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Web-Based Sources and Services for Sustainable Development in Academic Libraries: A Longitudinal Approach

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Abstract

The current study presents an insight into trends, modifications and innovations that have taken place on the engineering institute library websites within a span of ten years (2011- 2021) in the provision of web-based sources and services through content analysis method. Findings reveal that the provision of various web-based sources and services have improved over time generally, though some of the services have not improved as expected even after a decade. Social media services provided by the libraries are an area of concern as not much change was observed regardless of a period of ten years. A major change was seen in the provision of research support to the researchers in the form of various pertinent and modern research tools and services that were provided by the library websites in 2021. Libraries have added a variety of web-based resources over time along with improving the provision of services and sources that were present in 2011 and including some new and in-demand services and sources. Libraries, through increased provision of web-based services, enabled advantage of doorstep delivery of library services, have curtailed the need to travel to the library resulting in the reduction of environmental pollution by efficient use of energy resources and reduction of paper waste by the provision of web-based sources thus contributing significantly to sustainable development.

Keywords: Sustainable Development, Library Sustainability, Web-based Services, Web-based Sources, Library Websites.

Introduction

Sustainable development was defined by the Brundtland Commission (1987) as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs". Institutions of higher education are looked upon as the significant promoters of sustainable development (Karatzoglou, 2013). Institutions of higher education can be crucial promoters of sustainability through community engagement, communicating sustainability, creating awareness through user participation and interaction. As universities are centres for a variety of research, teaching and learning they provide a space for free expression

of ideas, knowledge creation and community engagement (Moore, 2005). Moreover, universities as the institutions of importance in society can be pivotal in elevating the importance of sustainable development through public discourse (Ferrer-Balas et al., 2008). Several studies have accentuated the importance of websites of academic institutions in sustainable development. Websites of academic institutions of higher education are crucial in the web-based communication of sustainability (Franz-Balsen & Heinrichs, 2007). Various websites feature facilitates communication regarding sustainability making it both easy and interactive. While one-way communication is provided by static web pages. In contrast, web pages with interactive features allow user engagement encouraging awareness and user participation in environmental initiatives (Amey et al., 2020). Websites of institutions of higher education need to communicate various facets of sustainability including social or economic and environmental sustainability in their web-based communication regarding sustainability (Dade & Hassenzahl, 2003). Universities are discussing sustainability topics, engaging with stakeholders through dedicated sustainability space on their websites and consequently developing support for sustainability through user engagement (Ott et al., 2016). Haridasan and Firdaus (2021) highlighted the importance of library websites in promoting sustainable development. The study advocated that the use of a web-based environment is conducive to the promotion of sustainability, according to them “an ideal and feasible way of promoting and maintaining environmental sustainability is the use of web-based sources and services or the use of a digital environment for the provision of information sources and services”. Since the majority of books published globally are used for scholarly purposes hence moving on to a digital information service model involving digital form for purchase and access of books can help in reducing CO2 emissions significantly (G. G. Chowdhury, 2014).

Research Design

The current study makes use of content analysis methodology to presents an insight into trends, modifications and innovations that have taken place on the Indian Institute of Technology (IIT) library websites within a span of ten years (2011- 2021) in the provision of web-based sources and services. The National Institutional Ranking Framework (NIRF) ranking list for the year 2020 in the category ‘Engineering’, namely ‘India Rankings 2020: Engineering’, was used for selecting the sample of the Indian Institute of Technology (IIT) for the study. All of the 17 IITs that were present on the NIRF ranking list were listed. From the listed 17 IITs a total of 13 IIT library websites were shortlisted as a sample (n=13) for the present study based on the following criteria:

- (1) An IIT with a current library website i.e. in 2021 along with an archive of the same website that appears in the Internet Archive in the year 2011.
- (2) An IIT that is engaged in the provision of web-based library services and resources through its website.

List of Selected Indian Institute of Technology (IIT)

Sl. No.	Name of IIT	Year of Establishment As an IIT	URL of the Library Website
1	IIT Kharagpur	1951	https://library.iitkgp.ac.in/
2	IIT Bombay	1958	https://www.library.iitb.ac.in/
3	IIT Madras	1959	https://cenlib.iitm.ac.in/
4	IIT Delhi	1961	https://library.iitd.ac.in/
5	IIT Guwahati	1994	http://www.iitg.ac.in/lib/
6	IIT Roorkee	2001	http://mgcl.iitr.ac.in/
7	IIT Ropar	2008	https://www.iitrpr.ac.in/library/
8	IIT Bhubaneswar	2008	https://library.iitbbs.ac.in/
9	IIT Gandhinagar	2008	https://iitgn.ac.in/research/library
10	IIT Jodhpur	2008	https://library.iitj.ac.in/
11	IIT Patna	2008	https://library.iitp.ac.in/
12	IIT Indore	2009	http://library.iiti.ac.in/
13	IIT Mandi	2009	http://library.iitmandi.ac.in/

Research questions

The study was designed to reveal the difference between the content, web-based resources and services of IIT library websites over a decade i.e. between the years 2011 and 2021 in a longitudinal study conducted using the Internet Archive's (IA) Wayback Machine. The Internet Archive is a huge library of digital collections. It is the largest and oldest archive on the Web. The Internet Archive through its Wayback Machine allows accessing the archived versions of Web pages (Thelwall & Vaughan, 2004; Alnoamany et al., 2014). The research questions formulated for the study intend to explore the trend changes in the provision of web-based resources and services during the last ten years. The following research questions were formulated for this study:

R1. How has the provision of web-based library services and resources by the Indian Institute of Technology (IIT) libraries changed during the decade of 2011-2021?

R2. Is there any improvement in the means of offering virtual reference services (VRS) by the IIT library websites during the period 2011-2021?

R3. What research support is provided by the IIT library websites currently for aiding the scholarly endeavours of their scholars/researchers and to what extent has it changed since 2011?

R4. What are the popular social media services provided by the IIT library websites? How has the trend changed between the period of 2011-2021?

Data Collection

The data was collected by surveying the contents of library websites both from the current IIT library websites and an archive of the same library website that appears in the Internet Archive in the year 2011. A checklist was prepared after reviewing the related literature from previous studies (Haridasan & Firdaus, 2021; Balaji et al., 2019; Al-Qallaf & Ridha, 2019; Wilson, 2015) which was used to collect the required data. The contents of the selected IIT library websites were surveyed from May 2020 - June 2020 and the same set of the library websites were visited through Internet Archive (<https://archive.org/web/>) during June 2011–December 2011. The period for data collection was prolonged as not all the websites had archives during May 2020 - June 2020 so data was collected during the month where the archive of the website appeared in the Internet Archive during June 2011–December 2011.

Literature review

Haridasan and Firdaus, (2021) highlighted the importance of library websites in promoting sustainable development. It was suggested by the study that library websites can serve as an effective tool for generating awareness about sustainability and related concepts by serving as a portal for accessing resources and information about sustainable development. Rafiq et al.(2021) studied the websites of QS world top-ranked medical libraries and observed that majority of the libraries were providing access to a variety of electronic information sources. However, some significant pieces of information such as library mission and objectives along with mobile apps, library virtual tours, guides and tutorials were provided by a lesser percentage of the libraries. However, a hundred per cent of the libraries were using social media tools such as Facebook, Twitter, Instagram, YouTube, and LinkedIn. A small percentage of libraries were also using platforms such as Zoom, Microsoft Teams, WebEx and Google meet etc. for the dissemination of information. Rahman and Batcha (2020) found that college library websites lagged in providing services such as 'Ask a Librarian', single-window search, FAQs, news-clippings, user manuals etc. Surprisingly, none of the library websites provided social networking facilities to their users nor did the library websites provide any feedback mechanism for their users. Al-Qallaf and Ridha (2019) revealed that all of the libraries studied were offering some kind of instructional tools such as tutorials, citation guides, instruction guides and OPAC search tips etc. on their websites. The study suggested making online tutorials by integrating various areas of scholarly research and information literacy skills for increased productivity rather than providing instructional activities over different web locations.

Haneefa and Jiji (2019) noted that only 2.02 % of the national library websites were providing virtual reference services however, OPAC was found to be a widely provided service. Devi and Verma (2018) suggested that the date of last update should be provided on the library websites for validating the currency of information. In a content analysis study of the engineering

institute's (IITs) library websites, they found that the date of last update was mentioned by only twenty-six per cent of the libraries also, a very low percentage of library websites were updated within a span of last three months. Content analysis of medical library websites by McConnaughy and Wilson (2018) revealed that hundred per cent of the medical library websites provided a contact email address on the library homepage, 77 % of them listed phone numbers, a significant percentage (61%) of them provided links to get feedback or suggestions, while only half of them had the chat box feature on the library home page. Links to a variety of social media platforms such as Facebook, Twitter, Blog, YouTube, LinkedIn, Pinterest etc. were also provided on the websites. Comeaux (2017) conducted a longitudinal study using the Internet Archive for finding out the changes that have occurred within a period of three years (2012-2015) in 37 academic library Web sites. It was revealed that the use of Web-scale discovery services increased significantly during these years and 'Summon' was found to be the most used discovery service overall. Moreover, the use of open-source content management systems increased extensively between the last three years. 'Drupal' was used by the majority of the libraries followed by the 'Word Press' Ott et al., (2016) reported that universities have embraced the concept of sustainable development strongly and are involved in engaging with stakeholders, reporting and communicating sustainability through dedicating a portion for this on of their websites. Aharony (2012) conducted a comparative analysis of academic library websites and traced the changes in academic library websites within a span of ten years using the Internet Archive. It was revealed that the presence of OPAC and other e-resources has increased tremendously. While a major change was observed in the presence of social media /Web 2.0 tools on the websites. None of the academic libraries offered these services in 2000. However, in 2010 quite a few libraries started offering web 2.0 services through library websites. The study also suggested that in 2010 libraries were offering more user-oriented services such as ask the librarian, site search and frequently asked questions. Dade & Hassenzahl (2003) carried out a large scale content analysis of the websites of institutions of higher education in the USA to explore the extent of communication about sustainability through their websites. The study revealed that the websites do not reflect many sustainability-related activities occurring in the institutions of higher education.

FINDINGS AND DISCUSSION

Web-Based Library Services

Web-Based Library Services are provided to the users through the Internet and the World Wide Web (WWW). Web-Based Services offered by the libraries through their websites provide users with a plethora of library services irrespective of the time and geographic constraint. Another advantage presented by web-based services that is favourable to sustainable development is the doorstep delivery of library services to the users consequently curtailing the need to travel to the

library resulting in the reduction of environmental pollution by efficient use of energy resources (Haridasan & Firdaus, 2021).

Table 1: Web-Based Library Services

Web-Based Library Services	Percentage 2011	Percentage 2021	Change in Per cent
OPAC	84.61(11)	100(13)	15.39 ↑
Information Repository (IR)	30.77(4)	100(13)	69.23 ↑
New Arrivals/ addition	38.46(5)	92.31(12)	53.85 ↑
Referral Service	46.15(6)	92.31(12)	46.16 ↑
Library App	0.00(0)	15.38(2)	15.38 ↑
News & Events	38.46 (5)	84.61 (11)	46.15 ↑
Online DDS	23.08 (3)	61.54 (8)	38.46 ↑
Virtual library tour	7.69 (1)	7.69(1)	0.00 --
Online renewal /reservation of books	0.00(0)	61.54(8)	61.54 ↑

↑ Increase; ↓ Decrease; -- No change

Table 1 shows that a majority of the libraries provided OPAC (Online Public Access Catalogue) on their library websites in 2010 (84.61%) though in 2021 the number increased to 100 per cent. A major change was observed in the provision of Information Repository (IR) on the library websites between the period 2011-2021. In 2011 only 30.77 per cent of libraries had IR on their websites however, the percentage increased substantially (69.23 %) by the year 2021 and 100 per cent of the libraries were providing Information Repository (IR) service to their users. Moreover, the provision of information about new arrivals or current addition to library collection increased by more than 50 per cent since 2011. Whereas, the provision of other web-based library services such as referral service, library news & events, online document delivery service (DDS) also increased significantly. While none of the libraries provided Library App and online renewal/reservation of books on their websites in the year 2011 in contrast provision of a facility for online renewal or reservation of books increased considerably in 2021. However, it is a bit surprising to note that even in the year 2021 Library App is made available by only 15.38 per cent of the libraries.

Virtual Reference Services

The need to adapt to the changing digital information environment along with the necessity to interact and communicate with the library users in a web-based environment has led to the evolution of traditional reference services to virtual reference services. Libraries use a wide variety of methods such as ask services, email, live chat etc. for responding to the reference questions of their users virtually. Virtual reference service has the capability of catering to the learning habits of those learners who are unable to the library due to the time constraint (Yang & Dalal, 2015)

Table 2: Virtual Reference Services

Virtual Reference Services	Percentage 2011	Percentage 2021	Change in Per cent
Email	84.61(11)	100(13)	15.39 ↑
Call/ Phone	76.92(10)	100(13)	23.08 ↑
Web forms	15.38(2)	46.15 (6)	30.77 ↑
FAQ	15.38(2)	38.46(5)	23.08 ↑
Ask Services	23.08(3)	38.46(5)	15.38 ↑
Instant Message/Chat	7.69(1)	15.38(2)	7.69 ↑
SMS/ Text message	0.00(0)	0.00(0)	0.00 --
Video-Conferencing	0.00(0)	0.00(0)	0.00 --

↑ Increase; ↓ Decrease; -- No change

It can be observed from table 2 that Email and Call/ Phone remain two of the most popular means for providing virtual reference services to the users in both the years i.e. in 2011 and 2021. The use of web forms as a source for responding to the reference query of the users changed considerably with an increase of about 30 per cent during 2011-2021. In 2011, only 15.38 per cent of libraries provided web form facility to their users however, 46.15 per cent of libraries were providing web forms in 2021. It is noteworthy that some of the important services for providing virtual reference such as instant message/chat, ask services, frequently asked questions (FAQ) did not improve much even after a decade (2011-2021), which is disappointing, as a study by Mawhinney (2020) showed a clear preference for 'live chat' over other virtual reference methods. Any support for virtual reference through SMS/ Text message and video-conferencing was however missing in both 2011 and 2021.

Online Research Tools/ Services

The goal of the academic libraries is to support the research and learning endeavours of their clientele. Though with time library services change constantly to serve and support their client and suffice their needs efficiently and in accordance with the ever-changing global information and research trends. Libraries are functioning as versatile study spaces that adapt to the speedy advances in digital technologies also supporting the changing trends and practices in research, and learning (ODonnell & Anderson, 2021). Providing research support is an important function of academic libraries. Libraries offer research support to the researchers in the form of various tools and services such as Remote Login, Tutorials and Guides, Plagiarism Check, Grammar Check services and Federated search tools.

Table 3: Online Research Tools/ Services

Online Research Tools/ Services	Percentage 2011	Percentage 2021	Change in Per cent
Remote Login	0.00(0)	100(13)	100 ↑
Discovery service/ Federated search tool	23.08(3)	23.08(3)	0.00 --
Plagiarism Check	0.00(0)	92.31(12)	92.31 ↑
Grammar Check	0.00(0)	84.61(11)	84.61 ↑
Tutorials and Guides	53.85(7)	69.23(9)	15.38 ↑
Link to citation managers	7.69(1)	53.85(7)	46.16 ↑

↑ Increase; ↓ Decrease; -- No change

It can be seen from table 3 that research support for researchers has improved extensively during the decade of 2011-2021. In 2021, the majority of libraries offer services such as Remote Login (100 %), Plagiarism Check (92.31%), and Grammar Check (84.61%) on the contrary none of the libraries provided these services in 2011. It is however surprising that the provision of discovery service or single-window search service did not improve regardless of a period of ten years. This data contradicts the findings of a longitudinal study by Comeaux (2017) who revealed that libraries have widely embraced web-scale discovery within a period of three years (2012 – 2015). Meanwhile, the most frequent research support that was provided by the libraries (53.85%) in 2011 was various tutorials and guides for solving researchers' queries whereas, 69.23 per cent of the libraries were having tutorials and guides on library websites in 2021.

Social Media Account/ Web 2.0 Services

Social media has become an important platform for communication and interaction. Social media tools are being extensively used for marketing and promotional activities in various organizations owing to their popularity (Choi & Joo, 2018). Social media has empowered libraries with the opportunity to move beyond the traditional borders of the library along with the possibility of engaging and connecting with new stakeholders and diverse user community (Harrison et al., 2017). Social media as a tool of great significance has bestowed libraries with a prompt and feasible method for promoting and publicising library events, marketing library services and sources along with the added advantage of user feedback, interaction and community engagement.

Table 4: Social Media Account/ Web 2.0 Services

Social Media Account/ Web 2.0	Percentage 2011	Percentage 2021	Change in Per cent
Facebook	0.00(0)	38.46(5)	38.46 ↑
Twitter	15.38(2)	38.46(5)	23.08 ↑
YouTube	0.00(0)	23.08(3)	23.08 ↑
Instagram	0.00(0)	15.38(2)	15.38 ↑
LinkedIn	0.00(0)	15.38(2)	15.38 ↑
Blog	15.38(2)	7.69(1)	7.69 ↓
Social Bookmarking	7.69(1)	7.69(1)	0.00 --

↑ Increase; ↓ Decrease; -- No change

Table 4 shows that libraries are lagging in the provision of social media/web 2.0 services to the users. Social media presence has not improved much over the duration of ten years. In 2011, a very small percentage of the libraries provided Twitter (15.38%), blogging (15.38%), and social bookmarking services (7.69%). Also, none of the libraries had any provision of Facebook, YouTube, Instagram and LinkedIn account on their websites in 2011.

Surprisingly, the provision of social media services did not get much better in 2021. While Facebook (38.46%) and Twitter (38.46%) were identified as two of the most common social networking services provided through library websites. Similarly, a content analysis study by McConaughy and Wilson (2018) found Facebook and Twitter to be the two most popular social media platforms. Only a small percentage of the libraries offered YouTube (23.08 %), Instagram (15.38), LinkedIn (15.38) facilities through their websites. Interestingly a decrease was observed in the percentage of libraries providing blogging services. Meanwhile, social bookmarking remained the least provided service in both 2011 and 2021.

Web-Based Resources

Web-based resources are vital sources of information in the current digital age. Libraries carry out the responsibility of selecting and making available quality and pertinent web resources to the users through their websites. Quality library resources are indispensable for providing quality library services (Li, 2006). Web resources serve as a pivotal tool for information access and dissemination consequently supporting research endeavours (Firdaus & Haridasan, 2015).

Table 5: Web-Based Resources

Web-Based Resources	Percentage 2011	Percentage 2021	Change in Per cent
Links to E-Journals	92.31(12)	100(13)	7.69 ↑
Links to E-Books	76.92(10)	100(13)	23.08 ↑
Links to Online Database	92.31(12)	100(13)	7.69 ↑
Links to ETD	53.85(7)	100(13)	46.15 ↑
E- Reports	15.38(2)	61.54(8)	46.16 ↑
Links to E-Newspapers	15.38(2)	38.46(5)	23.08 ↑
Links to E-reference sources	15.38(2)	7.69(1)	7.69 ↓
Links to Multimedia resources	23.08(3)	76.92(10)	53.84 ↑
Other E-sources	7.69(1)	38.46(5)	30.77 ↑

↑ Increase; ↓ Decrease; -- No change

The majority of the IIT library websites provided access to web-based resources such as electronic journals (92.31%), online databases (92.31%) and e-books (76.92%) in 2011. However, the number increased to a hundred per cent in 2021. A major change was observed in the provision of links to multimedia resources between 2011 and 2021, where an increase of 53.84 per cent was observed. In 2011, 23.08 per cent of the IIT libraries provided links to multimedia resources whereas, in 2021, 76.92 per cent of libraries started providing links to multimedia resources. Provision of Electronic Thesis and Dissertation (ETD) and e-reports also increased significantly by about 46 per cent. In 2021 hundred per cent of the libraries started providing Electronic Thesis and Dissertation (ETD) whereas, e-reports were provided by 61.54 per cent of the libraries. A decrease in the number of libraries providing links to e-reference sources was observed during 2011-2021. In 2011, 15.38 % of the libraries provided links to e-reference sources; however, the figure decreased to 7.69% in 2021. 38.46 per cent of the IIT libraries provided links to e-newspapers in 2021 in contrast only 15.38 per cent of libraries offered the same in 2011. In 2021, 38.46 per cent of IIT library websites provided access to electronic resources such as e-newsletters and old question papers, whereas in 2011 a meagre percentage of libraries (7.69%) had such e-resources on their websites.

Conclusion

A significant increase was observed in the percentage of various web-based library services since 2011. The provision of Information Repository (IR) on the library recorded the highest

percentage increase followed by online renewal/reservation service for books and new arrivals service. However, the only service which remains unchanged is the virtual library tour where no increase was observed regardless of a period of ten years. Reference services have always been an important service provided by the libraries, though with time its form has changed as libraries are now providing various virtual reference services. Provision of reference service through the web forms increased considerably over the years however, Email and Call/ Phone remain two of the most popular means for offering virtual reference services (VRS) by the IIT libraries. Though it is heartening to see that the use of web forms increased over time, still only less than fifty per cent of the libraries are offering web form facility through their websites in the year 2021. It is advisable that more libraries engage in providing this service and consequently eliminating paper wastage by the use of printed forms. A major difference was observed in the provision of research support through the IIT library websites. Where hundred per cent of the libraries started providing Remote Login service in 2021, in contrast to 2011 where none of the libraries provided Remote Login. Similarly, research support in form of plagiarism check and grammar check was provided by a majority of the libraries in 2021 on the contrary none of the libraries provided these services in 2011. The provision of social media/web 2.0 services did not improve much even after a decade. The study observed that not a large number of libraries are engaged in offering these services through library websites. However, Twitter was found to be the most popular social media service in 2011 whereas, in 2021, Facebook was the most popular social media service followed by Twitter. The majority of the IIT libraries started providing access to a range of web-based resources in 2021 in comparison to 2011 however, the provision of links to E-reference sources decreased slightly. Overall a general improvement in the provision of various web-based resources and web-based library services through the IIT library websites was observed since 2011. It is thus suggested that the provision of more user oriented web-based library services and pertinent web-based resources by libraries will motivate users to actively make use of these web-based resources and services which is conducive to sustainable development as studies have emphasised on the importance of a digital or web based environment for ecological sustainability (Haridasan & Firdaus, 2021; Chowdhury, 2010).

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