Webometric Analysis of Central Universities in India: A Study

Samir Kumar Jalal[1], Subal Chandra Biswas[2] and Parthasarathi Mukhopadhyay[2]

Birla Institute of Technology Mesra, Ranchi, India[1]
The University of Burdwan, Burdwan, India[2]
jalal_gtz, scbiswas_56{@yahoo.co.in}, psmukhopadhyay@gmail.com

Abstract

Web presence of Indian Universities has been reflected in general and Central Universities in particular. Webometric data have been collected through Yahoo! and Google search engines using special query syntax. An attempt has been made to rank Central Universities in India using appropriate webometric indicators. Results reveled that University of Delhi becomes top rank (with score 4.28 and Sikkim University occupied the last (with score 1.64) among Central Universities in India.

1. Introduction

In the wake of globalization, the planners and top administrators are giving emphasis to revise the strategies in the higher education to cope up with the changing paradigm, redefining the education system to compete with the global requirements. The globalization has made a remarkable impact on academic education system and Internet is the constant source of energy for the institute to make its facilities and opportunities available globally. In order to achieve the goal, there is a need to have websites of each academic institute in order to perform well and stay in the competition. People come to a website to get information. Therefore, the primary goal of the universities' website is to prove information to its users. Prospective students may use university website for choosing for their admission, to find out a particular course offered. Current students may look for semester examination schedule and results. Some students may download application form and prospectus. Some teacher may search for job vacancy and benefits. University websites are increasingly used for wide variety of purposes like attracting new students, online library catalogue. In the case of research, university website can announce existence research and promote individual achievement of individual, research group, departments and institutions as a whole.

Therefore, there is a high requirement to know the web presence of universities in general and Indian universities in particular. It is also required to measure the web impact through various WIFs using appropriate webometric indicators in order to enhance its efficiency through optimizing web content, analysis and re-designing.

Ingwersen [1] proposed the concept of Web Impact Factor to measure the impact of website. Most studies in the web impact of academic web sites have been carried our for data sets of university websites or department websites for departmental interlinks. The relationship between web impact measures and other measures like hyperlinks to organizations and research performance through peer-reviewed ratings or publication impact [2,3,4]. Although some studies reflect that there is no signification correlation between general WIF and research rating for Australian universities [5] but Thelwall [6] showed that there is a high correlation between research ratings and four different WIFs calculated from several source domains for UK universities.

The web presence can be measured with the help of search engine's advanced facilities. Here, we have taken the help of Yahoo!, AltaVista and Google wherever required. The webometric analysis can be performed through the number of webpages, number of rich files, number of inlinks and self-links. It can also be appropriate to see the number of Internet users, percentage of literacy, number of hosts, ICT literate and high-speed broadband facilities.

Since students, teachers, institutions, government and general public are interested to know the rankings of universities. The reputation of universities cannot be precisely measured by numbers. It would be very difficult to get a comprehensive and reliable data set for qualitative ranking. An attempt has been taken in this study to rank all the Indian universities with the help of appropriate webometric indicators

2. Higher Educational Systems in India

The domain of higher education in India operates through nearly 20,676 colleges affiliated to over 400 universities; there are more than 11.5 million students and along with faculty members both at the college and universities. The University Grants Commission (UGC) is a statutory organization established by an Act of Parliament in 1956 for the coordination, determination and maintenance of standards of university education. Apart from providing grants to eligible universities and colleges, the Commission also advises the Central and State Governments for the development of higher education.

Besides, All India Council of Technical Education (AICTE) and National Assessment and Accreditation Council (NAAC) are also working hard to render the quality education by implementing various quality improvement techniques and measures.

2.1. State Universities

State level universities are setup by an act of State Legislature. As per section 12(B) of the UGC Act, State Universities established after 17th June, 1972 shall not be eligible to receive any grant from the Central Government, UGC or any other Organization receiving funds from the Govt. of India, unless the Commission satisfies itself, as per the prescribed norms and procedures, that such a university is fit to receive grants. There are 181 State Universities in India.

2.2. Central University

There are 23 Central Universities under the purview of Ministry of HRD, created under Acts of Parliament.

2.3. Deemed University

There are total 150 Deemed Universities in India as of March 2009 out of which the list of 124 universities is mentioned in the UGC website [7] and remaining from other websites such as educationobserver.com. An institution of higher education, other than universities, working at a very high standard in specific area of study, can be declared by the Central Government on the advice of the UGC as an Institution 'Deemed-to-be-university'. Institutions that are 'deemed-to-be-university' enjoy academic status and privileges of a university. There are 20 National Institute of Technologies (NITs), which have been considered as Deemed Universities.

2.4. Institute of National Importance

All Indian Institute of Technologies are coming under the purview of institute of national importance. There are 24 universities are under the category of Institute of National Importance. The institute of national importance includes all IITs (including new IITs), IIMs and some other universities declared as national importance by UGC.

2.5. Distance Learning

Due to huge population pressure in India there is a over burden for the higher educational institute to accommodate the need of the people. Therefore, Open and Distance Learning (ODL) system is necessary for the country to set up a system wherein teachers and learners need not necessarily be present either at same place or same time and is flexible in regard to modalities and timing of teaching and learning as also the admission criteria without compromising necessary quality considerations. ODL system of the country consists of State Open Universities (SOUs), Institutions and Universities offering education and includes Correspondence Course Institutes (CCIs) in conventional dual mode universities. There are 13 open universities, one national Open University and many more duel universities in the distance educational system.

Table 1: Various types of universities having their websites in 2009

Type of Universities	Total	# of Univ. having website	Percentage	# of univ. having NOT website	Percentage
Central University	23	23	100%	0	0
Deemed University	150	125	83%	25	17%
State University	181	179	99%	2	1%
Institute of National Importance	24	24	100%	0	0
State Legislative	7	7	100%	0	0
State Private University	6	5	83%	1	17%
Open University	15	13	87%	2	13%
Total	406	376		30	

3. Literature Review

University web sites play an important role in facilitating a wide range of types of communication. A few reported hyperlink studies have focused on international academic web interconnectivity. In a study of 16 European countries, the importance of English for academic interlinking was established. Besides, universities' websites were tended to link mostly to countries geographically nearer [8]. Similar patterns may also appear within a single country such as the UK [6]) and Canada [9, 10]. Greece was an exception in the EU study.

4. Objectives

Following objectives have been set for this study, which have been mentioned below.

1. To measure the performance of Indian universities on the Web by examining their web presence and web impact.
2. To find out number of web pages, in-links and out-links for each university's website
3. To know the web presence of Indian Universities in the web Space.
4. To know the various Web Impact Factors (WIF) for the university domain level.
5. To find out suitable ranking of all the universities having web presence using appropriate webometric indicators.
6. To compare various ranking approach through Indian Universities especially Central Universities

5. Methodology

Following steps have been pursued to achieve the above objectives.

5.1 Selection of Universities

We have selected commercial search engines: AltaVista and Yahoo! for data collection because of its popularity, coverage and reliability. The list of Indian universities had been extracted through the following:

- The University Grants Commission (www.ugc.ac.in)
- State-wise List of Universities (www.123careers.net/university/); which gives the state-wise list of universities with address, phone no and Fax number;
- State-Wise List of Universities in India (UGC Recognised and NAAC accredited) extracted from (educationobserver.com/resources/universsities/)
- The list of Open Universities has been taken from the website of 'The Distance Education Council' (wwwdec.ac.in)
- The complete updated list of deemed universities has been taken from the UGC websites(www.ugc.ac.in).

5.2 Selection of Search Engines

We have used AltaVista, Yahoo, Google, Exalead, MSN and Google Scholar for retrieving the required webometric data for analysis purpose.

5.3 Use of Appropriate Query Syntax

The Webometric analysis is based on the data collected from the Web using various search engines. In each search engines there are some specific search keywords assigned by the search engines to retrieve the information from the Web. These specific search keywords along with search syntax (Table-2) are mentioned below:

Table 2: Webometric query syntax with results

Search Command	Results	Supported by
domain:abc	Total number of webpages	Google, AltaVista, Yahoo!
site:abc	Total number of webpages	Google, AltaVista, Yahoo!
linkdomain:abc –domain:abc	Total number of inlinks	AltaVista, Yahoo!
linkdomain:in domain:in	Total number of self-links	AltaVista, Yahoo!
linkdomain:abc	Total number of links	AltaVista, Yahoo!
site:abc	Report total	Google,
file:html	number of html files	AltaVista, Yahoo!
linkdomain:in AND domain:jp	Total number of links from Japan to India	Yahoo!
linkdomain:jp AND domain:in	Total number of incoming links from India to Japan	Yahoo!
Filetype:.doc	Retrieve total number of doc type files in the web	Yahoo!, AltaVista, Google
linkdomain:xyz AND linkdomain: abc NOT host:xyz host:abc	Retrieve the Co-link value between xyz domain with abc domain	AltaVista, MSN and others

5.4 Data Collection

AltaVista and Yahoo! had been chosen to collect the data for this study. Data collection was done during March 28 to April 3, 2009. All the domain names were verified to check whether Yahoo!, Google and AltaVista supports the domain name. For each of these domain a search was carried out to determine the total number of links, total webpages, selflinks and inlinks using the following commands:

- The total number of webpages to ccTLD, China (for example) domain:domainname
- The number of total links at the ccTLD, China (for example) linkdomain:domainname
- The number of inlinks can be calculated using the command linkdomain:domainname – domain:domainname
- The number of self-links can be measured using the formula linkdomain:domainname domain:domainname

5.5 Calculation of Web Impact Factors

WIF is the web versions of impact factor. There are three types of WIFs: WIF-simple, WIF-revived and WIF-overall. Due to non-satisfaction of WIF measures Prof Thelwall has introduced the concept of introducing staff member as a indicator for measuring the WIF. In the following Tables-3, various types of WIF calculations have been shown using the appropriate webometric indicators. The impact factor is a measure of frequency with which average article in a journal had been cited in a particular year or period. The WIF introduced by Ingwersen [1] is the ratio of the number of backlinks to a site, divided by the number of webpages at the site.

Let,

A = Total number of webpages to a particular site

B = Number of external backlinks to a given site

C = Number of self-links to a given site

D = Total number of links to a site

Therefore, WIF_{simple}= D/A; $WIF_{Revised}$ =B/A. and $WIF_{selflink}$ = C/A

6. Measuring Web Presence

Web presence can be measured according to several Web-based indicators, some of which include the number of pages, and the number of in and out-links. The data relating to the web presence of Indian universities have been retrieved using the above webometric query syntax (Table-2) as supported by the commercial search engines. Web Impact Factors (WIFs) were calculated and reported in order to compare the universities' web influence. Results indicate that half of Indian universities have made remarkable progress in their web presence, which is at an advanced stage of development.

Table 3: Calculation of WIFs for India (March 28, 2009)

Search Engines	Values				Results		
	Webpage	inlinks	self-link	Total links	WIF (Simple)	WIF (external)	WIF (self-link)
AltaVista	132000000	36100000	11500000	47500000	0.36	0.27	0.09
Google	372000000	349000000	479000	326000000	0.88	0.94	0.00
Yahoo	760000000	35700000	11400000	760000000	1.00	0.05	0.02

Source: AltaVista! Dated 28th March 2009

The above table-3 reflects that India as a whole is having strong value of WIF e.g. 0.94 through Google search engine.

Another study [11] on calculation of WIF for selected countries of Asia reflects that India is able to achieve 5th position based on WISER indicators.

Table 4: Calculation of WIF for Indian Academic Web Space (i.e. ac.in)

Search Engines	Values				Results		
	Webpage	inlinks	self-link	Total links	WIF (Simple)	WIF (external)	WIF (self-link)
AltaVista	2310000	434000	1080000	1130000	0.49	0.19	0.47
Google	7570000	26000000	369000	8880	0.00	3.43	0.05
Yahoo	1319835	445000	1100000	233,955	0.18	0.34	0.83

Source: AltaVista! Dated 28th March 2009

It has been found from above table-4 that Google search engine reported more than six times higher webpage than Yahoo! and more than double of the size of webpage than AltaVista.

Table 5: Distribution of Domain Name for the Central Universities

SLD	No of websites	Percentage (%)
.in	20	86.96
.ac.in	10	43.48
.ernet.in	2	8.696
.org	3	13.04
.nic.in	3	13.04
.org.in	1	4.348

It has been observed from the above table-5 that only (.in) domain contribute 87% and .ac.in domain share is 44%. Therefore, the lion share of webspace occupies the academic domain.

7. Measuring Web Impact Factors

Various types of calculation of WIFs have been shown in the following table-6.

Table 6: Calculation of WIFs for Central Universities in India based on WIF-inlinks

Name of University	Domain	Webpages (A)	Inlinks (B)	Self-links (C)	Total Links (D)	WIF-Simple	WIF-Inlinks
Aligarh Muslim University	amu.ac.in	815	18400	741	1988	2.44	22.58
Jamia Millia Islamia	jmi.nic.in	6132	2520	3860	2004	3.00	3.19
Mizoram University, Aizal	mzu.edu.in	26	83	12	78	1.52	2.42
Guru Gobind Singh Indraprastha University	ggsipu.nic.in	779	1510	312	451	0.56	1.43
Babasaheb Bhimrao Ambedkar University	bbauindia.org	40	109	18	118	0.96	1.41
North Eastern Hill University	nehu.ac.in	1351	829	946	397	0.89	1.37
University of Delhi	du.ac.in	34559	11800	17900	14104	0.98	1.26
Assam University, Silchar	assamuniversity.nic.in	144	388	50	337	0.44	0.50
Jawaharlal Nehru University	jnu.ac.in	3837	9280	2620	5826	0.33	0.41
Pondicherry University	pondiuni.org	268	1590	54	735	0.41	0.34
Tripura University	tripurauniversity.in	200	58	148	50	0.25	0.29
Sikkim University	sikkimuniversity.*in*	85	53	33	18	0.20	0.26
Rajiv Gandhi University	rgu.ac.in	58	73	44	57	0.11	0.12
University of Hyderabad	uohyd.ernet.in	3740	5270	1770	3579	0.58	1.94

Visva-Bharati University, Santiniketan,	visva-bharati.ac.in	1209	1730	948	678	2.74	5.93
Manipur University	manipuruniv.ac.in	155	94	77	88	2.95	2.73
University of Allahabad	allduniv.ac.in	420	287	244	108	2.34	2.69
Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya	hindivishwa.org	119	163	15	106	0.29	0.61
Nagaland University	nagauniv.org.in	54	44	16	35	0.47	0.63
Central Institute of English and Foreign Languages	ciefl.ac.in	665	418	18	314	0.26	0.68
Banaras Hindu University	bhu.ac.in	7338	3680	4340	3264	0.57	0.61
Maulana Azad National Urdu University	manuu.ac.in	949	246	450	189	0.21	0.62
Tezpur University	tezu.ernet.in	3951	461	2290	434	0.65	0.81

Source: Yahoo! March 28-April 3, 2009

It has seen from Table-6 that Aligarh Muslim University is having highest WIF-inlinks (22.58) due to its highest inlinks but Tezpur university, Assam is having WIF-inlinks least because of very low inlinks value.

8. Ranking of Central Universities in India

There are various approaches for ranking universities. Some of the methods have been explained in detail.

8.1. Ranking of Central Universities through WISER

University activity is multi-dimensional and this is reflected in its web presence. So the best way to build the ranking is combining a group of indicators that measures these different aspects. Almind & Ingwersen [12] proposed the first Web indicator, Web Impact Factor (WIF), based on link analysis that combines the number of external inlinks and the number of pages of the website, a ratio of 1:1 between visibility and size. This ratio is used for the ranking but adding two new indicators to the size component: Number of documents, measured from the number of rich files in a web domain, and number of publications being collected by Google Scholar database. As it has been already commented, the four indicators were obtained from the quantitative results provided by the main search engines as follows:

- **Size (S)**. Number of pages recovered from four engines: Google, Yahoo, Live Search and Exalead. For each engine, results are log-normalised to 1 for the highest value. Then for each domain, maximum and minimum results are excluded and every institution is assigned a rank according to the combined sum.
- **Visibility (V).** The total number of unique external links received (inlinks) by a site can be only confidently obtained from Yahoo Search, Live Search and Exalead. For each engine, results are log-normalised to 1 for the highest value and then combined to generate the rank.
- **Rich Files (R)**. After evaluation of their relevance to academic and publication activities and considering the volume of the different file formats, the following were selected: Adobe Acrobat (*.pdf*), Adobe PostScript (*.ps*), Microsoft Word (*.doc*) and Microsoft Powerpoint (*.ppt*). These data were extracted using Google and merging the results for each filetype after log-normalising in the same way as described before.
- **Scholar (Sc)**. Google Scholar provides the number of papers and citations for each academic domain. These results from the Scholar database represent papers, reports and other academic items.

The four ranks were combined according to a formula [13] where each one has a different weight:

Webometrics Rank (position) = 4*RankV +2*RankS +1*RankR+1*RankSc

Table 7: Ranking of Indian Central Universities based on WISER indicator in April 2009

Name of University	Webpages (A)	Inlinks (B)	Total Links (D)	Rich Files (R)					Google Scholar (F)	WISER Index Value
				DOC	PDF	PS	PPT	TOTAL		
University of Delhi	34559	11800	14104	2910	33000	191	265	36366	23900	4.28
Jawaharlal Nehru University	3837	9280	5826	1840	17000	32	84	18956	12200	3.96
Aligarh Muslim University	815	18400	1988	878	9030	52	26	9986	9410	3.91
Banaras Hindu University	7338	3680	3264	1500	16400	66	253	18219	18900	3.84
University of Hyderabad	3740	5270	3579	862	11100	90	102	12154	7900	3.77
Jamia Millia Islamia	6132	2520	2004	641	5450	23	20	6134	3130	3.55
Visva-Bharati University	1209	1730	678	297	3950	6	19	4272	1610	3.26

North Eastern Hill University	1351	829	397	334	3550	5	33	3922	2690	3.14
Pondicherry University	268	1590	735	643	3930	10	50	4633	1650	3.12
Guru Gobind Singh Indraprastha University	779	1510	451	267	2150	0	3	2420	229	3.03
Tezpur University	3951	461	434	317	1480	2	57	1856	550	2.95
University of Allahabad	420	287	108	297	5030	16	18	5361	5350	2.87
Central Institute of English and Foreign Languages	665	418	314	82	341	1	2	426	625	2.69
Assam University, Silchar	144	388	337	89	576	2	3	670	331	2.53
Maulana Azad National Urdu University	949	246	189	136	352	0	2	490	33	2.42
Manipur University	155	94	88	160	1920	0	7	2087	810	2.36
Tripura University	200	58	50	267	815	0	5	1087	257	2.16
Rajiv Gandhi University	58	73	57	487	2000	0	10	2497	225	2.15
Mizoram University, Aizal	26	83	78	90	659	0	5	754	113	1.98
Babasaheb Bhimrao Ambedkar University	40	109	118	33	173	0	1	207	64	1.96
Nagaland University	54	44	35	94	836	0	4	934	164	1.95
Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya	119	163	106	7	69	0	0	76	8	1.94
Sikkim University	85	53	18	26	176	0	1	203	2	1.64

Source: Yahoo! March 28-April 3, 2009

8.2 Ranking of Central Universities through WIF-inlinks

Ranking of Central universities can be made based on WIF-inlinks indicator. The result is explained (Table-6) where it is been reflected that Aligarh Muslim University become the top position with the WIF-inlink value (0.91) and Tezpur University is the last place with the value of WIF-inlink (0.31).

8.3 Comparison of Ranking of Central Universities in India

The comparison of ranking of Indian central universities is being done using WISER, NAAC and WIF-inlinks. In NAAC, there is various grading system for ranking the universities based through quality assessment. The latest method is CGPA (Cumulative Grade Point Average) method with 5 point scale, assigns grade A, B, C and D (very good, good, satisfactory and unsatisfactory respectively).

Table 8: Comparison of Ranking of Indian Central Universities in 2009

Name of University	Domain	WISER	WIF-inlinks	NAAC	World Rank
Aligarh Muslim University	amu.ac.in	3	1	-	-
Jamia Millia Islamia	jmi.nic.in	6	2	-	3278
Mizoram University, Aizal	mzu.edu.in	19	3	-	-
Guru Gobind Singh Indraprastha University	ggsipu.nic.in	10	4	A	-
Babasaheb Bhimrao Ambedkar University	bbauindia.org	20	5	-	-
North Eastern Hill University	nehu.ac.in	8	6	Four Star (70.6)	-
University of Delhi	du.ac.in	1	7	-	2358
Assam University, Silchar	assamuniversity.nic.in	14	8	-	-
Jawaharlal Nehru University	jnu.ac.in	2	9	-	3498
Pondicherry University	pondiuni.org	9	10	B++(83.5)	-
Tripura University	tripurauniversity.in	20	11	-	-
Sikkim University	sikkimuniversity.*in*	23	12	-	-
Rajiv Gandhi University	rgu.ac.in	21	13	B(70.2)	-
University of Hyderabad	uohyd.ernet.in	5	14	83.25	3707
Visva-Bharati University, Santiniketan,	visva-bharati.ac.in	7	15	-	-
Manipur University	manipuruniv.ac.in	19	16	B(73.35)	-
University of Allahabad	allduniv.ac.in	12	17	B++(81.55)	-

Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya	hindivishwa.org	22	18	-	-
Nagaland University	nagauniv.org.in	21	19	C++(67)	-
Central Institute of English and Foreign Languages	ciefl.ac.in	13	20	Five Star (75.3)	-
Banaras Hindu University	bhu.ac.in	4	21	A (86.05)	4878
Maulana Azad National Urdu University	manuu.ac.in	15	22	-	-
Tezpur University	tezu.ernet.in	11	23	B+(76.8)	-

Note: Abbreviation: NAAC= National Assessment Accreditation Council; WISER= Web Indicators for Science, Innovation and Research

The world ranking (Table-8) implies that only five central universities are having world rank among 6000 universities [12] in the world. Here hyphen implies that there is no score for these universities.

Table 9: Correlation between ranking of WISER and WIF-inlinks

Name of Central University	WISER (X)	WIF-inlinks (Y)	Square (X)	Square (Y)	XY	x=(X-Xbar)	y=(Y-Ybar)	xy	Square (x)	Square (y)
Aligarh Muslim University	3	1	9	1	3	-9.39	-11	103.30	88.19	121
Jamia Millia Islamia	6	2	36	4	12	-6.39	-10	63.91	40.84	100
Mizoram University, Aizal	19	3	361	9	57	6.61	-9	-59.48	43.68	81
Guru Gobind Singh Indraprastha University	10	4	100	16	40	-2.39	-8	19.13	5.72	64
Babasaheb Bhimrao Ambedkar University	20	5	400	25	100	7.61	-7	-53.26	57.90	49
North Eastern Hill University	8	6	64	36	48	-4.39	-6	26.35	19.28	36
University of Delhi	1	7	1	49	7	-11.39	-5	56.96	129.75	25
Assam University, Silchar	14	8	196	64	112	1.61	-4	-6.44	2.59	16
Jawaharlal Nehru University	2	9	4	81	18	-10.39	-3	31.17	107.97	9
Pondicherry University	9	10	81	100	90	-3.39	-2	6.78	11.50	4
Tripura University	17	11	289	121	187	4.61	-1	-4.61	21.24	1
Sikkim University	23	12	529	144	276	10.61	0	0.00	112.55	0
Rajiv Gandhi University	18	13	324	169	234	5.61	1	5.61	31.46	1
University of Hyderabad	5	14	25	196	70	-7.39	2	-14.78	54.63	4
Visva-Bharati University, Santiniketan,	7	15	49	225	105	-5.39	3	-16.17	29.06	9
Manipur University	16	16	256	256	256	3.61	4	14.44	13.02	16
University of Allahabad	12	17	144	289	204	-0.39	5	-1.96	0.15	25
Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya	22	18	484	324	396	9.61	6	57.65	92.33	36
Nagaland University	21	19	441	361	399	8.61	7	60.26	74.11	49
Central Institute of English and Foreign Languages	13	20	169	400	260	0.61	8	4.87	0.37	64
Banaras Hindu University	4	21	16	441	84	-8.39	9	-75.52	70.41	81
Maulana Azad National Urdu University	15	22	225	484	330	2.61	10	26.09	6.81	100
Tezpur University	11	23	121	529	253	-1.39	11	-15.30	1.93	121
Total	276	276	4324	4324	3541	-	-	229.00	1015.52	1012

Hence, Mean for the variable (X & Y) can be calculated as:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i = \frac{1}{n}(x_1 + \cdots + x_n).$$

In this case mean (X & Y) are same i.e. 12. Standard deviation will be calculated with the help of:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \overline{x})^2},$$

Where n=23.

In such a situation, standard deviation (X) & Y are same: square root of (1012/23) = $\sigma_{x=}$ $\sigma_{y=}$ 6.6332

We know that correlation coefficient relates the strength and direction of linear relationship between two variables. The coefficient of determination represents the percent of the data that is the closest to the line of best

fit. The coefficient of determination (i.e. $r^{2)}$ is such that $0 < r2 < 1$, and denotes the strength of the linear association between x and y. The formula can be given as follows:

$$r = \frac{n\sum xy - \left(\sum x\right)\left(\sum y\right)}{\sqrt{n\left(\sum x^2\right) - \left(\sum x\right)^2}\sqrt{n\left(\sum y^2\right) - \left(\sum y\right)^2}}$$

or

r^2 = COV(X, Y)/ σ^x * σ^y = [(1/N∑XY – mean(X)*mean(Y))/ σ_x * σ_y]

∑XY= 3541; Mean (X)=12;Mean (Y)=12; σ_x =6.6322 & σ_y = 6.6332

Therefore, the calculated value of r would be =0.2262

where, *n* is the number of pairs of data and r denotes correlation coefficient. σ_x is the standard deviation of X and c standard deviation of Y.

The correlation between WISER Ranking and WIF-inlinks is having correlation i.e. 0.2262 which implied that there is not much association or closeness between two ranking methods. In other words, there is a huge difference between two ranking methods.

Table 10: Reliability of ranking methods in comparison with world ranking for central universities

Name of University	Domain	WISER	WIF-inlinks	Inlinks	NAAC Score	World Rank
University of Delhi	du.ac.in	1	5	1	-	2358(1)
Jamia Millia Islamia	jmi.nic.in	5	4	5	-	3278(2)
Jawaharlal Nehru University	jnu.ac.in	2	1	2	-	3498(3)
University of Hyderabad	uohyd.ernet.in	4	2	3	83.25	3707(4)
Banaras Hindu University	bhu.ac.in	3	3	4	86.05	4878(5)

9. Motivation for Hyperlinks

Kim [14] investigated motivations for creating links in electronic publications in order to find out the relationship between citations and scholarly e-journals. He identified three factors- scholarly, social and technological reasons. Harrison [15] identified some principles of link creation and proposed a classification of links. Park [16] conducted a survey of 64 Korean webmasters of commercial websites to assess their motivations for linking to other websites. He found that webmasters were more likely to hyperlink to websites possessing practical content, information or services. Chu [17] analyzed sample of links and generated list of reasons of hyperlinks. He found that only 27% of the links were made out of research or teaching motivations. Kousha and Horri [18] made a survey in Iranian university and found that 63% hyperlinks were made for navigational purpose. Links between UK universities in the field of Mathematics, Physics and Sociology were analyzed. Wilkinson et al. [19] surveyed 414 links between UK university websites and classified them. They found that less than 1% of hyperlinks targeted formal scholarly articles in journals or conferences; 90% of targeted materials were some way or rather related to scholarly activity. Bar-Ilan [20] made an academic link studies and included categories for the type of sources and target pages of inter-university links in Israel. He found that 20% links related to research category while Wilkinson et al. found 27% links related to research. Thelwall [21] surveyed a sample of 100 random inter-site links to UK university homepage and found four types of motivations: ownership, social, general and navigation reasons. Thelwall [22] made an attempt to distinguish links between research related and non-research oriented.

10. Findings of the Study

Following are some of the findings observed from the study.

- As per WIF-inlinks, Aligarh Muslim University got the top rank whereas University of Delhi occupied top rank based on WISER;
- There is very very low correlation between WISER Rank and WIF-inlinks for the case of Indian Central Universities
- University of Delhi is having the highest webpage (34559) whereas Aligarh Muslim University is having highest number of inlinks (Table-7).
- Having World Rank (2358), University of Delhi occupied top position among Central universities in India

11. Conclusion

Indian universities are having a good web presence in general. Central universities in India were having total of 66894 webpages and 59086 outlinks (Table-7), producing an average score of 0.88 inlinks per page, which means that per 100 webpage there are 88 inlinks. An analysis of each university's average number of webpages, using yahoo! Search engine have shown that there are total of 2908 webpages and 2568 inlinks per university. Therefore, it seems that Indian Central Universities have made remarkable progress in developing their websites the a\study also reflected the comparison of different methodological approach and visibility of Indian universities. The study is able to raise further research possibility on the following aspects

- Comparison between results drawn from webometric studies and using other performance indicators (e.g. publication count and citation analysis) for Indian Universities.
- To employ other web performance measurements (e.g. relevance, link relationships, rankings, visibility, etc.)

- To establish suitable reasons for web sitation and categorization of sitations.

It is our findings that more than 75 Indian universities are having web-pages less than 100 therefore, they may not qualify for comparative webometric studies, especially for ranking purposes, due to underdeveloped websites. Similarly, universities which are operating under different economic, political and social conditions and unless these aspects are taken into consideration.

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