	**50**	**40**	**60**	**40**	**40**	**50**	**50**	**50**	**40**	**90**	**40**	**90**	**40**	**50**	**50**		

(Source: primary data)

Through multi-lingual option, any user can change the webpage language and read in his/her desired language while website visitor counter displays the number of unique visitor daily on particular website or webpage. Based on the total 10 parameters of "About Library Website", IIT Patna and IIT Ropar libraries' websites have fulfilled 90% of usability features while IIT Gandhinagar and IIT Guwahati libraries' websites have 60% usability features. Rests of the IITs libraries' websites have 40%-50% usability features.

4.9.1.2 About Library Home Page

The library name and logo creates a good impact on the website viewers and add authenticity to the website. In this regard, Table 4.5 shows that, all IITs libraries have library name or logo at a reasonable and noticeable location. The information on the websites should be clearly focused on the key tasks and study found that majority (94%) of the IITs libraries' websites are clearly focused on information content. Similarly majority (94%) libraries' websites have categorized products which are clearly visible to the users. Majority of libraries (94%) have emphasized the priority of information on their websites while 6% does not. Appropriate headings and its related information in the website provide systematic arrangement of information which users can easily access and 88% IITs libraries' websites are in-tuned with this feature. Archiving of past events creates good impact on the users. By this user can access the past information from the websites such as notices, circulars, new arrivals, events etc. from the websites; and 75% libraries are archiving and providing accessibility to their past events to the users while 25% are silent about this. Based on the total 6 parameters of "About Library Home Page", 75% IITs Libraries' Websites have fulfilled 100% usability features while IIT Hyderabad has only 17% usability

features. IIT Gandhinagar and IIT Madras have 83% usability features while IIT Kharagpur has 67% usability features.

Table 4.5: About Library Home Page

S. No.	Parameters \ Institutions	IIT Gandhinagar	IIT Bhubaneshwar	IIT Madras	IIT Guwahati	IIT Indore	IIT Kanpur	IIT Jodhpur	IIT Kharagpur	IIT Hyderabad	IIT Mumbai	IIT Patna	IIT Delhi	IIT Ropar	IIT Mandi	IIT Roorkee	IIT Varanasi	**Total**	**Percentage**
1	Items on the website are clearly focused on key tasks	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
2	Product categories are clearly visible	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
3	Library name or logo in reasonable and noticeable location	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
4	Archiving and accessing past events	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	**12**	**75**
5	Related information with appropriate heading	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	**14**	**88**
6	Emphasize the highest priority	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
Total		**5**	**6**	**5**	**6**	**6**	**6**	**6**	**4**	**1**	**6**	**6**	**6**	**6**	**6**	**6**	**6**		
Percentage		**83**	**100**	**83**	**100**	**100**	**100**	**100**	**67**	**17**	**100**	**100**	**100**	**100**	**100**	**100**	**100**		

(Source: primary data)

4.9.1.3.1 General Information & Services on the Libraries' Websites

Table 4.6 implicates that all the selected IITs library websites have mentioned their Opening Hours and about their Library information on their websites. This basic information saves the time of users and enables them to know about the library, its collection and services. The basic information regarding library staff, general library rules and regulations, library news and updates, library ICT infrastructure, link to institutional repository and plagiarism checking facility are to be placed on the website but from the selected sixteen Libraries' Websites, 94% libraries have mentioned it. Further 88% libraries' websites have mentioned about their library committee, 63% have working link of their Online Public Access Catalogue (OPAC) on their websites. Further, IIT Bhubaneshwar, IIT Madras, IIT Guwahati, IIT Indore, IIT Kanpur, IIT Kharagpur, IIT Mumbai, IIT Delhi and IIT Ropar Libraries' Websites have all usability features under the head of "General Information & Services". IIT Gandhinagar, IIT Jodhpur, IIT Patna, IIT Mandi and IIT Roorkee libraries' websites have 90% usability features while IIT Varanasi library website has 80% usability features. IIT Hyderabad library website has 30% usability features which is the least amongst all IITs libraries' websites.

Table 4.6a: General Information & Services on Libraries' Websites

S. No.	Institutions / Parameters	IIT Gandhinagar	IIT Bhubaneshwar	IIT Madras	IIT Guwahati	IIT Indore	IIT Kanpur	IIT Jodhpur	IIT Kharagpur	IIT Hyderabad	IIT Mumbai	IIT Patna	IIT Delhi	IIT Ropar	IIT Mandi	IIT Roorkee	IIT Varanasi	**Total**	**Percentage**
1	Opening Hours	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
2	Library Staff	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
3	Library Rules & Regulations	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
4	Library News/ Updates	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
5	About Library	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
6	Library Committee	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**14**	**88**
7	ICT Infrastructure	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
8	Links to (working) Web-OPAC	1	1	1	1	1	1	0	1	0	1	0	1	1	0	0	0	**10**	**63**
9	Link to IR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	**15**	**94**
10	Link to Plagiarism	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
Total		**9**	**10**	**10**	**10**	**10**	**10**	**9**	**10**	**3**	**10**	**9**	**10**	**10**	**9**	**9**	**8**		
Percentage		**90**	**100**	**100**	**100**	**100**	**100**	**90**	**100**	**30**	**100**	**90**	**100**	**100**	**90**	**90**	**80**		

(Source: primary data)

4.9.1.3.2 Contact Us on Libraries' Websites

Table 4.6b shows that all the IITs libraries' websites have Contact Us, Physical Address and E-mail address on their library websites. The "Contact Us" information enables viewers to reach the library easily through telephonic contact or e-mail; through physical address users can reach to the library or may have correspondence. There are 31% of the selected Libraries' Websites used Geo-location tools such as Google Maps or other for providing location information while IIT Gandhinagar, IIT Madras and IIT Mumbai libraries' websites have web forms for contacting. There are 50% libraries have Frequently Asked Questions or Help options for their users. Frequently Asked Questions (FAQ) saves the time of library users as well as library staff also. It acts as a virtual reference service and assists library users to solve their general type of queries. It consists of set of general questions along with their answers. IIT Gandhinagar, IIT Madras and IIT Mumbai libraries' websites have full usability features under "Contact Us" head followed by IIT Bhubaneshwar with 87% usability features, IIT Kanpur, IIT Jodhpur, IIT Patna, IIT Delhi and IIT Ropar Libraries' Websites with 67% usability features while rests of the IITs Libraries' Websites have 50% usability features.

Table 4.6b: Contact Us on Libraries' Websites

S. No.	Institutions / Parameters	IIT Gandhinagar	IIT Bhubaneshwar	IIT Madras	IIT Guwahati	IIT Indore	IIT Kanpur	IIT Jodhpur	IIT Kharagpur	IIT Hyderabad	IIT Mumbai	IIT Patna	IIT Delhi	IIT Ropar	IIT Mandi	IIT Roorkee	IIT Varanasi	**Total**	**Percentage**
1	"Contact Us" link	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
2	Physical address	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
3	e-mail	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
4	Maps	1	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	**5**	**31**
5	FAQ	1	1	1	0	0	1	1	0	0	1	1	1	0	0	0	0	**8**	**50**
6	Web forms	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	**3**	**19**
Total		**6**	**5**	**6**	**3**	**3**	**4**	**4**	**3**	**3**	**6**	**4**	**4**	**4**	**3**	**3**	**3**		
Percentage		**100**	**83**	**100**	**50**	**50**	**67**	**67**	**50**	**50**	**100**	**67**	**67**	**67**	**50**	**50**	**50**		

(Source: primary data)

4.9.1.4 Date and Time on Libraries' Websites

Table 4.7 states that IIT Madras, IIT Guwahati, and IIT Jodhpur libraries' websites have used "Date and Time" usability feature on their library website with International Time Zone; and among them IIT Guwahati and IIT Jodhpur have spelled out "Date and Month".

Table 4.7: Date and Time on Libraries' Websites

SN	Parameters / Institutes	Date and Time	International time zone	Spell out month and date	**Total**	**%**
1	IIT Gandhinagar	0	0	0	**0**	**0**
2	IIT Bhubaneshwar	0	0	0	**0**	**0**
3	IIT Indore	0	0	0	**0**	**0**
4	IIT Kanpur	0	0	0	**0**	**0**
5	IIT Kharagpur	0	0	0	**0**	**0**
6	IIT Hyderabad	0	0	0	**0**	**0**
7	IIT Mumbai	0	0	0	**0**	**0**
8	IIT Patna	0	0	0	**0**	**0**
9	IIT Delhi	0	0	0	**0**	**0**
10	IIT Ropar	0	0	0	**0**	**0**
11	IIT Mandi	0	0	0	**0**	**0**
12	IIT Roorkee	0	0	0	**0**	**0**
13	IIT Varanasi	0	0	0	**0**	**0**
14	IIT Madras	1	1	0	**2**	**67**
15	IIT Guwahati	1	1	1	**3**	**100**
16	IIT Jodhpur	1	1	1	**3**	**100**
Total		**3**	**3**	**2**		
Percentage		**19**	**19**	**13**		

4.9.1.5 Content Writing on Libraries' Websites

On the observation of Table 4.8, it has been found that all the sixteen selected IITs Libraries' Websites have adequate text-to-background contrast, Font size/spacing is easy to read, Flash & add-ons are used carefully, Critical content is above the "fold", Styles & colors are consistent, Emphasis (bold, etc.) is used carefully, Adds & pop-ups are unobtrusive, Main copy is concise & explanatory, URLs are meaningful & user-friendly, Page titles are explanatory, site is free from typographic errors and spelling mistakes, user friendly language and avoided redundant contents on their library website. These are basic and most desired website content creation principles which enables the viewers to for better exploration of the website. The systematic arrangement of heading provides systematic and relevant information under the one umbrella, 94% of the library websites have their major headings are clear & descriptive while rest are not. The alternate image tags acts as a meta-tags, which enables viewers as a media for information about the particular images and also increases the image accessibility and visibility on the Internet and 88% of the selected library websites have Images appropriate ALT tags in their most of Images. The 404 error represents the unavailability of any particular resources, so the websites administrators have to design custom not-found page with proper information so that viewer can understand and report the same to website administrator, 81% Site has custom not-found/404 page. Through the help functions websites users can get easy assistance for their queries immediately and 81% of the selected library websites has these functions and they also spell out abbreviations & acronyms on their library websites. IIT Bhubaneshwar, IIT Madras, IIT Guwahati, IIT Indore, IIT Kanpur, IIT Jodhpur, IIT Mumbai, IIT Patna, IIT Delhi and IIT Roorkee Libraries' Websites have all the usability features under the head of "Content Writings" while IIT Kharagpur,

IIT Ropar, IIT Mandi and IIT Varanasi Libraries' Websites have 94% of the usability features on their library websites. IIT Hyderabad library website has 89% of usability features whereas IIT Gandhinagar library website has 78% usability features which is the least amongst all IITs libraries' websites.

Table 4.8: Content Writings on Libraries' Websites

SN	Parameters \ Institutes	IIT Gandhinagar	IIT Bhubaneshwar	IIT Madras	IIT Guwahati	IIT Indore	IIT Kanpur	IIT Jodhpur	IIT Kharagpur	IIT Hyderabad	IIT Mumbai	IIT Patna	IIT Delhi	IIT Ropar	IIT Mandi	IIT Roorkee	IIT Varanasi	**Total**	**Percentage**
1.	Adequate text-to-background contrast	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
2.	Font size/spacing is easy to read	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
3.	Flash & add-ons are used carefully	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
4.	Critical content is above the "fold"	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
5.	Styles & colors are consistent	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
6.	Emphasis (bold, etc.) is used carefully	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
7.	Ads & pop-ups are unobtrusive	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
8.	Main copy is concise & explanatory	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
9.	URLs are meaningful & user-friendly	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**

SN	Institutes / Parameters	IIT Gandhinagar	IIT Bhubaneshwar	IIT Madras	IIT Guwahati	IIT Indore	IIT Kanpur	IIT Jodhpur	IIT Kharagpur	IIT Hyderabad	IIT Mumbai	IIT Patna	IIT Delhi	IIT Ropar	IIT Mandi	IIT Roorkee	IIT Varanasi	**Total**	**Percentage**
10.	Page titles are explanatory	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
11.	The site is free of typographic errors and spelling mistakes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
12.	User friendly language	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
13.	Avoid redundant contents	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
14.	Major headings are clear & descriptive	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**15**	**94**
15.	Images have appropriate ALT tags	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	**14**	**88**
16.	Site has custom not-found/404 page	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	**13**	**81**
17.	The library website has appropriate help functions.	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	**14**	**88**
18.	Spell out Abbreviations & Acronyms	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**14**	**88**
Total		**14**	**18**	**18**	**18**	**18**	**18**	**18**	**17**	**16**	**18**	**18**	**18**	**17**	**17**	**18**	**17**		
Percentage		**78**	**100**	**100**	**100**	**100**	**100**	**100**	**94**	**89**	**100**	**100**	**100**	**94**	**94**	**100**	**94**		

(Source: primary data)

4.9.1.6 Graphics and Animations on Libraries' Websites

Table 4.9 depicts that alternate tags act as a general source of information for new users. It can be used for providing alternate information to the users. The alternate tags can be used with multiple file formats or links such as Images, Audios, Videos or other file formats. There are 88% IITs libraries' websites have used alternate tags on their library websites with most of the files. The watermarked graphics puts negative impacts to the users, so all the selected Libraries' Websites have avoided it and also have effective control on blinking contents. Further IIT Gandhinagar, IIT Bhubaneshwar, IIT Madras, IIT Guwahati, IIT Indore, IIT Kanpur, IIT Jodhpur, IIT Kharagpur, IIT Hyderabad, IIT Mumbai, IIT Patna, IIT Delhi, IIT Ropar, and IIT Mandi libraries' websites have all the usability features under the head of "Graphics and Animations" while IIT Roorkee and IIT Varanasi libraries' websites have 67% of usability features.

Table 4.9: Graphics and Animations on Libraries' Websites

SN	Parameters / Institutes	Alternate Tags for Images & Links	Avoid watermark graphics	Control on scrolling and blinking contents	**Total**	**%**
1.	IIT Gandhinagar	1	1	1	**3**	**100**
2.	IIT Bhubaneshwar	1	1	1	**3**	**100**
3.	IIT Madras	1	1	1	**3**	**100**
4.	IIT Guwahati	1	1	1	**3**	**100**
5.	IIT Indore	1	1	1	**3**	**100**
6.	IIT Kanpur	1	1	1	**3**	**100**
7.	IIT Jodhpur	1	1	1	**3**	**100**
8.	IIT Kharagpur	1	1	1	**3**	**100**
9.	IIT Hyderabad	1	1	1	**3**	**100**

10.	IIT Mumbai	1	1	1	**3**	**100**
11.	IIT Patna	1	1	1	**3**	**100**
12.	IIT Delhi	1	1	1	**3**	**100**
13.	IIT Ropar	1	1	1	**3**	**100**
14.	IIT Mandi	1	1	1	**3**	**100**
15.	IIT Roorkee	0	1	1	**2**	**67**
16.	IIT Varanasi	0	1	1	**2**	**67**
Total		**14**	**16**	**16**		
Percentage		**88**	**100**	**100**		

4.9.1.7 Navigation Features on Libraries' Websites

Table 4.10 discusses about the navigation features on the libraries' websites. Navigation is very important for any website because it navigates users to their desired information. From the selected IITs libraries' websites, all of them have easily identifiable navigations and their navigation labels are clear & concise, links are consistent & easy to identify. Home page links are those links which redirect users to homepage of the website in one click and 94% of the Libraries' Websites have their active link for the institute homepage. The button and links acts as access to various resources and services, their usages and arrangement on the webpage must be ensured because excess buttons and links on the webpage distracts users, and from the selected Libraries' Websites 88% Libraries' Websites have reasonable number of buttons/ links on their Libraries' Websites while 12% Libraries' Websites have un-arranged buttons and links; 88% of the selected Libraries' Websites have linked their library logo to their institute home-page, path information for each pages, visited links colors and 81% of the library have links with informative words. IIT Bhubaneshwar, IIT Madras, IIT Guwahati, IIT Indore, IIT Kanpur, IIT Jodhpur, IIT Mumbai, IIT Patna, IIT Delhi, IIT Ropar, IIT Roorkee and IIT Varanasi libraries' websites have all the

usability features under the head of “Navigation Features” followed by IIT Gandhinagar library website with 78% usability features, IIT Kharagpur and IIT Hyderabad Libraries’ Websites with 67% usability features and IIT Mandi library website with 57% usability features.

Table 4.10: Navigation Features on Libraries' Websites

S. No.	Parameters \ Institutes	IIT Gandhinagar	IIT Bhubaneshwar	IIT Madras	IIT Guwahati	IIT Indore	IIT Kanpur	IIT Jodhpur	IIT Kharagpur	IIT Hyderabad	IIT Mumbai	IIT Patna	IIT Delhi	IIT Ropar	IIT Mandi	IIT Roorkee	IIT Varanasi	**Total**	**Percentage**
1	Main navigation is easily identifiable	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
2	Navigation labels are clear & concise	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
3	Links are consistent & easy to identify	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
4	Active link for homepage	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	**15**	**94**
5	Number of buttons/links is reasonable	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	**14**	**88**
6	Library logo is linked to home-page	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	**14**	**88**
7	Path information for each pages	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	**14**	**88**
8	links colors	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	**14**	**88**
9	links with informative words	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	1	**13**	**81**
Total		**7**	**9**	**9**	**9**	**9**	**9**	**9**	**6**	**6**	**9**	**9**	**9**	**9**	**5**	**9**	**9**		
Percentage		**78**	**100**	**100**	**100**	**100**	**100**	**100**	**67**	**67**	**100**	**100**	**100**	**100**	**56**	**100**	**100**		

(Source: primary data)

4.9.1.8 Searching Features on Libraries' Websites

Table 4.11 discuss about the searching features on the selected IITs libraries' website. Search box allows users to search the particular websites and easily get what they are looking for. From the selected library websites of IITs, 56% of them have search box at their library homepage which is wide and clearly visible while 38% libraries' websites have site search facility which is easy to access. IIT Gandhinagar, IIT Guwahati, IIT Kanpur, IIT Mumbai, IIT Ropar and IIT Varanasi Libraries' Websites have all the selected usability features under the head of "Searching Features" followed by IIT Jodhpur, IIT Hyderabad and IIT Delhi with 67% usability features and rests of IITs Libraries' Websites have no website searching facility available.

Table 4.11: Searching Features on Libraries' Websites

SN	Parameters / Institutes	Search box at homepage	Search box should be wide & clearly visible	Site search is easy to access	**Total**	**%**
1.	IIT Gandhinagar	1	1	1	**3**	**100**
2.	IIT Guwahati	1	1	1	**3**	**100**
3.	IIT Kanpur	1	1	1	**3**	**100**
4.	IIT Mumbai	1	1	1	**3**	**100**
5.	IIT Ropar	1	1	1	**3**	**100**
6.	IIT Varanasi	1	1	1	**3**	**100**
7.	IIT Jodhpur	1	1	0	**2**	**67**
8.	IIT Hyderabad	1	1	0	**2**	**67**
9.	IIT Delhi	1	1	0	**2**	**67**
10.	IIT Bhubaneshwar	0	0	0	**0**	**0**
11.	IIT Madras	0	0	0	**0**	**0**
12.	IIT Indore	0	0	0	**0**	**0**

13.	IIT Kharagpur	0	0	0	**0**	**0**
14.	IIT Patna	0	0	0	**0**	**0**
15.	IIT Mandi	0	0	0	**0**	**0**
16.	IIT Roorkee	0	0	0	**0**	**0**
Total		**9**	**9**	**6**		
Percentage		**56**	**56**	**38**		

4.9.1.9 Identity and Credibility of Libraries' Websites

Table 4.12 shows that all the selected IITs Libraries' Websites tagline makes their institute's purpose clear and also have clear path to their contact information, from that 94% of the library websites logo is prominently placed, their content is up-to-date, authoritative and trustworthy, and clear path to library information. From the selected Libraries' Websites, 44% library website's copyright information is clearly mentioned, Library use, Privacy & Disclaimer statement properly stated. IIT Bhubaneshwar, IIT Madras, IIT Guwahati, IIT Patna, IIT Delhi and IIT Ropar Libraries' Websites have all the selected usability features under the head of "Identity & Credibility" followed by IIT Kanpur library website with 87% usability features, IIT Gandhinagar, IIT Indore, IIT Jodhpur, IIT Kharagpur, IIT Mumbai, IIT Mandi, IIT Roorkee, IIT Varanasi and IIT Hyderabad Libraries' Websites with 71% usability features.

Table 4.12: Identity & Credibility of IITs Libraries' Websites

SN	Parameters \ Institutes	IIT Gandhinagar	IIT Bhubaneshwar	IIT Madras	IIT Guwahati	IIT Indore	IIT Kanpur	IIT Jodhpur	IIT Kharagpur	IIT Hyderabad	IIT Mumbai	IIT Patna	IIT Delhi	IIT Ropar	IIT Mandi	IIT Roorkee	IIT Varanasi	**Total**	**Percentage**
1	Tagline makes Institutes purpose clear	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
2	Clear path to contact information	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**16**	**100**
3	Library logo is prominently placed	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**15**	**94**
4	The content is up-to-date, authoritative and trustworthy	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
5	Clear path to Library information	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	**15**	**94**
6	Copyright information is clearly mentioned	1	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0	**7**	**44**
7	Library use, Privacy & Disclaimer statement properly stated	0	1	1	1	0	1	0	0	0	0	1	1	1	0	0	0	**7**	**44**
Total		**5**	**7**	**7**	**7**	**5**	**6**	**5**	**5**	**3**	**5**	**7**	**7**	**7**	**5**	**5**	**5**		
Percentage		**71**	**100**	**100**	**100**	**71**	**86**	**71**	**71**	**43**	**71**	**100**	**100**	**100**	**71**	**71**	**71**		

(Source: primary data)

4.9.1.10 Web 2.0 Applications on Libraries' Websites

Table 4.13 depicts that 31% IITs Libraries' Websites are using Social Networking Sites which is less. Nowadays many people are using social networking sites and library websites administrators use this opportunity to reach large number of their users. About 25% libraries' websites are using podcast/vodcast in the form of YouTube, 13% are using Blogs and few (6%) are using Wikis, Bookmarking/Tagging and Calendaring. IIT Mumbai library website has 83% of usability features under the "Use of Web 2.0 Applications" followed by IIT Gandhinagar, IIT Jodhpur, IIT Hyderabad and IIT Patna Libraries' Websites with 33% usability features, IIT Ropar library website has 17% usability features while rests of the IITs libraries' websites have not used any Web 2.0 applications on their libraries' websites.

Table 4.13: Web 2.0 Applications on Libraries' Websites

SN	Parameters / Institutions	Social Networking Sites	Podcast/ Vodcast	Blogs	Wikis	Bookmarking and Tagging	Calendaring	**Total**	**Percentage**
1	IIT Mumbai	1	1	1	1	1	0	**5**	**83**
2	IIT Gandhinagar	1	1	0	0	0	0	**2**	**33**
3	IIT Jodhpur	1	1	0	0	0	0	**2**	**33**
4	IIT Hyderabad	0	0	1	0	0	1	**2**	**33**
5	IIT Patna	1	1	0	0	0	0	**2**	**33**
6	IIT Ropar	1	0	0	0	0	0	**1**	**17**
7	IIT Bhubaneshwar	0	0	0	0	0	0	**0**	**0**
8	IIT Madras	0	0	0	0	0	0	**0**	**0**
9	IIT Guwahati	0	0	0	0	0	0	**0**	**0**
10	IIT Indore	0	0	0	0	0	0	**0**	**0**
11	IIT Kanpur	0	0	0	0	0	0	**0**	**0**

12	IIT Kharagpur	0	0	0	0	0	0	**0**	**0**
13	IIT Delhi	0	0	0	0	0	0	**0**	**0**
14	IIT Mandi	0	0	0	0	0	0	**0**	**0**
15	IIT Roorkee	0	0	0	0	0	0	**0**	**0**
16	IIT Varanasi	0	0	0	0	0	0	**0**	**0**
Total		**5**	**4**	**2**	**1**	**1**	**1**		
Percentage		**31**	**25**	**13**	**6**	**6**	**6**		

4.9.1.11 URL of the Homepage on Libraries' Websites

Table 4.14 shows that all the selected library websites have recall value and responsiveness to both **www.** and **domain name** (ex. mzu.edu.in) except IIT Patna library website. This enables their users to remember the URL of website and recall them whenever they need, about 69% of the selected IITs libraries' websites have link visited and not visited distinguishing usability features. IIT Gandhinagar, IIT Bhubaneshwar, IIT Madras, IIT Indore, IIT Kanpur, IIT Jodhpur, IIT Kharagpur, IIT Mumbai, IIT Delhi, IIT Roorkee and IIT Varanasi libraries' websites have all the usability features under the usability parameters head "URL of Homepage" followed by IIT Guwahati, IIT Hyderabad, IIT Ropar and IIT Mandi libraries' websites having 80% of the usability features. IIT Patna library website has 60% of the usability features which is the least amongst all IITs libraries' websites.

Table 4.14: URL of Libraries' Websites

S N	Parameters / Institutes	Recall value	Responsiveness with both www. & domain name	Level of domain name	URL is easy to remember	Distinguish between visited and not visited links	**Total**	**%**
1.	IIT Gandhinagar	1	1	1	1	1	**5**	**100**
2.	IIT Bhubaneshwar	1	1	1	1	1	**5**	**100**
3.	IIT Madras	1	1	1	1	1	**5**	**100**
4.	IIT Guwahati	1	1	1	1	0	**4**	**80**
5.	IIT Indore	1	1	1	1	1	**5**	**100**
6.	IIT Kanpur	1	1	1	1	1	**5**	**100**
7.	IIT Jodhpur	1	1	1	1	1	**5**	**100**
8.	IIT Kharagpur	1	1	1	1	1	**5**	**100**
9.	IIT Hyderabad	1	1	1	1	0	**4**	**80**
10.	IIT Mumbai	1	1	1	1	1	**5**	**100**
11.	IIT Patna	1	1	1	0	0	**3**	**60**
12.	IIT Delhi	1	1	1	1	1	**5**	**100**
13.	IIT Ropar	1	1	1	1	0	**4**	**80**
14.	IIT Mandi	1	1	1	1	0	**4**	**80**
15.	IIT Roorkee	1	1	1	1	1	**5**	**100**
16.	IIT Varanasi	1	1	1	1	1	**5**	**100**
Total		**16**	**16**	**16**	**15**	**11**		
Percentage		**100**	**100**	**100**	**93.75**	**68.75**		

4.9.1.12 Online Evaluation Tools

4.9.1.12.1 Global Rank of Libraries' Websites

Alexa Traffic Rank is a ranking system set by **www.alexa.com** which is calculated by using a combination of average daily visits to the selected websites and number of page views on the selected sites over the past 3 months globally.

The site with the highest combination of visitors and page views may be ranked at 1. As per the Table 4.15 and Fig. 4.1, Alexa Traffic Rank shows that IIT Madras was on the top with 3406 rank followed by IIT Kanpur (6224 rank), IIT Kharagpur (7000 rank), IIT Mumbai (7133 rank), IIT Delhi (11209 rank), and IIT Guwahati (14161 rank) etc.

Table 4.15: Global Rank of Libraries' Websites

SN	Name of Institute	Global Rank
1.	IIT Madras	3406
2.	IIT Kanpur	6224
3.	IIT Kharagpur	7000
4.	IIT Mumbai	7133
5.	IIT Delhi	11209
6.	IIT Guwahati	14161
7.	IIT Roorkee	26842
8.	IIT Varanasi	33081
9.	IIT Mandi	51610
10.	IIT Indore	57416
11.	IIT Gandhinagar	57925
12.	IIT Hyderabad	57932
13.	IIT Bhubaneshwar	71689
14.	IIT Ropar	81173
15.	IIT Patna	85972
16.	IIT Jodhpur	126047

(Source: https://www.alexa.com/siteinfo/)

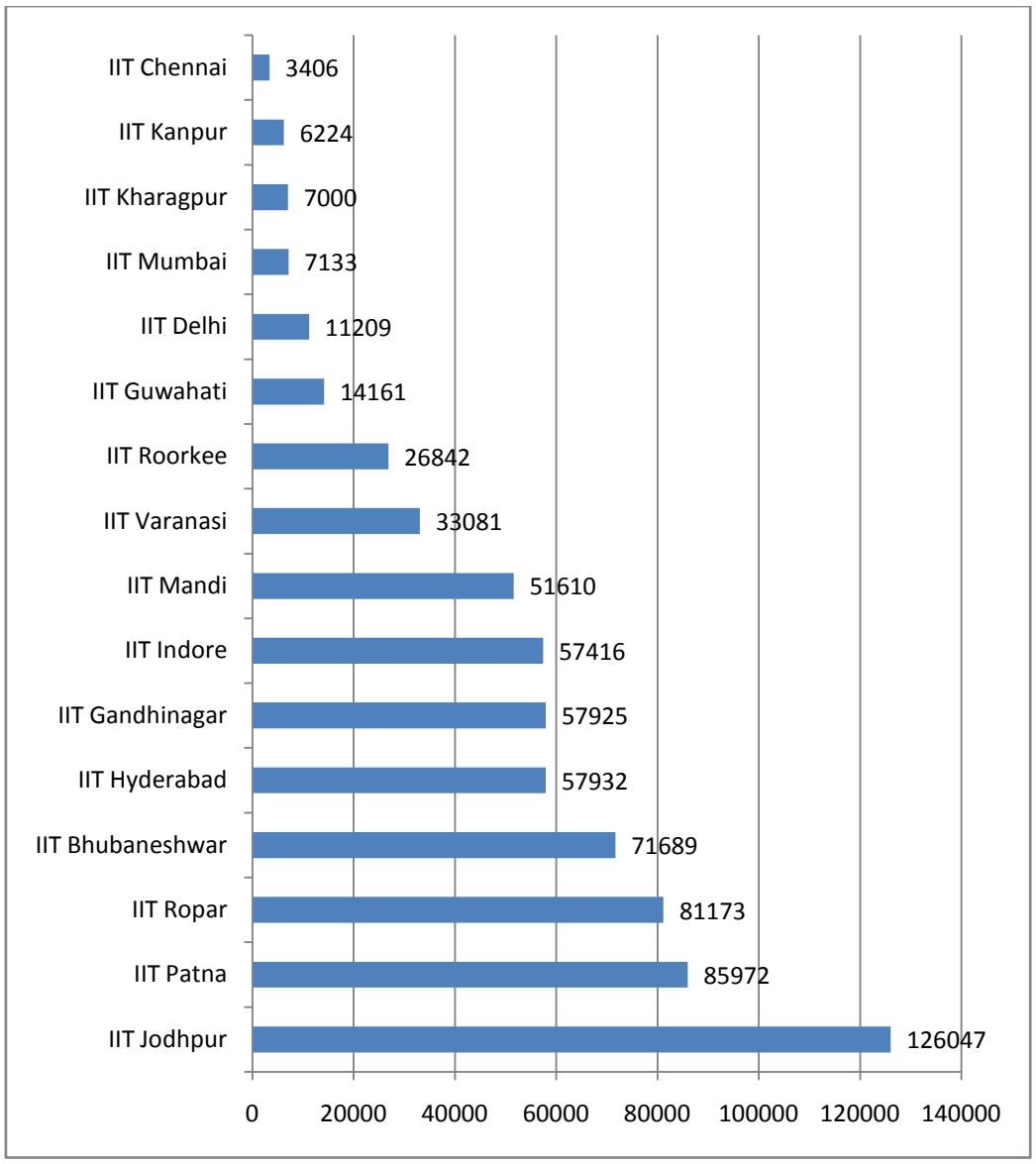

Fig. 4.1: Global Rank of IITs Libraries' Websites

4.9.1.12.2 Indian Rank of Libraries' Websites

Alexa Traffic Rank is having a facility to rank the websites of a particular region and rank them as per region wise. The website with the highest average combination of visitors and page views may be ranked at 1. As per the Table 4.16 and Fig. 4.2, Alexa Traffic Rank – India shows that IIT Madras was on the top with 331 rank followed by the IIT Kharagpur (486 rank), IIT Kanpur (519 rank), IIT Mumbai (569 rank), IIT Delhi (838 rank), and IIT Guwahati (1093 rank) etc.

Table 4.16: Indian Rank of Libraries' Websites

SN	Name of Institute	Rank in India
1.	IIT Madras	331
2.	IIT Kharagpur	486
3.	IIT Kanpur	519
4.	IIT Mumbai	569
5.	IIT Delhi	838
6.	IIT Guwahati	1093
7.	IIT Roorkee	2096
8.	IIT Varanasi	2201
9.	IIT Indore	4557
10.	IIT Gandhinagar	4749
11.	IIT Mandi	5005
12.	IIT Hyderabad	5104
13.	IIT Bhubaneshwar	5917
14.	IIT Ropar	6101
15.	IIT Patna	6153
16.	IIT Jodhpur	10146

(Source: https://www.alexa.com/siteinfo/)

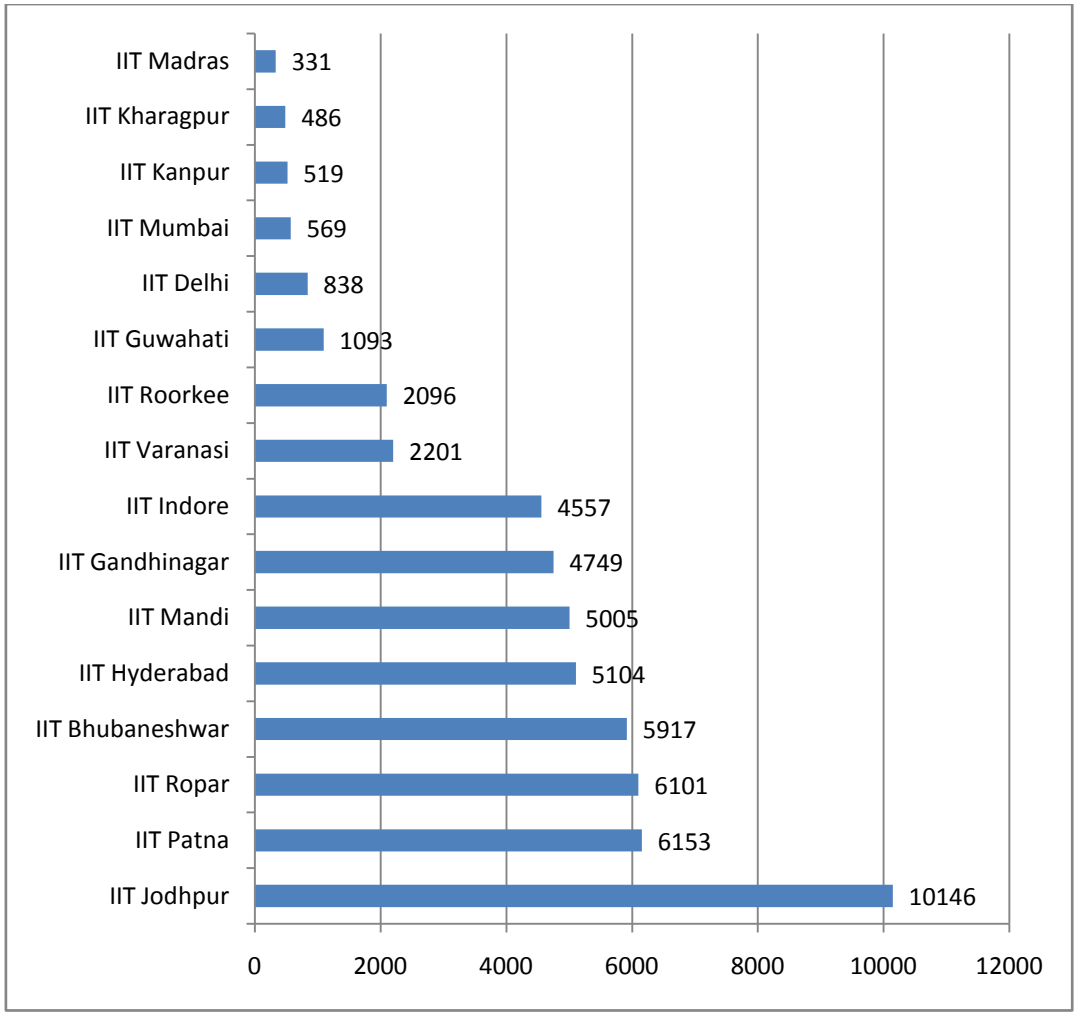

Fig. 4.2: Indian Rank of IITs Libraries' Websites

4.9.1.12.3 Comparison of Global Rank & Indian Rank

Table 4.17 is displaying the comparison between Global and Indian rank of selected library websites of IITs. It shows that IIT Kanpur has 2nd position with 6224 rank in Global ranking whereas in Indian ranking it is on 3rd position with 519 rank in India. Similarly IIT Mandi is on 9th position among IITs on Global ranking whereas placed on 11th position on Indian ranking; IIT Indore and IIT Gandhinagar also have the changes with their rankings.

Table 4.17: Comparison of Global Rank & Indian Rank

SN	Institute	Global Rank	Position among IITs	Rank in India	Position among IITs
1	IIT Madras	3406	1	331	1
2	**IIT Kanpur**	6224	2	519	**3**
3	**IIT Kharagpur**	7000	3	486	**2**
4	IIT Mumbai	7133	4	569	4
5	IIT Delhi	11209	5	838	5
6	IIT Guwahati	14161	6	1093	6
7	IIT Roorkee	26842	7	2096	7
8	IIT Varanasi	33081	8	2201	8
9	**IIT Mandi**	51610	9	5005	**11**
10	**IIT Indore**	57416	10	4557	**9**
11	**IIT Gandhinagar**	57925	11	4749	**10**
12	IIT Hyderabad	57932	12	5104	12
13	IIT Bhubaneshwar	71689	13	5917	13
14	IIT Ropar	81173	14	6101	14
15	IIT Patna	85972	15	6153	15
16	IIT Jodhpur	126047	16	10146	16

4.9.1.12.4 Google Page Rank of Libraries' Websites

Google Page Rank Checker or Google PR Checker is one of the few methods that determine the relevance or importance of a particular web page. Important or more significant pages tend to receive a higher Page Rank which is also more likely to appear at the top of the search engine results. The Google ranking of any page is based on the backlinks; the better quality is the backlinks the higher is the Google Page Rank. As per Table 4.18 IIT Jodhpur, IIT Patna, IIT Ropar, IIT Mandi, IIT Roorkee have scored Page Rank 7 which results higher page rank on the Google search results and better retrieval of visibility. Further IIT Gandhinagar, IIT Bhubaneshwar, IIT Guwahati, IIT Indore, IIT Kanpur, IIT Kharagpur, IIT Hyderabad, IIT Delhi, and IIT Varanasi have Page Rank 8 while IIT Madras and IIT Mumbai have Page Rank 9. It shows that IIT Madras and IIT Mumbai Libraries' websites have higher Page Rank than other IITs libraries' websites.

Table 4.18: Google Page Rank of Libraries' Websites

SN	Name of Institute	Google Page Rank
1.	IIT Madras	9
2.	IIT Mumbai	9
3.	IIT Gandhinagar	8
4.	IIT Bhubaneshwar	8
5.	IIT Guwahati	8
6.	IIT Indore	8
7.	IIT Kanpur	8
8.	IIT Kharagpur	8
9.	IIT Hyderabad	8
10.	IIT Delhi	8
11.	IIT Varanasi	8
12.	IIT Jodhpur	7
13.	IIT Patna	7
14.	IIT Ropar	7
15.	IIT Mandi	7
16.	IIT Roorkee	7

(Source: https://smallseotools.com/google-pagerank-checker/)

4.9.1.12.5 Mobile View Compatibility of Libraries' Websites

Table 4.19 depicts that the desktop version of a website might be difficult to view and use on a mobile device. The version that is not mobile-friendly requires the user to pinch or zoom in order to read the content. Users find this a frustrating experience and are likely to abandon the site. Alternatively, the mobile-friendly version is readable and immediately usable. From the 16 selected IITs libraries' websites, 44% of the libraries' websites are "mobile friendly" whereas rests are not compatible with mobile browsers.

Table 4.19: Mobile View Compatibility Libraries' Websites

SN	Name of Institute	Mobile Friendly Test
1	IIT Gandhinagar	0
2	IIT Bhubaneshwar	1
3	IIT Madras	1
4	IIT Guwahati	0
5	IIT Indore	1
6	IIT Kanpur	0

7	IIT Jodhpur	0
8	IIT Kharagpur	1
9	IIT Hyderabad	1
10	IIT Mumbai	0
11	IIT Patna	0
12	IIT Delhi	0
13	IIT Ropar	0
14	IIT Mandi	0
15	IIT Roorkee	1
16	IIT Varanasi	1

(Source: https://search.google.com/test/mobile-friendly?)

4.9.1.12.6 Page Load Time of Libraries' Websites

The principle of "saving the time of the reader" was codified in 1931 as one of S. R. Ranganathan's "Five Laws of Library Science." Ranganathan's defense of the user's time finds new expression today through the web, where a fast library website can save the user's time. The page load time depends upon three components of the website i.e. Page weight, page requests and page structure. The lesser page load time, the faster page loads on the web browser. As per the Table 4.20, IIT Varanasi has the least page load time i.e. 84.79 seconds which means its website load faster as compared to other IITs libraries' websites followed by IIT Guwahati (with 86.75 seconds), IIT Jodhpur (115 seconds), IIT Gandhinagar, IIT Ropar, and IIT Delhi etc. The average page load time for all the selected IITs libraries' websites is 221.29 seconds.

Table 4.20: Page Load Time of Libraries' Websites

SN	**Name of Institute**	**Page load time in seconds @ 56K Connection rate**
1.	IIT Varanasi	84.79
2.	IIT Guwahati	86.75
3.	IIT Jodhpur	115.00
4.	IIT Gandhinagar	120.55
5.	IIT Ropar	129.40
6.	IIT Delhi	133.14
7.	IIT Bhubaneshwar	157.20

8.	IIT Indore	166.59
9.	IIT Hyderabad	178.21
10.	IIT Madras	209.64
11.	IIT Kanpur	300.05
12.	IIT Roorkee	300.13
13.	IIT Mandi	300.21
14.	IIT Kharagpur	300.82
15.	IIT Mumbai	390.42
16.	IIT Patna	567.82

(Source: Data collected from analyze.websiteoptimization.com)

4.9.1.12.7 Total Objects on Libraries' Websites

Table 4.21 shows the objects on a particular website. These are total number of files used in design and development of that website. It may be any set of codes, javascripts, php files, etc. More number of objects responsible for webpage delay. Table 4.21 shows that IIT Delhi has the least number of objects i.e. 17 whereas IIT Hyderabad has the highest number of objects. On an average, there are 53 objects on IITs libraries' websites.

Table 4.21: No. of Objects on Libraries' Websites

SN	Name of Institute	No. of Objects
1.	IIT Delhi	17
2.	IIT Guwahati	18
3.	IIT Jodhpur	19
4.	IIT Kharagpur	24
5.	IIT Madras	28
6.	IIT Varanasi	31
7.	IIT Mandi	36
8.	IIT Ropar	43
9.	IIT Roorkee	45
10.	IIT Indore	46
11.	IIT Gandhinagar	56
12.	IIT Mumbai	74
13.	IIT Bhubaneshwar	75
14.	IIT Patna	98
15.	IIT Kanpur	111
16.	IIT Hyderabad	123

(Source: Data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.1.12.8 Total Images on Libraries' Websites

Table 4.22 reflects the total number of images on the selected IITs libraries' websites. IIT Delhi and IIT Ropar libraries' websites have the least number of images i.e. 6 images while IIT Patna library website has 71 images which is the highest among all IITs libraries' websites. Lesser the number of images leads faster loading of website. The average number of Images on selected IITs library websites is 30.

Table 4.22: No. of Images on Libraries' Websites

SN	Name of Institute	No. of Images
1.	IIT Delhi	6
2.	IIT Ropar	6
3.	IIT Guwahati	8
4.	IIT Madras	9
5.	IIT Varanasi	13
6.	IIT Jodhpur	15
7.	IIT Kharagpur	15
8.	IIT Mandi	24
9.	IIT Roorkee	24
10.	IIT Gandhinagar	29
11.	IIT Indore	38
12.	IIT Hyderabad	44
13.	IIT Mumbai	54
14.	IIT Bhubaneshwar	61
15.	IIT Kanpur	69
16.	IIT Patna	71

(Source: Data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.1.12.9 Size of Images on Libraries' Websites

Table 4.23 shows that IIT Delhi library website has the least image size i.e. 97425 bytes that enables them faster loading, easy browsing and increases its usability followed by IIT Guwahati (with 142011 bytes), IIT Varanasi (153092 bytes), IIT Hyderabad (220200 bytes) etc. IIT Mumbai library website has the highest size of images on its library website which leads to higher page load time (see Table 4.20). The average size of images on IITs libraries' websites is 1980212 bytes.

Table 4.23: Size of Images on Libraries' Websites

SN	Name of Institute	Size of Images (bytes)
1.	IIT Delhi	97425
2.	IIT Guwahati	142011
3.	IIT Varanasi	153092
4.	IIT Hyderabad	220200
5.	IIT Ropar	356515
6.	IIT Bhubaneshwar	382156
7.	IIT Patna	396361
8.	IIT Kharagpur	462422
9.	IIT Jodhpur	477964
10.	IIT Gandhinagar	479188
11.	IIT Madras	588516
12.	IIT Indore	725882
13.	IIT Roorkee	1017118
14.	IIT Mandi	1782579
15.	IIT Kanpur	5452595
16.	IIT Mumbai	17448340

(Source: Data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.1.12.10 CSS Files on Libraries' Websites

Table 4.24 shows the no. of CSS files available on libraries' websites. The maximum number of CSS files found in IIT Hyderabad library website (34) which is quite high and reducing these to one or two CSS files results faster loading of webpages. Combining, refine, and optimizing of CSS files enable progressive display. IIT Delhi, IIT Jodhpur and IIT Madras have single CSS file whereas IIT Indore does not have any CSS file. The average no. of CSS files in selected IITs libraries' websites is 9. Further Table 4.24 reflects the size of CSS files and found that IIT Kharagpur library website has the biggest CSS file size (1038090 bytes) which results slower loading of webpage. IIT Delhi library website has the least CSS file size (390 bytes) followed by IIT Mumbai, and IIT Madras. The average size of CSS files on IITs libraries' websites is 201957 bytes.

Table 4.24: No. & Size of CSS Files on Libraries' Websites

SN	Name of Institute	No. of CSS Files	Size of CSS Files
1.	IIT Indore	0	0
2.	IIT Madras	1	5425
3.	IIT Jodhpur	1	0
4.	IIT Delhi	1	390
5.	IIT Mumbai	2	3120
6.	IIT Mandi	3	115343
7.	IIT Guwahati	4	35627
8.	IIT Bhubaneshwar	5	144352
9.	IIT Kharagpur	5	1038090
10.	IIT Roorkee	5	262144
11.	IIT Patna	9	304087
12.	IIT Varanasi	9	534773
13.	IIT Kanpur	15	110100
14.	IIT Gandhinagar	19	21457
15.	IIT Ropar	23	142606
16.	IIT Hyderabad	34	513802

(Source: Data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.1.12.11 Size of Web Pages of Libraries' Websites

Total size of webpage effects the page load time, higher the size, takes more time to load. Table 4.25 shows that IIT Roorkee library website has the least size with 368250 bytes followed by IIT Ropar library website with 368050 bytes, IIT Guwahati library website with 417215 bytes whereas IIT Kanpur library website has the maximum sized website with 6291456 bytes. The average size of webpage of IITs libraries' websites is 1291429 bytes.

Table 4.25: Size of Webpage of Libraries' Websites

SN	Name of Institute	Size of Web page (bytes)
1.	IIT Ropar	368050
2.	IIT Roorkee	368250
3.	IIT Guwahati	417216
4.	IIT Patna	494927
5.	IIT Gandhinagar	548688
6.	IIT Jodhpur	557946
7.	IIT Varanasi	574619

8.	IIT Kharagpur	599785
9.	IIT Indore	789728
10.	IIT Madras	1023782
11.	IIT Bhubaneshwar	1055223
12.	IIT Delhi	1798261
13.	IIT Mandi	1855979
14.	IIT Mumbai	1884710
15.	IIT Hyderabad	2034237
16.	IIT Kanpur	6291456

(Source: Data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.1.12.12 Scripts on Libraries' Websites

Script files contains bundle of codes which are created for specific purposes for the functioning of the websites, more number of script file then more time websites takes to function because every time website have to run the script files. Table 4.26 shows that IIT Hyderabad has the highest number of scripts (38) followed by IIT Kanpur (20), IIT Mumbai (17) and IIT Madras (17), and IIT Ropar (11) etc. The average number of scripts in the selected IITs libraries' websites is 11. Further Table 4.26 represents size of scripts and found that IIT Jodhpur has the least script size (33593 bytes) on their library website while IIT Hyderabad library website has the maximum script size (964689 bytes). On an average, size of scripts in the selected IITs libraries' websites is 329840 bytes.

Table 4.26: No. & Size of Scripts in Libraries' Websites

SN	Name of Institute	No. of Scripts	Size of Scripts (bytes)
1.	IIT Jodhpur	2	33593
2.	IIT Kharagpur	2	157286
3.	IIT Guwahati	5	209421
4.	IIT Delhi	6	529192
5.	IIT Mandi	6	807403
6.	IIT Varanasi	6	315621
7.	IIT Gandhinagar	7	41535
8.	IIT Bhubaneshwar	7	159733
9.	IIT Indore	7	56444
10.	IIT Roorkee	9	238026

11.	IIT Patna	10	608174
12.	IIT Ropar	11	128974
13.	IIT Madras	17	405843
14.	IIT Mumbai	17	123424
15.	IIT Kanpur	20	498073
16.	IIT Hyderabad	38	964689

(Source: Data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.1.12.13 HTML Size of Libraries' Websites

The HTML size represents the size of webpage excluding other file types. Lighter the html page easier the websites works. Table 4.27 shows that IIT Gandhinagar library website has the least HTML size with 6508 bytes followed by IIT Indore (7402 bytes), IIT Mumbai (9826 bytes), IIT Delhi (23978 bytes) and so on. IIT Mandi library website has the heaviest HTML size among all IITs libraries' website (975175 bytes). The average HTML size of selected IITs libraries' websites is 329840 bytes.

Table 4.27: HTML Size of Libraries' Websites

SN	Name of Institute	HTML Size (bytes)
1.	IIT Gandhinagar	6508
2.	IIT Indore	7402
3.	IIT Mumbai	9826
4.	IIT Delhi	23978
5.	IIT Madras	23998
6.	IIT Bhubaneshwar	27285
7.	IIT Guwahati	30157
8.	IIT Jodhpur	46389
9.	IIT Hyderabad	62915
10.	IIT Kanpur	109051
11.	IIT Kharagpur	188743
12.	IIT Ropar	335544
13.	IIT Roorkee	419430
14.	IIT Varanasi	534773
15.	IIT Patna	943718
16.	IIT Mandi	975175

(Source: Data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.1.12.14 Links on of Libraries' Websites

Internal Links refers to any links from one webpage of any domain, which is linked to another page within the same domain. It can be linking to categories or main site navigation, within articles to related content or the footer etc. It has many advantages as it helps build page authority, usability, connections between other webpages of same domain, user experience, and potentially increase website rankings. As per the Table 4.28, IIT Varanasi library website has the highest number of *Internal Links* (103) followed by IIT Ropar (93), IIT Gandhinagar (90), IIT Kanpur (85), IIT Patna (63), IIT Jodhpur (61) etc. IIT Guwahati has the least *Internal Links* (8) amongst IITs libraries' websites. The average number of *Internal Links* on the selected libraries' websites of IITs is 55.

Table 4.28: No. of Internal & External Links on Libraries' Websites

SN	Name of Institute	Internal Links	External Links
1.	IIT Guwahati	8	15
2.	IIT Mandi	11	3
3.	IIT Hyderabad	13	15
4.	IIT Kharagpur	32	4
5.	IIT Madras	43	14
6.	IIT Bhubaneshwar	48	11
7.	IIT Delhi	52	18
8.	IIT Indore	55	38
9.	IIT Mumbai	60	26
10.	IIT Roorkee	60	99
11.	IIT Jodhpur	61	34
12.	IIT Patna	63	50
13.	IIT Kanpur	85	112
14.	IIT Gandhinagar	90	11
15.	IIT Ropar	93	17
16.	IIT Varanasi	103	58

(Source: Data collected from https://www.duplichecker.com/site-link-analyzer.php)

An *External Link* is beneficial for a website, if it links to popular and relevant pages that are highly ranked and related to the content on web page. Valuable *External*

Links will also help to improve the authority of website, by providing a viewer with references. Table 4.28 shows that IIT Kanpur has the maximum number of *External Links* (112) on its library website as comparison to other IITs libraries' websites. After IIT Kanpur library website, IIT Roorkee has 99 *External Links* followed by IIT Varanasi (58), IIT Patna (50), IIT Indore (38), IIT Jodhpur (34) and so on. IIT Mandi library website has the least *External Links* (3). The average number of *External Links* on the selected IITs libraries' websites is 33.

4.9.2 IIMs Libraries' Websites

By the prepared checklist, data were collected for 13 IIMs libraries' websites as well as organized and tabulated. The qualitative and quantitative outcomes of the IIMs libraries' website were recorded in the following tables.

4.9.2.1 About Library Website

Table 4.29 discusses about the Libraries' Websites of IIMs, which reflects that all the selected IIMs Libraries' Websites have their own library website, have page title with informative words and page load time is also reasonable. From the selected IIMs Libraries' Websites, 69.23% of the selected Libraries' Websites have webmasters e-mail and rest of the 30.77% does not; about 53% of the selected IIMs Libraries' Websites have memorable URL and mentioned browser related information on their website. Browser related information enables users to know the supported web browsers or any particular applications required for functioning of any particular application such as adobe flash player for running of flash based application, some applications require java for running of java based applications, etc. About 46% of the selected libraries' websites have website map, in a website map page, index of all the

links is available where any viewer can get their desired information easily and quickly. There are 30.77% Libraries' Websites which have mentioned website update date, it helps users to know the frequency and time of update of the website and also have multi-lingual options, by using this any user change the webpage language in their desired language and only two libraries have stated visitor counter on their websites. IIM Udaipur library websites has the maximum (90%) usability features under the usability head of "About Library Website" followed by IIM Lucknow and IIM Indore library websites with 80% usability features, IIM Rohtak, IIM Ranchi and IIM Shillong Libraries' Websites with 70% of usability features, IIM Bangalore Library Website has 60% of the usability features, IIM Ahmedabad, IIM Raipur and IIM Tiruchirapalli Libraries' Websites have 50% of the usability features, IIM Kozhikode and IIM Kolkata Libraries' Websites have 40% of usability features and IIM Kashipur Library Website has the least usability features i.e. 30%.

Table 4.29: About Library Website

S. No.	Parameters \ Institutes	IIM Ahmedabad	IIM Bangalore	IIM Raipur	IIM Rohtak	IIM Ranchi	IIM Kozhikode	IIM Kolkata	IIM Lucknow	IIM Indore	IIM Udaipur	IIM Shillong	IIM Tiruchirapalli	IIM Kashipur	**Total**	**Percentage**
1	Separate website	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
2	Page title with informative words	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
3	Site load-time is reasonable	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
4	Webmaster e-mail	1	1	1	1	1	0	0	1	1	1	1	0	0	**9**	**69.23**
5	The home page of the site has a memorable URL	1	1	0	0	0	1	1	1	0	1	0	1	0	**7**	**53.85**
6	Browser related information e.g. browser support, resolution, etc	0	0	1	1	1	0	0	1	1	1	1	0	0	**7**	**53.85**
7	Website map	0	0	0	1	1	0	0	0	1	1	1	1	0	**6**	**46.15**
8	Multi-Lingual Options	0	0	0	1	0	0	0	0	1	1	1	0	0	**4**	**30.77**
9	Website update date	0	1	0	0	0	0	0	1	1	1	0	0	0	**4**	**30.77**
10	Visitor Counter	0	0	0	0	1	0	0	1	0	0	0	0	0	**2**	**15.38**
Total		**5**	**6**	**5**	**7**	**7**	**4**	**4**	**8**	**8**	**9**	**7**	**5**	**3**		
Percentage		**50**	**60**	**50**	**70**	**70**	**40**	**40**	**80**	**80**	**90**	**70**	**50**	**30**		

(Source: primary data)

4.9.2.2 About Library Home Page

Table 4.30 provides brief details about selected library homepage of IIMs libraries' websites. It shows that 92.31% of the selected IIMs libraries websites information is clearly focused on user's key tasks and their information categories are clearly visible on their pages, 84.62% of the libraries' websites information arranged on priority basis. From the selected libraries' websites, 76.92% of the libraries' websites placed their library name or logo at reasonable and noticeable location on their websites and have related information with appropriate heading, an appropriate heading in the website provides systematic arrangement of information and users can easily access to them and 46.15% of the selected library websites have archived and accessing their past events. Archiving of past events creates good impact on the users, by this viewers can access the past information such as notices, any circulars, and etc. IIM Ahmedabad, IIM Bangalore, IIM Raipur, IIM Ranchi, IIM Kozhikode and IIM Kashipur libraries' websites have the maximum usability features under the usability heads of "About Library Home Page" followed by IIM Lucknow and IIM Indore Libraries' Websites have 83% of usability features, IIM Udaipur, IIM Shillong and IIM Tiruchirapalli Libraries' Websites have 67% of usability features, IIM Kolkata library website has 50% of the usability features and at the last IIM Rohtak library website.

Table 4.30: About Library Home Page

SN	Institutes / Parameters	IIM Ahmedabad	IIM Bangalore	IIM Raipur	IIM Rohtak	IIM Ranchi	IIM Kozhikode	IIM Kolkata	IIM Lucknow	IIM Indore	IIM Udaipur	IIM Shillong	IIM Tiruchirapalli	IIM Kashipur	**Total**	**Percentage**
1	The items on the home page are clearly focused on users' key tasks	1	1	1	0	1	1	1	1	1	1	1	1	1	**12**	**92.31**
2	Product categories are provided and clearly visible on the homepage	1	1	1	0	1	1	1	1	1	1	1	1	1	**12**	**92.31**
3	Emphasize the highest priority	1	1	1	0	1	1	0	1	1	1	1	1	1	**11**	**84.62**
4	Show the Library name or logo in reasonable and noticeable location	1	1	1	0	1	1	1	1	1	0	0	1	1	**10**	**76.92**
5	Related information with appropriate heading	1	1	1	0	1	1	0	1	1	1	1	0	1	**10**	**76.92**
6	Archiving and Accessing past events	1	1	1	0	1	1	0	0	0	0	0	0	1	**6**	**46.15**
Total		**6**	**6**	**6**	**0**	**6**	**6**	**3**	**5**	**5**	**4**	**4**	**4**	**6**		
Percentage		**100**	**100**	**100**	**0**	**100**	**100**	**50**	**83**	**83**	**67**	**67**	**67**	**100**		

(Source: primary data)

4.9.2.3.1 General Information & Services on the Libraries' Websites

Table 4.31a states that, from the selected IIMs Libraries' Websites, all the libraries have mentioned information "about us", which give brief details about the library, 77% of the selected libraries have stated their ICT Infrastructure on their website, 69% have stated opening hours of their library, mentioned details about their library staff and general library rules which is less, 62% of them have Library News & Updates section on their website, 46% have functional link of their Online Public Access Catalogue and 31% have active link to Institutional Repository and also stated about their Library Committee and only 23% of the libraries have mentioned anti-plagiarism tools on their library website. These basic information saves users times and enable them to know about the library, its collection and services. The basic information regarding library staff, general library rules and regulations, library news and updates, library ICT infrastructure, link to institutional repository and plagiarism checking facility etc. are important information for any library and needs to be placed on the website.

IIM Kozhikode library website has all the usability features under the heads of "General Information & Services" followed by IIM Ahmedabad and IIM Bangalore Libraries' Websites with 90% of the usability features, IIM Kolkata and IIM Tiruchirapalli Libraries' Websites have 80% of the usability features, IIM Raipur library website has 70% of the usability features, IIM Indore and IIM Kashipur Libraries' Websites have 60% of the usability features, IIM Lucknow library website has 50% of the usability features, IIM Udaipur library website have 30% of the usability features further followed by IIM Shillong, IIM Rohtak and IIM Ranchi Libraries' Websites.

Table 4.31a: General Information & Services on Libraries' Websites

SN	Parameters \ Institutes	IIM Ahmedabad	IIM Bangalore	IIM Raipur	IIM Rohtak	IIM Ranchi	IIM Kozhikode	IIM Kolkata	IIM Lucknow	IIM Indore	IIM Udaipur	IIM Shillong	IIM Tiruchirapalli	IIM Kashipur	**Total**	**Percentage**
1.	About Library	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
2.	ICT Infrastructures	1	1	1	0	0	1	1	1	1	0	1	1	1	**10**	**77**
3.	Opening Hours	1	1	1	0	0	1	1	1	1	0	0	1	1	**9**	**69**
4.	Library Staff	1	1	1	0	0	1	1	1	1	0	0	1	1	**9**	**69**
5.	Library Rules & Regulations	1	1	1	0	0	1	1	1	1	0	0	1	1	**9**	**69**
6.	Library News & Updates	1	1	1	0	0	1	1	0	1	0	0	1	1	**8**	**62**
7.	Links to (working) Web-OPAC	1	1	0	0	0	1	1	0	0	1	0	1	0	**6**	**46**
8.	Library Committee	1	1	1	0	0	1	0	0	0	0	0	0	0	**4**	**31**
9.	Link to IR	1	1	0	0	0	1	1	0	0	0	0	0	0	**4**	**31**
10.	Link to Plagiarism	0	0	0	0	0	1	0	0	0	1	0	1	0	**3**	**23**
Total		**9**	**9**	**7**	**1**	**1**	**10**	**8**	**5**	**6**	**3**	**2**	**8**	**6**		
Percentage		**90**	**90**	**70**	**10**	**10**	**100**	**80**	**50**	**60**	**30**	**20**	**80**	**60**		

(Source: primary data)

4.9.2.3.2 Contact Us on Libraries' Websites

Table 4.31b shows that 92% of the selected IIMs library websites have mentioned Contact Us on their website, Physical address and stated their e-mail; 31% have mentioned Frequently Asked Questions (FAQ) and 23% have Web forms for contacting and none of the IIMs Libraries' Websites have mentioned Maps. About "Contact Us" on IIMs Libraries' Websites usability parameters, IIM Ahmedabad and IIM Kozhikode have maximum usability features i.e. 83%, followed by IIM Bangalore, IIM Raipur and IIM Kashipur with 67% usability features, IIM Rohtak, IIM Ranchi, IIM Kolkata, IIM Lucknow, IIM Indore, IIM Udaipur and IIM Tiruchirapalli have 50% usability features and IIM Shillong was without any usability features in this category. IIM Ahmedabad and IIM Kozhikode Libraries' Websites have maximum usability features under the "Contact Us" heads of usability features followed by IIM Bangalore, IIM Raipur and IIM Kashipur Libraries' Websites.

Table 4.31b: Contact Us on Libraries' Websites

SN	Parameters / Institutes	Contact Us link	Physical address	e-mail	FAQ	Web forms	Maps	**Total**	**Percentage**
1.	IIM Ahmedabad	1	1	1	1	1	0	**5**	**83**
2.	IIM Kozhikode	1	1	1	1	1	0	**5**	**83**
3.	IIM Bangalore	1	1	1	1	0	0	**4**	**67**
4.	IIM Raipur	1	1	1	1	0	0	**4**	**67**
5.	IIM Kashipur	1	1	1	0	1	0	**4**	**67**
6.	IIM Rohtak	1	1	1	0	0	0	**3**	**50**
7.	IIM Ranchi	1	1	1	0	0	0	**3**	**50**
8.	IIM Kolkata	1	1	1	0	0	0	**3**	**50**
9.	IIM Lucknow	1	1	1	0	0	0	**3**	**50**
10.	IIM Indore	1	1	1	0	0	0	**3**	**50**
11.	IIM Udaipur	1	1	1	0	0	0	**3**	**50**
12.	IIM Tiruchirapalli	1	1	1	0	0	0	**3**	**50**
13.	IIM Shillong	0	0	0	0	0	0	**0**	**0**
Total		**12**	**12**	**12**	**4**	**3**	**0**		
Percentage		**92**	**92**	**92**	**31**	**23**	**0**		

4.9.2.4 Date and Time on Libraries' Websites

Table 4.32 shows that none of the selected IIMs libraries websites have date and time usability features on their libraries' websites.

Table 4.32: Date and Time on Libraries' Websites

SN	Parameters / Institutes	International time zone	Spell out month and date	**Total**
1.	IIM Ahmedabad	0	0	**0**
2.	IIM Bangalore	0	0	**0**
3.	IIM Raipur	0	0	**0**
4.	IIM Rohtak	0	0	**0**
5.	IIM Ranchi	0	0	**0**
6.	IIM Kozhikode	0	0	**0**
7.	IIM Kolkata	0	0	**0**
8.	IIM Lucknow	0	0	**0**
9.	IIM Indore	0	0	**0**
10.	IIM Udaipur	0	0	**0**
11.	IIM Shillong	0	0	**0**
12.	IIM Tiruchirapalli	0	0	**0**
13.	IIM Kashipur	0	0	**0**
	Total	**0**	**0**	
	Percentage	**0**	**0**	

(Source: primary data)

4.9.2.5 Content Writing on Libraries' Websites

Table 4.33 shows that all the selected IIMs library websites have adequate text-to-background contrast, font size/spacing is easy to read, flash and add-ons are used carefully, ads and pop-ups are unobtrusive and the site is free of typographic errors and spelling mistakes and avoided redundant contents, 92% of the selected Libraries' Websites have consistent Styles & colors, Emphasis (bold, etc.) is used carefully, Main copy is concise & explanatory, User friendly language, Spelled out Abbreviations & Acronyms, 85% of the websites content is above the "fold" and their Page titles are explanatory, 77% of the library websites major headings are clear & descriptive, 62% of the websites have custom not-found/404 page and their URLs are

meaningful & user-friendly, 38% library websites have has appropriate help functions and only 23% of the Libraries' Websites images have appropriate alternate tags which is very less. In content writings heads, IIM Ahmedabad, IIM Raipur and IIM Kozhikode have 100% usability features followed by IIM Bangalore, IIM Kolkata, IIM Lucknow, IIM Indore and IIM Tiruchirapalli with 89% usability features. IIM Rohtak has the least usability features (44%) on its library website.

Table 4.33: Content Writings on Libraries' Websites

S. No.	Parameters / Institutes	IIM Ahmedabad	IIM Bangalore	IIM Raipur	IIM Rohtak	IIM Ranchi	IIM Kozhikode	IIM Kolkata	IIM Lucknow	IIM Indore	IIM Udaipur	IIM Shillong	IIM Tiruchirapalli	IIM Kashipur	**Total**	**Percentage**
1	Adequate text-to-background contrast	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
2	Font size/spacing is easy to read	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
3	Flash & add-ons are used carefully	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
4	Ads & pop-ups are unobtrusive	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
5	Main copy is concise & explanatory	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
6	The site is free of typographic errors and spelling mistakes	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
7	Avoid redundant contents	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
8	Styles & colors are consistent	1	1	1	0	1	1	1	1	1	1	1	1	1	**12**	**92**
9	Emphasis (bold, etc.) is used carefully	1	1	1	0	1	1	1	1	1	1	1	1	1	**12**	**92**
10	User friendly language	1	1	1	1	1	1	1	1	1	1	1	1	0	**12**	**92**
11	Spell out Abbreviations &	1	1	1	0	1	1	1	1	1	1	1	1	1	**12**	**92**

S. No.	Parameters / Institutes	IIM Ahmedabad	IIM Bangalore	IIM Raipur	IIM Rohtak	IIM Ranchi	IIM Kozhikode	IIM Kolkata	IIM Lucknow	IIM Indore	IIM Udaipur	IIM Shillong	IIM Tiruchirapalli	IIM Kashipur	**Total**	**Percentage**
	Acronyms															
12	Critical content is above the "fold"	1	1	1	0	0	1	1	1	1	1	1	1	1	**11**	**85**
13	Page titles are explanatory	1	1	1	0	0	1	1	1	1	1	1	1	1	**11**	**85**
14	Major headings are clear & descriptive	1	1	1	0	0	1	1	1	1	1	0	1	1	**10**	**77**
15	Site has custom not-found/404 page	1	0	1	0	0	1	1	1	1	0	1	1	0	**8**	**62**
16	URLs are meaningful & user-friendly	1	1	1	0	0	1	1	1	0	1	0	1	0	**8**	**62**
17	The library website has appropriate help functions.	1	1	1	0	0	1	0	0	1	0	0	0	0	**5**	**38**
18	Images have appropriate ALT tags	1	0	1	0	0	1	0	0	0	0	0	0	0	**3**	**23**
Total		**18**	**16**	**18**	**8**	**11**	**18**	**16**	**16**	**16**	**15**	**14**	**16**	**13**		
Percentage		**100**	**89**	**100**	**44**	**61**	**100**	**89**	**89**	**89**	**83**	**78**	**89**	**72**		

(Source: primary data)

4.9.2.6 Graphics and Animations on Libraries' Websites

Table 4.34 implicates that all the selected IIMs libraries' websites have avoid watermark graphics and 92.31% have control on scrolling and blinking contents. From the selected Libraries' Websites, 16.67% of the Libraries' Websites have used alternate tags for images and links which are very less. IIM Ahmedabad, IIM Raipur and IIM Kozhikode Libraries' Websites have all the usability features related to "Graphics and Animations" head followed by IIM Bangalore, IIM Rohtak, IIM Ranchi, IIM Lucknow, IIM Indore, IIM Udaipur, IIM Shillong, IIM Tiruchirapalli and IIM Kashipur Libraries' Websites. IIM Kolkata library website has least usability features in this regard.

Table 4.34: Graphics and Animations on Libraries' Websites

SN	Parameters / Institutes	Alternate Tags for Images & Links	Avoid watermark graphics	Control on scrolling and blinking contents	**Total**	**%**
1.	IIM Ahmedabad	1	1	1	**3**	**100**
2.	IIM Raipur	1	1	1	**3**	**100**
3.	IIM Kozhikode	1	1	1	**3**	**100**
4.	IIM Bangalore	0	1	1	**2**	**67**
5.	IIM Rohtak	0	1	1	**2**	**67**
6.	IIM Ranchi	0	1	1	**2**	**67**
7.	IIM Lucknow	0	1	1	**2**	**67**
8.	IIM Indore	0	1	1	**2**	**67**
9.	IIM Udaipur	0	1	1	**2**	**67**
10.	IIM Shillong	0	1	1	**2**	**67**
11.	IIM Tiruchirapalli	0	1	1	**2**	**67**
12.	IIM Kashipur	0	1	1	**2**	**67**
13.	IIM Kolkata	0	1	0	**1**	**33**
Total		**3**	**13**	**12**		
Percentage		**23.08**	**100.00**	**92.31**		

(Source: primary data)

4.9.2.7 Navigation Features on Libraries' Websites

Table 4.35 implicates that from the selected IIMs Libraries' Websites, 92% of the IIMs libraries' websites have active link for their homepage on their website and they are consistent and easy to identify, 85% of them have main navigation easily identifiable and the number of buttons/links are also reasonable, 77% of the Libraries' Websites have clear navigation labels which are concise and used link colors to identify visited or unvisited links, 46% of the links have alternate informative words and their library logo is linked with home-page, 38% of the selected websites have mentioned path information of each page. Under the "Navigation Feature" heads, IIM Ahmedabad and IIM Kozhikode Libraries' Websites have 100% usability features followed by IIM Bangalore and IIM Indore Libraries' Websites with 89% usability features, IIM Raipur and IIM Kashipur Libraries' Websites have scored 78% usability features, IIM Lucknow and IIM Udaipur libraries' websites have 67% usability features, IIM Kolkata library website has 56% usability features and so in. IIM Shillong library website has the least usability features (22%) in this regard.

Table 4.35: Navigation Features on Libraries' Websites

S. No.	Parameters / Institutes	IIM Ahmedabad	IIM Bangalore	IIM Raipur	IIM Rohtak	IIM Ranchi	IIM Kozhikode	IIM Kolkata	IIM Lucknow	IIM Indore	IIM Udaipur	IIM Shillong	IIM Tiruchirapalli	IIM Kashipur	**Total**	**Percentage**
1	Active link for homepage	1	1	1	1	1	1	1	1	1	1	1	1	0	**12**	**92**
2	Links are consistent & easy to identify	1	1	1	1	1	1	1	1	1	1	0	1	1	**12**	**92**
3	Main navigation is easily identifiable	1	1	1	1	0	1	1	1	1	1	0	1	1	**11**	**85**
4	Number of buttons/links is reasonable	1	1	1	0	1	1	0	1	1	1	1	1	1	**11**	**85**
5	Navigation labels are clear & concise	1	1	1	0	0	1	1	1	1	1	0	1	1	**10**	**77**
6	Links colors	1	1	1	1	0	1	0	1	1	1	0	1	1	**10**	**77**
7	Links with informative words	1	0	0	0	1	1	0	0	1	0	0	1	1	**6**	**46**
8	Library logo is linked to home-page	1	1	1	0	0	1	0	0	0	0	0	1	1	**6**	**46**
9	Path information for each pages	1	1	0	0	0	1	1	0	1	0	0	0	0	**5**	**38**
Total		**9**	**8**	**7**	**4**	**4**	**9**	**5**	**6**	**8**	**6**	**2**	**8**	**7**		
Percentage		**100**	**89**	**78**	**44**	**44**	**100**	**56**	**67**	**89**	**67**	**22**	**89**	**78**		

(Source: primary data)

4.9.2.8 Searching Features on Libraries' Websites

Table 4.36 shows that from the selected library websites, 61% of the libraries websites have Search box at homepage and it is wide and visible, 39% of the libraries' websites search is easy to access. IIM Rohtak, IIM Ranchi, IIM Lucknow, IIM Indore, IIM Udaipur, IIM Shillong and IIM Kashipur Libraries' Websites have all usability features under the head of "Searching Features" followed by IIM Ahmedabad, IIM Bangalore, IIM Kozhikode and IIM Kolkata Libraries' Websites with 67% usability features; IIM Raipur and IIM Tiruchirapalli Libraries' Websites does not have searching facility.

Table 4.36: Searching Features on Libraries' Websites

SN	Parameters / Institutes	Search box	Search box should be wide & clearly visible	Site search	**Total**	**%**
1.	IIM Rohtak	1	1	1	**3**	**100**
2.	IIM Ranchi	1	1	1	**3**	**100**
3.	IIM Lucknow	1	1	1	**3**	**100**
4.	IIM Indore	1	1	1	**3**	**100**
5.	IIM Udaipur	1	1	1	**3**	**100**
6.	IIM Shillong	1	1	1	**3**	**100**
7.	IIM Kashipur	1	1	1	**3**	**100**
8.	IIM Ahmedabad	1	1	0	**2**	**67**
9.	IIM Bangalore	1	1	0	**2**	**67**
10.	IIM Kozhikode	1	1	0	**2**	**67**
11.	IIM Kolkata	1	1	0	**2**	**67**
12.	IIM Raipur	0	0	0	**0**	**0**
13.	IIM Tiruchirapalli	0	0	0	**0**	**0**
Total		**11**	**11**	**7**		
Percentage		**61**	**61**	**39**		

(Source: primary data)

4.9.2.9 Identity and Credibility of Libraries' Websites

Table 4.37 shows that all the selected IIMs Libraries websites tagline makes their institute purpose clear and their content is up-to-date, authoritative and trustworthy and have clear path to contact information, 85% of the libraries have clear path to

library resources and services information, 54% of the libraries have copyright information, 31% of the selected libraries logo is prominently placed and 15% of the libraries' websites have stated their library use, privacy & disclaimer statement.

Table 4.37: Identity & Credibility of Libraries' Websites

S. No	Parameters / Institutes	IIM Ahmedabad	IIM Bangalore	IIM Raipur	IIM Rohtak	IIM Ranchi	IIM Kozhikode	IIM Kolkata	IIM Lucknow	IIM Indore	IIM Udaipur	IIM Shillong	IIM Tiruchirapalli	IIM Kashipur	**Total**	**Percentage**
1	Tagline makes Universities' purpose clear	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
2	The content is up-to-date, authoritative and trustworthy	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
3	Clear path to contact information	1	1	1	1	1	1	1	1	1	1	1	1	1	**13**	**100**
4	Clear path to Library information	1	1	1	1	1	1	1	0	1	1	0	1	1	**11**	**85**
5	Copyright information is clearly mentioned	0	0	1	0	1	0	0	1	1	1	1	1	0	**7**	**54**
6	Library logo is prominently placed	1	1	0	0	0	1	0	0	0	0	0	0	1	**4**	**31**
7	Library use, Privacy & Disclaimer statement properly stated	0	0	1	0	0	0	0	0	1	0	0	0	0	**2**	**15**
Total		**5**	**5**	**6**	**4**	**5**	**5**	**4**	**4**	**6**	**5**	**4**	**5**	**5**		
Percentage		**71**	**71**	**86**	**57**	**71**	**71**	**57**	**57**	**86**	**71**	**57**	**71**	**71**		

(Source: primary data)

From the selected Libraries' Websites, IIM Raipur and IIM Indore Libraries' Websites have 86% of usability features, IIM Ahmedabad, IIM Bangalore, IIM Ranchi, IIM Kozhikode, IIM Udaipur, IIM Tiruchirappalli and IIM Kashipur Libraries' Websites have 71% usability features while IIM Rohtak, IIM Kolkata, IIM Lucknow and IIM Shillong Libraries' Websites have 57% usability features.

4.9.2.10 Web 2.0 Applications on Libraries' Websites

Table 4.38 shows that from the 13 selected IIMs Libraries' Websites, 77% are using social networking sites, 54% are using bookmarking and tagging facilities, 46% are using podcast/vodcast facilities, 23% are using blogs, 23% have calendaring and 15% have wikis. On comparison to other IIMs Libraries' Websites, IIM Indore and IIM Shillong Libraries' Websites have more usability features in use of "Web 2.0 Applications" followed by IIM Bangalore, IIM Ranchi and IIM Lucknow Libraries' Websites have 67% usability features, IIM Udaipur library website has 50% usability features while IIM Ahmedabad and IIM Rohtak Libraries' Websites have 33% usability features. IIM Raipur and IIM Kozhikode Libraries' Websites have 17% and IIM Kolkata, IIM Tiruchirappalli and IIM Kashipur Libraries' Websites have no Web 2.0 applications on their websites.

Table 4.38: Web 2.0 Applications on Libraries' Websites

S. No.	Parameters / Institutes	IIM Ahmedabad	IIM Bangalore	IIM Raipur	IIM Rohtak	IIM Ranchi	IIM Kozhikode	IIM Kolkata	IIM Lucknow	IIM Indore	IIM Udaipur	IIM Shillong	IIM Tiruchirapalli	IIM Kashipur	**Total**	**Percentage**
1	Blogs	0	0	0	1	0	0	0	0	1	0	1	0	0	**3**	**23**
2	Wikis	0	0	0	0	1	0	0	0	1	0	0	0	0	**2**	**15**
3	bookmarking and Tagging	1	1	0	0	1	0	0	1	1	1	1	0	0	**7**	**54**
4	Social Networking Sites	1	1	1	1	1	1	0	1	1	1	1	0	0	**10**	**77**
5	Calendaring	0	1	0	0	0	0	0	1	0	0	1	0	0	**3**	**23**
6	Podcast/ Vodcast	0	1	0	0	1	0	0	1	1	1	1	0	0	**6**	**46**
Total		**2**	**4**	**1**	**2**	**4**	**1**	**0**	**4**	**5**	**3**	**5**	**0**	**0**		
Percentage		**33**	**67**	**17**	**33**	**67**	**17**	**0**	**67**	**83**	**50**	**83**	**0**	**0**		

(Source: primary data

4.9.2.11 URL of the Homepage on Libraries' Websites

Table 4.39 shows that from the thirteen selected IIMs libraries' websites, 92% of the libraries' websites have recall value, responsive to both www. & domin and have top level domain, 62% of the Libraries' Websites can distinguish between visited and not visited links and their Libraries' Websites URL are easy to remember. IIM Ahmedabad, IIM Bangalore, IIM Kozhikode, IIM Kolkata, IIM Lucknow, IIM Indore and IIM Udaipur Libraries' Websites have full usability features under URL of the homepage heads, followed by IIM Shillong and IIM Tiruchirapalli libraries' websites with 80% usability features. IIM Raipur, IIM Rohtak and IIM Ranchi Libraries' Websites have 60% usability features while IIM Kashipur library website has no usability features under "URL of the Homepage".

Table 4.39: URL of Libraries' Websites

SN	Parameters / Institutes	Recall value	Responsiveness with both www. & domin	Top level domain	URL is easy to remember	Distinguish between visited and not visited links	**Total**	**%**
1.	IIM Ahmedabad	1	1	1	1	1	**5**	**100**
2.	IIM Bangalore	1	1	1	1	1	**5**	**100**
3.	IIM Kozhikode	1	1	1	1	1	**5**	**100**
4.	IIM Kolkata	1	1	1	1	1	**5**	**100**
5.	IIM Lucknow	1	1	1	1	1	**5**	**100**
6.	IIM Indore	1	1	1	1	1	**5**	**100**
7.	IIM Udaipur	1	1	1	1	1	**5**	**100**
8.	IIM Shillong	1	1	1	0	1	**4**	**80**
9.	IIM Tiruchirapalli	1	1	1	1	0	**4**	**80**
10.	IIM Raipur	1	1	1	0	0	**3**	**60**
11.	IIM Rohtak	1	1	1	0	0	**3**	**60**
12.	IIM Ranchi	1	1	1	0	0	**3**	**60**
13.	IIM Kashipur	0	0	0	0	0	**0**	**0**
Total		**12**	**12**	**12**	**8**	**8**		
Percentage		**92**	**92**	**92**	**62**	**62**		

(Source: primary data)

4.9.2.12 Online Evaluation Tools

4.9.2.12.1 Global Rank of Libraries' Websites

Table 4.40 implicates that IIM Kolkata Library website is on 53050 rank followed by IIM Ahmedabad (75951 rank), IIM Kozhikode (84736 rank), IIM Bangalore (94239 rank) and so in. IIM Kashipur Library Website is having the least rank (i.e. 834450 rank) among IIMs Libraries' Websites.

Table 4.40: Global Rank of Libraries' Websites

SN	Institute	Global Rank
1.	IIM Kolkata	53050
2.	IIM Ahmedabad	75951
3.	IIM Kozhikode	84736
4.	IIM Bangalore	94239
5.	IIM Lucknow	162434
6.	IIM Indore	208703
7.	IIM Udaipur	404514
8.	IIM Ranchi	413591
9.	IIM Tiruchirapalli	461303
10.	IIM Rohtak	543981
11.	IIM Shillong	543981
12.	IIM Raipur	577873
13.	IIM Kashipur	834450

(Source: data collected from https://www.alexa.com/siteinfo/)

4.9.2.12.2 Indian Rank of Libraries' Websites

As per Table 4.41, the Alexa Traffic Rank – India shows that IIM Kashipur library website is on the top with 3431 rank followed by IIM Udaipur library website (3635 rank), IIM Kolkata library website, IIM Indore library website, and so on. IIM Bangalore library website has been ranked at 43449 rank among Indian websites.

Table 4.41: Indian Rank of Libraries' Websites

SN	Institute	Rank in India
1.	IIM Kashipur	3431
2.	IIM Udaipur	3635
3.	IIM Kolkata	5419
4.	IIM Indore	6256
5.	IIM Ahmedabad	6702
6.	IIM Ranchi	13508
7.	IIM Tiruchirapalli	13814
8.	IIM Rohtak	29766
9.	IIM Raipur	31627
10.	IIM Lucknow	35611
11.	IIM Kozhikode	38122
12.	IIM Shillong	40926
13.	IIM Bangalore	43449

(Source: data collected from https://www.alexa.com/siteinfo/)

4.9.2.12.3 Google Page Rank of Libraries' Websites

Google Page Rank Checker or Google PR Checker is one of the few methods that determine the relevance or importance of a particular web page. Important or more significant pages tend to receive a higher Page Rank, which are also more likely to appear at the top of the search engine results. The Google ranking of any page is based on the backlinks; the better quality is the backlinks the higher is the Google Page Rank. As per the Table 4.42, IIM Kashipur library website has Page Rank 9 which is the highest Page Rank amongst IIMs libraries' websites followed by IIM Bangalore library website (8). Majority of IIMs libraries websites have Page Rank 6 IIM Shillong does not have any Page Rank.

Table 4.42: Google Page Rank of Libraries' Websites

S. No.	Name of Institute	Google Page Rank
1.	IIM Shillong	0
2.	IIM Rohtak	5
3.	IIM Raipur	6
4.	IIM Ranchi	6
5.	IIM Kozhikode	6
6.	IIM Indore	6
7.	IIM Udaipur	6
8.	IIM Tiruchirapalli	6
9.	IIM Ahmedabad	7
10.	IIM Kolkata	7
11.	IIM Lucknow	7
12.	IIM Bangalore	8
13.	IIM Kashipur	9

(Source: data collected from https://smallseotools.com/google-pagerank-checker/)

4.9.2.12.4 Mobile View Compatibility of Libraries' Websites

Table 4.43 depicts that the desktop version of a website might be difficult to view and use on a mobile device. The version that is not mobile-friendly requires the user to pinch or zoom in order to read the content. Users find this a frustrating experience and are likely to abandon the site. Alternatively, the mobile-friendly version is readable and immediately usable. From the 13 selected IIMs libraries' websites, 46% of the libraries' websites are "mobile friendly" whereas rests are not compatible with mobile browsers.

Table 4.43: Mobile View Compatibility Libraries' Websites

S. No.	Institutes	Mobile View Compatibility
1.	IIM Ahmedabad	1
2.	IIM Bangalore	1
3.	IIM Raipur	0
4.	IIM Rohtak	0
5.	IIM Ranchi	0

6.	IIM Kozhikode	0
7.	IIM Kolkata	0
8.	IIM Lucknow	0
9.	IIM Indore	1
10.	IIM Udaipur	1
11.	IIM Shillong	1
12.	IIM Tiruchirapalli	0
13.	IIM Kashipur	1

(Source: data collected from https://smallseotools.com/google-pagerank-checker/)

4.9.2.12.5 Page Load Time of Libraries' Websites

The page load time depends upon three components of the website i.e. Page weight, page requests and page structure. As per the Table 4.44, IIM Kashipur library website has the least page load time i.e. 24.29 seconds which means its website load faster as compared to other IIMs libraries' websites followed by IIM Kolkata library website with 85.07 second. IIM Raipur library website has the highest page load time i.e. 595.09 seconds.

Table 4.44: Page Load Time of Libraries' Websites

S. No.	Institutes	Page load time @ 56K Connection rate in sec.
1.	IIM Kashipur	24.29
2.	IIM Kolkata	85.07
3.	IIM Kozhikode	113.31
4.	IIM Rohtak	142.10
5.	IIM Indore	147.60
6.	IIM Udaipur	151.42
7.	IIM Shillong	199.40
8.	IIM Ranchi	299.10
9.	IIM Bangalore	300.03
10.	IIM Tiruchirapalli	300.32
11.	IIM Ahmedabad	300.36
12.	IIM Lucknow	375.78
13.	IIM Raipur	595.09

(Source: data collected from www.analyze.websiteoptimization.com)

4.9.2.12.6 Total Objects on Libraries' Websites

The objects on particular websites are total number of files used in design and development of that website; it may be any set of codes, javascripts, php files etc. More number of objects is responsible for web page delay. As per Table 4.45, IIM Kashipur library website has the least number of objects i.e.5 while IIM Bangalore library website has the highest number of objects i.e. 182.

Table 4.45: Total No. of Objects on Libraries' Websites

S. No.	Institutes	Total Objects
1.	IIM Kashipur	5
2.	IIM Kolkata	11
3.	IIM Kozhikode	29
4.	IIM Shillong	32
5.	IIM Tiruchirapalli	41
6.	IIM Ranchi	48
7.	IIM Lucknow	68
8.	IIM Udaipur	73
9.	IIM Rohtak	78
10.	IIM Indore	84
11.	IIM Ahmedabad	112
12.	IIM Raipur	146
13.	IIM Bangalore	182

(Source: data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.2.12.7 Total Images on Libraries' Websites

Table 4.46 shows that IIM Kashipur library website has 2 images on its website which makes their website light; and resulting fast loading of webpages, easily accessible via low tech devices with slow bandwidth. IIM Kolkata library website has 4 images while IIM Bangalore library website has the highest number of images i.e. 151.

Table 4.46: No. of Images on Libraries' Websites

S. No.	Institutes	Number of Images
1.	IIM Kashipur	2
2.	IIM Kolkata	4
3.	IIM Kozhikode	16
4.	IIM Ranchi	19
5.	IIM Udaipur	24
6.	IIM Shillong	24
7.	IIM Tiruchirapalli	33
8.	IIM Lucknow	46
9.	IIM Rohtak	51
10.	IIM Indore	64
11.	IIM Raipur	105
12.	IIM Ahmedabad	120
13.	IIM Bangalore	151

(Source: data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.2.12.8 Size of Images on Libraries' Websites

Table 4.47 implicates that from the selected IIMs Libraries' Websites, IIM Kashipur library website has the least size of images i.e. 103290 bytes while IIM Bangalore library website has the highest size i.e. 24536678 bytes. IIM Udaipur library website has images size of 188953 bytes followed by IIM Shillong (228589 bytes), IIM Rohtak (254541 bytes), IIM Kolkata (328924 bytes), IIM Indore (446811 bytes) and so on.

Table 4.47: Size of Images on Libraries' Websites

S. No.	Institutes	Image Size (bytes)
1.	IIM Kashipur	103290
2.	IIM Udaipur	188953
3.	IIM Shillong	228589
4.	IIM Rohtak	254541
5.	IIM Kolkata	328924
6.	IIM Indore	446811
7.	IIM Kozhikode	478424
8.	IIM Ranchi	660602

9.	IIM Ahmedabad	943719
10.	IIM Tiruchirapalli	1181606
11.	IIM Raipur	1281204
12.	IIM Lucknow	1298365
13.	IIM Bangalore	24536678

(Source: data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.2.12.9 CSS Files on Libraries' Websites

Table 4.48 shows that IIM Kolkata library website has the least number of CSS files i.e.1 while IIM Ahmedabad library website has the highest number of CSS files i.e. 38. IIM Tiruchirapalli and IIM Kashipur libraries' websites have 2 CSS files while IIM Indore and IIM Shillong libraries websites have 3 CSS files. Further, Table 4.48 shows that IIM Kashipur library website has 672 bytes of CSS files which is the least among all IIMs libraries' websites. The smaller the CSS size faster the loading of webpage. IIM Raipur library website has the heaviest CSS file size among all IIMs libraries' websites. IIM Kolkata library website has 968 bytes of CSS file size while rests of the IIMs have higher the CSS file size.

Table 4.48: No. & Size of CSS Files on Libraries' Websites

S. No.	Institutes	No. of CSS files	Size of CSS files (bytes)
1.	IIM Kolkata	1	968
2.	IIM Tiruchirapalli	2	10771
3.	IIM Kashipur	2	672
4.	IIM Indore	3	7873
5.	IIM Shillong	3	576716
6.	IIM Kozhikode	5	3737
7.	IIM Rohtak	8	45976
8.	IIM Bangalore	9	254803
9.	IIM Lucknow	9	210921
10.	IIM Ranchi	11	105906
11.	IIM Udaipur	11	114294
12.	IIM Raipur	17	839302
13.	IIM Ahmedabad	38	392796

(Source: data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.2.12.10 Size of Web Pages of Libraries' Websites

The total size of page affects the page load time. The higher the size takes more time to load. Table 4.49 shows that IIM Kashipur library website has the least webpage size i.e.116862 bytes followed by IIM Ranchi library website (367001 bytes), IIM Kolkata library website (415819 bytes) and so on. IIM Bangalore library website has the highest size of 27892121 bytes.

Table 4.49: Size of Webpage of Libraries' Websites

S. No.	Institutes	Page Size (bytes)
1.	IIM Kashipur	116862
2.	IIM Ranchi	367001
3.	IIM Kolkata	415819
4.	IIM Shillong	483393
5.	IIM Kozhikode	539460
6.	IIM Rohtak	634744
7.	IIM Indore	653593
8.	IIM Tiruchirapalli	1465728
9.	IIM Lucknow	1817296
10.	IIM Udaipur	1939865
11.	IIM Raipur	2839431
12.	IIM Ahmedabad	3565158
13.	IIM Bangalore	27892121

(Source: data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.2.12.11 Scripts on Libraries' Websites

Table 4.50 reflects that IIM Kashipur library website has no scripts while IIM Shillong library website has the least (3) number of scripts followed by IIM Kolkata library website (4), IIM Tiruchirapalli library website (5), IIM Kozhikode library website (7), IIM Lucknow library website (12) and so on. IIM Ahmedabad library website has the highest number of scripts i.e.57 on their library website. Further Table 4.50 shows that IIM Kashipur library website has no script which result no script size while IIM Kozhikode library website has the least script size i.e.50268 bytes followed by IIM Kozhikode library website (65418 bytes), IIM Kolkata library website (65418

bytes), IIM Ranchi library website (145752 bytes) and so on. IIM Ahmedabad library website has the highest size of scripts i.e.1572864 bytes.

Table 4.50: No. & Size of Scripts in Libraries' Websites

S. No.	Institutes	No. of Scripts	Size of Scripts (bytes)
1.	IIM Kashipur	0	0
2.	IIM Shillong	3	147849
3.	IIM Kolkata	4	65418
4.	IIM Tiruchirapalli	5	234034
5.	IIM Kozhikode	7	50268
6.	IIM Lucknow	12	218216
7.	IIM Ranchi	14	145752
8.	IIM Bangalore	15	900726
9.	IIM Indore	15	181105
10.	IIM Rohtak	18	286523
11.	IIM Raipur	22	490846
12.	IIM Udaipur	25	1258291
13.	IIM Ahmedabad	57	1572864

(Source: data collected from http://www.websiteoptimization.com/services/analyze/)

4.9.2.12.12 HTML Size of Libraries' Websites

Table 4.51 explains that IIM Ahmedabad library website's html page size is 1267 bytes which is the least amongst all IIMs libraries' websites followed by IIM Kozhikode library website (with 7031 bytes), IIM Indore library website (17804 bytes), IIM Kolkata library website (20509 bytes), IIM Tiruchirapalli library website (39317 bytes), IIM Rohtak library website (47704 bytes) and so on. IIM Bangalore library website has the heaviest size of HTML files i.e. 753926 bytes. The average HTML size of IIMs Libraries' Websites is 167469 bytes.

Table 4.51: HTML Size of Libraries' Websites

S. No.	Name of Institute	HTML size (bytes)
1.	IIM Ahmedabad	1267
2.	IIM Bangalore	753926
3.	IIM Raipur	228079
4.	IIM Rohtak	47704
5.	IIM Ranchi	178257
6.	IIM Kozhikode	7031
7.	IIM Kolkata	20509
8.	IIM Lucknow	89749
9.	IIM Indore	17804
10.	IIM Udaipur	555745
11.	IIM Shillong	471859
12.	IIM Tiruchirapalli	39317
13.	IIM Kashipur	116862

4.9.2.12.13 Links on Libraries' Websites

Table 4.52 shows that IIM Kolkata library website has the least number of *Internal Links* i.e.4 on its library website followed by IIM Kozhikode library website (50), IIM Kashipur library website (53), IIM Tiruchirapalli library website (88), IIM Bangalore library website (96), IIM Lucknow library website (109) and so on. IIM Udaipur library website has the highest number of *Internal Links* i.e. 291 among all IIMs libraries' websites.

Table 4.52: No. of Internal & External Links on Libraries' Websites

S. No.	Institutes	Internal links	External Links
1.	IIM Kolkata	4	0
2.	IIM Kozhikode	50	9
3.	IIM Kashipur	53	9
4.	IIM Tiruchirapalli	88	1
5.	IIM Bangalore	96	195
6.	IIM Lucknow	109	11
7.	IIM Raipur	112	35
8.	IIM Ranchi	124	45
9.	IIM Shillong	133	12
10.	IIM Rohtak	184	6

11.	IIM Ahmedabad	257	135
12.	IIM Indore	271	26
13.	IIM Udaipur	291	31

(Source: data collected from https://smallseotools.com/website-link-analyzer-tool/)

Further, Table 4.52 shows that IIM Kolkata library website has no *External Link* on its library website. IIM Tiruchirapalli library website has the least number of *External Link* on its website i.e. 1 followed by IIM Rohtak library website (6), IIM Kozhikode library website (9), IIM Kashipur library website (9) and so on. IIM Bangalore library website has the highest number of *External Links* i.e.195 on its library website among all IIMs libraries' websites.

4.9.3 Factors Affecting Webpage Load Time @56K Connection Rate

There are several factors which are responsible for page load time@56K connection rate. These factors are given below:

a) Web hosting set up

When any resource-intensive website works, it requires a high bandwidth network connection and resource-intensive web-server, but some web-hosting agencies cannot able to increase their bandwidth and upgrading of web-server on time due to lack of financial as well as technical resources. It gives enough opportunity to experience slow and intermittent webpage load time. The geographical location of the web-server also plays critical role in the delay of page load time due to physical boundaries between the web-server location and users' access location.

b) Numbers of Widgets and Plug-ins

There are numbers of online widgets and plug-ins (like Google Analytics, Google AdSense, Web page statistics provider, RSS feeders, etc.) that offers more useful

features for a website but technically in the background delays the loading of the webpage at the same time. The more plug-ins and widgets leads to delay in page load time.

c) Lack of Compressed Files

Libraries' websites use varieties of file types for serving the user's demand which needs numbers of files. In such a scenario, files uploaded in the library websites makes its size heavier. Libraries websites are not using compressed files to reduce the website size. There are numbers of file compression tools available which compresses the files and makes it available in compressed sizes without losing its properties, such as GZIP. It compresses all the website files such as images, CSS, Javascript, and HTML files by more than 50% of their file size and reduces page load time.

d) Excess Use of Embedded Media Files

Interactive as well as dynamic website creation involves inclusion of numbers of embedded files (such as Objects, Images, CSS, Scripts, PDF, and Video etc.) nowadays. The more number of embedded objects leads to increased page load time@56K connection rate. The number of embedded files on the webpage requires more resources on the web-server for timely reaction and faster loading of websites. The lack of supportive resources leads to slower loading of webpages. Some of the important embed media files are:

i) Objects

The <object> tag defines an embedded object within a webpage. It is used to embed multimedia files (like audio, video, Java applets, ActiveX, PDF, Flash files, other database and coding files) in webpages. As the number of objects

increases, the webpage takes more time to load. The size of objects as well as variety of objects plays an important role in page load time due to nature of the objects embedded in the website.

ii) Images

Images are the most used files embed in the webpages. The number of images, size and their types affects the page load time. There are many popular image formats such as:

- ***Graphic Interchange Format (GIF)***, it compresses images so that the image details are lost during the compression, it also has an extremely limited color range which is suitable for the web but not for printing. Due to low image size, it is extensively used in websites.
- ***Joint Photographic Experts Group (JPEG)***, these files are images that have been compressed to store a lot of information in small size. As compared to GIF, the JPEG files are heavier in size. More number of JPEG files in websites increases page load time.
- ***Portable Network Graphics (PNG)***, it was created as an open format to replace GIF, because the patent for GIF was owned by one company and nobody else was interested to pay the license fee. It also allows for a full range of color and better compression.
- ***Tagged Image File Format (TIFF)***, it is the most common file type used in photography as it holds more image data which results in huge image size. Due to increase in the image size, TIFF has been less used in webpages.

Thus, the type of image also plays an important role in webpage loading because of above-stated properties and their sizes.

iii) Cascading Style Sheets (CSS)

CSS is a style sheet language used for describing the presentation of a document written in a markup language like HTML. It is designed to enable the separation of presentation and content, including layout, colors, and fonts which can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics. The number of CSS files and its size decides the display of webpages on the web-browsers. As the number of CSS files increases the web browsers have to enquire it again and again which increase page load time.

iv) Scripts

It is a text document containing a list of commands that need to be executed by a certain program or scripting manager so that the desired automated action could be achieved. They are invisible to the user's eye but their availability within the code of a website defines how the website response to certain actions and as requested by the user. The number of Script files and its size decides the automated action on the webpages. As the number and size of Script files increases, the more automated actions have to be performed and result is increase in page load time.

v) Text files

It includes those files which have text embed such as .doc/.docx (Microsoft Word file), .odt (Open Office Writer document file), .pdf (PDF file), .rtf (Rich Text Format), .tex (A LaTeX document file), .txt (Plain text file), .wks/.wps (Microsoft Works file), .wpd (WordPerfect document), etc. The number of

text files and its size decides the display of files on the web-browsers. As the number of text files increases the web browsers have to enquire it again and again which increases page load time.

vi) Video files

The videos, music and image slideshows are great sources of content, but they take more time to load at slow connections which affects page load speed.

e) Inclusion of Unwanted Links in Website Head

The <head> ….. </head> tag of the webpage plays an important role in the loading of the webpage and it is required to be placed at the top of all HTML document. The <head> elements of the webpage do not display on web pages (for the most part). The elements inside it are hidden from visitors, but they are still very useful as they convey information to the web browser, search engines, metadata, character set, links to external files such as CSS files, Javascripts, Objects, etc. Sometimes website administrators use as many as links in the <head> elements of the webpage and they are not aware of its consequences which results in slow loading of the webpages.

4.9.4 Usability Score of IITs Libraries' Websites

On the basis of prepared checklist, total usability score of IITs libraries' websites were categorized and displayed in Table 4.53. As per the Table 4.53, IIT Mumbai library website has been found on the top with 74 usability score among IITs libraries' websites followed by IIT Ropar with 73 usability score, IIT Guwahati with 72 usability score, IIT Jodhpur with 71 usability score, IIT Patna with 70 usability score, IIT Madras with 69 usability score, IIT Bhubaneshwar with 68 usability score, IIT Kanpur with 68 usability score, IIT Delhi with 68 usability score, IIT Gandhinagar

with 65 usability score, IIT Indore with 63 usability score, IIT Varanasi with 63 usability score, IIT Roorkee with 62 usability score, IIT Kharagpur with 58 usability score, IIT Mandi with 56 usability score and IIT Hyderabad with 48 usability score. IIT Hyderabad library website has been found with lowest usability score amongst IITs libraries' websites. There are 86 website usability parameters based on 11 heads and Online Evaluation Tools cover 16 website usability parameters. Table 4.53 represents 86 website usability parameters and website usability scores are based on these 86 website usability parameters only.

From the analysis, it has been found that IIT Mumbai library website covers 86% of website usability features while IIT Hyderabad library website covers 55.8% website usability features. IITs libraries' websites usability feature score ranges between 55% - 86% of website usability score.

Table 4.53: Usability Score of IITs Libraries' Websites

S. No.	Parameters	IIT Gandhinagar	IIT Bhubaneshwar	IIT Madras	IIT Guwahati	IIT Indore	IIT Kanpur	IIT Jodhpur	IIT Kharagpur	IIT Hyderabad	IIT Mumbai	IIT Patna	IIT Delhi	IIT Ropar	IIT Mandi	IIT Roorkee	IIT Varanasi	**Total**
1	Library Website (10)	6	5	4	6	4	4	5	5	5	4	9	4	9	4	5	5	**84**
2	Library Home Page (6)	5	6	5	6	6	6	6	4	1	6	6	6	6	6	6	6	**87**
3a	General Information & Services (10)	9	10	10	10	10	10	9	10	3	10	9	10	10	9	9	8	**146**
3b	Contact Us (6)	6	5	6	3	3	4	4	3	3	6	4	4	4	3	3	3	**64**
4	Date and Time (3)	0	0	2	3	0	0	3	0	0	0	0	0	0	0	0	0	**8**
5	Content Writing (18)	14	18	18	18	18	18	18	17	16	18	18	18	17	17	18	17	**278**
6	Graphics and Animations (3)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	**46**
7	Navigation Features (9)	7	9	9	9	9	9	9	6	6	9	9	9	9	5	9	9	**132**
8	Searching Features (3)	3	0	0	3	0	3	2	0	2	3	0	2	3	0	0	3	**24**
9	Identity & Credibility (7)	5	7	7	7	5	6	5	5	3	5	7	7	7	5	5	5	**91**
10	Web 2.0 Applications (6)	2	0	0	0	0	0	2	0	2	5	2	0	1	0	0	0	**14**
11	URL of the Homepage (5)	5	5	5	4	5	5	5	5	4	5	3	5	4	4	5	5	**74**
Total (86)		**65**	**68**	**69**	**72**	**63**	**68**	**71**	**58**	**48**	**74**	**70**	**68**	**73**	**56**	**62**	**63**	**1048**

(Source: primary data)

4.9.5 Usability Score of IIMs Libraries' Websites

On the basis of prepared checklist, total usability score of IIMs libraries' websites were categorized and displayed in Table 4.54. As per the Table 4.54, IIM Ahmedabad library website has been found on the top with 69 usability scores followed by IIM Kozhikode library website with 68 usability score, IIM Bangalore library website with 67 usability score, IIM Indore library website with 67 usability score, IIM Lucknow library website with 61 usability score, IIM Raipur library website with 60 usability score, IIM Udaipur library website with 58 usability score, IIM Tiruchirapalli library website with 55 usability score, IIM Kolkata library website with 51 usability score, IIM Ranchi library website with 49 usability score, IIM Kashipur library website with 49 usability score, IIM Shillong library website with 47 usability score and IIM Rohtak library website with 37 usability score. IIM Rohtak library website has been found with lowest usability score amongst IIMs libraries' websites. There are 86 website usability parameters based on 11 heads and Online Evaluation Tools cover 16 website usability parameters. Table 4.54 represents 86 website usability parameters and website usability scores are based on these 86 website usability parameters only.

From the analysis, it has been found that IIM Ahmedabad library website covers 80% of website usability features while IIM Rohtak library website covers 43% website usability features. IIMs libraries' websites usability feature score ranges between 43% - 80% of website usability score.

Table 4.54: Usability Score of IITs Libraries' Websites

SN	Parameters \ Institutes	IIM Ahmedabad	IIM Bangalore	IIM Raipur	IIM Rohtak	IIM Ranchi	IIM Kozhikode	IIM Kolkata	IIM Lucknow	IIM Indore	IIM Udaipur	IIM Shillong	IIM Tiruchirapalli	IIM Kashipur	**Total**
1	Library Website	5	6	5	7	7	4	4	8	8	9	7	5	3	**78**
2	Library Home Page	6	6	6	0	6	6	3	5	5	4	4	4	6	**61**
3a	General Information & Services	9	9	7	1	1	10	8	5	6	3	2	8	6	**75**
3b	Contact Us	5	4	4	3	3	5	3	3	3	3	0	3	4	**43**
4	Date and Time	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
5	Content writing	18	16	18	8	11	18	16	16	16	15	14	16	13	**195**
6	Graphics and Animations	3	2	3	2	2	3	1	2	2	2	2	2	2	**28**
7	Navigation features	9	8	7	4	4	9	5	6	8	6	2	8	7	**83**
8	Searching Features	2	2	0	3	3	2	2	3	3	3	3	0	3	**29**
9	Identity & Credibility	5	5	6	4	5	5	4	4	6	5	4	5	5	**63**
10	Web 2.0 applications	2	4	1	2	4	1	0	4	5	3	5	0	0	**31**
11	URL of the Homepage	5	5	3	3	3	5	5	5	5	5	4	4	0	**52**
Total		**69**	**67**	**60**	**37**	**49**	**68**	**51**	**61**	**67**	**58**	**47**	**55**	**49**	**738**

(Source: primary data)

4.9.6 Usability Scores of IITs & IIMs

From the observation of Table 4.55, it has been found that IITs libraries' websites have scored 84 usability score in "*About Library Website*" category while IIMs libraries' websites have scored 78 usability score. It represents that IITs libraries' websites have more usability features as compared to IIMs libraries' websites. In "*About Library Home Page*" category IITs libraries' websites have score 87 usability score as compared to IIMs libraries' websites (61). IITs libraries' websites are much better than IIMs libraries' websites in terms of usability scores. In the case of "*General Information & Services*" category, IITs libraries' websites have almost double usability score (146) as compared to IIMs libraries' websites (75). In "Contact Us" category, IITs libraries' websites scored 64 usability score whereas IIMs libraries' websites scored 43 usability scores. In the case of "*Date and Time*" category IITs libraries' websites have scored 8 usability scores while IIMs libraries' websites have not scored any usability points. In "*Content Writing*" category, IITs libraries' websites have scored 278 usability score and IIMs libraries' websites have scored 195 usability scores which displays that IITs libraries' website are much better than IIMs libraries' websites.

Table 4.55: Comparative Usability Scores – Parameters wise

SN	Parameters Heads	Usability Score of IITs	Usability Score of IIMs
1	About Library Website	84	78
2	About Library Home Page	87	61
3a	General Information & Services	146	75
3b	Contact us	64	43
4	Date and Time	8	0
5	Content writing	278	195
6	Graphics and Animations	46	28
7	Navigation features	132	83

SN	Parameters Heads	Usability Score of IITs	Usability Score of IIMs
8	Searching Features	24	29
9	Identity & Credibility	91	63
10	Web 2.0 Applications	14	31
11	URL of the Homepage	74	52
Total		**1048**	**738**

Under the "*Graphics and Animations*" category, IITs libraries' websites have scored 46 usability score whereas IIMs libraries' websites have scored 28 usability score. Under "*Navigation Features*" category, IITs libraries have scored 132 usability score whereas IIMs libraries' websites have scored 83 usability scores. Under "*Searching Features*" category, IITs libraries' websites scored 24 usability score and IIMs libraries' websites scored 29 usability scores which are more than IITs score. It shows that IIMs libraries' websites are much better that IITs libraries' website in terms of searching features. In the case of "*Identity & Credibility*" category, IITs libraries' websites scored 91 usability score and IIMs libraries' websites scored 63 usability score. In the "*Use of Web 2.0 Applications*" category, IIMs libraries are much ahead to IITs libraries' websites and scored 31 usability scores while IITs scored 14 usability score. In "URL of the Homepage" category, IITs libraries' websites have scored 74 usability scores while IIMs libraries' websites have scored 52 usability scores which are much less than IITs usability scores. Fig 4.3 clearly depict that usability scores of IITs libraries' websites are much better than IIMs libraries' websites.

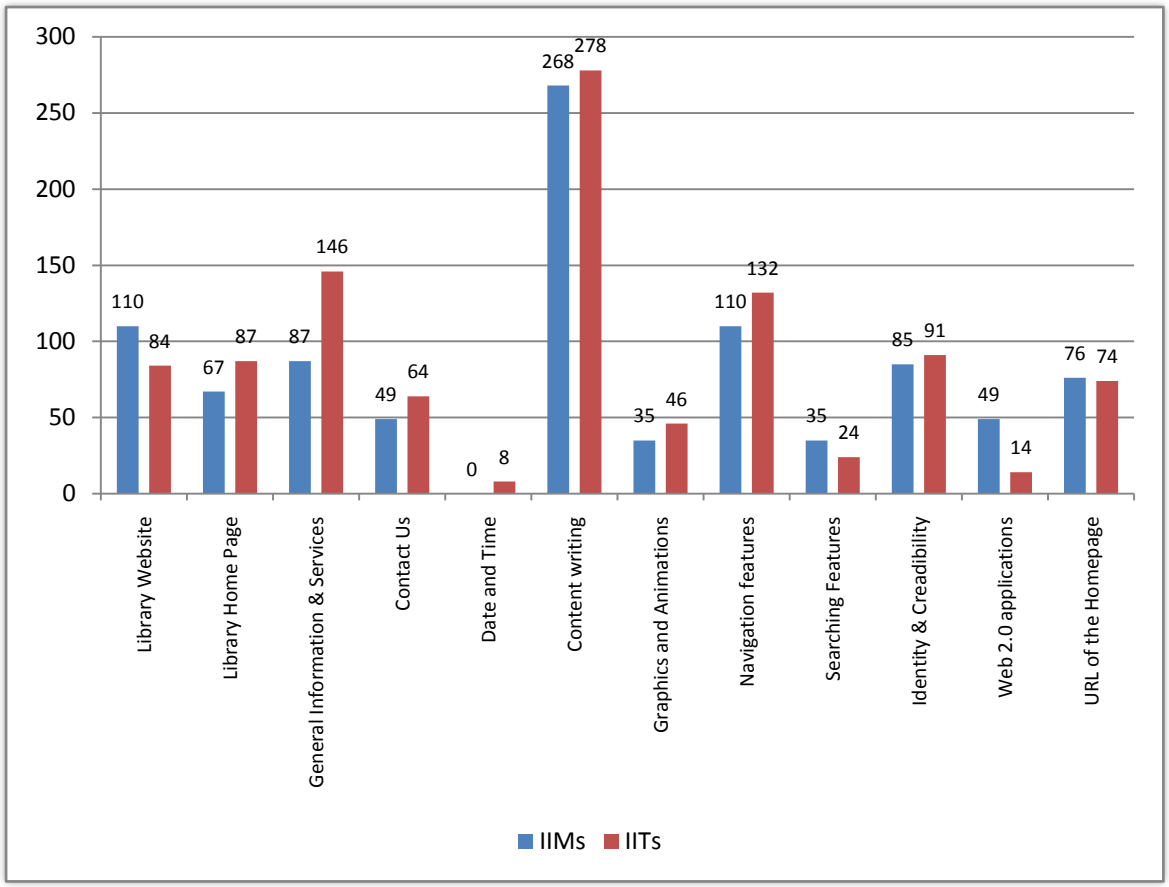

Fig. 4.3: IITs & IIMs Usability Scores

On the basis of prepared parameters, the total gained usability score of IITs libraries' websites is 1048 and IIMs libraries' websites is 738. After evaluation of IITs and IIMs libraries' websites, it has been found that IITs libraries' websites have more website usability features than IIMs libraries' websites.

4.10 MAJOR RESEARCH FINDINGS

The analysis of the data collected through the prepared parameters have revealed number of findings which are as follows:

1) The present study is confined to 16 IITs Libraries' Websites and 13 IIMs Libraries' Websites. All the 29 selected libraries' websites of IITs and IIMs were functional at the time of data collection and during online evaluation.

2) From the study, it has been found that all the selected IITs libraries' websites have their own library website with suitable and memorable website titles. From the selected IITs Libraries' Websites, majority (94%) of the IITs libraries' websites have reasonable load time while rests of the usability features have not been undertaken seriously. IIT Patna and IIT Ropar libraries' websites have covered majority (90%) of the usability features under "*About Library Website*" while rests were below that.
3) All the IITs libraries' websites have library name or logo at a reasonable and noticeable place while majority (94%) of the IITs libraries' websites were clearly focused on their key tasks as well as placing the information on priority basis. All the IITs libraries' websites covered more than 75% usability features on their websites in "Library Home Page" category. Further, IIT Bhubaneshwar, IIT Guwahati, IIT Indore, IIT Kanpur, IIT Jodhpur, IIT Mumbai, IIT Patna, IIT Delhi, IIT Ropar, IIT Mandi, IIT Roorkee and IIT Varanasi libraries' websites have scored all the usability features under the "Library Home Page" category.
4) All the IITs libraries' websites have mentioned their Opening Hours and "About Library" information on their libraries' websites while majority (94%) of the libraries' websites have mentioned library staff information, library rules and regulations, library news/updates, ICT infrastructure, link to IR and link to plagiarism checking facility. Further IIT Bhubaneshwar, IIT Madras, IIT Guwahati, IIT Indore, IIT Kanpur, IIT Kharagpur, IIT Mumbai, IIT Delhi and IIT Ropar libraries' websites have all the usability features under the head of "General Information & Services".

5) All the IITs libraries' have "Contact Us" link on their websites as well as mentioned their "physical address and E-mail" also. In terms of Website Map, FAQ, and Web Forms libraries' websites have not given importance to these usability features. IIT Gandhinagar, IIT Madras and IIT Mumbai libraries' websites have used full usability features under "Contact Us" category.

6) IIT Madras, IIT Guwahati and IIT Jodhpur libraries' websites have used "Date and Time" features on their libraries' websites while rests of the IITs libraries' websites have neglected these usability features.

7) From the study, it has been observed that almost every IITs libraries' websites have utilized majority (81%) of usability features. All the IITs libraries' websites have adequate text-to-background contrast, Font size/spacing is easy to read, Flash & add-ons are used carefully, critical content is above the "fold", Styles & colors are consistent, Emphasis (bold, etc.) is used carefully, Adds & pop-ups are unobtrusive, Main copy is concise & explanatory, URLs are meaningful & user-friendly, Page titles are explanatory, site is free from typographic errors and spelling mistakes, user friendly language and avoided redundant contents on their library website. Further, IIT Bhubaneshwar, IIT Madras, IIT Guwahati, IIT Indore, IIT Kanpur, IIT Jodhpur, IIT Mumbai, IIT Patna, IIT Delhi and IIT Roorkee libraries' websites have all the usability features under the head of "Contents Writings".

8) Under the usability head "Graphics and Animations" majority (88%) of the IITs libraries' websites have used alternate tags while all the libraries' websites have avoided "watermark graphics' and also have "effective control on blinking contents". Except IIT Roorkee and IIT Varanasi, all the IITs libraries' websites have utilized all the usability features.

9) All of the IITs libraries' websites have easily identifiable navigations, their navigation labels are clear & concise, links are consistent & easy to identify while 94% of the libraries have active link for the institute homepage, 88% of the libraries' websites have reasonable number of buttons/links, 88% of the libraries' websites have their library logo linked to their institute home-page, path information for each pages, and visited links colors. Except 4 IITs libraries' websites, all have utilized full usability features mentioned under the category of "Navigation Features".

10) From the selected IITs libraries' websites, 56% of them have "search box" at their library homepage which is "wide and clearly visible" while 38% libraries' websites have "site search facility which is easy to access".

11) All the IITs libraries' websites "tagline makes their institutes purpose clear" and also have "clear path to their contact information". Majority of the IITs libraries' websites (94%) have "logo at prominent place, up-to-date content, and clear cut path to library related information". IIT Bhubaneshwar, IIT Madras, IIT Guwahati, IIT Patna, IIT Delhi and IIT Ropar libraries' websites have all the usability features under the head of "Identity & Credibility".

12) Web 2.0 Applications have been found weakly applied to IITs libraries' websites. Social Networking Sites have been utilized by 31% libraries' websites while other usability features have been utilized less than it. IIT Mumbai library website has utilized 83% of the usability features while rests of the libraries are in poor condition.

13) All the IITs libraries' websites have "recall value" and "responsiveness to both **www.** and **domain**", and "level of domain name". All the IITs libraries' websites have more than 80% usability features except IIT Patna.

14) Alexa Global Traffic Rank shows that IIT Madras library website was on the top with 3406 global rank followed by IIT Kanpur (6224 global rank), and IIT Kharagpur (7000 global rank).
15) Alexa Traffic Rank – India shows that IIT Madras library website was on the top with 331 Indian rank followed by IIT Kharagpur (486 rank) and IIT Kanpur (519 rank).
16) As per the Google Page Rank Checker, IIT Madras and IIT Mumbai have the highest Page Rank.
17) From the study, it has been found that 44% IITs libraries' websites are mobile friendly.
18) In terms of website Page Load Time, IIT Varanasi has been found with the least page load time i.e. 84.79 seconds followed by IIT Guwahati (86.75 seconds) and IIT Jodhpur (115 seconds) while the highest page load time found for IIT Patna (567.82 seconds).
19) In terms of number of "objects" on the libraries' websites, it has been found that IIT Delhi has the least number of objects (17) followed by IIT Guwahati (18 objects) and IIT Jodhpur (19 objects) while IIT Hyderabad has the maximum objects (123 objects).
20) IIT Delhi and IIT Ropar have the least number of Images (6 images each) followed by IIT Guwahati (8 images) and IIT Madras (9 images) while IIT Patna library website has the highest number of images (71) in its website.
21) IIT Delhi library website has the least image size i.e.97425 bytes followed by IIT Varanasi (153092 bytes) and IIT Hyderabad (220200 bytes).

22) The maximum number of CSS files found in IIT Hyderabad library website (34) while the least number of CSS files found on IIT Madras, IIT Jodhpur, and IIT Delhi (1 CSS file each).
23) IIT Kharagpur library website CSS size is 1038090 bytes which is the highest among all IITs libraries' websites. IIT Delhi library website has the least CSS file size followed by IIT Mumbai and IIT Madras.
24) IIT Roorkee library website has the least size website with 368250 bytes while IIT Kanpur library website has the maximum website size with 6291456 bytes.
25) IIT Hyderabad library website has the highest number of scripts (38) while IIT Jodhpur and IIT Kharagpur have the least number of scripts (2 scripts each).
26) IIT Jodhpur has the least sized (33593 bytes) scripts on their library website while IIT Hyderabad library has the biggest sized (964689 bytes) scripts.
27) IIT Gandhinagar library website has the least HTML size (6508 bytes) while IIT Mandi library website has the highest HTML size (975175 bytes).
28) IIT Varanasi library website has the maximum 103 Internal Links while IIT Guwahati has the least Internal Links (8) on its library website. IIT Kanpur has the maximum number of External Links (112) on its library website while IIT Mandi has the least External Links (3) to its library website.
29) All the IIMs libraries' websites have their own library website and have page title with informative words as well as reasonable page load time. Rests of the usability features have not been addressed properly on the IIMs libraries' websites. IIM Udaipur library website has utilized 90% usability features under "About Library Websites".
30) From the IIMs libraries' websites, majority (92%) IIMs libraries' websites information is clearly focused on user's key tasks and their information

categories are clearly visible on their home pages while 84% libraries' websites information arranged on priority basis. IIM Ahmedabad, IIM Bangalore, IIM Raipur, IIM Ranchi, IIM Kozhikode and IIM Kashipur libraries' websites have utilized all the usability features under the category of "About Library Home Page".

31) From the IIMs libraries' websites, all the IIMs libraries have mentioned "about library" information on their library websites while 77% libraries' have stated their ICT infrastructure, 69% have stated opening hours of their library, library staff, and general library rules. About 62% of them have library news & updates on their website while rests of the usability features have not been addressed properly. IIM Kozhikode library website has all the usability features under the heads of "General Information & Services" followed by IIM Ahmedabad and IIM Bangalore libraries' websites with 90% of the usability features.

32) In the IIMs libraries' websites, 92% of the libraries' websites have mentioned "Contact Us" on their websites, Physical address and their e-mail while Frequently Asked Questions by 31% libraries' websites and web forms by 23% libraries' websites. IIM Ahmedabad and IIM Kozhikode have the 83% usability features while rests of the IIMs have less usability features on their libraries' websites.

33) IIMs libraries websites have totally neglected the "Date and Time" usability features on their library websites.

34) In terms of "Content Writings", all the IIMs libraries' websites have adequate text-to-background contrast, font size/spacing is easy to read, flash and add-ons are used carefully, ads and pop-ups are unobtrusive and the site is free of

typographic errors and spelling mistakes and avoided redundant contents while 92% libraries' websites have consistent styles & colors, carefully used emphasis (bold, etc.), concise & explanatory main copy, user friendly language, spelled out abbreviations & acronyms. In "Content Writings" category, IIM Ahmedabad, IIM Raipur and IIM Kozhikode have scored 100% usability scores while IIM Bangalore, IIM Kolkata, IIM Lucknow, IIM Indore and IIM Tiruchirapalli scored 89% usability features.

35) All the IIMs libraries' websites have "avoided watermark graphics" and 92.31% have "control on scrolling and blinking contents" while 23% have used "alternate tags for images and links". IIM Ahmedabad, IIM Raipur and IIM Kozhikode libraries' websites have all the usability features related to "Graphics and Animations".

36) In "Navigation Features", 92% IIMs libraries' websites have "active link for their homepage" on their website and they are "consistent and easy to identify" while 85% libraries' websites have "easily identifiable navigation" and "reasonable number of buttons/links". IIM Ahmedabad and IIM Kozhikode libraries' websites have scored 100% usability features under the "Navigation Features".

37) From the selected libraries' websites, 61% libraries have "search box" at homepage which is clearly visible while 39% libraries websites have "site search". IIM Rohtak, IIM Ranchi, IIM Lucknow, IIM Indore, IIM Udaipur, IIM Shillong and IIM Kashipur libraries' websites have utilized all the usability features under the head "Searching Features".

38) All the IIMs libraries' websites have clear cut tagline with updated content and clear path to contact information while 85% libraries have clear path to library

resources and services on their websites. IIM Raipur and IIM Indore libraries' websites have utilized 86% of usability features.

39) From the IIMs libraries' websites study, it has been found that "Web 2.0 Applications" on libraries' websites have not been fully utilized. There are 77% libraries' which have used social networking sites on their websites while 54% have used bookmarking and tagging facilities. Further, IIM Indore and IIM Shillong libraries' websites have utilized 83% of the usability features mentioned under "Web 2.0 Applications" category.

40) From the selected IIMs library websites, 92% of the library websites have recall value, responsive to both www. & domin and have top level domain, while 62% libraries' websites have distinguishing features between visited and not-visited links and their libraries' websites URLs are easy to remember. IIM Ahmedabad, IIM Bangalore, IIM Kozhikode, IIM Kolkata, IIM Lucknow, IIM Indore and IIM Udaipur libraries' websites have used full usability features under "URL of the Homepage" category.

41) Alexa Global Traffic Rank shows that IIM Kolkata library website is on the 53050 rank which is the top rank amongst IIMs followed by IIM Ahmedabad library website (75951 rank) and IIM Kozhikode library website (84736 rank).

42) Alexa Traffic Rank – India shows that IIM Kashipur library website is on the top with 3431 rank followed by IIM Udaipur library website (3635 rank) and IIM Kolkata library website (5419 rank).

43) As per Google Page Rank Checker, IIM Kashipur library website has scored the highest Page Rank 9 amongst all the IIMs libraries' websites.

44) From the 13 selected IIMs libraries' websites, 46% of the libraries' websites are "mobile friendly" whereas rests are not compatible with mobile browsers.

45) IIM Kashipur library website has the least page load time i.e.24.29 seconds while IIM Raipur has the maximum page load time i.e. 595.09 seconds.
46) IIM Kashipur library website has the least number of objects (5) while IIM Bangalore library website has the maximum number of objects (182 objects).
47) IIM Kashipur library website has the least number of images (2 images) on its website while IIM Bangalore library website has the maximum number of images i.e.151 on its website.
48) From the selected IIMs libraries' websites, IIM Kashipur library website has the least size of images i.e. 103290 bytes while IIM Bangalore library website has the maximum image size i.e. 24536678 bytes.
49) IIM Kolkata library website has the least number of CSS files i.e. 1 CSS file while IIM Ahmedabad library website has the maximum number of CSS files i.e. 38.
50) IIM Kashipur library website has the least CSS size i.e. 672 bytes while IIM Raipur library website has the maximum CSS file size on its website i.e. 839302 bytes.
51) IIM Kashipur library has the least webpage size i.e. 116862 bytes while IIM Bangalore library website has the maximum webpage size of 27892121 bytes.
52) IIM Kashipur library website has no scripts. IIM Shillong library website has the least (3) number of scripts while IIM Ahmedabad library website has the maximum number of scripts (57) on its website.
53) IIM Kashipur library website has no script which result no script size. IIM Kozhikode library website has the least script size i.e. 50268 bytes while IIM Ahmedabad library website has the maximum size of scripts (1572864 bytes).

54) IIM Ahmedabad library website has least HTML page size i.e. 1267 bytes while IIM Bangalore library website has the highest HTML page size i.e. 753926 bytes.

55) IIM Kolkata library website has the least number of Internal Links (4) on its library website while IIM Udaipur has the maximum Internal Links (291) on its library website.

56) IIM Kolkata library website has no External Links on its library website. IIM Tiruchirapalli library website has only 1 external link which is the least number of External Links while IIM Bangalore library website has the maximum number of External Links (195 External Links).

57) From the total usability score, it has been found that IIT Mumbai library website has achieved the highest usability score followed by IIT Ropar library website and IIT Guwahati library website. IIT Hyderabad library website has achieved the least usability score amongst all IITs libraries' websites.

58) From the total usability score, it has been found that IIM Ahmedabad library website has achieved the highest usability score followed by IIM Kozhikode library website and IIM Bangalore library website. IIM Rohtak library website has scored the least score amongst all IIMs libraries websites.

59) From the study, amongst the all IITs and all IIMs libraries websites, it has been found that IITs libraries' websites are much better than IIMs libraries' websites in terms of usability.

60) IITs libraries' websites have achieved 1048 usability scores while IIMs libraries' websites have scored 738 usability scores which show that IITs libraries' websites have utilization usability parameters in much better way than IIMs libraries' websites.

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Chapter – 5: CONCLUSION AND SUGGESTIONS

5.1 Introduction

The present chapter explores the brief details of data analysis for which the raw data was collected using the prepared parameters and as described in Chapter 4: Analysis of Data & Presentation of Findings. As mentioned earlier, the collected data were arranged into simple tabular form in Microsoft Excel. There were several tables made for the collection of a huge amount of data. These data were collected institute wise i.e. sixteen IITs & thirteen IIMs. In the present study, an attempt has been made to analyze the usability features of the selected IITs and IIMs libraries websites.

The objectives laid down for the present study were as follows:

a) To formulate evaluation criteria for assessing the usability of the selected libraries' websites.
b) To find out usability, efficiency, and effectiveness of selected libraries' websites.
c) To investigate the libraries' websites usability features and problems.
d) To rank the selected libraries' websites based on their usability analysis score.
e) To offer suggestions for improving the usability of selected libraries' websites.

The study is limited to library website usability analysis of sixteen IITs and thirteen IIMs libraries' websites of India. Further, information has been collected under twelve categories of the total of 102 parameters. These parameters come under the category of Library Website, Library Home Page, General Information & Services, Contact us, Date and Time, Content writing, Graphics, and Animations, Navigation Features, Searching Features, Identity & Credibility, Web 2.0 Applications, URL of the Homepage and Online Evaluation Tools.

5.2 RESEARCH OBJECTIVES

The following section presents a discussion on the laid objectives:

a) ***Formulate evaluation criteria for assessing the usability of the selected libraries' websites.***

One of the objectives of the study is to develop the evaluation criteria for assessing the usability of the selected institutions libraries' websites, in the present study evaluation criteria were developed and the same is appended as Appendix - II.

b) ***Find out usability, efficiency, and effectiveness of selected libraries' websites.***

One of the objectives of the study is to find the usability, efficiency and effectiveness of selected IITs and IIMs libraries' websites of India. For that purpose, usability, efficiency, and effectiveness checking parameters were designed and as per parameters, all the selected libraries websites have been consulted and collected data were tabulated and interpreted. After the evaluation, it is found that the IITs libraries' websites were more usable, efficient and effective than on IIMs libraries' websites. All the selected IITs libraries' websites gained 1048 usability score and IIMs libraries' websites gained 738 usability score. For calculating the usability, efficiency, and effectiveness of selected libraries' websites, the parameters were characterized into various heads/categories and their sub-heads. The brief score of IITs and IIMs heads/categories wise has been given in Table 5.2.

Table 5.1: Ranks of IITs and IIMs based on Usability Score

Rank	IITs	Total Usability Score	IIMs	Total Usability Score
1	IIT Mumbai	74	IIM Ahmedabad	69
2	IIT Ropar	73	IIM Kozhikode	68
3	IIT Guwahati	72	IIM Bangalore	67
4	IIT Jodhpur	71	IIM Indore	67
5	IIT Patna	70	IIM Lucknow	61
6	IIT Chennai	69	IIM Raipur	60
7	IIT Bhubaneshwar	68	IIM Udaipur	58
8	IIT Kanpur	68	IIM Tiruchirapalli	55
9	IIT New Delhi	68	IIM Kolkata	51
10	IIT Gandhi Nagar	65	IIM Ranchi	49
11	IIT Indore	63	IIM Kashipur	49
12	IIT Varanasi	63	IIM Shillong	47
13	IIT Roorkee	62	IIM Rohtak	37
14	IIT Kharagpur	58		
15	IIT Mandi	56		
16	IIT Hyderabad	48		

(Source: primary data)

Table 5.1 shows that IIT Mumbai library website has the maximum usability, efficiency, and effectiveness features among all IITs libraries' websites followed by IIT Ropar library website, IIT Guwahati library website, IIT Jodhpur library website, and IIT Patna library website. IIT Hyderabad library website has the least usability, efficiency, and effectiveness features. Further Table 5.1 shows that IIM Ahmedabad library website has the maximum usability, efficiency, and effectiveness features among all IIMs libraries websites followed by IIM Kozhikode library website, IIM Bangalore library website, IIM Indore library website, and IIM Lucknow library website. IIM Rohtak library website has the least usability, efficiency, and effectiveness features.

Table 5.2: Usability Score – Category/ Head wise

SN	Parameter Categories/ Heads	Usability Score of IITs	Usability Score of IIMs
1	About Library Website	84	78
2	About Library Home Page	87	61
3a	General Information & Services	146	75
3b	Contact us	64	43
4	Date and Time	8	0
5	Content writing	278	195
6	Graphics and Animations	46	28
7	Navigation features	132	83
8	Searching Features	24	29
9	Identity & Credibility	91	63
10	Web 2.0 applications	14	31
11	URL of the Homepage	74	52
Total		1048	738

(Source: primary data)

From the analysis of Table 5.2, the usability, efficiency, and effectiveness features of selected IITs libraries' websites has been found more as compared to IIMs libraries' websites.

The mobile view websites increase the usability, efficiency, and effectiveness of the websites. The desktop version of any website might be difficult to view and use on a mobile device. User has to pinch or zoom in order to read the content of the websites. Users find this a frustrating experience and are likely to abandon the site. From the selected IITs libraries' websites, 44% of the libraries' websites are "mobile view friendly" whereas rests are not compatible with mobile browsers and 46% of the IIMs libraries' websites are "mobile view friendly" and rests of the IIMs libraries' websites are not compatible with mobile browsers.

The page load time depends upon three components of the website i.e. Page weight, page requests and page structure. The lesser page load time, the faster page loads on the web browser and increase the usability, efficiency, and effectiveness. From the selected IITs libraries' websites, IIT Varanasi has the least page load time and IIT Patna library website has maximum page load time, whereas in IIMs, IIM Kashipur library website has the least page load time and IIM Raipur library website has the highest page load time (see Table 4.20 and Table 4.44). There are many supported files that are used in design and development of that website. More number of objects is responsible for web page delay and less number of objects leads to fast loading of websites leads to increase in usability, efficiency, and effectiveness of that website. From the selected IITs libraries' websites, IIT Delhi has the least number of objects, whereas IIT Hyderabad has the highest number of objects and in IIMs, IIM Kashipur library website has the least number of objects while IIM Bangalore library website has the highest number of objects which leads to slow page loading and late responding (see Table 4.45 and Table 4.44).

The number and size of images on the websites decides the weight of websites, less number and size of images makes their website lighter; and resulting fast loading of webpages, easily accessible via low tech devices with slow bandwidth which results increase in usability of that website. From the selected IITs libraries' websites, IIT Delhi library website has least number and size of images whereas IIT Patna library website has maximum number of images and in IIMs, IIM Kashipur library website has least number and size of images whereas IIM Bangalore library website has highest number and size of images (see Table 4.47 and 4.46).

c) ***To investigate the libraries' websites usability features and problems.***

One of the objectives of the present study is to investigate the libraries' website usability features and problems. For the present study, usability checking parameters were developed and designed; and as per designed parameters, one checklist has been prepared through which primary data related to study have been collected and tabulated. After the careful evaluation of usability features and usability scores of individual libraries' websites, it is found that the IITs libraries' websites have more usability features, and in contrary to these IIMs libraries' websites have faced more usability problems, so reported less usability features than IITs libraries' websites. Further, more specifically libraries' websites were lacking usability features like library website layout, searching features, lack of Web 2.0 applications, URL structure of their websites etc.

d) ***To rank the selected libraries' websites based on their usability analysis score.***

One of the objectives of the present study is to rank the selected libraries' websites based on their usability score. On the basis of individual libraries' websites usability score, the common rank has been generated for IITs & IIMs libraries' websites in Table 5.3.

Table 5.3: Ranking of the Institutes

Rank	Name of Institutes	Total Usability Score
1	IIT Mumbai	74
2	IIT Ropar	73
3	IIT Guwahati	72
4	IIT Jodhpur	71
5	IIT Patna	70
6	IIM Ahmedabad	69
6	IIT Chennai	69
7	IIM Kozhikode	68
7	IIT Bhubaneshwar	68

Rank	Name of Institutes	Total Usability Score
7	IIT Kanpur	68
7	IIT New Delhi	68
8	IIM Bangalore	67
8	IIM Indore	67
9	IIT Gandhi Nagar	65
10	IIT Indore	63
10	IIT Varanasi	63
11	IIT Roorkee	62
12	IIM Lucknow	61
13	IIM Raipur	60
14	IIM Udaipur	58
14	IIT Kharagpur	58
15	IIT Mandi	56
16	IIM Tiruchirapalli	55
17	IIM Kolkata	51
18	IIM Ranchi	49
18	IIM Kashipur	49
19	IIT Hyderabad	48
20	IIM Shillong	47
21	IIM Rohtak	37

(Source: primary data)

e) ***To offer suggestions for improving the usability of selected libraries' websites.***

One of the objectives of the present study is to offer suggestions for improving the usability of selected libraries' websites. During the process of data collection and analysis, some important suggestions have been recorded categorically for the improvement of libraries' websites usability. The suggestions are as follows:

About Library Website

i) Libraries' websites may be more dynamic, value added and compatible with all web browsers.

ii) Libraries' websites can provide information about facility of Anti-Plagiarism, document submission process, software using for checking plagiarism, and its features to their users.

About Library Home Page

i) Library website may mention its' purpose, update date and target audience.

General Information & Services

i) General library information like collections, types of collections, total carpet area, year of establishment, location, feedback, annual report, funding agency, budget heads and vendor lists can also be given on library website.

ii) Libraries' may link their Institutional Repositories on their libraries' websites and make them publically accessible.

iii) Web-OPAC may be linked with library websites and should be accessible from out of campus.

iv) All the forms like Book Recommendation Form, No Dues, Membership Forms, etc. can be made available on library website.

v) Libraries' websites may have to provide online reference service.

vi) Library sections can also be mentioned over their websites.

vii) Libraries have to conduct online user training program to make user aware about how to access the library website, how to use Web-OPAC and other library facilities and services.

viii) Libraries have to mention the teaching learning/ research supporting aided software on their websites and have to put tutorials stating that how to use them.

ix) A standard format can be developed for the creation of university library website.

Contact us

i) Ask Librarian/ Library Chat may also be given on library website for query and raising complaint by the user.

Content writing

i) All e-resources may be given in a separate webpage under the category of E-Resources.

ii) Website content may be placed under proper categories and sub-categories.

Graphics and Animations

i) An attractive library image can be given on library website to attract users to visit the library.

Searching Features

i) Library website may have "site search engine" so that any information seeker may get their desired information easily.

ii) Facility of "Single Window Search" may also be provided on library website to save the time of the user.

Web 2.0 applications

i) Libraries' websites of IITs and IIMs may also take the advantage of social networking applications like Social Networking Sites, Blogs, RSS Feed, Instagram, Vimeo and Android App, YouTube etc.

URL of the Homepage

i) All the libraries' websites may have clear and visible links on their institute's home page.

5.3 SOME OBSERVATIONS

The world is not perfect and same also applies for library websites. The libraries' websites of institutions play key role in dissemination of information to the users and provide a platform for the access to library resources and services. It is most important for a library to follow certain common guidelines while building a library

website. The usability study of libraries' websites enabled the researcher to provide some practical observations about improving the library website. It is observed that most of the libraries' websites were not updated with the time and some of them have incomplete information on its website. The library website link on the institute's home page should be clearly visible, while most of the cases library website link was found under the central facilities or some other navigational heads of the institute's website. Library website managers should have to use more recent images of frequent readers, images of any special occasions like book fair/exhibition, quiz competitions, sections or facilities of the library etc. to make their website more attractive and updated.

5.4 FINAL OUTCOME

The present study is confined to 16 IITs and 13 IIMs libraries' websites of India. Thus, there are 29 reputed academic libraries' websites which were included in the study. Usability parameters were prepared and categorized under twelve heads/categories which consist of 102 parameters. The quantitative rating system ("1" and "0") was used to determine the evaluation checklist. "1" is used for 'Yes' i.e. the terms or parameters are present on the selected libraries' websites while "0" is used for 'No' i.e. the terms/parameters are not available on the selected libraries' websites. After usability evaluation, it is found that the IITs libraries' websites have more usability, efficiency, and effectiveness as compared to IIMs libraries' websites. On the basis of usability score, the IITs and IIMs libraries' websites were ranked accordingly. Among IITs libraries' websites, IIT Mumbai library website has found on the top followed by IIT Ropar library website, IIT Guwahati library website, IIT Jodhpur library website, IIT Patna library website, IIT Chennai library website, IIT

Bhubaneshwar library website, IIT Kanpur library website and IIT Gandhinagar library website. Among IIMs libraries' websites, IIM Ahmedabad library website has been found on the top followed by IIM Kozhikode library website, IIM Bangalore library website, IIM Indore library website, IIM Lucknow library website, IIM Raipur library website, IIM Udaipur library website, IIM Tiruchirapalli library website, IIM Kolkata library website, and IIM Ranchi library website. In some usability feature, both IITs and IIMs libraries' websites are weak and need improvement such as website layout, searching features, Web 2.0 Applications, and URL structure.

5.5 SCOPE OF FURTHER RESEARCH

The present study was carried out on "Usability Analysis of IITs and IIMs Libraries' Websites: An Evaluative Study". However further studies warranted to look into the evaluation of libraries' websites. The Libraries' websites usability analysis is an open and vast area of research, due to rapid change in technology and continuous change in user preferences, further research is required in this area to evaluate the libraries' websites usability, efficiency, and effectiveness. With the help of developed parameters in the present study, other academic libraries' websites may also be evaluated to analyze and evaluate their usability and efficiency.

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Appendix – I: IITs & IIMs in MHRD Website

MHRD | Government of India
Ministry of Human Resource Development

Published on *Government of India, Ministry of Human Resource Development* (http://mhrd.gov.in)

Home > Printer-friendly > IIMs

Institutions

IIMs

S.No.	Name of the Organisation	Website
1	Indian Institute of Management Vastrapur, Ahmedabad - 380015	http://www.iimahd.ernet.in/ [1]
2	Indian Institute of Management Bannerghatta Road, Bangalore - 560076	http://www.iimb.ernet.in/ [2]
3	Indian Institute of Management Raipur, Govt. Engg. College Campus, Old Dhantari Road, Sejbahar, Raipur, Chhattisgarh - 492015	http://www.iimraipur.ac.in/ [3]
4	Indian Institute of Management Humanities Block, MDU Rohtak, Haryana	http://www.iimrohtak.ac.in/ [4]
5	Indian Institute of Management Ranchi,Suchna Bhawan, Audrey House Campus, Meur's Road, Ranchi, Jharkhand	http://www.iimranchi.ac.in/ [5]
6	Indian Institute of Management Kozhikode, Kunnamangalam P.O., Kozhikode, Kerala - 673571	http://www.iimk.ac.in/ [6]
7	Indian Institute of Management Diamond Harbour Road, Joka, Kolkata - 700104	http://www.iimcal.ac.in/ [7]
8	Indian Institute of Management Prabandh Nagar, Off. Sitapur Road, Lucknow - 226013	http://www.iiml.ac.in/ [8]
9	Indian Institute of Management Indore, Pigdamber, Rau, Madhya Pradesh - 453331	http://www.iimidr.ac.in/ [9]
10	Indian Institute of Management Udaipur, Rajasthan	http://www.iimu.ac.in/ [10]
11	Rajiv Gandhi Indian Institute of Management Mayurbhanj Complex Shillong	http://www.iimshillong.in/ [11]
12	Indian Institute of Management Tiruchirappalli, National Institute of Technology Campus, Tiruchirappalli, Tamil Nadu - 620015	http://www.iimtrichy.ac.in/ [12]
13	Indian Institute of Management Kashipur, Uttarakhand	http://www.iimkashipur.ac.in [13]

Last Updated by admin on Thu, 04/23/2015 - 12:35

Last Updated/Reviewed on: 08-May-2015 | 13:15 PM

Source URL: http://mhrd.gov.in/iims

Links:
[1] http://www.iimahd.ernet.in/
[2] http://www.iimb.ernet.in/
[3] http://www.iimraipur.ac.in/
[4] http://www.iimrohtak.ac.in/
[5] http://www.iimranchi.ac.in/
[6] http://www.iimk.ac.in/
[7] http://www.iimcal.ac.in/
[8] http://www.iiml.ac.in/
[9] http://www.iimidr.ac.in/
[10] http://www.iimu.ac.in/
[11] http://www.iimshillong.in/
[12] http://www.iimtrichy.ac.in/
[13] http://www.iimkashipur.ac.in

MHRD | Government of India
Ministry of Human Resource Development

MHRD | Government of India
Ministry of Human Resource Development

Published on *Government of India, Ministry of Human Resource Development* (http://mhrd.gov.in)

Institutions

IITs

S.No.	Name of the Organisation	Website
1	Indian Institute of Technology (IIT) Gandhi Nagar (Mentored by IIT, Bombay Temporarily at : Vishwakarma Govt. Engineering College, Chandkheda, Ahmedabad	http://www.iitgn.ac.in/ [1]
2	Indian Institute of Technology (IIT) Bhubaneshwar (Mentored by IIT, Kharagpur) Temporarily at : Samantauri, Bhubaneswar	http://www.iitbbs.ac.in/ [2]
3	Indian Institute of Technology (IIT) P.O. IIT, Chennai-600036	http://www.iitm.ac.in/ [3]
4	Indian Institute of Technology (IIT) North Guwahati, Guwahati – 781039	http://www.iitg.ernet.in/ [4]
5	Indian Institute of Technology (IIT) Indore (Mentored by IIT, Bombay) Temporarily at : Institute of Engineering & Technology, DAVV Campus, Khandwa Road, Indore - 452 017	http://www.iiti.ac.in/ [5]
6	Indian Institute of Technology (IIT) P.O. IIT, Kanpur - 208076	http://www.iitk.ac.in/ [6]
7	Indian Institute of Technology (IIT) Rajasthan (Mentored by IIT, Kanpur) Temporarily at : IIT, Kanpur	http://www.iitj.ac.in/ [7]
8	Indian Institute of Technology (IIT) P.O. Kharagpur - 721302	http://www.iitkgp.ac.in/ [8]
9	Indian Institute of Technology (IIT) Hyderabad (Mentored by IIT, Madras) Temporarily at : Ordinance Factory, Medak	http://www.iith.ac.in [9]
10	Indian Institute of Technology (IIT) Powai, Mumbai - 400076	http://www.iitb.ac.in/ [10]
11	Indian Institute of Technology (IIT) Patna (Mentored by IIT, Guwahati) Temporarily at : Navin Govt. Polytechnic, Patliputra Colony, Patna - 800013	http://www.iitp.ac.in/ [11]
12	Indian Institute of Technology (IIT) Hauz Khas, New Delhi - 110016	http://www.iitd.ac.in/ [12]
13	Indian Institute of Technology (IIT) Ropar (Mentored by IIT, Delhi) Temporarily at : Nangal Road, Rupnagar, Punjab	http://www.iitrpr.ac.in/ [13]
14	Indian Institute of Technology (IIT) Mandi (Mentored by IIT, Roorkee) Temporarily at : IIT Mandi Cell, Hafiz Mohammad Ibrahim Building, (Old Central Library). IIT Roorkee, Roorkee - 24766	http://www.iitmandi.ac.in/ [14]
15	Indian Institute of Technology (IIT) Roorkee - 247667	http://www.iitr.ernet.in/ [15]
16	Indian Institute of Technology (Banaras Hindu University) Varanasi - 221005	http://iitbhu.ac.in [16]

Last Updated/Reviewed on: 13-Apr-2015 | 18:40 PM

Source URL: http://mhrd.gov.in/iits

Links:
[1] http://www.iitgn.ac.in/
[2] http://www.iitbbs.ac.in/
[3] http://www.iitm.ac.in/
[4] http://www.iitg.ernet.in/

Annexure - II: Usability Analysis Parameters

S. N.	Parameters Heads	Parameters	Scoring
1	**Library Website**	Separate website	
2		Page title with informative words	
3		The home page of the site has a memorable URL	
4		Site load-time is reasonable	
5		Website map	
6		Multi-Lingual Options	
7		Browser related information e.g. browser support, resolution, etc	
8		Visitor Counter	
9		Webmaster e-mail	
10		Website update date	
11	**Library Home Page**	The items on the home page are clearly focused on users' key tasks	
12		Product categories are provided and clearly visible on the homepage	
13		Show the Library name or logo in reasonable and noticable location	
14		Archiving and Accessing past events	
15		Related information with appropriate heading	
16		Emphasize the highest priority	
17	**General Information & Services**	Opening Hours	
18		Library Staff	
19		Library Rules & Regulations	
20		Library News & Updates	
21		About Library	
22		Library Commettee	
23		ICT Infrastrucute	
24		Links to (working) Web-OPAC	
25		Link to IR	
26		Link to plagiarism	
27	**Contact us**	"Library Contact Us" link on Homepage	
28		Physical address	
29		e-mail	
30		Maps	
31		FAQ/Help	
32		Web forms	
33	**Date and Time**	Date and time	
34		International time zone	
35		Spell out month and date	
36	**Content writing**	Adequate text-to-background contrast	
37		Font size/spacing is easy to read	

38		Flash & add-ons are used carefully	
39		Images have appropriate ALT tags	
40		Site has custom not-found/404 page	
41		Major headings are clear & descriptive	
42		Critical content is above the "fold"	
43		Styles & colors are consistent	
44		Emphasis (bold, etc.) is used carefully	
45		Ads & pop-ups are unobtrusive	
46		Main copy is concise & explanatory	
47		URLs are meaningful & user-friendly	
48		Page titles are explanatory	
49		The site is free of typographic errors and spelling mistakes	
50		The library website has appropriate help functions.	
51		User friendly language	
52		Avoid redundant contents	
53		Spell out Abbreviations & Acronyms	
54	**Searching Features**	Search box at homepage	
55		Search box should be wide & clearly visible	
56		Site search is easy to access	
57	**Graphics and Animations**	Alternate Tags for Images & Links	
58		Avoid watermark graphics	
59		Control on scrolling and blinking contents	
60	**Navigation features**	Active link for homepage	
61		Main navigation is easily identifiable	
62		Number of buttons/links is reasonable	
63		Navigation labels are clear & concise	
64		Links are consistent & easy to identify	
65		links colours	
66		links with informative words	
67		Path information for each pages	
68		Library logo is linked to home-page	
69	**Identity & Creadibility**	Library logo is prominently placed	
70		Tagline makes Universities's purpose clear	
71		The content is up-to-date, authoritative and trustworthy	
72		Clear path to Library information	
73		Clear path to contact information	
74		Copyright information is clearly mentioned	
75		Library use, Privacy & Disclamier statement properly stated	
76	**Web 2.0 applications**	Blogs	
77		Wikis	

78		bookmarking and Tagging	
79		Social Networking Sites	
80		calendering	
81		podcast/vodcast	
82	**URL of the Homepage**	Recall value	
83		Responsiveness with both www. & domain.com	
84		Domaim level structure	
85		URL is easy to remember	
86		Distinguish between visited and not visited links	
1	**Online Tools**	Global Rank	
2		Rank In India	
3		Google Page Rank	
4		Mobile friendly test	
5		Page load time	
6		Total objects	
7		Total Number of images	
8		Total Number of CSS	
9		Webpage Size	
10		Total Number of script	
11		Totak HTML size	
12		Total Image Size	
13		Total script size	
14		Totak CSS size	
15		Internal links	
16		External links	

PARTICULAR OF THE CANDIDATE

NAME OF THE CANDIDATE	: NITESH KUMAR VERMA
DEGREE	: Ph.D
DEPARTMENT	: LIBRARY AND INFORMATION SCIENCE
TITLE OF THE THESIS	:USABILITY ANALYSIS OF INDIAN INSTITUTES OF TECHNOLOGY AND INDIAN INSTITUTES OF MANAGEMENT LIBRARIES' WEBSITE: AN EVALUATIVE STUDY
DATE OF ADMISSION	: 11.08.2014

APPROVAL OF THE RESEARCH PROPOSAL

1. BOS :
2. SCHOOL BOARD : 22.05.2015

REGISTRATION NO. & DATE : MZU/Ph.D./720 of 22.05.2015

EXTENSION (IF ANY) : NO

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High School: 2006	Central Board of Secondary Education, New Delhi

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RESEARCH INTEREST:

- Website Evaluation, Website Designing and Development, Library Automation.

(Nitesh Kumar Verma)