Chapter 2

Review of Literature

Review of literature has been undertaken appearing in different sources on the study area “Digital resources management with reference to Indian university libraries” to know the present state of affairs and also the scope of further development. Printed and digital (both online and offline) resources covering different aspects of the study area have been scrutinized and discussed below. The researcher started the review of literature covering from macro to micro, appearing in both printed and digital forms. The UGC-INFONET e-journal consortia of INFLIBNET resources were searched in the Krishna Kanta Handiqui Library of Gauhati University and also at the Department of Library & Information Science, Gauhati University. The publisher sites were searched to retrieve and download full text papers including Emerald <http://www.emeraldinsight.com>, Elsevier Science <http://www.sciencedirect.com> etc. Open Access journal search directories like Directory of Open Access Journal (DOAJ) <http://www.doaj.org> and Open Access Journal Search Engine (OAJSE) <http://oajse.com> etc. were searched for relevant literature on the study area.

Documents available in different universities and higher educational and research institutional libraries including University of Hyderabad, University of Mysore, University of Delhi, Indian Statistical Institute- Bangalore, Indian Institute of Science- Bangalore, Indian Institute of Technology- Delhi, Guwahati, Kharagpur, and Madras, Indian Institute of Management-Bangalore, Central Food Technological Research Institute- Mysore, British Council Library –Hyderabad were also searched.

The following is an attempt made to present the literature review in the form of a summary or series of annotation or description of each consulted work, with critical analysis of the researcher appended therein. The concept of literature review is arranged according to the
development of ideas and within ideas; the arrangement is done according to the date of publication.

**Higher Education and University Library System in India**

With more than 500 universities which include 44 central universities, 285 state universities, 130 deemed universities, and 111 private universities [http://www.ugc.ac.in/]; and 33 institutes of national importance [http://mhrd.gov.in/] and their libraries, the university library system in India is one of the biggest academic library systems in the world. These libraries play a major role in teaching-learning process and research for future developments in India. The university libraries in India have started acquiring digital resources by buying access from publishers or aggregators, got access from consortia, and some have stared digitization project of their rare and valuable collection to increase the access. Therefore, it will be justified to study the higher education and university library system in India.

In “*Higher education in India: Issues, concerns and directions*” published by UGC (2003, December) stress was given on improving the library facilities for higher educational institutions in India. Some of the recommendations like “Libraries should be fully equipped with the latest books, journals and periodicals”; “E-Learning appears to be a fast emerging mode of global entry at the present time. The Universities and other Institutions of higher education can design their web sites for offering online education worldwide”; and “Arranging facilities for E-learning and distance learning” depicted the need for acquiring latest technology and resources for the improvement of the university libraries in India.

Chakrabarti (2007) in “*The Higher Education and Research in India: an Overview*” presented an overview of the higher education institutions of India. Vital information regarding central, deemed, and state universities, institutes of national importance is given in this report. Information regarding regulatory body of higher education in India like University Grants Commission (UGC), All-India Council of Technical Education (AICTE);
including a number of major apex bodies that are responsible for research and development like Indian Council of Agricultural Research (IACR), Indian Council of Social Science Research (ICSSR), Council of Scientific and Industrial Research (CSIR) is discussed in detail.

Varatharajan & Chandrashekara (2007) in “Digital Library Initiatives at Higher Education and Research Institutions in India” presented the major digital library initiative at the higher educational and research libraries in India. They described the initiatives by Digital Library of India (DLI), Traditional Knowledge Digital Library (TKDL), Digital Library initiative at the National Library of India, Khuda Baksh Oriental Public Library, Indira Gandhi Memorial Library of University of Hyderabad and many more. Two major initiative of ETD (Electronic Theses and Dissertation), Vidyanidhi Projects and ETD project of INFLIBNET Centre are cited; besides a number of digital repositories of higher education and research institutions of India.

Sunder (2009) in “Yash Pal Committee Report on Higher Education: A Review” analyzed the recommendation proposed by Yash Pal Committee. Yash Pal Committee has proposed an apex regulatory body in the field of higher education in India, National Commission for Higher Education and Research (NCHER), to take over the responsibilities of the Universities Grants Commission (UGC), the All India Council for Technical Education (AICTE), and all educational aspects of 13 professional regulatory bodies such as the Bar Council of India (BCI). The proposed commission will be directly responsible to the Parliament, along the lines of Election Commission of India <http://eci.nic.in/eci_main1/index.aspx>, to protect it from political interference; according to the suggestions made by Prof. Yash Pal.

Singh (2009) in “Future of Academic Libraries in India: Challenges and Opportunities” gave emphasis to change the academic libraries in the changing ICT environment. According to him, library consortia, institutional repositories and open access archives have
some of the ways to cope with the price escalation and budget cut of the academic libraries in India.

**Digital Resources**

Digital resources may be born-digital or surrogate of printed resources converted to digital form. There are different forms of digital resources according to their content like e-book, e-journal, ETD, e-zine, online database, etc. They may be open access or subscribed digital resources. Though the digital resources have advantage like fast and multiple accesses, searching facility; but the long-term accessibility is a matter of concern even today although high level technological options are available.


In 2001, Arora made a detailed discussion in “Electronic publishing: an overview” about different types of electronic resources and their publishing. He charted the various media types and various formats in which electronic resources can be published. On economics of electronic publishing, he presented the various pricing models particularly on e-journal. Several publishers, aggregators, and non-commercial portals of current e-journal market were introduced by him in this work. This work can definitely be considered as a handbook on electronic publishing mainly for e-journal for the beginners.

Lee & Wu (2002) in “Do librarians dream of electronic serials? A beginner’s guide to format selection” discussed the factors to be considered for selection of optimal format for a particular digital resource. Content, functionality, longevity, users, and cost are some helpful factors identified by them.

In 2004, Singh in her paper “Collection management in the electronic environment” described briefly the different types of electronic resources, their pricing structure, and their criteria of selection. Discussing about the importance of subject gateways, she mentioned “currently, so much literature is available on the Internet that a searcher is often required to spend time sifting retrieval for relevant information. To solve this problem, information professionals and subject experts have created subject gateways that include high quality resources on subjects”.

Gorman (2005) in his paper “The Acceptability of digital resources” addressed the issue of lack of persistent identifier of digital resources. Regarding the problem of resource discovery of digital resource he said “if I create a digital object and hand this over to my university library… simply by making access available online may not be adequate… my book or object in one system driven by a specific search tool; my colleague is in a different, possibly incompatible, system that uses a different search tool. Result-communication failure. Libraries… in conjunction with creators and vendors must begin developing some common policies that on the one hand control the rights associated with digital materials whilst also enabling a seamless transition from one institution to another.”

**Digitization**

Digitization is the process of creating digital resources from printed one by a set of process like scanning, indexing, storing and retrieval. Before starting a digitization project, factors like selection of materials to be digitized, cost involved, in-house or outsourcing method to be adopted, hardware & software to be used, storage media, file format etc. are to be scrutinized thoroughly.
In 2000, Wheeler in his article “Scanning book tables of contents: a preliminary report on costs and procedures” reported the assessed cost of the pilot project of some monograph tables of contents (TOCs) of documents available at Yale University, USA. Some unanticipated issues like commonness of the book, TOC length, state of the book, old printing types etc. took a lot of time to deal with. Software use to scan, scan size, scan density etc. was decided provisionally after considering the issues in the digitization project. Most of the hardware and software used in the project were already existed except the manpower cost. The inclusion of the scanned TOCs enhanced the retrieval efficiency from the online catalogue.

In “Building digital libraries: data capture”, Arora (2001) discussed how to build-up digital collection, buying access to external digital collections from publishers and aggregators, the pricing model to deal with their subscription in detail. The different stages of scanning process to convert the printed documents to digital form were presented comprehensively. Different hardware like scanner, digital camera; software like OCR software, image compressor technology, file formats to be used for different types of digital resources were discussed with suitable example.

To run a digitization project cost is an important issue. Eden (2001) in “Getting started with library digitization projects: funding your first (and subsequent) digital projects” provided guidance how to prepare for, and apply for funds and grants to start a digitization project.

Reddy (2001) in “A proposal for action plan for digitization of university libraries” outlined the action plan for digitization at Indira Gandhi Memorial Library, University of Hyderabad. He discussed the issues to be considered while planning for digitization at the university libraries like in-house or outsourcing, cost involved, copyright/intellectual property rights (IPR) issue, security, standards, formats, protocols to be followed and other technical issues. This paper can guide the university libraries in India willing to start
digitization projects of their rare and valuable resources and preserve them for future generation.

Mieczkowska & Pryor (2002) in “Digitised newspapers at Norfolk and Norwich Millennium Library” tried to focus on the digitization of newspaper project at Norfolk Library, UK. This paper discussed some issues like OCR, IPR issues, access of the newspaper digitization project. In 2003, Chapman in “Managing text digitization” provided a questionnaire for the digitization project managers to find out the functional requirement according to their project goals. This questionnaire can help in building a good framework for digitization project.

The “Best practices, standards and techniques for digitizing library materials: a snapshot of library digitization practices in the USA” is a survey of literature on the digitization projects of the libraries in the USA (Liu, 2004). This paper highlighted the best practices, trends, associated standards and technologies in the digitization projects.

Chapman (2005) in “Managing text digitization” presented a decision checklist for managers seeking to create specifications and infrastructure for text digitization. He interpreted available guidelines, products, and services for managing text digitization projects. Wentzel (2006) in “Scanning for Digitization projects” discussed the technical processes involved in digitization process like scanner, digital cameras, scanner driver software, resolution, bit depth, file format and finally some recommendations given by Digital Library Federation (DLF) is given.

To know what is going on in different digitization projects, “Library digitization projects, issues and guidelines: a survey of the literature” by Lopatin (2006) is an informative source. He discussed important issues like digitization project management, funding, selection of materials, legal issues like copyright in digitization, metadata creation, interoperability, and preservation which were pointed out in some literature on digitization project. This article is a good starting point on digitization.
In 2008, Bansode in “Creation of digital of manuscripts at Shivaji university, India” described the digitization process adopted for digitization of the manuscripts at Shivaji University, Maharashtra, India. According to him, the foremost reason behind digitization is to enhance access and improve preservation of documents, mainly rare ones. The selection of documents for digitization was on the basis of physical condition and the existing quality. Fragile and poor condition document are not suitable for scanning as it may cause further damage. After digitization, the master copy of the images is stored in .tiff format; and .jpeg file format is used for providing access to the documents.

**Optical Character Recognition (OCR)**

Simply capturing the image of a textual document is not enough if we want to make the digitized textual document full-text searchable by the users. Here the need of application of OCR comes. But, the accuracy of OCR depends on various factors like nature of the original document, scanning method applied, nature of printing of the textual document.

“Deciding whether Optical Character Recognition is feasible” by Tanner (2004) gave us guidance about OCR feasibility. It briefly discussed about accuracy of the OCR technology. The success of application of OCR depends upon the method of scanning applied and nature of the original paper, document, printing, text alignment etc. Tanner advised to consider the factors like scanning method, the nature and condition of the original document, nature of printing, and output requirements to assess whether application of OCR will be feasible or not.

“Optical Character Recognition (OCR): What You Need to Know” by Phoenix Software International <http://www.phoenixsoftware.com/pdf/ocrdatalentry.pdf> depicted the brief history of OCR, types of recognition engines like OCR, Intelligent Character Recognition (ICR), Optical Mark Recognition (OMR), Magnetic Ink Character Recognition (MICR), and Barcode Recognition. A guideline to get best results by using OCR technology is suggested.
Metadata

For the retrieval and preservation of digital resources, metadata is an essential element. Metadata was first used to index the digital resources and then come to the area of digital preservation. Gradually, the concept of metadata harvesting has come to study and research of metadata. The protocol like OAI-PMH (Open Archives Initiative- Protocol for Metadata Harvesting) is the result of Open Archive Initiative <http://www.openarchives.org>, which was developed to retrieve metadata between open archive repositories and to give the facility of open access of digital resources to the users.

Luisa Calanag, Tabata & Sugimoto (2004) in “Linking preservation metadata and collection management policies” suggested a collection management guide in the form of a requirement analysis matrix for general applicability where preservation decisions can be assigned according to local requirements. Encapsulating or linking the resource to adequate metadata helps in long term preservation of the digital resources.

In 2004, Inês Cordeiro in “From rescue to long-term maintenance: preservation as a core function in the management of digital assets” mentioned about the importance of descriptive, structural and administrative metadata for digital preservation. Discussing about preservation metadata, which is a particular form of administrative metadata that keeps the record of migration and emulation process applied on a particular digital resources, he gave the examples of Open Archival Information System (OAIS) and METS (The Metadata Encoding and Transmission Standard). OAIS provides a reference model for archival systems with long-term preservation function, while METS provides an XML-based document format for encoding metadata that supports the management and exchange of digital objects among repositories.

Simeoni (2004) in “The case of metadata harvesting” describes the importance of metadata harvesting in resource discovery of the distributed digital repositories. OAI-PMH (Open Archives Initiative- Protocol for Metadata Harvesting), which follows modern and well-tested design practices being a lightweight HTTP-based client-server protocol of XML-
encoded requests and responses between a service provider and data provider, has the potential to include in metadata harvesting model.

Maxymuk (2005) in “Preservation and Metadata” wrote that digital data deteriorate and must frequently be refreshed to a new storage medium. He also mentioned that though a number of metadata schemes have been developed, Dublin Core (<http://dublincore.org/>) is the most popular one as it represents a minimalist approach to metadata and consists of a base set of optional elements that can be repeated.

Westbrooks (2005) in “Remarks on metadata management” defined metadata management as the sum of activities designed to create, preserve, describe, maintain access, and manipulate metadata. Bell& Lewis (2006) in “Using OAI-PMH and METS for exporting metadata and digital objects between repositories” described the creation and application of a bridge to export automatically the theses and ingest between the IR of University of Wales Aberystwyth (UWA) and archival repository of the National Library of Wales (NLW). The UWA repository used DSpace (<http://www.dspace.org/>) and NLW used Fedora (<http://fedoraproject.org/>). OAI-PMH (<http://www.openarchives.org/pmh/>) was used to identify the items to be exported and METS (<http://www.loc.gov/standards/mets/>) was used for actual transmission of the required metadata for each item to be exported.

Digital Library Software

To organize and give the user a proper platform to browse, search and access to different digital resources digital library software is used. Many proprietary as well as free and OSS (Open Source Software) software are available to build digital library. Among these, OSS has gained popularity among the information professionals in building digital repository around the world.

Hoe-Lian Goh, Chua, Anqi Khoo, Boon-Hi Khoo, Bok-Tong Mak, & Wen-Min Ng (2006) in “A checklist for evaluating open source digital library software” charted a checklist for Digital Library software evaluation and used it to evaluate four Open Source digital library
software packages. Firstly, broad requirements like content management, user interface, user administration, system administration were considered for evaluating digital library software. After that, a checklist of 12 features for the digital library software was formulated, the check points of which were content management, content acquisition, metadata, search support, access control and privacy, report and inquiry capabilities, preservation, interoperability, user interface, standards compliance, automatic tools, support and maintenance. Greenstone was found to be the best performer, followed by CDSware, Fedora and EPrints.

“Selection of software for a digital library is not an easy task” said Cervone (2006) in “Some considerations when selecting digital library software”. According to him, we have to consider security and authentication issues, long term cost and maintenance, vendor viability as well as documentation in selecting digital library software. We have to think about the long term storage and continued technical viability. One important observation made by him is that OSS is particularly attractive as it has the guarantee of access to the source code for the long term. If the original developer loses interest in the product, the users of the software at least have the potential to make required changes according to their need.

Krishnamurthy (2008) in “Open access, open source and digital libraries: A current trend in university libraries around the world” described the open access and open source movement in the university libraries around the world. Stating the popularity of OSS, he pointed out that most of the university libraries prefer using OSS for managing their digital libraries.

**Institutional Repository**

Any digital resource generated by an institution can be captured and made available through intranet to the users of a particular institution locally and through internet globally. This repository is popularly known as Institutional Repository (IR) worldwide.
While going to speak about the importance of IR in the institutions of higher education, Lynch (2003) in “Institutional Repositories: Essential Infrastructure for Scholarship in the Digital Age” commented “Our institutions of higher education have overlooked an opportunity to support our most innovative and creative faculty for at least a decade now, to the detriment of both the faculty members and the institutions themselves. These faculties have been exploring ways in which works of authorship in the new digital medium can enhance teaching and learning and the communication of scholarship; such innovations are essential to keeping scholarship vital and effective, and they must not only be supported but nurtured. Indeed, nurturing these innovations reaches to the core mission of our universities and to the core values of our universities”.

In his paper, “The role of open source software in building institutional repository” Deka (2006) discussed the advantages of setting up IR by university library. “Establishing an institutional repository also enables a university to publicize its research and teaching programmes by enabling access to the work of its staff and students” he said. Some of the initiatives of setting up IR by the institutions of higher education in India and OSS software that can be used to build up IR are discussed in detail.

Mittal & Mahesh (2008) in “Digital libraries and repositories in India: an evaluative study” identified and evaluated the collections within digital libraries and institutional repositories in India available in the public domain. They found that most of the IRs are using Open Source Software (OSS). Users of DSpace software are highest and collection sizes of most digital libraries are few hundred except Digital Library of India (DLI).

Stevenson & Hodges (2008) in “Setting up a university digital repository: experience with DigiTool” presented the experience of the project of creation of digital repository at Liverpool John Moores University, UK using DigiTool which is a proprietary software. It was found that DigiTool can be used to create an open access digital repository.
**File Format**

One of the critical issues to be considered while creating, storing, and preserving digital resources is file format. Storage space required to store, delivery via intranet or internet, and long-term accessibility of the digital resources depend upon what file format is chosen for the digital resources.

In 2005, Stanescu in “Assessing the Durability of Formats in a Digital Preservation Environment: The INFORM Methodology” presented a methodology called INFORM for measuring the preservation durability of digital formats. This methodology was developed for investigating and measuring the risk factors of digital formats and providing guidelines for preservation action plans. It defines tools, processes, and metrics necessary to select digital formats most apt to sustain the passage of time. INFORM methodology is descriptive not prescriptive giving archivists and managers of digital archives full control over the preservation actions they choose.

Williamson (2005) in “Strategies for managing digital content formats” discussed about the issue of long term preservation of digital resources and choice of proper formats. He pointed out three points for which individuals or organizations may choose to utilize proprietary formats rather than open formats. These are delayed development of open formats, organizational expertise, and reluctance to move to open formats.

Bernier (2006) in “An Introduction to JPEG 2000” discussed the benefits, limitations, and role of JPEG 2000 file format. He mentioned that the most obvious benefit of using JPEG 2000 is its increased compression capability. JPEG 2000 has both lossless and lossy compression option. So, it can be used for master archival image using lossless option; and for displaying over the web lossy option can be used.

Noonan, McCrory, and Black (2010) in “PDF/A: A Viable Addition to the Preservation Toolkit” found that PDF/A is most appropriate for files that are primarily text documents,
and that it is significantly easier to get files into PDF/A form if those files are born-digital or when one has control over making them digital.

Security of Digital Resources
All the pains of digitization project, or setting up an IR by an institution may go in vain or the institution may be all at sea by losing everything; if we consider only the issues like digitization, digital preservation, metadata etc.; but overlook the vital issues of security of the digital resources like IPR (Intellectual Property Rights), DRM (Digital Rights Management), access management, etc.

In 1999, Paskin, the first director of International DOI (Digital Object Identifier) <http://www.doi.org/> Foundation (IDF), in “The digital object identifier system: digital technology meets content management” had thrown light on the DOI initiative launched in the year 1997. He discussed about the technological aspects and relevance of DOI to users.

Chandrakar (2006) in “Digital object identifier system: an overview” gave an idea of (DOI) system developed by the IDF where a handle is assigned to a digital resource to identify it uniquely. Explaining the DOI system, he pointed out some advantages of DOI system like globally accepted unique identifier of digital resources, persistence, etc.

Management of Digital Resources
It is a tough challenge to manage the digital resources for the LIS professionals. With a variety of format, availability of different protocols to organize, different hardware and software platform to use, different acquisition modes, different pricing policy, IPR issues, access management of these resources have made it really a challenging job. Following are some of the literature where these issues are raised by different authors.

White & Crawford (1997) in “Developing an electronic information resources collection development policy” identified 12 factors to be kept in mind for selection of digital resources which are relevance, redundancy, demand, ease of use, availability of use,
stability of coverage, longevity, cost, predictability of pricing, equipment and technical support.

In 2002, Pandian, Jambhekar, & Karisidappa in “IIM digital library system: consortia-based approach” proposed a consortia-based model to facilitate information access and use by providing a single web-enabled window to the users, not only the resources of their own library but the resources of other institutions as well.

“DLF electronic resource management initiative”, the editorial of OCLC Systems & Services, Chang (2003) presented recent progress the Electronic Resource Management Initiative (ERMI) of the Digital Library Federation (DLF). The main goal of ERMI is to develop XML-based schemata/DTDs (Document Type Definition) and tools for managing data associated with licensing issues. Working with National Information Standards Organization (NISO), ERMI has produced many working documents one of which is NISO white paper, where it is suggested to use ONIX (Online INformation Exchange) metadata scheme for serial subscription data exchange.

Cox (2003) in “Choosing a library portal system” wrote that portal gives the library a tool to channel users towards preferred resources. It increases the ability of the library to ensure that costly electronic journals and databases are used, by offering a simple way to browse the available resources. It supports searching by carrying users through from bibliographic searches to full text options.

Hussein, Fox, Kelapure, Krowne, & Luo (2003) in the article “Building digital libraries from simple building blocks” suggested that framework based on OAI (Open Archives Initiative) which is called Open Digital Library (ODL) model can be applied to build a digital library instead of monolithic digital library software. ODL system can be used to apply web-based services to cater the need of the user community.
Breeding (2004) in “The Many Facets of Managing Electronic Resources” discussed two fundamental aspects of electronic resource management, back-end acquisition function and front-end content delivery. He discussed about traditional online catalogue approach, e-journal holding data services, and electronic resource management applications in the back-end section. Links from the online catalogue, e-journal locator resources, linking to full text, open URL-based link resolvers, and about federated search were explained in front-end management section.

Sanchez Vignau, & Presno Quesada (2006) in “Collection Development in a digital environment: an imperative for information organizations in the twenty-first century” divided the collection development process of digital resources into five stages. These are gathering, evaluation, organization, construction and maintenance of digital collections. Explaining the first stage, they said there are two main channels for gathering information about digital collection. One is associated with content digitization and the other one for obtaining digital format from different sources. Evaluation determines the inclusion of a digital resource into a collection based on selected criteria. Preservation format, technological requirements are determined in the organization stage. Using different software, preferably OSS like DSpace, Greenstone, Eprints etc., collection can be classified and categorized. Digital preservation is the fifth stage, where digital collections and formats are regularly evaluated and upgraded for future accessibility.

Davies (2007) in “Library and institutional portals: a case study” suggested that we can avoid the cost of developing a library portal for resource discovery, federated search, and dynamic linking service by using the technology which is used for institutional portal.

Moghaddam & Mostafa (2007) in “The importance of aggregators for libraries in the digital era” tried to focus on different types of aggregators and their role in digital collection management. “Aggregators have been helping libraries to facilitate their services to users but they have some disadvantages for libraries such as the lack of library influence
in selecting individual titles; the lack of control over the contents of aggregator packages; and the confusion of library users when accessing different packages”, according to them.

Singh, Khan, & Chauhan, (2007) in “Electronic resource management: emerging key issues” discussed about various e-resources and their subscription model. While discussing about the downloaded e-resources from the UGC-INFONET Digital Library Consortium, he suggested to manage these huge resources in the university libraries of India by using some open source digital library software like DSpace, Greenstone, EPrints, etc.

Sonker, & Mahawar (2007) in “Digital Library: Processes, Services, Challenges and Opportunities” discusses about the processes, services, challenges and opportunities of digital library. Economic, technological obsolescence, lack of expertise, and copyright are the major challenges according to him. But he mentioned that expand services, promote collections, e-governance and revenue generation are some opportunities of digital library.

Chandel (2008) in “E-resources and their management” discussed the development of e-resources, their features and the problem areas faced by the information professionals while managing the e-resources. According to him, hybrid nature of the libraries, collection building, and pricing policies are the areas to be dealt with while managing e-resources. The libraries should have proper distribution of budget for print as well as for e-resources and a well defined acquisition policy for e-resources, he suggested.

Lahkar (2008) in “Content creation: How Information professionals can take lead” stated the importance of Content Management System (CMS) to manage the resources, particularly the digital resources. “Traditionally indexing of resources are being done manually … Major shifting from print resources to digital resources is the order of the day. In this situation… cannot meet the requirements of the users by adopting only such indexes”. He advised to apply CMS to meet the user demand and also for better organization of the digital resources of the libraries.
Resnick, Ugaz, Burford, & Carrigan, (2008) in their paper “E-resources: transforming access services for the digital age” presented practical, experience-derived advice on establishing an Electronic Resources (ER) HelpDesk service based on a pilot project undertaken by the librarians at Texas A&M University, USA. It was found that including librarians with experience in licensing and managing ERs in providing help desk services can improve response time, problem resolution, systematic information capture, and led to the development of an ER HelpDesk database with enhanced functionality.

Digital Reference Service
The concept of rendering reference & information service has changed significantly after the appearance of the digital resources and their growing popularity among the users. The concept of reference service has come to fulfill the need of giving reference service to online particularly to the users of digital resources.

Stemper & Butler (2001) in “Developing a model to provide digital reference services” projected the planning and implementation of a digital reference service model called InfoPoint for the distant learners of the University of Minnesota, USA. As the users are distant learners, so a Web request form was designed in the model called infoPoint. Jane, & McMillan (2003) in “Online in real-time? Deciding whether to offer a real time virtual reference service” projected the results of an investigation on providing online real-time service at the University of Canterbury with comments and recommendations.

In 2004, Henley in “Digital reference services for young library users: a comparison of four services” compared four digital reference service namely Ask Bob, Ask a Librarian, Ask Zach, and IPL Youth Ask a Question. He described the eleven facets identified by Virtual Reference Desk (VRD), ranging from accessibility to response policy and timescales and cover training, privacy, access and regular review of the service which can be used to improve digital reference service.
Digital Preservation

Long term access of digital resources is a major drawback, although digital resources have many advantages over printed resources. The fast improving technology has made it difficult to preserve the hardware and software accessibility of digital resources. That is why, digital preservation is one of the most vital topic in digital resources management.

In 2003, Solbakk in his paper “Critical technological and architectural choices for access and preservation in a digital library environment” described some basic architectural choices for access and preservation of digital resources at the National Library of Norway. He informed that a digital repository was established to handle the access and preservation of the digital resources where every object is given a globally unique Uniform Resource Name (URN) for identification.

Inês Cordeiro (2004) in “From rescue to long-term maintenance: preservation as a core function in the management of digital assets” discussed about different preservation strategies like migration, emulation, encapsulation, etc. He stated that digital preservation should be viewed as a matter of continuing management involving the whole life cycle of digital information. He discussed about Open Archival Information System (OAIS), published by the Consultative Committee on Space Data Systems which can help to look after different preservation goals.

Anderson (2005) in “Digital Preservation: Will Your Files Stand the Test of Time” discusses about three areas file format, storage media, and technology infrastructure. He pointed out that when choosing a file format, the safest choice for preservation purpose is a standard. If a proprietary format is used, preference should be given to that format which has open specifications. He has suggested one to-do list for file format for digital preservation. He advised never to use cheap storage media, and to adopt the policy of continuous redundancy. Regarding the frequent changing of software technology, Anderson advised to prefer open access or non-proprietary software. Preparing a digital preservation plan with scheduled migration of materials to new media, offsite backup, a disaster
recovery plan and scheduled regular testing of media and backups can protect us from unwanted threat.

Jiazhen & Daoling (2007) in “Status of the preservation of digital resources in China: results of a survey” conducted a survey on the challenges in preserving Chinese digital resources. From the survey, they found that, complex nature of digital resources, different storage formats for same type of resource due to non standardization, inability to read the data due to high use, and weak data back-up management are the main challenges of preservation of digital resources in China.

The researcher has made an attempt to include and cite the relevant works on the different areas in the review of literature. But the literature on the study area Digital resources management is so vast that it is nearly impossible to include all the important literature in this review. The present review cannot be claimed as a comprehensive one; only selected and available writings on different areas are included.