Use of web technology in providing information services by south Indian technological universities as displayed on library websites

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Abstract

Purpose - This paper aims to discuss the present status of using new generation web technology, social media and Web 2.0 features among the technological university library websites in south India. It assesses the library websites as a primary platform and one-stop portal for information services and examines as to how much library websites are effective in providing web-based information services.

Design/Methodology/Approach - The library websites of the technological universities in south India were evaluated on the basis of a relative weight checklist. The criteria for the checklist was drawn on the basis of availability of websites for library, resource discovery tools, access to scholarly content and Web 2.0 tools. The various issues and challenges in adapting new web technologies in academic environment are discussed.

Findings - Using the current web development technologies and deploying for mainstream web information services is not widespread as web information services are yet to take off widely in academic libraries. The majority of university libraries are found to be working in the conventional library settings and the diffusion rate of web information services is relatively low.

Originality/value - As this is an assessment of the existing online information infrastructure facilities of the engineering universities in south India, the awareness of web-based information services, their viability, and service values can be enhanced. More emphasis is underlined to improve upon the current learning, online educational facilities and benchmarking electronic information services for sustainability is highlighted.

Paper type – Case study

Keywords - Web technology, Web information services, Web 2.0, Technological universities, Academic library websites, South India

1. Introduction

1.1 Technical education in India

India as an emerging destination of knowledge economy is getting widely recognised as a global hub for education and trade. Globalisation of innovation and groundbreaking technologies are providing easier access to information resources in enriching the learning experience. Unlike the past, the phenomenal growth of Information and Communication Technology (ICT) has impacted tremendously and the world is rapidly shrinking as the learning communities are brought closer. The globalisation vastly fosters global education by forging partnerships and facilitating cultural exchanges across various countries in the information-driven global village. The response of higher education to globalisation had been empirically evidenced in India from the pre-reform period 1980 to 1991 to post-reform period from 1991 to 2005. Indian higher education has substantially grown after the liberalisation of higher educational policies. Table 1 clearly indicates the magnitude of globalisation, economic growth and higher education of India in the final two decades of 20th century. Although the outlay of the total government expenditure during post-reform period was not proactive in the country, the total number of higher educational institutions had increased dramatically owing to liberal education policies (Selvam, 2010). Total number of universities in India was 378, and the colleges 18064 in 2007; enrollments had increased from 7,50,000 to 1,400,000 in 2007 and are continuing to grow exponentially as the government is strategising on capacity expansion, inclusiveness, incentives and access to quality education (Planning Commission, 2008 p. 22). Indo-US educational tie-ups are rising in the recent years, with estimation that 120 educational partnerships between USA and India were established so far (Kannan, 2010). As the gross domestic product (GDP) of

India is growing consistently during the post-liberalisation period with 6.07 percent in 2008, the rate of youth literacy had also grown gradually at 82.1 percent (World Bank, 2010).

During the last few decades, Indian technical education comprising of technology, engineering, management, pharmaceutical, computing, and information technology studies have expanded with government liberalising and allocating more funds to ensure inclusivity. Moreover, encouraging public-private partnerships and upgrading the technical education system in response to the demanding workforce for the fast growing diverse industries is also on the rise. In continuing the strides to ensure the economic development and progress, government of India is keen on establishing more educational institutions to keep the Gross Enrolment Ratio (GER) up. The present GER is 45 hundred thousand in higher and technical education, which is being expected to increase to 16% in 2012, while the government has set the target of 30% increase by 2020 (http://www.aicte-india.org/expansion.htm). India turns out to be having one of the largest technical education systems in the world, with 1511 educational institutions. It had been found that the average intake was 365 per institute and the growth rate of academic output for the period from 2001 to 2006 was 20.3% in degree level engineering education. As on 2006, two prominent states in southern India, Andhra Pradesh (280) and Tamil Nadu (268) were the top states to have more number of engineering institutions with an annual sanctioned intake of 1,07,575 and 1,05,318 respectively (Banerjee & Muley, 2007, pp. 7 & 43).

"Take in Table (1)"

Table 1: Magnitude of globalisation, economic growth and higher education in India.

Variables	**Pre-reform Period (1980-81-1990-1991)**	**Post-reform Period (1991-92-2004-05)**	**Percent of Change**
Globalisation	8.65	14.53	67.97
Economic Growth	5.65	6.16	9.03
Higher Education/GDP	0.72	0.71	-1.37
Higher Education/Total Government Expenditure	2.45	2.49	1.63
Number of Higher Educational Institutions	5,932	13,985	135.75

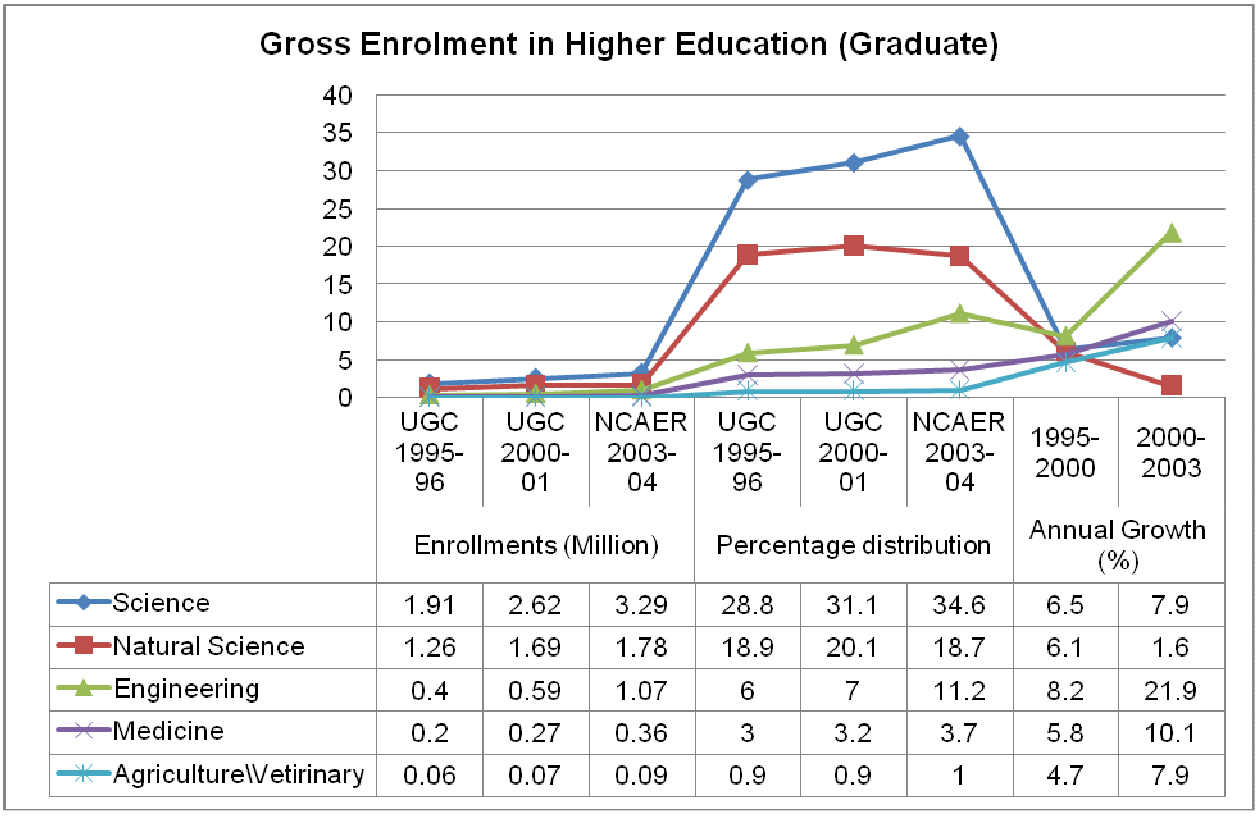
Note: Annual average growth in percentage (Selvam, 2010).

Due to the neo-liberal policies in the late 1970s to 1980s, the higher education was led to rapid privatisation, expansion and subsequent entry of more private players in the sector, started capitalising the education market potential. Nonetheless, setting up of more technical institutions by government has been planned for strengthening skilled human resources for the growing economy. Under the eleventh Five Year Plan 2007-2012, government has been establishing new 8 Indian Institute of Technology (IITs), 7 Indian Institute of Management (IIMs), 10 National Institute of Technology (NITs), 20 International Institute of Information Technology (IIITs) and 2 Schools of Planning and Architectures, of which many of them are work in progress and have already started the programmes (http://www.aicte-india.org/mhrd.html).

In addition to the established 7,000 engineering colleges, producing 8,00,000 graduates every year, in the academic year 2009-10 alone, 205 new institutions were approved for setting up institutions in engineering studies (Vaidhyasubramaniam, 2010). For the growing robust economy, National Association of Software and Service Companies (NASSCOM, 2006) projected the new services market in engineering services - Engineering Services Outsourcing (ESO) and the global spending value of this market would be $750 billion per year. Capitalising on expanding global engineering services, India is expected to be global player in having quality engineering and technical workforce. Of the 1400 odd engineering colleges, only a fraction of graduates are considered for jobs based on employability skills and market-ready competencies. Despite the fact that Indian workforce is in high scarcity for the global off-shoring and domestic engineering services industry, the apprehension of the productivity of graduates and their domain expertise for employability is still high (NASSCOM, 2010, p. 9). According to the Indian Science Report (2005, p.35), commissioned by National Council of Applied Economic Research, the annual growth in enrollments in engineering education had been increasing year by year at a rate of 21.09 % in 2003 (See Figure 1).

"Take in Figure (1)"

Figure 1: Gross enrolment in higher education at graduate level



	UGC 1995-96	UGC 2000-01	NCAER 2003-04	UGC 1995-96	UGC 2000-01	NCAER 2003-04	1995-2000	2000-2003
	Enrollments (Million)			Percentage distribution			Annual Growth (%)	
Science	1.91	2.62	3.29	28.8	31.1	34.6	6.5	7.9
Natural Science	1.26	1.69	1.78	18.9	20.1	18.7	6.1	1.6
Engineering	0.4	0.59	1.07	6	7	11.2	8.2	21.9
Medicine	0.2	0.27	0.36	3	3.2	3.7	5.8	10.1
Agriculture\Vetirinary	0.06	0.07	0.09	0.9	0.9	1	4.7	7.9

Note: UGC=University Grants Commission, India. NCAER=National Council of Applied Economic Research. Source: India Science Report (Shukla, 2005, p. 8).

1.2 Current Scenario in Technical Education

Looking at the current status of technical education in India, the education policies should evolve with the changing demands of employability and career prospects. Poising a futuristic outlook, federal and state policies of technical education should revamp on organisation restructuring, strategic revitalisation of functional areas, uniformity and academic reforms to overcome deficiencies in regional imbalances, providing operational freedom and autonomy, backed-up with quality policies and accreditation procedures in place. Furthermore, the education should be strengthened to have a learner-centric pedagogy and should stimulate practical, result-oriented learning to ensure quality-controlled, up-to date, relevant innovative education for all.

At present the current technical education system has been handicapped with these prevalent issues nationwide:

1. State-funded universities are more burdened with administrative functions of regulatory and affiliation works of regional technical institutions in its jurisdiction, impeding the progress and prospects of research output. Moreover, the flexibility in interdisciplinary curriculum and academic freedom are less.
2. State and national councils of higher and technical education need more activism for effective compliance of international educational standards and accreditation.
3. The existing bureaucratic accreditation procedures managed by various quality councils and accreditation bodies, call for standardisation and quality assurance of Indian programmes.
4. The current practices of rote learning and pedagogical approach emphasise more on theory-based examinations, thus learner aspiration largely inherent on scoring marks not life skills and career competencies.
5. Higher learning systems are more of monotonous, not an enabler of thinking, not participatory, and completely lacks student-oriented approach. Hence, the system should change likely where students collaborate more with faculty so as to spark off to intellectual enquiry and to be inquisitive.

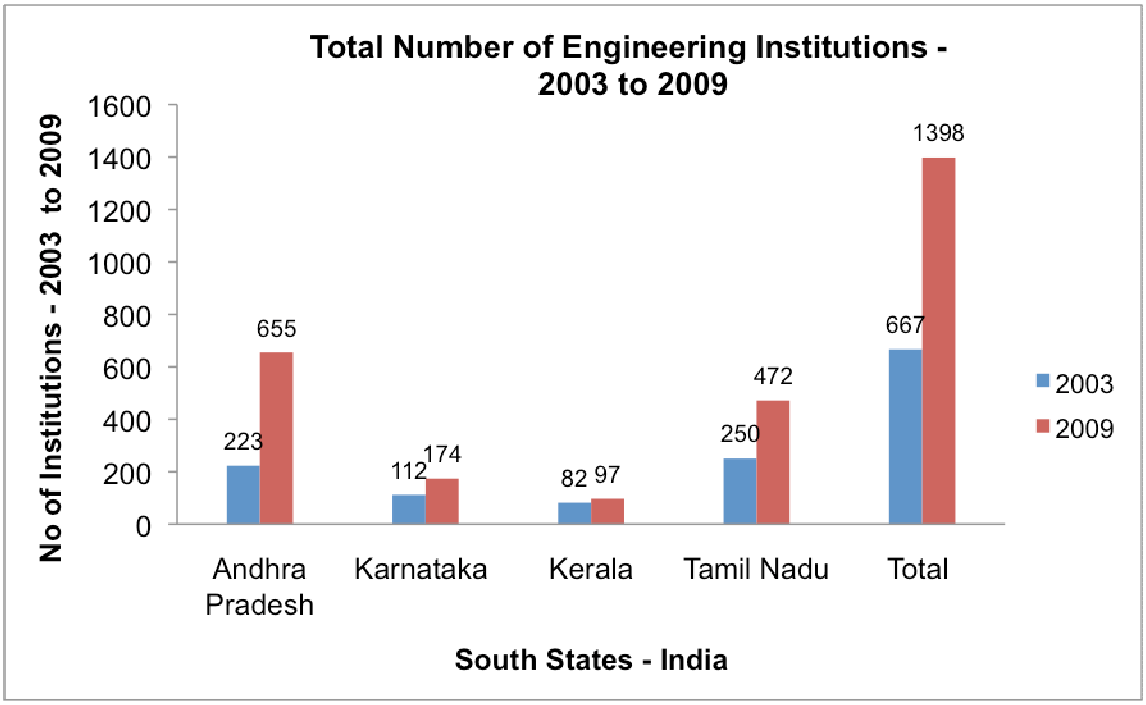
1.3 The rise of technical education in south India

Andhra Pradesh, Tamil Nadu, Karnataka, and Maharashtra states account for nearly 55% of the engineering colleges and 58% of enrolments in the country (Planning Commission, 2008, p. 28). In the last few decades, south India has been in dominance establishing more technical institutions with annual capacity additions by new entrants in the technical education sector, which is still on the uptrend to date (See Figure 2).

Unfortunately, the information infrastructure facilities like developing course contents for students, enhancing participatory learning, expanding the scope of library and information services, engaging education through social media, understanding the student information seeking behaviour, did not keep pace with the growing student enrollments. Information and communication technologies have widely impacted the learning process and education, but the crossover of quality and reality has to be examined as to how far these thriving professional institutions are best in providing quality technical education.

“Take in Figure (2)”

Figure 2: The number of colleges established during 2003 through 2009 in south India.



Note: The data has been taken from the respective websites of state directorates [1] of technical education for 2009, and the 2003 data is as cited by Varshney (2006, p. 24).

2. Statement of the problem

With the emergence of Internet, the web based information services have put wide impact on the provision of library and information services. Booming technical education sector has given access to formal education to many, but the quality of the education, assisted with enriching information services require more attention and strategic directions to ensure all the learners have access to information infrastructure and resources.

Many studies have been undertaken to investigate the usability, user satisfaction and the library services globally and in Indian academic settings. However, the online library services support to the growing academic community is a big cause of concern, as it calls for transformation of conventional library services to rolling out online information services as well as scaling up cyberinfrastructure in academic libraries. This study attempts to evaluate the use of web technology perceived by library and information service community in select technological academic library websites in south India.

3. Hypotheses

The following hypotheses are formulated for the purpose of conducting the investigation of this study, although the generalisations are provisional.

- The academic library websites serve as primary access point of information access and resources. The information resources and services provided by the libraries are well displayed and have online presence.
- The augmentation of websites for library, resource discovery tools, accessibility to scholarly content and Web 2.0 tools are widely implemented to bring satisfaction to the end-users.

4. Objectives of the Study

The goal of this study is to examine at the use of new developments in web technology, content updateness of library websites, online information services supporting the faculty and students as to:

- What is the current level of diffusion of web technologies among the academic libraries?
- What are the challenges need to be addressed in providing quality web information services?
- How academic library websites accommodate the challenges and opportunities to facilitate learning?

5. Literature Review

Academic libraries were confronted when the Web emerged as the potential replacement for information services. As the profound tasks of selecting, collecting, organising, and disseminating information was taken over by Internet it became an uphill task to prove our ideal expertise in organising information with exemplary models of websites. Liu (2008) described academic library websites are libraries' "virtual presentation to the world. Academic library Web sites provide access to online catalogs, electronic databases, subject resources, library instruction/tutorials, and digital collections. In alignment with each institution's mission, academic library web sites are gateways to information that supports faculty and students' research and educational needs". Thomas and McDonald, (2005) had put it "libraries are facing a new generation of online users who are technologically savvy and integrate information access and use in all spheres of their lives to an unprecedented degree. They approach the traditional library with certain expectation that may conflict with the existing services, policies, and values of the library as information broker".

Stover (1997) offered that "academic library web sites are needed to support their college or university, primarily through supporting the three-fold mission of higher education--research, instruction, and service". Felstead (2004), undertaking a survey of integrated library management systems of academic market of UK and North America during 1999-2003, found out "growth of web services may enable a new approach to the procurement of library management systems". Hiong (2001), while examining the twelve Malaysian academic library websites reported "academic library web sites in Malaysia have not come up to expectations as virtual expressions of the quality levels of the academic libraries. There are very strong expectations of these web sites because people would expect information professionals as one of several professions vying for leadership in the information age to organise and present information in a way that best fits the users' attention and knowledge".

Looking at the challenges of college and research libraries' in a digital library environment Kibirige and DePalo (2001) stressed on "an urgent need to develop user-education programs that emphasize the nature and various types of digital collections; interfaces; hardware and software requirements; telecommunications access modes and making such programmes part of continuing education; as remote users continue to grow as a segment of our academic library community, instruction services have to change to accommodate their needs as well. Developing subject guides to reliable Internet sites for research purposes on the library home page and web-based online tutorials linked to the library web site would enable patrons to have immediate access to instruction". Another study involving of maintaining web pages for children Coomes and Liew (2007) provided a snapshot of "how libraries have responded to recommendations of involving stakeholders in the design and development of their services of children's web pages in a number of public and state libraries in New Zealand and Australia. The development of children's web pages is usually the responsibility of teams of internal

stakeholders, with the librarians responsible overall for the library web site being involved most, followed by children's librarians".

Frank (2007) had viewed from usability standpoint to enhance library website of Northwestern University. "Many problems have not been solved either because of issues related to vendor-supplied products that cannot be modified or lack of resources within the library to perform all of the activities required to bring all areas of the website up to standards. And while significant movement has been made in establishing an environment based on evidence-based practice, global acceptance still remains elusive. However, by continuing to work on developing evidence-based models that take into account the unique issues related to librarianship, it is believed that evidence-based practice will become the norm, if we continue to develop and reinforce these evidence-based skills".

Pagan, Balseiro and Loucil (2010) in their case study of using Web 2.0 tools and open source software for libraries at three libraries of University of Puerto Rico observed that "the library visibility is in its online web pages; the libraries strategise for creating the library web page. The use of open source software and incorporation of tools and services known as Web 2.0 allows one to understand the ongoing development of these services". A survey of East Midlands University libraries by Manuel, Dearnley and Walton (2010) found that “institutional setting and university policy are great influential factors in developing web presence of libraries and considerable awareness of web analytics was demonstrated by four of the six libraries in their survey".

5.1 Literature on Indian Library Services Perspectives

Looking at the published literature from library development enthusiasts and scholars it is reported that library services in India want radical changes in redefining the library and information services. Library websites as gateways of research and primary media for information access is still in its infancy in Indian context. Studying the user perception towards the library and information services of south Indian agriculture universities, Kannappanavar and Swamy (2010) found that “there is a need to develop the culture of interlibrary loan services and electronic transmission of documents, besides databases of theses, journal articles, and library catalogues must be made available to users”. Evaluating the content, currency, and accuracy of academic library websites in Bangalore City, Konnur, Rajani and Madhusudhan (2010) reported, “library websites in Bangalore city have not come up to expectations as virtual expressions of academic excellence. There is a lack of information organisation in most of the studied websites”. Kumar and Biradar (2010) investigating the use of information and communication technologies in college libraries in Karnataka found that “college libraries are not up to the mark, and not providing the quality information services attributing to the lack of a good library policy, high rate of unplanned growth, irrelevant collections and lack of support from parent organisation and so forth”. Rao and Choudhury (2009), investigating the electronic resources at National Institutes of Technology reported, “libraries are obtaining more than ten to twenty databases invariably, and ninety percent have audio-visual course materials” which proves that the libraries are acquiring the various resources but not web-available.

Evaluating the knowledge management practices among selected libraries in Bangalore and Jammu & Kashmir states, Aswath and Gupta (2009) have “pointed out the under-utilisation of resources in majority of the libraries”. Investigating the perception and usage of e-resources and the Internet by Indian academe (Kumar and Kumar, 2008), found that “it is necessary that the university and college library professionals should be more proactive in working with the academic community to develop training programs as an enabler to use electronic information sources more effectively”. Investigating the library services quality, Sahu (2007) has undertaken

a case study of Jawaharlal Nehru University Library, recommending "tailor made comprehensive information programmes for streamlining better information services". According to Malhan (2006), examining the functioning of university libraries in India pointed out, "libraries are perceived as overheads unable to demonstrate visible contributions to the productivity and profitability of the enterprise". Kanamadi and Kumbar (2006) reasoned their findings with "cursory approach of librarians' in developing academic online services at Mumbai business school libraries".

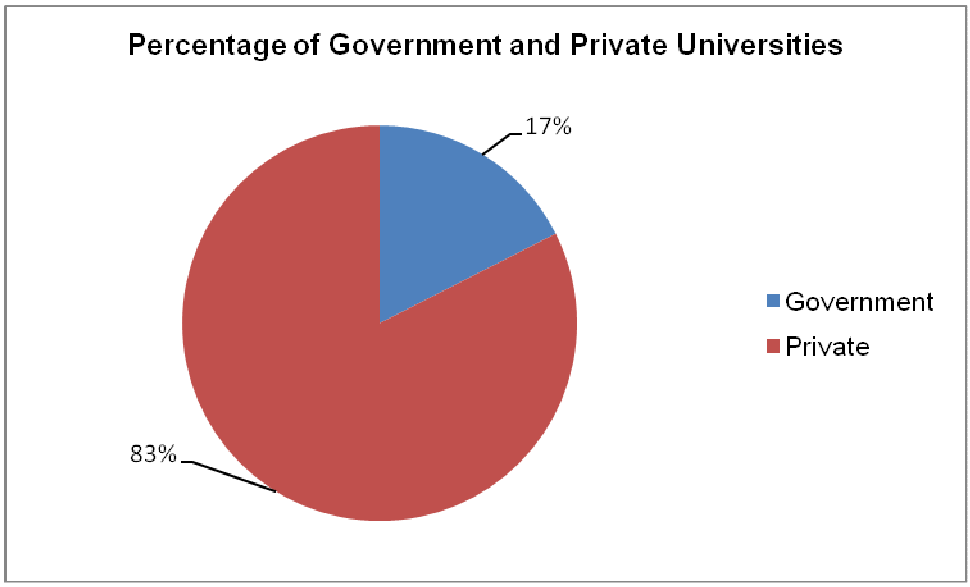
Moreover, Jeevan and Pathy (2005) assessed the preparedness of premier IIT libraries in India on "personalised content delivery and information services and found this customised service prototype to be in nascent stage among the Indian Institutes of Technology libraries". In studying the library automation and networking in India, Vyas (1997) found that "academic libraries are not under pressure as against the scientific and technical libraries".

6. Methodology

For the purpose of this study, we have identified the universities including deemed to be universities in south India offering technical courses in engineering, computing and management disciplines to study the impact of technology assisted learning and web presence of academic libraries. Majority of the institutions are privately-held, whereas state-run universities are very few. A stratified sample of 40 institute library websites was selected to test the hypotheses of technology use and deployment of web technology in academic libraries (See figure 3).

"Take in Figure (3)"

Figure 3: The percentage of private and state-funded universities.



The sample reflects the universities established in the post-independence development of India. The sample includes the state-funded and autonomous institutions to make the sample as representative as possible (See Appendix 1 for complete list of universities).

6.1 Framework for evaluation

An analysis framework is designed to evaluate the library websites in general. The framework is developed by giving weights to the chosen functional area of topic on their relative importance in providing web-based information products and services. The topics used to evaluate the websites are broadly grouped into four categories: (1) websites for library, (2) resource discovery tools, (3) access to scholarly content, and (4) Web 2.0 tools. This framework is designed to check the presence or absence of these topics as web component tools. The "Relative Weight Checklist" is attached in Appendix 2 with the methodology adapted for calculation.

6.1.1. Websites/pages for library

The websites for the library is considered as a means of prefatory, single point of contact, a place of bridge connecting the library staff and institutions. It acts as a "virtual entrance (Poll, 2007) to the library and as interface for all kinds of first-hand information services between the user groups and library administration. The typical library website conveys important information about the library, such as the address of the library, opening hours, the link to online catalogue and the various services of the library. Hence, keeping the importance of the library website a weight of 10 out of 100 (10%) has been allotted to this category.

6.1.2. Resource discovery tools

For academic libraries, access to subjects will be important, as the interests of students and staff will vary as to faculty (Poll, 2007). In any pursuit for course readings and research, resource discovery tools are essential to find the resources for the courses, bibliography and further readings. With more and more discovery tools available over the Internet, being semantically enriched by search engines, online subject gateways and catalogues were considered as indicators for evaluating the websites. Maness (2006) had noted that Library 2.0 demands libraries focus on collaborative discovery systems. Similarly, custom search engines increasingly become the norm of the academic library websites as the search engine for the website increases the discovery of the embedded hybrid information resources. Search engines and search engine optimisation are getting rigorous as the present situation calls for indexing the hidden content of library resources on the deep web and exposure of library content to commercial search engines for better discovery. Listing the requirements of search technology academic libraries have to consider (Lossau, 2004) "indexing of qualified content resources, handling of data heterogeneity, advanced navigation functionality, flexible ordering and ranking schemes for results display and automatic extraction of metadata". Discovery tools add greater value in the process to involve with wider community by integrating all type of digital content and the scale and richness of resources require customisation for discovery services (Brazier, 2007). Subject gateways based on the resource description ensure the primary focus on distributed Internet resources, providing access to the sophisticated and subject resources (Koch, 2000). Relating the subject gateways to the universal bibliographic control (Stoklasová, Balíkova and Celbová, 2003) stressed the importance of subject gateways in integrating heterogeneous information sources. Looking beyond the inventory functions of OPAC 2.0, library catalogues have emerged as versatile discovery platforms providing web service access to catalogue search, but library strategy is to think about catalogues as a platform that can support many discovery applications not just the OPAC, as this enhance long-term end-user discovery and use of library collections (Sierra, Ryan and Wust, 2007). Dempsey (2006), "reflecting upon the resources required to keep library catalogue data accurate and up-to-date, noted libraries ought to explore methods for integrating this data into relevant applications…discovery of the catalogued collection will be increasingly disembedded or lifted out, from the ILS system and re-embedded in a variety of other contexts". Linking the Semantic Web phenomenon to the library catalogues Blyberg (2007), predicted the future of OPACs are

semantically enriched, ontology-rich, facilitating cooperative approach to data sharing as integrated library systems are becoming semantically intelligent to discovery processes. The allotted category weight for this category is 50 out of 100. So, the 50 % of the total category weight has been allotted and distributed among the subcategories. The 25%, 45 % and 30 % of the sub-category weights are given to the search engines, online subject gateways and web OPACs respectively.

6.1.3. Access to scholarly content

For providing visibility to scholarly literature published by the scholarly societies, refereed peer-reviewed journals, university publications and digital repositories, libraries assimilate and provide access to the scholarly content on library websites. Institutional subscriptions and Internet resources availability were checked; institutional repository, personalised user services and e-learning options available on the websites were also explored too. The presence of institutional digital library provides a platform for the research community in the campus to publish their research output quickly as it provides a dependable archive of the published work. A survey by Inger and Gardner (2008) on navigational behaviour of users found that nearly 60% of respondents recognised that library technology most likely, therefore, link servers, intermediated their navigational route to e-journals more than 95% of the time. Presumably, therefore, at least 70% of the survey respondents were in institutions with highly effective technology implementations". Hawkins (2005) described "web technology allows for exciting possibilities including collaborative creation of content, a blurred distinction between creators and users, and greater and more targeted access to and publicity of scholarly information." Formulating the goals for digital libraries supporting e-learning Sharifabadi (2006), had noted "it improves student performance; increases the quantity, quality and comprehensiveness of Internet-based educational resources; make these resources easy to discover and retrieve for students, parents, and educators; and ensure that these resources are available over time. In the e-learning environment, digital libraries are considered as a federation of library services and collections that function together to create a digital learning community with a wide range of supported materials including curricula and courseware materials etc". Maloney (2007) discussing the importance of e-learning, projected it as a model that incorporates the paradigm-altering technologies of Web 2.0 into teaching and learning. Keeping all these points in consideration the allotted category weight for scholarly content category is 30 out of 100. At the sub-category level the e-learning tools have been given 70% importance as audio-visual based education and resources mark the viable just in time learning avenues in education and 30% is given to digital repository presence.

6.1.4. Web 2.0 tools

As web 2.0 tools getting more popularised, the availability of web 2.0 tools - Really Simple Syndication (RSS) feeds, multimedia objects, weblogs and presence of any components of social media were taken into consideration. Harinarayana and Raju (2010) stated "collaboration and participation are the most attractive features of Web 2.0". In his analysis of 57 library websites found that 64.91% have Instant Messaging and RSS feeds, 26.32% have blogs to promote library services, 1.75% has Wikis, 5.26% have podcasts, and this trend suggests that Web 2.0 will grow and its utility will increase in libraries". As this indicates stronger possibilities of interaction, which will eventually, retain users for exuberant resource discovery, sharing and networking for information access and use. Most used feature of Web 2.0 tools is RSS, it helps the user to get updated information without having to visit the website not only it eases to sift through websites but also reduces the information overload (Harinarayana and Raju, 2010). Photos, videos of multimedia tools throng the websites as the Library 2.0 is interactive, collaborative and outgrowing into multi-media web-based technologies to web-based library collections not just merely text (Maness 2006). The simplicity of blogs in publishing the content,

and the features it allows others to record their comments has revolutionised the web publishing world Harinarayana and Raju (2010); Maness (2006) had also wondered blogs nonetheless as integral productions in a body of knowledge, and the absence of them in a library collection could soon become unthinkable. Examination of Social Networking Sites like Facebook, Flickr, Twitter, were checked. The use of social media is a catching trend on library websites to share, revisit and network with peers but also it allows generating content. Harinarayana and Raju have argued (2010) that the uniqueness of these sites is that they enable to share highly personal to academic interests of users. The category weight assigned to this category is 10 out of 100. Out of which 10% to RSS feeds, 30% to Multimedia objects, Blogs/Wikis got 50% and 10% for social media have been assigned at the subcategory level.

6.2 Scope and Limitations

In order to complete this research in time, the scope of the study is confined to the following limitations:

1. The number of universities is higher than the sample of the universities taken for the study in the region. Many of the state-run universities are furcated over the years regionally, and the data on those library websites were not available.
2. Due to the non-availability of data of all the institutions in South India, it was decided to choose the best and old institutions including India's first autonomy granted engineering colleges in the southern region of India.
3. Since, we were evaluating the basic features of library websites we have restricted to the availability and online presence of web components of libraries; when exclusive library website features not available, the general view of institutional websites were taken into account.
4. This study does not investigate the website evaluation criteria such as usability, credibility, user interface, and web analytics etc. Checking the service quality, validation, web analytics of the library websites have not been tested.

7. Analysis and Observations

With the analysis of collected data and calculation of the category scores, one broad generalised observation can be made, since the birth of web technology, the quality of the library websites have not progressed proactively. The outlook of web-based library services needs revival, that the innovative approaches and fresh thinking should redefine largely benefitting all the stakeholders. Couple of factors can be attributed to the slow development of academic libraries in India. Most prominently it could be:

- the level of importance and organisational support academic libraries are meted out in the organisation's mission;
- organisational conflicts between the libraries and parent organisations in terms of resources allocation and continuous evaluation and
- performance of staff, their perception and the level of technical expertise in service delivery. The human resources of library services need continuous training to realise their potential as the current services remains more of conventional, outdated and lack of innovation in outreach and information marketing.

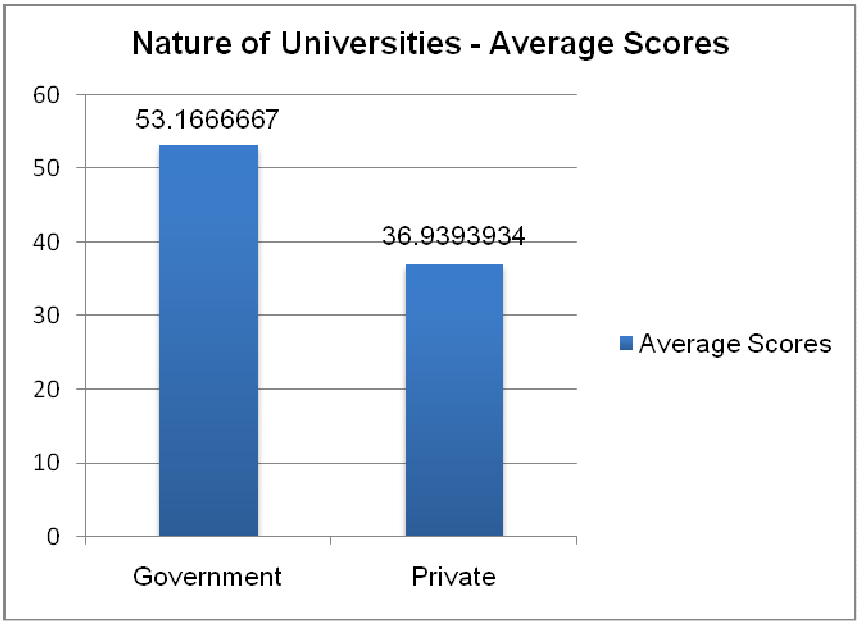
No subject specialists, or liaison librarians, library and user guides, tailor-made information programmes nor information products targeting specific community were available. The rankings of the forty academic library websites are attached in the Table 2. The observations are further explained below:

7.1 Average score of universities by nature

Figure 4 shows the average scores of institutions categorised by nature of funding government funding universities and private universities. Government institutions have 53.16 average score, whereas the private universities show 36.93 out of the 100 allotted weightings.

"Take in Figure (4)"

Figure 4: The nature of universities –government and private and their average scores.

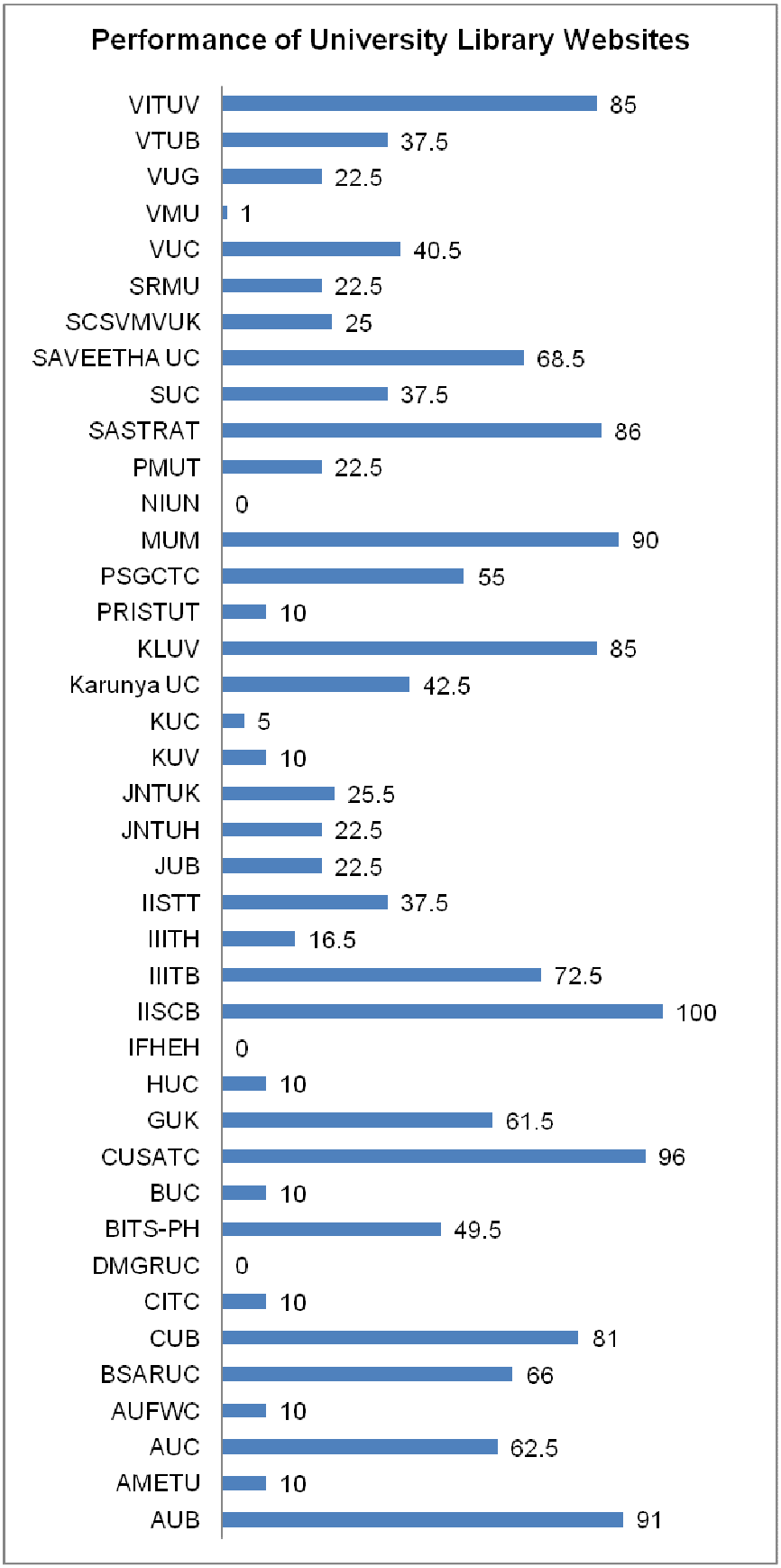


7.2 Top ranking university libraries

Indian Institute of Science scores in all the criteria and aspects; a well-designed library website and layout of web pages have variety of resources assimilated for discovery. Cochin University of Science and Technology got 96, followed by Amrita University with 91. Manipal University has scored 90, and SASTRA with 86. Then, VIT University and KL University secured 85 scores each and Christ University got 81. (For expanded form of abbreviations see the Appendix 1)

"Take in Figure (5)"

Figure 5: Scorecard of academic library websites of universities.



7.3 Outlook and diffusion of web technologies is low

Though, relatively few library websites are dynamic, vibrant and resource-rich, majority stand way behind to adapt new generation web technologies to facilitate learning and information services. It is found that most of the websites are just limited to providing the basic information and in many cases that is in sub-standards. Websites for libraries are not exclusive but few examples of library websites are found satisfactory. Most of the libraries' basic services like Online Public Access Catalogue (OPAC), recommendations, reference desk and feedback options are not web accessible, which further reduces the visibility of library holdings and services (See Table 2.)

7.4 Private universities versus state-run universities

Many privately-held institutions are proactive and user-friendly in their library website content, whereas state-funded university websites need active web content. Anna University Chennai has an exclusively devoted Library website at http://www.annauniv.edu/Library/index.html) but content visibility is low. Multimedia tools like podcasting, streaming media, web-friendly shareable options are sparsely available. Private universities have interesting advanced web personalised features, which enables interactivity, networking among the peers and online communities. To mention a few, MyVIT of VIT University (http://vit.ac.in/myvit.asp) and Academy Web of SASTRA University (http://webstream.sastra.edu/academyweb/usermanager/youLogin.jsp) and open courseware of SRM University (http://www.srmuniv.ac.in/audiovideo.php?page=open_course_ware) are personalised web services found to be noteworthy. Although, many advertisements of private universities heavily use the library for publicity, the same is not visible on their websites. Visvesvaraya Technological University has an exclusive e-learning centre with satellite based and web-based course offerings at (http://elearning.vtu.ac.in/).

7.5 Lack of resource-rich content, discovery services and collaborative web 2.0 tools

In the growing digital web environment, resource discovery tools should be handy to direct the users to relevant resources and the library websites should serve discoverability purpose. Through this analysis it has been found that majority of the libraries do not provide discovery tools, whereas many of them just confine to display the list of institutional subscription resources on their websites. Multimedia tools, audio-visual streaming contents are not embedded on the websites.

8. Issues and Challenges in Developing Web-based Information services

Though academic libraries of technical institutions are being established, scaling up the library operations and the quality of services over the years, revamping the information infrastructure, establishing liaison programmes and lack of support from parent organisations are big causes of concern for the long-term growth of academic libraries. To raise the profile of libraries, academic libraries have been struggling in terms of financial outlay, human resources planning and infrastructure upgrade to build library image in outreach, liaison programmes and enriching web information services. The following prominent three challenges are discussed here pertinent to web information services development:

8.1 Funding for university libraries

Funding for the libraries and electronic information resources is a predominant issue, as many educators continue to educate the learners without providing access to minimum course readings and information resources. Though traditional library services are widely available, the

electronic information resources are not accessible to many. Federal funded institutions like IITs and NITs have arrangements with international and national cooperatives and consortia, whereas the state-funded and private institutions are facing lot of difficulties to fund and expand electronic information services in the absence of continuous federal and state funding assessments for information resources and policies. With no policy and review of needs assessment conducted nationally, disparities in availability of information resources, inequitable access, regional imbalances, and lack of coordination among the policy agencies are found to widely exist. Moreover, conducting periodical audits, cost sharing, cost-benefit analysis of institutional subscription resources and robust accreditation mechanisms for library development are not streamlined for institutional development. The standards and norms for funding the library services on a national scale need to be revised with the changing times to critically examine and determine the investments on information resources and teaching aids, for budget allocation, resource sharing and to ensure equitable access to all stakeholders in technical education.

8.2 Manpower training and development

As per the All India Council of Technical Education (AICTE) quality norms and standards 8.11.1 (http://www.aicte.ernet.in/8staff.htm), a minimum of one qualified librarian, one assistant librarian and four library assistants should constitute staffing in libraries. But standards and policies pertaining to acquisition of books, human resources development and training, key values and result areas, outcomes assessment, roles and responsibilities are not intelligibly laid out. Job description and roles of library staff are not clear and revised as to the emerging trends and needs. Lack of library personnel appraisal and training and development policies badly affect the functioning of libraries for expected results and to keep up the performance of staff productive and accountable. Despite the guidelines, majority of the libraries are either understaffed or underpaid. Information marketing skills among the library professionals in India is low with lack of substantial training, poor professional mentoring platforms and networking skills among the peers. Poor outreach, lack of information literacy skills, no initiatives on liaison programmes and subject specialisation, lack of good compensation and lackadaisical professional development are the other factors that the workforce are lagging behind. Team spirit, leadership development, sensitisation programmes and management skills are neither encouraged, nor are the workplaces motivating. Moreover, the AICTE norms and standards 12.3.9, states the policies of establishing library infrastructure and information resources access facilities (http://www.aicte.ernet.in/12norms_engineering.htm), but there is no precise performance evaluation system for library and personnel by and large, resulting in indifferent attitude, evading responsibilities, with no domain expertise, and lack of accountability towards the library services.

8.3 Re-engineering Information Infrastructure

The information infrastructure requirements for technical education required to be upgraded to the next generation enhancements and to the evolving online library ecosystem. Library infrastructure should be developed in providing e-learning options, personalised information services, course content delivery, online information consultancy and referencing, availability of information resources for research and projects. The status quo of information infrastructure is dismal in many universities that cyberinfrastructure has to scale up to the new breed of library operations – institutional repository, digital libraries, and virtual referencing for which libraries have to invest through strategic long-term planning, and financial means to build the infrastructure. Libraries need to be networked and equipped to enable information resources sharing by latest information technologies to ensure stable and perpetual information resources access, whereas presently cooperative cataloguing and interlibrary loan services are least in use. Growing open source tools and technologies provide greater flexibility and operational

freedom and have much to offer to the delight of educators and learners. Using information technology, open tools and other crucibles are important today for librarians and educators to harness the potentials of technology augmenting for the target users.

9. Conclusion

The library ecosystem is changing, so do the patron worlds and expectations. The looming large web technology and its applications for libraries are exploited worldwide; the open source world also offers variety of solutions at almost no cost for developing web-based information sources. However, to start and strengthening library web services require strategic planning, training and exposure to latest technologies and constant learning in the long-term. In order that libraries are rated as best service units, the library personnel should strive hard to engage with the learning community in variety of roles and functions– e-learning, course content development, online subject gateways, information literacy and orientation programmes. Librarians need to cultivate the habit of interaction, lead the change in scholarly communication, designing information products, and developing information marketing programmes. As the technology world unfolds for libraries, librarians have to be IT-savvy to understand the e-pulse of the today's readers – "digital natives." Spearheading the library development moment we need to be at the forefront to be the change with proactive principles and innovative spirit to initiate timely projects.

Overall, the performance of online library services is far from satisfactory and can be rescaled in many institutions, yet there is room for massive transformation and change for the growing economy. The implementation of web technology could be realised only when the library personnel are skilled, and passionate to re-create the libraries' mission. Given the parent organisation support, technological university libraries can build robust information architectures if combined with training, collaboration and continuous feedback from all the stakeholders – faculty, staff, and above all end-users.

Table 2: Scorecard of the universities libraries websites[1] (See Appendix 2 for calculation of scores)

S. No	Name of University	Year Estd.	Websites/ pages for library (CW[2]= 10)		Resource Discovery Tools (CW= 50)						Access to Scholarly Content (CW= 30)				Web 2.0 Tools[4] (CW= 10)								Total: 100
			Feature present (SCW[3]=10)		Search Engines (SCW= 2.5)		Online Subject gateways (SCW=4.5)		Web OPAC (SCW= 3.0)		e-learning tools (SCW=7.0)		Digital Repository (SCW= 3.0)		RSS (SCW =1.0)		Multimedia (SCW =3.0)		Blogs (SCW=5.0)		Social Media (SCW =1.0)		
1	Amrita University, Bangalore	1994	15	10	1	12.5	1	22.5	1	15	0	0	1	21	1	1	1	3	1	5	1	1	91
2	AMET University, Chennai	1993	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
3	Anna University, Chennai	1978	1	10	0	0	1	22.5	0	0	1	9	1	21	0	0		0	0	0	0	0	62.5
4	Avinashilingam University for Women, Coimbatore	1957	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
5	BS Abdur Rahman University, Chennai	1984	1	10	1	12.5	1	22.5	0	0	0	0	1	21	0	0	0	0	0	0	0	0	66
6	Christ University, Bangalore	1969	1	10	1	12.5	1	22.5	1	15	0	0	1	21	0	0	0	0	0	0	0	0	81
7	Coimbatore Institute of Technology, Coimbatore	1956	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
8	Dr MGR University, Chennai	1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	BITS-Pilani, Hyderabad	2008	1	10	1	12.5	0	0	1	15	1	9	0	0	0	0	1	3	0	0	0	0	49.5
10	Bharath University, Chennai	1984	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
11	Cochin University of Science and Technology, Cochin	1971	1	10	1	12.5	1	22.5	1	15	1	9	1	21	1	1	0	0	1	5	0	0	96
12	Gitam University, Visakhapatnam	1980	0	0	0	0	1	22.5	1	15	0	0	1	21	0	0	1	3	0	0	0	0	61.5
13	Hindustan University, Chennai	1985	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
14	ICFAI Foundation for Higher Education, Hyderabad	1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Indian Institute of Science, Bangalore	1909	1	10	1	12.5	1	22.5	1	15	1	9	1	21	1	1	1	3	1	5	1	1	100
16	Indian Institute of Information Technology, Bangalore	1999	1	10	0	0	1	22.5	1	15	0	0	1	21	1	1	1	3	0	0	0	0	72.5
17	Indian Institute of Information Technology, Hyderabad	1998	0	0	1	12.5	0	0	0	0	0	0	0	0	1	1	1	3	0	0	0	0	16.5
18	Indian Institute of Space Science & Technology, Trivandrum	2007	1	10	1	12.5	0	0	1	15	0	0	0	0	0	0	0	0	0	0	0	0	37.5

19	Jain University, Bangalore	1990	0	0	1	12.5	0	0	0	0	0	0	0	0	1	1	1	3	1	5	1	1	22.5
20	Jawaharlal Nehru Technological University, Hyderabad	1972	1	10	1	12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22.5
21	Jawaharlal Nehru Technological University, Kakinada	1946	1	10	1	12.5	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	25.5
22	Kalasilingam University, Virudhunagar	1984	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
23	Karpagam University, Coimbatore	1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	5
24	Karunya University, Coimbatore	1986	1	10	0	0	1	22.5	0	0	1	9	0	0	0	0	0	0	0	0	1	1	42.5
25	KL University, Vijayawada	1980	1	10	1	12.5	1	22.5	1	15	0	0	1	21	0	0	1	3	0	0	1	1	85
26	PRIST University, Thanjavur	1994	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
27	PSG College of Technology, Coimbatore	1951	1	10	1	12.5	1	22.5	0	0	0	0	0	0	1	1	1	3	1	5	1	1	55
28	Manipal University, Manipal	1957	1	10	1	12.5	1	22.5	1	15	1	9	1	21	0	0	0	0	0	0	0	0	90
29	Noorul Islam University, Nagarcoil	1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	Periyar Maniammai University, Thanjavur	1988	1	10	1	12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22.5
31	SASTRA University, Thanjavur	1984	1	10	1	12.5	1	22.5	1	15	0	0	1	21	1	1	1	3	0	0	1	1	86
32	Saveetha University, Chennai	2001	1	10	1	12.5	0	0	1	15	0	0	0	0	0	0	0	0	0	0	0	0	37.5
33	Sathyabama University, Chennai	1987	1	10	0	0	1	22.5	1	15	0	0	1	21	0	0	0	0	0	0	0	0	68.5
34	Sri Chandrasekharendra Saraswathi Vishwamahavidyalaya, Chennai	1993	1	10	0	0	0	0	1	15	0	0	0	0	0	0	0	0	0	0	0	0	25
35	SRM University, Chennai	1985	1	10	1	12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22.5
36	Vels University, Chennai	1992	1	10	1	12.5	0	0	1	15	0	0	0	0	0	0	1	3	0	0	0	0	40.5
37	Vinayaka Missions University, Salem	1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
38	Vignan University, Guntur	1997	1	10	1	12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22.5
39	Visvesvaraya Technological University, Belgaum	1998	0	0	1	12.5	0	0	0	0	0	0	1	21	1	1	1	3	0	0	0	0	37.5
40	VIT University, Vellore	1984	1	10	1	12.5	1	22.5	1	15	0	0	1	21	0	0	1	3	0	0	1	1	85

Note: [1]Wherever the data is not available on the library websites, university websites have been checked. [2]CW=Category Weight. [3]SCW = Sub-Category Weight. [4] For web 2.0 tools, the university websites were also included, since in many cases, library websites do not have web 2.0 components. [5] 1 and 0 represent presence and absence of a particular web component respectively.

Note

[1] Statistics on south Indian engineering colleges were collected from the respective state departments and directorates of technical education for the year 2009 as provided below:

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2. Department of Technical Education, Government of Karnataka, available at: http://dte.kar.nic.in/ (accessed 10 August 2010).
3. Directorate of Technical Education, Government of Kerala, available at: http://www.dtekerala.gov.in/ (accessed 8 August 2010).
4. Directorate of Technical Education, Government of Tamil Nadu, available at: http://intradote.tn.nic.in/ (accessed 7 August 2010).

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Appendix – 1 List of Universities

Names of university libraries with abbreviated forms and unique resource locators (URLs).

S. No	Name of the University	Abbreviated Form	Unique Resource Identifiers of University Library
1	Amrita University	AUB	http://engineering.amrita.edu/blr/
2	AMET University	AMETU	http://www.ametuniv.ac.in/faculty-library.htm
3	Anna University, Chennai	AUC	http://www.annauniv.edu/Library/index.html
4	Avinashilingam University for Women	AUFWC	http://www.avinuty.ac.in/library.htm
5	BS Abdur Rahman University	BSARUC	http://bsauniv.ac.in/info.aspx?id=50&mid=15
6	Christ University	CUB	http://library.christuniversity.in/
7	Coimbatore Institute of Technology	CITC	http://www.cit.edu.in/Library_faclti.htm
8	Dr MGR University	DMGRUC	http://www.drmgrdu.ac.in/
9	BITS-Pilani, Hyderabad	BITS-PH	http://www.bits-hyderabad.ac.in/library.php
10	Bharath University	BUC	http://www.bharathuniv.com/library.htm
11	Cochin University of Science and Technology	CUSATC	http://library.cusat.ac.in/
12	GITAM University	GUK	http://gitam.edu/eresource/endex.htm
13	Hindustan University	HUC	http://www.hindustanuniv.ac.in/library.html
14	ICFAI Foundation for Higher Education	IFHEH	http://www.ifheindia.org/fst/index.asp?mode=resources_facilities
15	Indian Institute of Science	IISCB	http://www.library.iisc.ernet.in/About.aspx
16	International Institute of Information Technology, Bangalore	IIITB	http://www.iiitb.ac.in/information/library/
17	International Institute of Information Technology,	IIITH	http://www.iiit.ac.in/institute/infrastructure

	Hyderabad		
18	Indian Institute of Space Sciences & Technology, Trivandrum	IISTT	http://www.iist.ac.in/facilities/library
19	Jain University	JUB	http://jainuniversity.ac.in/Download/Infrastructure.pdf
20	Jawaharlal Nehru Technological University, Hyderabad	JNTUH	http://www.jntuh.ac.in/university-library.php
21	Jawaharlal Nehru Technological University, Kakinada	JNTUK	http://www.jntuk.edu.in/currentstudents/library/
22	Kalasilingam University	KUV	http://www.kalasalingam.ac.in/facilities.php
23	Karpagam University	KUC	http://www.karpagamuniversity.ac.in/
24	Karunya University	Karunya UC	http://www.karunya.edu/library/
25	KL University	KLUV	http://www.kluniversity.in/lib/default.aspx
26	PRIST University	PRISTUT	http://www.prist.ac.in/activities/library.html
27	PSG College of Technology	PSGCTC	http://www.psgtech.edu/library/libindex.htm
28	Manipal University	MUM	http://www.manipal.edu/CampusLife/Libraries/CentralLibraryMIT/Pages/Overview.aspx
29	Noorul Islam University	NIUN	http://www.niuniv.com/Library.pdf
30	Periyar Maniammai University	PMUT	http://www.pmu.edu/library.html
31	SASTRA University	SASTRAT	http://www.sastra.edu/index.php?option=com_content&view=article&id=1277&Itemid=637
32	Saveetha University	SUC	http://www.saveetha.ac.in/engweb/library/default.aspx
33	Sathyabama University	SAVEETHA UC	http://www.sathyabamauniversity.ac.in/sitepagethree.php?mainref=4
34	Sri Chandrasekharendra Saraswathi Vishwamahavidyalaya, Kancheepuram	SCSVMVUK	http://www.kanchiuniv.ac.in/Library.html
35	SRM University	SRMU	http://www.srmuniv.ac.in/about_us.php?page=library_activities
36	Vels University	VUC	http://www.velsuniv.org/library.htm
37	Vinayaka Missions University	VMU	http://www.vinayakamission.com
38	Vignan University	VUG	http://www.vignanuniversity.org/library/library.html
39	Visvesvaraya Technological University, Belgaum	VTUB	http://elearning.vtu.ac.in/index.asp
40	Vellore Institute of Technology University	VITUV	http://www.vit.ac.in/Library/Exceptional_library.asp

Appendix – 2: Relative Weight Checklist

Procedure:

1. Place a checkmark for each component that is available in the websites being evaluated.
2. Within each category, add the sub-category weights of the checked items, divide the total by 10, and multiply the resulting number by the category weight to obtain the category score.

3. To obtain consolidated score, sum all the category scores.
4. Category weights sum to 100, while sub-category weights sum to 10.

Checklist Categories		**Weight**
1.0 Websites for library		**10**
1.1 Web component present	10.0	
Category Score		
2.0 Resource discovery tools		**50**
2.1 Search engines	2.5	
2.2 Online research gateways	4.5	
2.3 Web OPACs	3.0	
Category Score		
3.0 Access to scholarly content		**30**
3.1 Digital repository	3.0	
3.2 E-learning	7.0	
Category Score		
4.0 Web 2.0 tools		**10**
4.1 RSS	1.0	
4.2 Multimedia(Photos, Video etc)	3.0	
4.3 Blog/wikis	5.0	
4.4 Social media (bookmarks, Facebook etc.)	1.0	
Category Score		
Consolidated Score		**100**