CHAPTER-II

DESIGN AND EVALUATION OF R&D LIBRARY WEBSITES: AN OVERVIEW
2.1. Introduction

R&D has been defined as systematic activity combining both basic and applied research, and aimed at discovering solutions to problems or creating new products or procedures, or to improvement of existing products and procedures. R&D may result in ownership of intellectual property such as patents. In accounting for R&D costs, the development costs may be carried forward but the basic and applied research costs are often written-off as incurred. India has an extensive network of R&D institutions. Most of the institutions are Government supported. These institutions cover virtually every branch and facet of research and technology ranging from very general to aerospace.

2.2. Classification of R & D Institutions in India

The Department of Science and Technology (DST) has been compiling information on the details of R&D institutions in the country since 1978 for conducting National level survey on resources (both financial and human) deployed on R&D activities. The latest Directory (2010) contains information on the 4288 R&D Institutions.

The term R&D institution, used in this Directory refers to either a national laboratory or a research institute or a research station or private and public sector in-house R&D unit or a not for profit Scientific and Industrial Research Organization (SIRO) or an academic institution. The Organizations under various sectors are not homogeneous and are of varied sizes in terms of infrastructure, facilities and research inputs like manpower and expenditure etc. deployed on S&T activities.
The Directory has classified R&D institutions in India into five groups.

- Public Sector (Public Sector includes in-house R&D units of Central Public Sector and State Public Sector)
- Universities (Includes Deemed Universities and Institutes of National Importance)
- Central Sector (GOI Funded)
- State Sector (R&D institutions funded by respective state governments)
- Private Industry (Private Industry includes DSIR recognized in-house R&D units, Scientific and Industrial Research Organizations and Industries not recognized by DSIR but performing R&D activities taken from CMIE database.)

**Figure-2.2F: Sector wise number of R&D Institutions**

![Sector wise Number of R&D Institutions (2010)](chart.png)

**Source:** Directory of R&D Institutions in India 2010. Published by Department of Science and Technology GOI

**Private Sector R&D Institutions:** Scientific and Industrial Research Organizations (SIRO's) and in-house R&D units of Private Sector industry recognized by Department of Scientific and Industrial Research (DSIR) come under this sector. This includes Industries performing R&D but not registered with DSIR. The details of such units have been taken from the Central Monitoring of Indian Economy (CMIE) database.
**State Sector R&D Institutions:** These are research institutions funded by individual state governments. The maximum number of state government funded R&D institutions are located in Maharashtra (846), which is followed by Tamil Nadu, Karnataka and Gujarat with 437 (10.2%), 404 (9.4%) and 375 (8.7%) respectively.

**Central Sector R&D Institutions:** With liberalization, the Indian economy is increasingly exposed to the forces of globalization. Earlier many Indian companies sourced technology from abroad. This source is now drying up. This is due to the adoption of international patent laws and due to the multinationals (from whom Indian companies sourced their technology) now becoming direct players in the Indian economy. Realizing the need to receive a substantial gain through the application of S&T for the up-liftment of the economy, central Government continued to shoulder the major share of the financial resources devoted to R&D activities.

Scientific research in India was largely done in government owned labs and institutions especially central government. With the drying up of technology from foreign sources, many private Indian companies turned to the already existing labs in the country for their research needs, because for most of them to set up their own research lab was beyond their means of both funds and time. Further, since the government had other priorities (like investment in relatively neglected sectors such as education, health, law and order and upgradation of infrastructure); Indian R&D institutions had to tap other sources of funds. These two imperatives mean that there is pressure on central research institutions to improve their quantity and quality of research output at a higher level. Improving the productivity of research enables these institutions to be ready to cater to industry needs and to source research funds from global sources. There is thus interest in what factors affect these institutions’ research productivity (GOI, 2010).
Universities/ Academic Sector R&D Institutions: Higher Education Sector comprising of universities with S&T faculty, deemed universities and institutions of national importance. All the State Agriculture Universities are included in the respective State Government list in the State Sector. In India, there are 282 academic sector R&D institutions are functioning.

Public Sector R&D Institutions: Public Sector includes in-house R&D units of Central Public Sector and State Public Sector.

2.3. Libraries in R&D Institutions

“Libraries have a recognized social function in making knowledge publicly available to all. They serve as local centers of information and learning, and are local gateways to national and global knowledge” (Pitroda, 2007).

Research libraries are established to serve the needs of special user group viz., Scientist, the technologist, the planner, the industrialist, the statistician and so on and its collection is limited to special subject (Single/cluster of specific subject/interrelated) through special services. Such libraries are attached to a specific institution or organization. Each library will be well known for its subject specific collections of books, journals and specifically technical reports from respective research agencies such as ICAR, ICMR, CSIR, ICSSR and so on. Libraries offer Online, Web and CD-ROM based literature search services including access to e-journals, News clipping services, Online Public access Catalogue, Union Catalogue of Serials on a specified subject. Holdings and services of each library reflects the user’s interest largely. Role of the research library is depending upon the nature of the parent organization where the research library exists. But all such libraries are actively involved in developing specialized collections to provide different kinds of personalized services such as current awareness services, selective
dissemination of information, indexing and abstracting, document delivery, online and CD ROM search services, among other services.

Research libraries have forged pathways to serve the users more effectively. They have been early adopters of digital technologies, so that the users can be served in a better way. Libraries have assisted to bring in recent transformations in research activities. Although managing information resources remain an important activity of the research library, a focus will be more on distilling information. Users are conferred with vast amount of information. Even after shifting out the irrelevant, there often remains far too much to read and comprehend on a particular topic. The challenge is to provide products and services that help scientists sort out large quantities of information into manageable and actionable packages. In an R&D institution, the size of a collection of books, journals, and reports can no longer be considered as an indicator of the Library’s service capability, nor its effectiveness. New quality metrics is based on the effectiveness of narrowing a body of information to that which is most relevant must be developed as it continues to assess the value to users (Nicol & English, 2012).

The research library regards internally generated information with the same level of importance as externally published literature. Collectively, both represent the institutions’ knowledge base, one that must be managed and exploited. Libraries are required to implement systems that provide clients with effective, easy-to-use tools to locate and retrieve specific information, facilitate the management of this information, and once found, help incorporate the information into new documents. Users need to offer the expertise needed to enable customers to integrate automated document management into their document creation process and to link the information created internally with related published information.
Research libraries have used ICT that permits them to advance the use of digital information and bring information resources and services directly to users at their workstations. These tools make it possible to easily customize products to meet users’ unique needs. Libraries anticipate increasing reliance on ICT to enhance collaborative efforts within as well as between the institutions of same interest.

Research libraries have used the term clients or customers rather than patrons. The change in terminology is more than semantic. It signifies a realization that information seekers no longer need to use the Library to obtain information, rather, customers will have multiple, easy-to-use channels for information searching and delivery. The Library becomes the channel of choice only when it is perceived to be providing value not obtainable from other sources. In a real sense, the Library must compete for customers’ business. Competition drives libraries to tailor products and services to individual needs (Gresehover, Jone & Toratino, 2000).

2.3.1. Need for Libraries in R&D Institutions

Owing to the importance of research, there is need to set-up Library at the various institutions. The factors affecting the need are;

- Changing attitude of research/trend towards front-line research
- High degree of urgency for nascent (current and updated) information by the users
- R & D pursuit of specials
- To search for the unknown from the available sources
- Multilingualism, high degree of availability of information in other than English languages, Thesaurus etc.
- Exponential growth of information in electronic form and its services compared to print form
- Focus on Information discovery from Information explosion in all forms in all areas
• Great inventions and discoveries in all fields affects in increasing specialization in the field
• Pressure towards work at international level in the field/topic with modern aspects
• Exponential entrance of users with different nationalities, cultures, field of interest and languages etc mark their place in research area/net which impacts in generation of new research
• Societal relevance, research is for betterment of the society

2.3.2. Type of resources to be part of R&D Library Collection
• **Books:** Each research library is expected to systematically build its collection on a respective discipline and its related area which parent organization is working on. Collection of books can be both in print and electronic medium.

• **Subject specific Magazines and Journals:** Each research library subscribes to current magazines and journals on a respective discipline and its related areas in print and electronic or either of it.

• **Bound Volumes:** Bound volumes are older individual periodicals (magazines and scientific journals) that the library has bound into larger volumes. These will be kept for reference to the users.

• **Technical Reports:** This is so called as scientific report, is a document that describes the process, progress, or results of technical or scientific research or the state of a technical or scientific research problem. It might also include recommendations and conclusions of the research.

• **Monographs:** A monograph is a specialist work of writing on a single subject or an aspect of a subject

• **Project Reports:** The project report is a document, which gives an account of the project proposal to ascertain the prospects of the proposed plan/activity. The project report contains detailed information about:
  o The process to be followed
  o Equipments required
- Resources required
- Man power required
- Cost involved
- Technical specifications

- **Government Publications:** These are documents and information produced by government departments and central government organizations. They include parliamentary publications, legislation, policy documents, discussion documents, statistics and reports.

- **Standards:** A standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose. These will be used for project specific purposes.

- **Audio/Video materials:** Any specific resource in Audio/Video format. Example: Lectures from subject experts and project specific talks will be recorded and archived in the form of audio/video for further use.

- **Conference Proceedings:** Proceedings of the conferences / seminars organized on a specified subject area will be provided in the research library for the use of researchers.

- **Patents:** Copies of the patents on a specified subject area will be kept in the research library so that researchers working on those areas may refer them.

2.3.3. **E-Resources to be subscribed:** E-resources to be subscribed in different R&D institutions irrespective of their subject area.
Table-2.3.3.1: List of E-resources and subject coverage

<table>
<thead>
<tr>
<th>S. No</th>
<th>E-Resources</th>
<th>Subject area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Academic Research</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>2</td>
<td>Aerospace &amp; High Technology</td>
<td>Natural &amp; Applied Sciences</td>
</tr>
<tr>
<td></td>
<td>Database</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Agricola</td>
<td>Agriculture</td>
</tr>
<tr>
<td>4</td>
<td>AGRIS-Agricultural Database</td>
<td>Agriculture</td>
</tr>
<tr>
<td>5</td>
<td>Analytical Abstracts</td>
<td>Natural &amp; Applied Sciences</td>
</tr>
<tr>
<td>6</td>
<td>Analytical Science</td>
<td>Natural &amp; Applied Sciences</td>
</tr>
<tr>
<td>7</td>
<td>Arts &amp; Humanities Citation</td>
<td>Social Sciences</td>
</tr>
<tr>
<td></td>
<td>Index</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>arXiv</td>
<td>Natural &amp; Applied Sciences</td>
</tr>
<tr>
<td>9</td>
<td>ACM Digital Library</td>
<td>Computer Science &amp; Engg.</td>
</tr>
<tr>
<td>10</td>
<td>Astrophysics Data System</td>
<td>Physics</td>
</tr>
<tr>
<td>11</td>
<td>Biological Abstracts</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>12</td>
<td>BioOne</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>13</td>
<td>Bioinformatic Harvester</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>14</td>
<td>Books In Print</td>
<td>Books-Multidisciplinary</td>
</tr>
<tr>
<td>15</td>
<td>CAB Abstracts</td>
<td>Natural &amp; Applied Sciences</td>
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<tr>
<td>16</td>
<td>CeRA</td>
<td>Agriculture</td>
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<td>17</td>
<td>Chemical Abstracts Service</td>
<td>Natural &amp; Applied Sciences</td>
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<td>18</td>
<td>ChemXSeer</td>
<td>Natural &amp; Applied Sciences</td>
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<tr>
<td>19</td>
<td>Citebase Search</td>
<td>Multidisciplinary</td>
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<tr>
<td>20</td>
<td>CiteULike</td>
<td>Natural &amp; Applied Sciences</td>
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<td>21</td>
<td>CiteSeer</td>
<td>Natural &amp; Applied Sciences</td>
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<tr>
<td>22</td>
<td>CiteSeerX</td>
<td>Natural &amp; Applied Sciences</td>
</tr>
<tr>
<td>23</td>
<td>Compendex</td>
<td>Natural &amp; Applied Sciences</td>
</tr>
<tr>
<td>24</td>
<td>Current Index to Statistics</td>
<td>Social Sciences</td>
</tr>
<tr>
<td>25</td>
<td>Current Contents</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>S. No</td>
<td>E-Resources</td>
<td>Subject area</td>
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<td>--------------------------------------------</td>
</tr>
<tr>
<td>26</td>
<td>DOAJ</td>
<td>Journals</td>
</tr>
<tr>
<td>27</td>
<td>EconBiz</td>
<td>Social Sciences</td>
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<tr>
<td>28</td>
<td>EconLit</td>
<td>Social Sciences</td>
</tr>
<tr>
<td>29</td>
<td>EMBASE</td>
<td>Medical</td>
</tr>
<tr>
<td>30</td>
<td>ERIC</td>
<td>Education</td>
</tr>
<tr>
<td>31</td>
<td>Food Science and Technology Abstracts</td>
<td>Food science, Food technology, Nutrition</td>
</tr>
<tr>
<td>32</td>
<td>GoPubMed</td>
<td>Medicine</td>
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<tr>
<td>33</td>
<td>PubMed</td>
<td>Medicine</td>
</tr>
<tr>
<td>34</td>
<td>IEEE Xplore</td>
<td>Computer Science, Engineering, Electronics</td>
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<tr>
<td>35</td>
<td>Information Bridge: DAE</td>
<td>Multidisciplinary</td>
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<tr>
<td>36</td>
<td>Informit</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>37</td>
<td>IngentaConnect</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>38</td>
<td>Indian Citation Index</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>39</td>
<td>Inspec</td>
<td>Physics, Engineering, Computer Science</td>
</tr>
<tr>
<td>40</td>
<td>JSTOR: Journal Storage</td>
<td>Multidisciplinary (Historical)</td>
</tr>
<tr>
<td>41</td>
<td>MathSciNet</td>
<td>Mathematics</td>
</tr>
<tr>
<td>42</td>
<td>MedlinePlus</td>
<td>Medicine</td>
</tr>
<tr>
<td>43</td>
<td>Merck Index</td>
<td>Chemistry, Biology, Pharmacology</td>
</tr>
<tr>
<td>44</td>
<td>Microsoft Academic Search</td>
<td>Computer Science</td>
</tr>
<tr>
<td>45</td>
<td>PsycINFO</td>
<td>Psychology</td>
</tr>
<tr>
<td>46</td>
<td>PubChem</td>
<td>Chemistry</td>
</tr>
<tr>
<td>47</td>
<td>PubMed</td>
<td>Biomedical</td>
</tr>
<tr>
<td>48</td>
<td>PubPsych</td>
<td>Psychology</td>
</tr>
<tr>
<td>49</td>
<td>Readers' Guide to Periodical Literature</td>
<td>Journals and Magazines</td>
</tr>
<tr>
<td>50</td>
<td>Russian Science Citation Index</td>
<td>Scientific journals</td>
</tr>
<tr>
<td>S. No</td>
<td>E-Resources</td>
<td>Subject area</td>
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<tr>
<td>51</td>
<td>SafetyLit</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>52</td>
<td>SciDiver.com</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>53</td>
<td>SciELO</td>
<td>Journals</td>
</tr>
<tr>
<td>54</td>
<td>Science.gov</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>55</td>
<td>Science Accelerator</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>56</td>
<td>Science Citation Index</td>
<td>Science (General)</td>
</tr>
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<td>57</td>
<td>ScienceDirect</td>
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<td>Scopus</td>
<td>Multidisciplinary</td>
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<tr>
<td>59</td>
<td>SearchTeam</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>60</td>
<td>Social Science Citation Index</td>
<td>Social science</td>
</tr>
<tr>
<td>61</td>
<td>SSRN: Social Science Research Network</td>
<td>Social Sciences</td>
</tr>
<tr>
<td>62</td>
<td>SPIRES-HEP</td>
<td>Physics, (High Energy)</td>
</tr>
<tr>
<td>63</td>
<td>SpringerLink</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>64</td>
<td>Ulrich's Periodicals Directory</td>
<td>Periodicals-Multidisciplinary</td>
</tr>
<tr>
<td>65</td>
<td>Web of Knowledge</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>66</td>
<td>Web of Science</td>
<td>Science (General)</td>
</tr>
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<td>WestLaw</td>
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<td>68</td>
<td>WorldCat</td>
<td>Multidisciplinary</td>
</tr>
<tr>
<td>69</td>
<td>World Wide Science</td>
<td>Multidisciplinary</td>
</tr>
</tbody>
</table>

2.3.4. **Nature of Services Provided**

- **Circulation:** Users of the institution may borrow the books and periodicals from the library. This facility will be extended to all the users.

- **Current Awareness Service (CAS):** CAS is a generic announcement mechanism in which the user of the information will be informed, as soon as possible after the publication but before absorption into
comprehensive secondary sources, of current literature on a broad subject area in which user is interested. This service will be delivered at a broad level. This can be in the form of an e-mail alert. List of new arrivals of books and journal issues and table of contents are best examples of CAS.

- **Selective Dissemination of Information (SDI):** SDI can be considered as a by-product of the CAS in the sense that it not only provides current information, but also provides it selectively. SDI is more user-oriented and caters to an individual’s specific information needs in his/her areas of interest. Unlike CAS, SDI provides a more personalized experience to the user.

- **Web-OPAC:** Web OPAC is a single largest library database for any library. This includes bibliographic records of books, journals, technical reports, patents, standards, etc. OPAC will be accessible with both quick and advanced search features. Users may search for any resource through OPAC.

- **Access to Subject Gateways:** Subject gateways or portals are similar to directories but each one is subject specific rather than offering a range of topics. Users will find databases, digital libraries, repositories and journals on a specific subject area at one stop. Social Science Information Gateway (SOSIG), Science Gateway (SciGate) and Aerospace Information Gateway (Aero Info) are best examples for subject gateways.

- **Online Document Delivery Service:** Libraries will deliver the copies of papers from journals, conference proceedings and other sources from their collection to the users. In general document delivery requests will be for papers published in journals.

- **Literature Search Service:** This is an organized search for materials on specific subject, which usually involves using databases that contains quality information. When a user is asked for articles or information on
a special area, library staff will search for the information required and share the same with the user.

- **Access to e-resources**: Access to the E-resources subscribed by the respective library will be provided through the library website. In addition access to open access resources in the same subject area will also be listed on the websites and link will be provided to the same.

- **Online Reference Service**: Users may approach the library staff for any kind of assistance such as searching e-resources, using OPAC, placing request for new procurement / subscription of new documents, etc. Library staff will communicate with the user through e-mail with a solution.

- **Bulletin Board Service**: Bulletin boards have many variants. A typical bulletin board is one in which library staff posts information to be displayed on the board for users. Some bulletin boards have social feature. They allow users to communicate with each other interactively and leave messages. Some bulletin boards are used as a platform to exchange research information.

- **Discussion Forum**: A forum is essentially an online discussion between two or more individuals. These conversations are displayed in discussion threads, which allow users to carry on discussion on a particular topic. In the discussion forum service, e-mail names and address are grouped under single name. Through e-mail everyone in the discussion group get a copy of the message. Ideas can be exchanged on different areas of interest. Discussion groups are often managed using list server operated using the same software that runs many internet mailing lists.

- **Translation Service**: The literature published in languages other than English will be translated to English and circulated to users in research libraries. This is one of the on demand services being rendered to high level scientists.
- **Inter Library Loan:** Users may borrow the books or issues of journals from other libraries also, provided that library is part of the same research agency or governing council. Users may find the book through searching OPAC and place a request for the copy. Library staff will approach the library where that particular book is available and arrange to get the same.

**2.3.5. Users of R&D Libraries**

UNESCO Institute for Statistics has classified R&D personnel into three categories based on the nature of the work they performing, Researcher, Technical Staff and Support Staff. Researcher is the one who manages different research activities and technical staff is the one who really carries out the research work in the guidance of researchers. Both of these will be always in need for latest information on their area of research. Supporting staff includes the personnel from admin and other service providers. The staff covered under researcher and Technical staff is given below:

<table>
<thead>
<tr>
<th>Scientist/ Researcher</th>
<th>Technical Staff</th>
<th>Support Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal Scientist</td>
<td>Principal technical Officer</td>
<td>Admin</td>
</tr>
<tr>
<td>Scientists (With different Grades)</td>
<td>Technical Officer</td>
<td>Assistants</td>
</tr>
<tr>
<td>Research Officer</td>
<td>Superintending Engineer</td>
<td>Craftsman</td>
</tr>
<tr>
<td>Professor</td>
<td>Engineer</td>
<td>Service Providers</td>
</tr>
<tr>
<td>Doctors</td>
<td>Technician</td>
<td></td>
</tr>
<tr>
<td>Associate Professor</td>
<td>Lab Assistant</td>
<td></td>
</tr>
<tr>
<td>Project Manager</td>
<td>Project Associate</td>
<td></td>
</tr>
<tr>
<td>Assistant Professor</td>
<td>Project Assistant</td>
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</tbody>
</table>

**2.3.6. Role of R&D Libraries**

A research library will be having collection of materials on one or more subjects depending on the areas in which parent institution is involved into. Library aims at supporting scholarly or scientific research and it acts not just as a building stacked with books, rather it is a repository and source of
information and ideas, a place for learning and enquiry and for the generation of thought and the creation of new knowledge. Library is instrumental in transforming an unequal society into an egalitarian, progressive knowledge society.

2.4. Concept of Website

This is an age, in which information is being generated at a rampant rate and the World Wide Web acts as an electronic conduit for the dissemination of this information. This medium provides users with access to an endless variety of information including news, research, healthcare information, crime statistics, and multimedia. The Web has become a centralized entity in most parts of the society.

Libraries have long used technology to provide and improve access to their collections and services. From the earliest automated circulation systems and catalogs, through the rise of Internet based resources, to the explosion of the web, libraries have used technology for more effective delivery of content to their constituents. Libraries first used the web to provide access to their catalog of holdings and basic information about their organization. During the 1990’s libraries began to use the web to deliver additional content including access to e-resources, information about specific collections and services. Libraries often use the web for services as e-reference via e-mail, chat and instant messaging systems.

The web has become a ubiquitous source of information for most of the primary audience of all kinds of libraries. A website, as defined generally, is a set of related WebPages of information that are meaningfully linked together, electronically on the internet. The general rule of thumb is to consider all electronic documents on the web with addresses beginning with a unique hostname as belonging to one website. In order to locate and access a website, one needs to enter its file address or Uniform Resource Locator (URL) into appropriate space provided for by the browser. The URL is standard for
specifying an object on the internet. Supposing one enters a hypothetical URL such as http://www.guglibrary.net/facilities.htm in a given web browser, no matter where in the world one may be or wherever that website may be hosted, the same page should pop up on the screen.

**URL:** can be divided into four parts:

- The protocol/ access method used (i.e. hypertext protocol - *http*)
- The server/ host name (i.e. *www.guglibrary.net.)*
- The folder name (i.e. *facilities.htm*)
- The file name and extension (i.e. *facilities.htm*)

A website is a collection of WebPages. Web page intern consists of text, graphics and multimedia. The language used for writing a webpage is Hypertext Markup Language (HTML). Files or pages created using HTML can be accessed via Hyper Text Transfer Protocol (HTTP). This is a protocol that transforms information from websites server to display in the user’s web browser. All publically accessible websites are seen collectively as constructing the WWW.

Home page is the entry point of any website. It introduces one to the purpose and objectives of the website and provides link to lower level pages of the site. It is very much emphasized that the web designer should provide return home link feature from all the subsequent pages of the website (Lumsden, 2012).

**Importance of the WWW**

The web has become an integral part of our life. No one can live without using the Web - no email, no access to breaking news, no up to the minute weather reports, no way to shop online, meet new people from different towns, cities or countries, no way of instant messaging, etc. Present generation has
grown to be dependent on this technology. It is one of the greatest inventions ever created.

The web is always growing, and always evolving. The Web can’t actually be tracked down; we can’t point at it and say “there it is!” The Web is a continual, an ongoing process. It never has stopped replicating itself or progressing since the day it was created, and it probably will keep evolving as long as people are around to keep developing it and using it every single hour of the day. It’s made up of personal relationships, business partnerships, and global associations. If the Web didn’t have these interpersonal relationships it would not exist (Lee & Robert, 1994).

2.4.1. Web Design and Development

Many people use the two terms “web design” and “web development” interchangeably, but they really do have two different meanings. A clear idea on the difference between these two is given below.

- **Web Design**
  
  Web design encompasses many different skills and disciplines in the production and maintenance of websites. The different areas of web design include web graphic design; interface design; authoring, including standardized code and proprietary software; user experience design; and search engine optimization. The term web design is normally used to describe the design process relating to the front-end or the customer facing part. A web designer is concerned with how a site looks and how the customers interact with it. Good web designers know how to put together the principles of design to create a site that looks great. They also understand about usability and how to create a site that customers want to navigate around.

- **Web Development**
  
  Web development is a broad term and it refers to the back-end works of the website. A web developer focuses on how a site works and how the
customers get things done on it. Web development can range from developing the simplest static single page of plain text to the most complex web-based internet applications, electronic businesses, and social network services. A more comprehensive list of tasks to which web development commonly refers, may include web design, web content development, client liaison, client-side/server-side scripting, web server and network security configuration, and e-commerce development. Among web professionals, "web development" usually refers to the main non-design aspects of building web sites: writing markup and coding (Kyrnin, 2014).

2.5. Web usability and Accessibility

Web usability is an approach to make web sites easy to use for an end-user, without the requirement that any specialized training be undertaken. The user should be able to intuitively relate the actions one needs to perform on the web page with other interactions they do in similar contexts, e.g., press a button to perform some action.

Some broad goals of usability could be;

- Present the information to the user in a clear and concise way.
- Give the correct choices to the users in an obvious way.
- Remove any ambiguity regarding the consequences of an action (e.g. clicking on delete/remove/purchase).
- Place important items in an appropriate area on a web page or a web application.

People use ‘Usability’ and ‘Accessibility’ synonymously. But they are not synonyms. Generally, web accessibility refers to the degree to which web information is accessible to all human beings (e.g., disabled, able-bodied, old and young). That is, the goal of web accessibility is to allow universal access to information on the Web by all people but especially by people with disabilities (e.g., blindness, low vision, deafness, hard of hearing, physical disabilities or cognitive disabilities). In addition, the information must be accessible by
automatic machine tools (e.g., site indexing tools, robots). This information is adequately explained by Letourneau (2009) who defines web accessibility to mean "anyone using any kind of web browsing technology must be able to visit any site and get a full and complete understanding of the information and must have the full and complete ability to interact with the site if that is necessary".

The term accessible design is used to refer to design intended to maximize the number of potential customers who can readily use a website. Accessible design can impact market size and market share through consideration of the functional needs of all consumers, including those who experience functional limitations as a result of ageing or disabling conditions. A functional limitation describes a reduced sensory, cognitive, or motor capability associated with human ageing, temporary injury, or permanent disability that prevents a person from communicating, working, playing, or simply functioning in an environment where other people in the population can function.

2.5.1. Website Accessibility and Usability Guidelines

The growing community of website accessibility experts has formulated countless guidelines, and a subset of these is currently in common use. Accessibility guidelines can also be considered as guidelines for effective web design and development as these help to make the websites effective.

Usability, accessibility and visual appearance, determine the success or failure of a web-site. Since the visitor of the page is the only person who clicks the mouse and therefore decides everything. Hence, website should be designed keeping the user in consideration. This can be a standard approach for successful and profit-oriented web design for all kind of websites. After all, if users can’t use a feature, it might as well not exist. Hence, there is need for properly designed set of guidelines for design and development of websites.
Many agencies and individuals have designed guidelines for design and development of websites at different levels. Guidelines cover from the basic rules of web design to usability accessibility of the websites. U.S. Department of Health and Human Services’ (HHS) has made a tremendous effort in this regard. Research-Based Web Design and Usability Guidelines reflect HHS’ commitment to identifying innovative, research-based approaches that result in highly responsive and easy-to-use Web sites for the public. Similar guidelines have been developed by W3C and National Informatics India (NIC) from India. Forgoing paragraphs provides the major guidelines.

- **Research Based Web Design and Usability Guidelines**

  These guidelines are designed by U.S. Department of HHS. Since, the Federal government is the largest single producer, collector, consumer, and disseminator of information in the United States, they decided to have a set of guidelines on web design and development so that all websites can be developed uniformly. These Guidelines help move U.S. in that direction by providing practical, yet authoritative, guidance on a broad range of Web design and communication issues. Having access to the best available research helps to make the right decisions the first time around and reduces the possibility of errors and costly mistakes.

  Since their introduction in 2003, the Guidelines have been widely used by government agencies and the private sector, and have been implemented in academic curriculum, and translated into several foreign languages. Efforts have been made to encourage all government agencies to use these Guidelines to harness the Web in support of the President’s vision of a Federal government that is citizen-centered and results-oriented.

  Guidelines assist those involved in the creation of Web sites to base their decisions on the most current and best available evidence. The Guidelines are particularly relevant to the design of information-oriented sites, but can be applied across the wide spectrum of Web sites. This new edition of the
Guidelines updates the original set of 187 guidelines, and adds 22 new ones. Many of the guidelines were edited, and numerous new references have been added. There are now 209 guidelines. All these guidelines have been grouped into 18 major groups or chapters and each chapter in turn contains several guidelines.

Successful use of the Guidelines depends on how they are disseminated and used within an organization. Simply providing the Guidelines to designers and managers may not be enough to spur the adoption and use of these guidelines (HHS, 2006).

- Guidelines for Indian Government Websites 2009

With the increased demand for Government information and services through web, it has become imperative for the Indian Government to effectively reach out to as many citizens as possible through their websites. Establishing policies and practices for effective delivery of information and services through the websites has gained importance. This necessitated the development of Guidelines for Indian Government Websites (GIGW), with an aim to foster development of citizen centric and universally accessible websites.

National Informatics Centre has developed these GIGW as an initiative under the National Portal of India Project. Development of these guidelines involved an extensive consultation process involving representatives from National Informatics Centre and various other Indian Government Departments, at the Centre and State levels. Established and recognized Guidelines of other countries as well as International bodies like ISO and W3C have also been referred to, while drafting these guidelines.

These guidelines are an outcome of extensive deliberation by the Content Advisory Committee, feedback from government departments and advice of experts in Information Technology and Government processes.
Guidelines of other countries as well as International bodies like ISO and W3C were also consulted (NIC, 2009).

Special attention has been paid to ensure that the content of the guidelines conform to the overarching philosophy of ensuring that the government websites are citizen centric and user friendly. Inclusion of the chapter on Compliance Matrix which provides a checklist of the essential elements which a government website should have would ease compliance. The write-up has been kept simple with minimal use of technical jargon, examples have also been provided to ease comprehension and provide clarity of the concept under discussion.

**Major considerations to be followed, while developing a Government website in India**

- Government of India identifiers such as National Emblem/official logo of India
- Enhancing visual appealing by using proper images with size, color contrast and multimedia combination
- Scope and quality of the content to be properly maintained
- Proper use of markup languages HTML, XHTML and CSS etc…
- GIGW suggests use of leading practices and takes into account risks and security threats associated with the application source code
- Hosting server infrastructure as well as facilities at data centers is important for hosting and promotion of Government Websites
- GIGW provides an insight to the best practices for the management of websites. One of the crucial aspects of the guidelines is appointment of Web Information Manager.
- Government websites must ensure compliance with GIGW while developing /re-designing their websites.
- Websites should frame proper policies for developing and maintaining websites
• **W3C Web Content Accessibility Guidelines Conformance**

The World Wide Web Consortium (W3C) is the main international standards organization for the WWW. Founded and currently led by Tim Berners-Lee, the consortium is made up of member organizations which maintain full-time staff for the purpose of working together in the development of standards for the WWW.

W3C publishes Web Content Accessibility Guidelines (WCAG), which provide a series of checkpoints for web content development. These checkpoints are broken down into three priorities, depending on their impact on accessibility.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Description</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority 1</td>
<td>A web content developer must satisfy this checkpoint. Satisfying this checkpoint is a basic requirement for some groups to be able to use web documents.</td>
<td>![WAI-A](WCAG 1.0)</td>
</tr>
<tr>
<td>Priority 2</td>
<td>A web content developer should satisfy this checkpoint. Satisfying this checkpoint will remove significant barriers to accessing web documents.</td>
<td>![WAI-AA](WCAG 1.0)</td>
</tr>
<tr>
<td>Priority 3</td>
<td>A web content developer may address this checkpoint. Satisfying this checkpoint will improve access to web documents.</td>
<td>![WAI-AAA](WCAG 1.0)</td>
</tr>
</tbody>
</table>

Each description will be provided with a symbol displayed for each priority on a website when that website satisfies the description: If none of these guidelines are satisfied, one or more groups will find it impossible to access information in the document.
W3C involves the standards for building and Rendering Web pages, including HTML, CSS, SVG, device APIs, and other technologies for Web Applications (“WebApps”). This also includes information on how to make pages accessible to people with disabilities, to internationalize them, and make them work on mobile devices (W3C, 2013).

Guidelines focuses on the aspects mentioned below in details.

- Use of HTML and CSS
- Use of JavaScript Web API’s
- Proper use of graphics
- Use of multimedia
- Ensuring proper web accessibility
- Internationalization of websites
- Ensure compatibility to use websites on mobile
- Privacy statement of the website should be clearly stated
- Mathematics and formula are used on the web for reports

- **Texas Department of Insurance (TDI) Web Development Guidelines**

  TDI has developed set guidelines based on W3C guidelines for design and development of websites. All websites, web pages and applications belonging to TDI need to be compliant with the W3C standards. By following the W3C standards, pages and applications will be well-structured, compatible, and useable, while also working well with assistive technologies. TDI uses XHTML 1.0 and CSS Web standards for all TDI websites. Keep attributes and values one word and lowercase (TDI, 2013).

- **Writing for the Web: Guidelines for MIT Libraries**

  MIT has framed a set of guidelines of library websites. This guide gives best practices, tips, and tricks that will help increase readership and improve usability of web pages (MIT, 2014).
2.6. Evaluation of Websites

The websites have become a vital part of research institutions and one of their most visible faces to the external world. Websites act as a marketing tool designed to promote research activities and services through web. A website can range from being an informative online brochure through minute information on research interest. A well designed website can reach far more potential users than other forms of medium at a fraction of cost. Despite of all the advantages, the real problem with the web occurs with type and quality of information published on the web as there are no set of rules and standards available to govern web content properly. A web author may write whatever he feels in the format which a user feels comfortable with (Nigel, Bevan. 2005).

The web by its very nature was designed to provide for unrestricted exchange of information. Web sites may contain factual information, opinions, data, ideas, propaganda, self-promotion and/or commercialism. Anyone who can create their own web page or pay someone to create a web page can put information on the Internet. Each person not only selects the topic which they choose to write about, but also the manner in which the web page is designed and the extent to which the information provided is credible. Furthermore, most of the Internet resources are not reviewed or “filtered”. In other words, unlike the more traditional information media (such as books, magazines and videos), which pass through an editor, the content of a Web page does not have to be approved by anyone before it is made public. Seldom is there a reviewing process conducted by peers or an authority, or checking by a publication or editor or selection by a librarian during collection development. Conversely, anyone is capable of selecting and using anything on the Internet. Unfortunately, in many cases gullible clients often believe: “If it is on the Internet, it must be true”. This kind of view is typically accepted without checking the credibility of the websites consulted. That attitude does not necessarily portray sincerity, which is why a deliberate attempt to evaluate and classify website qualities is crucial. Just as the websites are dynamic in nature,
their evaluation has to be a continuous process for effective results to be obtained (Ongus, Kemparaju & Nymboga, 2006).

Website evaluation enables planners and developers to keep up with the increasingly diverse nature of sites that are posted on the Internet. It is also imperative to evaluate websites for the purposes of quality control, given the fact that anyone and any organization can publish anything on the Internet at any chosen time. The capacity of the users to critically evaluate information is central within the research process of locating resources for academic purposes. Apart from being able to differentiate between fact and fiction, it's important for users to be able to assess the relevance, accuracy and suitability of information to their particular purpose (Jose, 2002).

- **Need for Websites Evaluation**

  Website evaluation is a necessary process to enable planners and developers to keep up with the increasingly diverse nature of sites that are posted on the Internet. It is also imperative to evaluate websites for the purposes of quality control, given the fact that anyone and any organization can publish anything on the Internet at any chosen time. This is the fundamental nature of the WWW! One of the most positive aspects of the Web is that it provides a means for people to express themselves; it allows for freedom of speech and ideas; and allows people to meet and communicate who would not ordinarily ever have met. As long as the Web retains these qualities of freedom, it will also remain unmonitored and unregulated. Furthermore, most of the Internet resources are not reviewed or “filtered”. In other words, unlike the more traditional information media, which pass through an editor, the content of a Web page does not have to be approved by anyone before it is made public. Seldom is there a reviewing process conducted by peers or an authority, or checking by a publication or editor or selection by a librarian during collection development. Conversely, anyone is capable of selecting and using anything on the Internet. Unfortunately, in many cases gullible clients often
believe: “If it is on the Internet, it must be true”. This kind of view is typically accepted without checking the credibility of the websites consulted. That attitude does not necessarily portray sincerity, which is why a deliberate attempt to evaluate and classify website qualities is crucial. Just as the websites are dynamic in nature, their evaluation has to be a continuous process for effective results to be obtained (Ongus, et.al.2006).

- **How to evaluate a Website**

  Although many people evaluate Web sites (particularly commercial sites) based on their look and feel, for academic and research purposes, it is far more important to evaluate the content and organization of a site. A website which is unattractive cannot be put off because much of the quality information resides on sites that are unadorned by flashy graphics and images. On the flip side of the coin, many sites that look great have little real substance. If a user is citing information for assessment purposes, the reader (or the marker) will be unimpressed by the attractiveness of that source, more that users have been able to verify the accuracy and objectivity of the content it contains.

  When using a Web site for research purposes, in the first instance look for sites that contain at least the author's name, title or position, organizational affiliation, contact details and the date of creation. Sometimes users are tipped off by the general tone or style of a site, or the apparent competence of the writer. However, some authors go to great lengths to disguise the main objective of a site and user will need to look much harder and further for clues about the overall integrity and accuracy of the information provided. User should then go on to test for some further indicators of quality in the areas of authority, purpose, objectivity, coverage, currency, accuracy, design and organization, ease of access, navigation, search process and value additions included on the websites.
2.6.1. Website Evaluation Methods/Approaches

Applying principles for the design of usable applications is not sufficient for ensuring the usability of the final product. Even though accurate design techniques are used, it is still necessary to check the intermediate results, and test the final application for verifying if it actually shows the expected features, and meets the user requirements. The role of evaluation is to help verifying such issues.

The main goals of evaluation are to assess the application functionality, to verify the effect of its interface on the user, and to identify any specific problem with the application, such as aspects which show unexpected effects when used in their intended context. Evaluating Web applications in particular consists in verifying if the application design allows users to easily retrieve and browse contents, and invoke available services and operations. This therefore implies not only having appropriate contents and services available into the application, but also making them easily reachable by users through appropriate hypertexts (Ivory, 2013).

There are many ways to conduct an evaluation. Five major approaches have been considered as critical for evaluation of any kind of websites.

**Testing:** An evaluator observes participants interacting with an interface (i.e. completing tasks) to determine usability problems. It requires that users perform a set of tasks through physical artifacts, being the prototypes of systems, while the experimenter observes users’ behaviors and collects empirical data about the way users’ execute the assigned tasks. Typical data collected during user testing are user execution time, number of errors, and user satisfaction. After the test completion, the collected data are then interpreted and used to ameliorate the level of the application usability.
In order to avoid any inconvenience related to the reliability of results, the design of the test and its execution has to be carefully planned and managed. A good usability testing could be therefore articulated as follows:

- Defining the goals of the test
- Defining the sample of users that will participate in the test
- Selecting tasks and scenarios
- Establishing how to measure the level of usability of the system
- Preparing the needed material and the experimental environment

**Inspection:** An evaluator uses a set of criteria or heuristics to identify potential usability problems in an interface. According to such methods evaluators examine usability related aspects of an application, trying to detect violations of established usability principles, and then provide feedback to designers about possible design improvements. The inspectors can be usability specialists, or also designers and engineers with special expertise (e.g., knowledge of specific domains or standards). In any case, the application of such methods relies on a good understanding of the usability principles, and more specifically of how they apply to the specific application to be analyzed, and on the particular ability of the evaluators in discovering critical situations where principle violations occur.

Different methods can be used for inspecting an application. Among them, the most commonly used are heuristic evaluation, in which usability specialists judge whether the application properties conform to established usability principles. Being a very informal method of evaluation, it prescribes having a small set of experts analyzing the application against a list of recognized usability principles provided to heuristics. This technique is part of the so-called discount usability methods. In fact, some researchers have shown that it is a very efficient usability engineering method, with a high benefit-cost ratio.
During the evaluation session, each evaluator goes individually through the system interface at least twice. The first step is to get a feel of the flow of the interaction and the general scope of the application; the second is to focus on specific objects and functionality, evaluating their design and implementation against a list of heuristics. The output of a heuristic evaluation session is a list of usability problems with reference to the violated heuristics. Reporting problems in relation to heuristics enables the easy generation of a revised design, in accordance with what is prescribed by the guidelines underlying the violated principles. Once the evaluation has been completed, the findings of the different evaluators are compared.

The other method which can be used in inspection is cognitive walkthrough, which uses detailed procedures for simulating users’ problem-solving processes, trying to see if the functions provided by the application are efficient for users, and lead them to the next correct actions.

Cognitive walkthrough is largely applied to evaluate presentation aspects in the application interface. Its use is recommended in the advanced phases of the Web application development, for evaluating high fidelity prototypes for which the interaction functionalities already work. The typical cognitive walkthrough procedure prescribes that, on the basis of selected scenarios of use, a series of tasks are chosen to be performed on the interface by an expert evaluator. The evaluator executes such tasks, and after the completion of each elementary action s/he tries to interpret the application answer, and to evaluate the steps forward for the achievement of the end user goal, by answering the following standard questions:

- ✓ Are the feasible and correct actions sufficiently evident to the user, and do the actions match with her/ his intention?
- ✓ Will the user associate the correct action’s description with what s/he is trying to do?
Will the user receive feedback in the same place where s/he has performed her/his action and in the same modality?

Does the user interpret the system’s response correctly: does s/he know if s/he has made a right or wrong choice?

Does the user properly evaluate the results: is s/he able to assess if s/he got closer to her/his goal?

Does the user understand if the intention s/he is trying to fulfill cannot be accomplished with the current state of the world: does s/he find out alternative goals?

**Inquiry:** Participants provide feedback on an interface via interviews or surveys etc…

**Analytical Modeling:** An evaluator employs user and interface models to generate usability predictions.

### 2.7. Guidelines for Websites Evaluation

Effective maintenance of institution’s website has all the time remained a challenge for web administrators. There is a need for an evaluative tool, which will assist ensuring best practice principles and guidelines are followed during the web design and maintenance process. Web usability expert community has formulated countless guidelines and they are being used widely.

Many of these guidelines have been developed based on developer expertise, project experiences, and subjective studies. Existing user interface design recommendations were extended to include designing user interfaces for the Web. Many of these guidelines were incomplete or too general to apply them in the design process. In the following few paragraphs some of the guidelines, which have covered all features have been provided.
Karen McLachlan’s Cyber Guide Internet Evaluation Form

The "WWW Cyber Guide" Internet evaluation forms were developed by Karen McLachlan informally as a means of introducing the World Wide Web to novice users in 1996 and the same had undergone review process in the year 2002. The model has categorized the evaluation components in two groups i.e. Content Features and Design Features (Cyberbee, 2008). Evaluation components included in each group are as follows;

List of attributes to be considered for evaluating the websites for design features
- ✔ Downloading speed
- ✔ Homepage design
- ✔ Ease of navigation
- ✔ Use of multimedia
- ✔ Browser compatibility
- ✔ Quality of the Presentation
- ✔ Maintenance
- ✔ Availability of further information

List of attributes to be considered for evaluating the websites for content feature
- ✔ Efficiency of the website
- ✔ Information Providers
- ✔ Information Currency
- ✔ Information Quality

McLachlan had suggested a way to determine the value of the Web site which was considered for the use. Against each criterion three options will be given to user, “Y” for “Yes”, “N” for “No”, and “NA” for “Not Applicable”. Based on the number of YES and number of NO user may decide whether this website is usable or not.

The well known usability expert Jim, Kapoun has provided guidelines for Web Evaluation. Author has given five criteria for evaluating websites (Cornell, 2014).

Accuracy
✓ Who wrote the page and can a user contact the author?
✓ What is the purpose of the document and why was it produced?
✓ Is this person qualified to write this document?

Authority
✓ Who published the document and is it separate from the "Webmaster?"
✓ Check the domain of the document, what institution publishes this document?
✓ Does the publisher list their qualifications?

Objectivity
✓ What goals/objectives does this page meet?
✓ How detailed is the information?
✓ What opinions (if any) are expressed by the author?

Currency
✓ When was it produced?
✓ When was it updated?
✓ How up-to-date are the links (if any)?

Coverage
• Are the links (if any) evaluated and do they complement the documents' themes?
• Is it all images or a balance of text and images?
• Is the information presented cited correctly?
• Benjamin Keevil’s Usability Index Checklist for Measuring the Websites: (1998)

Benjamin Keevil (1998) has published Usability Index Checklist for measuring the Website in the annual Special Interest Group on Systems Documentation conference in Quebec City, Province of Quebec, Canada, Sept, 24 to 26, 1998 (Keevil, B. 1998).

The paper describes the development of a checklist, one can use to measure the usability index of Website. The checklist has over 200 questions in five major categories:

- Finding the information
- Understanding the information
- Supporting user tasks
- Evaluating technical accuracy
- Presentation of information

• The WAI initiative by the World Wide Web Consortium (W3C) (2011)

"Evaluating Websites for Accessibility" is a multi-page resource suite that outlines different approaches for evaluating websites for accessibility. While it does not provide checkpoint-by-checkpoint testing techniques, it does provide general procedures and tips for evaluation in different situations, from website development to ongoing monitoring of existing sites. The approaches in these pages were intended to supplement other content management and quality assurance procedures (W3C, 2014).

2.8. Automated Web Evaluation Tools

An automated web evaluation method is one, where software/tool is used to evaluate a Website. Evaluation tool can help to find out certain types of design difficulties, such as pages that will load slowly, missing links, use of jargon, potential accessibility problems, etc. Though automated evaluation methods are useful, they should not be used as a substitute for evaluations or
usability testing with typical users. There are many commercially available automated evaluation tools available for evaluating variety of Websites (Section 508).

There is no single tool which can cover all the features of a Website, rather it is required for an evaluator to rely on more than one tool, as these are specific to a particular feature.

**Illinois Functional Accessibility Evaluator (FAE)**

FAE analyzes web pages for markup languages that are consistent with the use of iCITA HTML Best Practices for the development of functionally accessible web resources, which also support interoperability.

The iCITA HTML Best Practices are not a new standard, but rather a statement of techniques for implementation of the W3C Web Content Accessibility Guidelines (WCAG), the United States Federal Government Electronic and Information Technology Accessibility Standards (Section 508) and the Illinois Information Technology Accessibility Act (IITAA). Following the best practices in developing web resources not only improves accessibility for people with disabilities, but also improves interoperability, giving everyone the benefit of having more options for accessing and using those resources (FAE, 2014).

FAE organizes the analysis of documents based on the following categories:

- Navigation & orientation
- Text Equivalents
- Scripting
- Styling
- HTML Standards
- **Web Accessibility Evaluation Tool (WAVE)**

  WAVE is a free web accessibility evaluation tool developed by Web AIM. It is used to aid human in the web accessibility evaluation process. Rather than providing a complex technical report, WAVE shows the original web page with embedded icons and indicators that reveal the accessibility of that page. WAVE supports the evaluation of websites against WCAG 1.0 and Section 508. WAVE5 which supports WCAG 2.0 is currently in beta.

  Toolbar analyses the websites for the Errors on found WebPages and highlights structure of the website (WAVE, 2012).

- **SEO Quake Toolbar**

  This tool is, as the name denotes, SEO focused. It is a toolbar plug-in for internet browser that gives Google/ Alexa scores, and Page rank. It is great for monitoring and analyzing links. It also offers features that can analyze users’ keyword density, and then diagnose problem areas on users’ website (SEO Quake, 2014).

  Toolbar lets the users’:
  - Access important SEO metrics like Domain Authority and Page Authority for every page a user visits.
  - Analyze links as which user browses the web.
  - Conduct keyword research for Google and Bing with the SERP overlay.
  - Create custom searches by search engine, country, and region or city.
  - See what matters: highlight no-followed, followed, internal, and external links and keywords.
  - Audit a site quickly with the Analyze Page overlay to surface useful metadata, measure page load speed, and analyze complex redirect paths.
  - Easily export data to Excel.
• **Pingdom**

Pingdom is great at evaluating website in some key metrics. For instance, it takes a look at website’s speed and bottlenecks, and identifies areas where administrator can make simple changes for big performance boosts (Pingdom, 2014). Features to be evaluated are size, loading speed of the websites and performance of the website.

• **AChecker**

AChecker is a free, open source Web accessibility evaluation tool developed by Inclusive Design Research Institute. This tool supports the widest range of web accessibility standards and guidelines compared with all other free web accessibility evaluation tools, namely BITV 1.0, Section 508, WCAG 1.0, WCAG 2.0 and Stanca Act (AChecker, 2011).

• **W3C Mark up Validation Service**

Consortium for World Wide Web has developed a markup validation service tool for HTML and CSS. By entering URL of the webpage or directly uploading the file user may check for the validation errors on the webpage.

2.9. **Library Websites of R&D Institutions**

Technology-led developments have created new opportunities and challenges for libraries in creation, promotion, dissemination and storage of information. The library is one of the many institutions undergoing change in the face of technological advances. This, in turn has led to the generation of new services, as well as modification of existing library services and their deliverables. As a result, a move has occurred towards new communication paradigms and the shift from face to face human contact to human machine interaction, from paper to electronic delivery, from text centered mode to multimedia and from physical presence to virtual presence (Madhusudhan & Nagabhushanam, 2012).
The web has become commonplace throughout the world, a natural complement to traditional library services and develops innovative ways to meet the information needs of users. Traditional online services have transformed themselves into web-based services using web technologies. The web also offers libraries the potential for more revolutionary change as well. Library websites have become the main point of access and catalyst for new web-based library services in all kinds of libraries. A library website is a virtual public face, the quasi equivalent of the front door, signage, pathfinder, surrogates to the collections, services and it is used as a window to the WWW (Diaz, 1998). It also serves as an integrated interface to a wide variety of digital resources and web-based library services for users over a network (Letha, 2006).

The library Web site can play a variety of roles in R&D institution. First, a library Website often serves the role of a library workstation, both for the users and for the librarians serving them. This necessitates a presentation and organization, which allows users to know all that the library has to offer electronically, and in a way that makes sense. It is a tool that will help to speed up or slow down the reference librarians' work in assisting patrons to find information. It is a tool that will help or hinder the user in expanding research or in finding the answer to a very simple question, such as how to determine, if the library has a particular book and where it might be found.

Users in research libraries always depend on e-resources, rather than printed materials. Library Website serves as a delivery mechanism for databases, electronic texts and journals, research reports, patents and for the library OPAC. In delivering these resources, the Web necessitates dialog between researchers and technical service librarians to determine how and where to represent access to all this information. The web has allowed librarians to find new roles as information generators, as well as to continue the functions of information gathering, organization and access.
Additionally, a library Web site can become an agent for archiving and retaining information that appears on other sites. Some consortia are looking at ways of retaining copies of free electronic journal articles that are not maintained by any publisher. Such activity requires agreements on copyright and access rules, beyond the technical issues of gathering and ensuring complete runs of journals. Other projects are being developed between libraries, consortia, and publishers for access to proprietary information that a library has in fact contracted.

Importantly, the library Web site is a window to provide access to information and also a component of the Web at large. Libraries are making use of the great wealth of resources available on the Web at no cost. Before using the resources, libraries are properly examining the reliability, accuracy, and completeness of these resources. Where trust in a resource is engendered and as it relates to the needs of a library's users, these resources are being incorporated into library websites as part of catalog or in separate lists or databases created by bibliographers and reference librarians.

An all-important function of the research library's Web site is to serve as a communication tool for a library and its users. A library website can let user know organizational details with mission statement. Even better, the Website can allow user to hear from the users through interactive forms, chat rooms, and e-mail links. But libraries can also do so through examination of their log files to learn how many people visit library website, where they come from, what they use, and what sort of problems they encounter (Diaz, 1998).

As a component of the Web at large, libraries are increasing their user base by making services and resources available to a potentially worldwide audience. Policy decisions may have to be made to determine the extent of services and the definitions of users in this easy-to-access environment, where
internal resources may be stretched. Additionally, libraries might wish to consider what uniqueness they have to offer in this vast network when placing priorities on what is to be accomplished on the Web site.

2.10. Evaluation of Library Websites

The library website represents an important component in the user experience, as library bookmarks and brochures may have seen a decline in use. The library website represents the "face" of the library and showcases its print and electronic resources and promotes services to users, such as circulation, reserves, reference, library instruction, library events, and interlibrary loan, access to e-resources and subject gateways. The library website displays information such as library hours, policy information, directions, the staff directory, and basic contact information. The library website is a living document, unlike a brochure, poster, or flyer. The library website also represents a virtual space where information is collected, organized, and presented. When developing this virtual space, it is important to reflect the needs of the user properly. Website has to be developed in such a way that users must be able to locate the necessary information with ease (Manzari, 2006).

Although R&D libraries have extensive experience in providing computer-based information services, a great deal of effort has been invested in transforming useful information and services into Web based services. Research libraries have dynamically created Websites and improvements on the design and layout of the Websites have been made progressively. Since, users of the R&D library are researchers and technical staff and they are always in need for nascent information with timely services, it is vital for staff members to keep the website in line with the expectations of users.

Evaluation of website is a process which helps library staff to keep control on the quality of the website and make it always relevant to the user.
needs. With the changing expectations, content and design features have to be modified to make the website user-centered, current, relevant, uncluttered, and contain language that can be understood by the user. The library website should not only provide information, but also be a learning tool (House, 2007). Evaluation at a regular interval keeps the website up to date and makes it more useful for the user.
References:


