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Abstract

This paper examines and explores the web impact factor through a webometric study of the present 16 Indian Institute of Technology (IIT) of India. Identifies the domain systems of the websites; analyzes the number of web pages and link pages, and calculates the simple web impact factor (WIF), self link web impact factor and external web impact factor of all the IIT. Also reflects that some IIT have higher number of web pages, but correspondingly their link pages are very small in number and websites fall behind in their simple, self link and external link web impact factor.

Introduction

The World Wide Web has now become one of the main sources of information on academic and research activities and therefore it is an excellent platform to test new methods of evaluating webometric activities. Webometric studies have focused their analyses mainly in the performance of the academic web domains, because academic institutions like colleges and universities are stable and well-defined institutions on the Web since long time ago. Furthermore, this interest is due to the possibility of building web indicators which explain the academic activity and production (Scharnhorst and Wouters, 2006; Thelwall, 2001, 2002). This has produced several studies that compare the academic web development in different countries through web indicators (Ingwersen, 1998; Smith, 1999) or through visualization (Heimeriks and Van Den Besselaar, 2006; Polanco et. al., 2001).

Academic institutions, web sites, in many countries, are large multifaceted communication devices, and are increasingly used for a wide variety of purposes, from attracting new students to providing online library catalogues. In terms of research, academic institutions, web sites can announce the existence and promote the achievements of individuals, research groups, institutes and departments. They can also disseminate their findings, either by hosting online articles or by publishing summaries, data sets or tools. The pages themselves can be created centrally, by administrators or webmasters, or locally by individuals for themselves or their research team or projects. Potential benefits of an effective web presence include greater research impact, attracting students, media interest and commercial contacts. In this context, it is quite logical to investigate the measures of the effectiveness of web sites, both to study the communication activity that they represent and to build useful evaluation metrics (Vaughan and Thelwall, 2005).

Concept of Webometrics

The Online Dictionary of Library and Information Science defines a web page as "an electronic document written in HTML script, stored on a Web server and accessible using Web browser software at a unique Internet address (URL), usually one of a group of related, interlinked files that together comprise a Web site. A Web page may include formatted text, graphic material, audio and/or video elements, and links to other files on the Internet" (DLIS).

The term, 'webometric' was coined from two English words i.e. "web" & "metrics". The word 'web' is the short of World Wide Web and 'metrics' denotes the mathematical theory of measurement. The ODLIS defines webometrics as "description and evaluation of the impact of the Internet as a scholarly communication tool, primarily by means of quantitative analysis of web-based scholarly and scientific communications" (ODLIS). Sometimes it is used synonymously with 'cybermetrics'. Simply, Webometrics, therefore, is the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the Web, drawing on bibliometric and informetric approaches.

Ramesh Babu, Jeyshankar and Nageswara Rao (2010) defined 'webometrics' as a quantitative study of web-related phenomena. The webometrics study could be applied to web with commercial search engines providing the raw data.

Bojorneborne (2004), on the other hand, defined webometrics as "the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the web, drawing on bibliometric and informatic approaches. This definition covers both the construction and usage aspects of the web, which embrace the following four key domains of webometrics study:

- Web page content analysis.
- Weblink structure analysis (e.g. hyperlink, self link and external link).
- Web usage analysis (e.g. exploting log files for users searching and browsing behaviour).
- Web technology analysis (including search engine performance).

Indian Institute of Technology (IIT)

Indian Institutes of Technologies (IITs) are a group of 16 autonomous engineering and technology-oriented institutes of higher education and learning established and declared as Institutes of National Importance by the Parliament of India. The IITs were created primarily to train scientists and engineers, with the aim of developing a skilled workforce to support the economic and social development of the country.

The details of all the existing IITs are listed in Table 1, which gives a brief sketch of all 16 IITs in India with their year of establishment, located city/ town with URL.

Table 1 List of IITs in India (chronological order)

Name of the IIT	Year of Estd.	Short Name	City/ Town	State/ UT	URL
IIT Kharagpur	1951	IITKGP	Kharagpur	West Bengal	www.**iitkgp**.ernet.in/
IIT Bombay	1958	IITB	Mumbai	Maharashtra	www.**iitb**.ac.in/
IIT Madras	1959	IITM	Chennai	Tamil Nadu	www.**iitm**.ac.in/
IIT Kanpur	1959	IITK	Kanpur	Uttar Pradesh	www.**iitk**.ac.in/
IIT Delhi	1963	IITD	New Delhi	New Delhi	www.**iitd**.ac.in/
IIT Guwahati	1994	IITG	Guwahati	Assam	www.**iitg**.ac.in
IIT Roorkee	2001	IITR	Roorke	Uttarakhand	www.**iitr**.ac.in/
IIT Ropar	2008	IITRPR	Rupnagar	Punjab	www.**iitr**pr.ac.in/
IIT Bhubaneswar	2008	IITBBS	Bhubaneswar	Odisha	www.**iitbbs**.ac.in/
IIT Hyderabad	2008	IITH	Hyderabad	Andhra Pradesh	www.**iith**.ac.in/
IIT Gandhinagar	2008	IITGN	Gandhinagar	Gujarat	www.**iitgn**.ac.in/
IIT Patna	2008	IITP	Patna	Bihar	www.**iitp**.ac.in/
IIT Rajasthan	2008	IITJ	Jodhpur	Rajasthan	www.**iitk**.ac.in/**iitj**/
IIT Mandi	2009	IIT Mandi	Mandi	Himachal Pradesh	www.**iitmandi**.ac.in/
IIT Indore	2009	IITI	Indore	Madhya Pradesh	www.**iiti**.ac.in/
IIT (BHU) Varanasi	2010	IITBHU	Varanasi	Uttar Pradesh	www.it**bhu**.ac.in/

Review of Literature

The Web provides a fertile ground for the extension of the bibliometric techniques developed for the conventional print environment. A number of studies have been published, establishing the concept of webometrics (Larson, 1996; Almind and Ingwersen, 1997; Rousseau, 1997; Smith and Thelwall, 2002; Bjorneborn, 2004; Bjorneborn and Ingwersen, 2004). In particular, the WIF has been proposed by Ingwersen (1998) as a method of gauging the influence of web sites on each other, and of analysing links between institutions. He proposed Web Impact Factors by analogy with Journal Impact Factors (JIF), and Mike Thelwall has developed the WIF in several papers in order to find possible correlations to traditional research productivity indicators (Bjorneborn, 2004).

The WIF as a useful measure of the overall influence of a web site, using the backlinks or inlinks (links coming into a site from other sites) to the web site, has been proposed independently by two bibliometric researchers. It is an interesting illustration of the dominance of English language research publishing that the concept of WIF was published first in a Spanish language journal by Rodríguez i Gairin (1997), but was not widely noticed until published in an English language journal by Ingwersen (1998).

Thelwall (2002) in his study entitled, "Conceptualizing documentation on the web: an evaluation of different heuristic-based models for counting links between university websites" states that the earlier weblink studies have used the webpage as the primary indivisible source document for counting purposes. He defined three alternative heuristics for the educational arena based upen the directory, the domain and the whole university site, and examined 108 UK university institutional websites.

Noruzi (2005) invested the web impact factor for the Iranian universities and introduced a new system of measurement. Ramesh Babu, Jeyshankar and Nageswara Rao (2010) studied the websites of central

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universities of India. Ortega and Aguillo (2008) have analyzed the Visualization of the Nordic academic web: link analysis using social network tools.

Objectives

The basic objective of the present study is to formulate a methodology for the calculation of web impact factor (WIF) of Top Level Domains (TLDs), Second or Top-Level Domains (STLDs) of the Indian IITs. The other objective includes:

- To identify and analyze the websites of all IITs of India;
- To identify the domain systems of all the IIT websites in India as per the web pages;
- To calculate the number of link pages, number of self link pages, external and internal link pages of the IIT websites and rank them according to their coverage and
- To calculate the simple, self link and external web impact factor of all the 16 IITs included in the present study.

Scope

The present study makes a webometric analysis of IITs websites in India. The study examined the websites of 16 IITs in the country and aimed at to establish a kind of academic ranking of these websites by measuring their web impact factor. The ranking of websites will help the reader to compare and identify IITs websites in India according to their WIF.

Methodology of the Study

When undertaking a WIF study, it is necessary to select a suitable search engine that will count the number of pages in the web site studied, and the number of pages linking to the web site. It should have a large database, covering as much of the Web as possible (Smith, 1999)**.** Currently, AltaVista satisfies these requirements most fully, with one of the largest databases and search commands both for links and for number of pages at a web site (Notess, 2002).

Thus, the present study uses altavista search engine (www.altavista.com) for collecting the required data. Altavista's advanced queries were used to collect the approximate number of pages in each websites. The following search statement are used to collect data for each of the 16 IITs websites as:

- domain:www.iitb.ac.in- this will extract the number of web pages at the website under www.iitb.ac.in.
- linkdomain:www.iitb.ac.in- it will retrieve total number of web pages linking to the websites under www.iitb.ac.in.
- linkdomain:www.iitb.ac.in AND domain:www.iitb.ac.in- it will provides a complete report of number of web pages under www.iitb.ac.in which provides hyperlinks to this website www.iitb.ac.in; which is called self-links pages (links from the same website).
- Linkdomain:www.iitb.ac.in AND NOT domain:www.iitb.ac.in– which provides the report of number of pages not under www.iitb.ac.in. But this website provide hyperlinks to www.iitb.ac.in. It is called external-link pages.
- Linkdomain:www.iitb.ac.in NOT domain:www.iitb.ac.in- it reveals the number of links incoming from other websites*.*

Results and Discussion

Distribution of Data by Domain Name

Table 2 shows the classification of IITs by their domain name, further, it shows that only two types of domain extensions were observed in the present study of the IITs. Almost all IITs, except IIT-KGP

websites have '.ac.in' (93.75 per cent) extension where as only IIT-KGP web site has '.ernet.in' (6.25 per cent) extension respectively.

Table 2 Classification of IITs by their domain

Sl. No.	Domain	No. of IITs	Percentage (%)
1.	.ac.in	15	93.75
2.	.ernet.in	1	6.25
Total		**16**	**100**

Distribution of Data by SWIF

Table 3 arranges the rank of the IITs in India according to their simple web impact factor (SWIF). Simple Web Impact Factor has been calculated by the following formula:

Simple Web Impact Factor (SWIF) = B/A

Where, A= Number of web page and

B= Link web page.

IIT, Kharagpur occupies the first place with 2053 link pages and 15 numbers of web pages with 136.866 SWIF, followed by IIT-Madras and Bhubaneswar occupies second and third ranks having 2.098 and 1.861 SWIF respectively. Though IIT-Delhi (10983), IIT-Roorke (12596) and IIT-Kanpur (70110) have more number of web pages compared to all other IITs, but still they have occupied 9th, 14th and 15th position in the ranking respectively as because their number of link pages are very less compared to their number of web pages.

Table 3 Simple web impact factor for IITs

Name of the IIT	NWP (A)	LWP (B)	SWIF (B/A)	Ranked by SWIF
IIT Kharagpur	15	2053	136.866	1
IIT Madras	4846	10169	2.098	2
IIT Bhubaneswar	122	227	1.861	3
IIT Bombay	5576	8470	1.519	4
IIT Guwahati	935	1093	1.168	5
IIT Patna	268	292	1.089	6
IIT Ropar	267	198	0.741	7
IIT Indore	226	148	0.654	8
IIT Delhi	10983	6943	0.632	9
IIT Hyderabad	639	382	0.597	10
IIT Mandi	300	145	0.483	11
IIT Gandhinagar	627	251	0.401	12
IIT Rajasthan	461	154	0.334	13
IIT Roorkee	12596	3929	0.311	14
IIT Kanpur	70110	19459	0.277	15
IIT (BHU) Varanasi	3099	615	0.198	16

NWP= No. of Web Page, LWP= Link Web Page, SWIF= Simple Web Impact Factor

Distribution of data by SLWIF

The self link web impact factor of IITs is shown in Table 4, which is calculated by adopting the following formula:

Self Link Web Impact Factor (SLWIF) = C/A

Where, C= Simple Link Web Page (SLWP) and

A= Number of web page

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Analysis of the resultant data shows that, Indian Institute of Technology, Kharagpur occupies first place with 15 NWP, 13 SLWP with 0.867 SLWIF followed by IIT-Guwahati and IIT-Patna remained at the second and third position with SLWIF of 0.562 and 0.549 respectively. Similarly, Indian Institute of Technology, Hyderabad (0.487), Mandi (0.46), Indore (0.43), Varanasi (0.414), Ropar (0.412), Gandhinagar (0.399), Roorkee (0.355) stood at fourth, fifth, sixth, seventh, eighth, ninth and tenth positions respectively.

Table 4 Self-link web impact factor for IITs

Name of the IIT	NWP (A)	SLWP (C)	SLWIF (C/A)	Ranked by SLWIF
IIT Kharagpur	15	13	0.867	1
IIT Guwahati	935	525	0.562	2
IIT Patna	268	147	0.549	3
IIT Hyderabad	639	311	0.487	4
IIT Mandi	300	138	0.46	5
IIT Indore	226	97	0.43	6
IIT (BHU) Varanasi	3099	1280	0.414	7
IIT Ropar	267	110	0.412	8
IIT Gandhinagar	627	250	0.399	9
IIT Roorkee	12596	4470	0.355	10
IIT Madras	4846	1710	0.353	11
IIT Bombay	5576	1710	0.307	12
IIT Delhi	10983	2720	0.248	13
IIT Bhubaneswar	122	28	0.23	14
IIT Kanpur	70110	10800	0.155	15
IIT Rajasthan	461	51	0.111	16

Note: NWP= No. of Web Page, SLWP= Simple Link Web Page, SLWIF= Simple Link Web Impact Factor

Distribution of data by EWIF

Table 5 shows the rank distribution of all IITs according to their external web impact factor (EWIF) which is calculated by taking the following formula:

External Web Impact Factor (EWIF) = D/A

Where, D= External link web page and

A= Number of web pages

It is clearly visible from Table 5 that again IIT-Kharagpur is having 13 ELWP and 15 NWP with 0.867 EWIF and occupies the first position among all the 16 IITs; followed by IIT-Varanasi with 0.22 EWIF. Though IIT- Kanpur stood at the 10th position having maximum number of external-link web pages (3830) compared to other IITs but its EWIF is too low compared to its number of web pages which is quite insignificant.

Table 5 External link web impact factor for IITs

Name of the IIT	NWP (A)	ELWP (D)	EWIF (D/A)	Ranked by EWIF
IIT Kharagpur	15	13	0.867	1
IIT (BHU) Varanasi	3099	680	0.22	2
IIT Roorkee	12596	2190	0.174	3
IIT Hyderabad	639	91	0.143	4
IIT Bombay	5576	758	0.136	5
IIT Bhubaneswar	122	11	0.091	6
IIT Ropar	267	19	0.072	7
IIT Delhi	10983	762	0.07	8
IIT Guwahati	935	53	0.057	9
IIT Kanpur	70110	3830	0.055	10
IIT Indore	226	11	0.049	11
IIT Mandi	300	13	0.044	12
IIT Gandhinagar	627	25	0.04	13
IIT Rajasthan	461	17	0.037	14
IIT Madras	4846	158	0.033	15
IIT Patna	268	7	0.027	16

Note: NWP= No. of Web Page, ELWP= External-Link Web Page, EWIF= External-link Web Impact Factor

Distribution of data by RWIF

Table 6 exhibits the rank distribution of all the 16 IITs according to their revised web impact factor (RWIF) which has been calculated by putting the following formula:

Revised Web Impact Factor (RWIF) = E/ A

Where, E= Internal Link Web Page and

A= Number of Web Page.

Indian Institute of Technology, Kharagpur again ranked first position with 15 web pages, 13 in-link web pages and 0.867 RWIF; followed by Indian Institute of Technology Varanasi with 3099 NWP, 672 ILWP and 0.217 RWIF. IIT-Roorkee occupied 3rd position with 0.176 RWIF. Though Indian Institute of Technology, Kanpur is again having maximum number of in-link web pages (4100) compared to all IITs, but it stood at 10th position due to its less (0.059) RWIF as compared to in-link web pages which seems to be quite insignificant.

Table 6 Revised link web impact factor for IITs of India

| Name of the IIT	NWP (A)	ILWP (E)	RWIF (E/A)	Ranked by RLWIF
IIT Kharagpur	15	13	0.867	1
IIT (BHU) Varanasi	3099	672	0.217	2
IIT Roorkee	12596	2210	0.176	3
IIT Hyderabad	639	107	0.168	4
IIT Bombay	5576	782	0.141	5
IIT Bhubaneswar	122	11	0.091	6
IIT Mandi	300	23	0.077	7
IIT Ropar	267	19	0.072	8
IIT Delhi	10983	772	0.071	9
IIT Kanpur	70110	4100	0.059	10
IIT Indore	226	13	0.058	11
IIT Guwahati	935	52	0.056	12
IIT Rajasthan	461	20	0.044	13
IIT Gandhinagar	627	25	0.04	14
IIT Madras	4846	160	0.034	15
IIT Patna	268	7	0.027	16

Note: NWP= No. of Web Page, ILWP- Internal Link Web Page, RWIF= Revised Web Impact Factor

Daily Page Views of IITs Vs. Daily Search Percentage

The daily page views of the Indian Institute of Technologies have also been analyzed. The graphs were obtained from Alexa (Alexa web analyst). The graphs of such views are depicted as follows with the percentage. Due to less number of views, Alexa is unable to create the viewer's graph of IIT-Ropar, Bhubaneswar, Hyderabad, Patna, Rajasthan. It is also important to note that, Alexa was also unable to establish graph views with the web address of www.iitd.ac.in, however produced with the web address of www.iitd.ernet.in.

Daily Pageviews (percent) — iitmandi.ac.in

Daily Pageviews (percent) — itbhu.ac.in

Daily Pageviews (percent) — iiti.ac.in
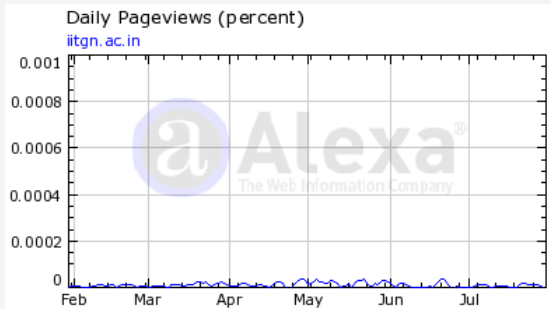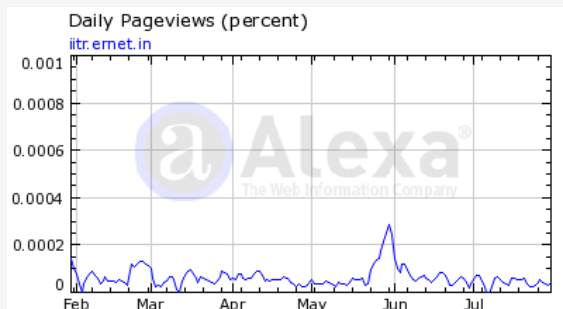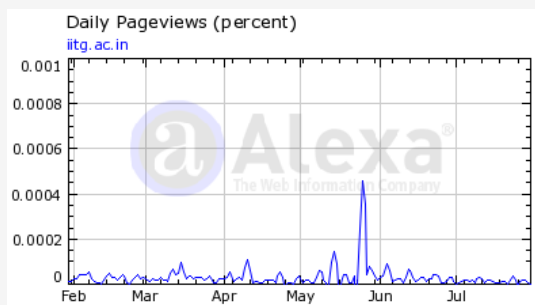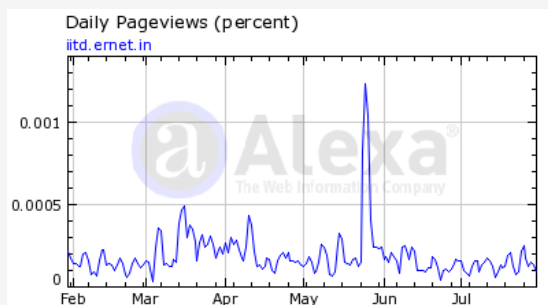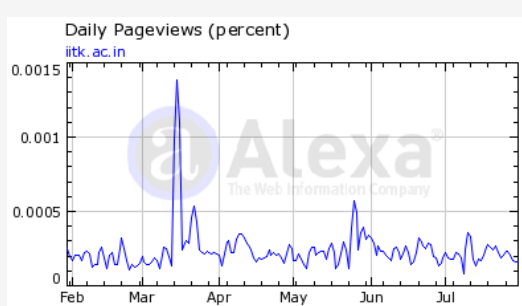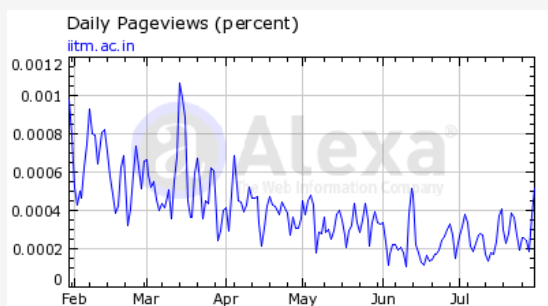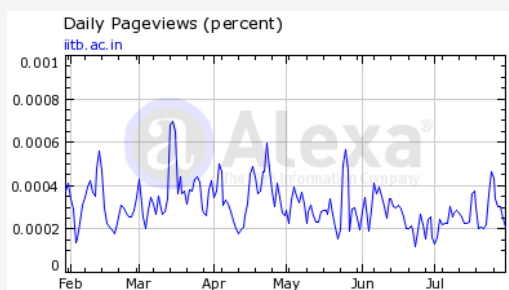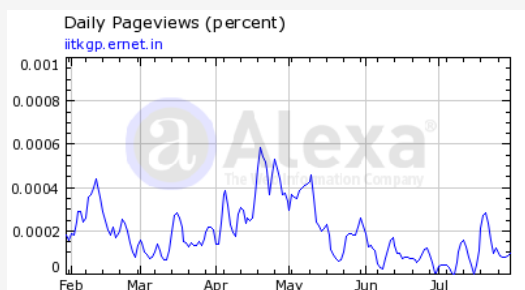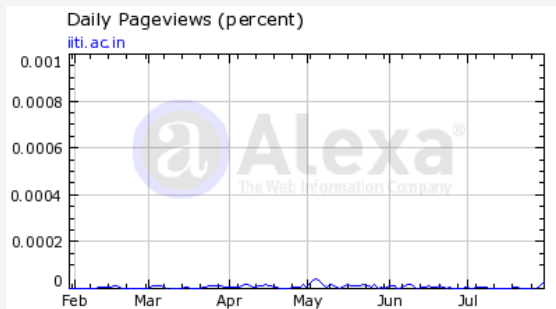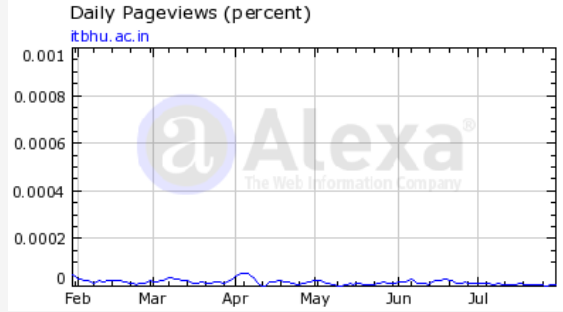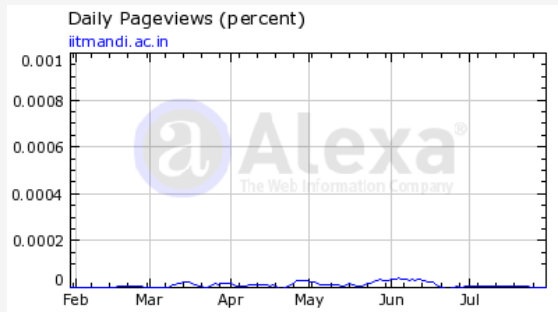
Table 7 Daily Search Percentage of the IITs

Name of the IIT	Last 30 days site traffic (in %)	Last 7 days site traffic (in %)	Yesterday site traffic (in %)	Mean site traffic (in %)	Rank
IIT Madras	22.7	23.3	20	22	1
IIT Bombay	23.9	19	19.2	20.7	2
IIT Delhi	23	21.5	16.7	20.4	3
IIT Kanpur	21.7	22.5	11.1	18.44	4
IIT Kharagpur	17.4	14.3	7.1	12.94	5

Findings and Conclusion

Web Impact Factor and link analysis of Indian Institute of Technologies is an unexplored area of webometic research. The present study, hopefully, provides a fair idea and information about the website of all the 16 IITs of the country. There is a scope for further webometric research in this area. The followings are the major findings of the present study:

- All most all the IITs except IIT-Kharagpur have "ac.in" extension.
- In all the analysis part such as SWIF, SLWIF, EWIF, RWIF IIT-Kharagpur occupies first position.
- IIT-Ropar, Bhubaneswar, Hyderabad, Patna & Rajasthan has very less number of search positions which could not be tracked by Alexa Web Analyst.
- IIT-Madras stood at the first position at Daily search percentage of the IITs followed by IIT-Bombay, Delhi Kanpur & Kharagpur respectively.

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