A Webometric Analysis of Private University Websites in Bangladesh

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By

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CERTIFICATE

This is to certify that the thesis entitled "**A Webometric Analysis of Private university Websites in Bangladesh**" submitted by Sajia Sultana, for the degree of Master of Philosophy (MPhil) in the Department of Information Science and Library Management, University of Dhaka, is her original work carried out under my supervision and guidance, and is worthy of examination.

Dr. S.M. Zabed Ahmed
Supervisor

Abstract

There have been many research studies conducted on webometrics, especially on the impact of websites and the web impact factor. This current research analyzes the private university websites in Bangladesh according to some common webometrics indicators. It examines and explores 54 private university websites in Bangladesh and identifies the number of web pages and link pages, and calculates their Simple Web Impact Factor, Self-link Web Impact Factor and External link Web Impact Factor. The results indicate that some private universities have relatively high number of web pages, but correspondingly their link pages are low in number and the websites fall behind in their simple, self-link and external link web impact factors. It is also found that the external link web pages provide more than other link pages. Based on these findings, it is clear that the private universities in Bangladesh do not have much visibility on the web. In a cross sectional study, the websites are analyzed and compared using Google and Blekko search engines and tested by histogram, scatter plot and the line of best fit for reliability and then by regression analysis. The search results obtained are also compared using related *t*-test. This research also used SocSciBot personal web crawler to generate link data to develop micro-link topology. The result shows that the private universities in Bangladesh are not well-connected in the topology framework. Finally, the major reasons for webometric ranking are discussed and the suggestions for improving the ranking of universities are presented.

To my parents

and

Jawad, my son

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List of Acronyms

LIS	Library and Information Science
WWW	World Wide Web
HTML	Hypertext Markup Language
FTP	File Transfer Protocol
GUI	Graphical User Interface
XHTML	Extensible HyperText Markup Language
XML	Extensible Markup Language
ICT	Information and Communication Technologies
UGC	University Grants Commission
WIF	Web Impact Factor
IITs	Indian Institutes of Technology
IIMs	Indian Institutes of Management
WISER	Web Indicators for Science, Technology and Innovation Research
MDS	Multi-dimensional Scaling
IT	Information Technology
RAE	Research Assessment Exercise
SWIF	Simple Web Impact Factor
SLWIF	Self-link Web Impact Factor
ELWIF	External link Web Impact Factor
JIF	Journal Impact Factor
SEO	Search engine optimization
ADM	Alternative Document Model
LWP	Link Web Pages
SLWP	Self-Link Web Pages
ELWP	External link Web Pages
NWP	Number of Web pages
OA	Open Access

Chapter 1:
Introduction

1.1 Introduction

The field of Library and Information Science (LIS) is no longer confined to four walls but it has been broadened to embrace new concepts like automation, information retrieval, digitization, wikis, metadata, blogs, open access, and other web-related technologies (Wani, Bakshi and Gul, 2008). LIS is highly interdisciplinary by nature and is affected by the incessant evolution of technologies. Basically, it deals with the efficient collection, storage and retrieval of information. Metric studies are one of the primary areas of information science research today. Different metrics studies in LIS such as librametrics, bibliometrics, scientometrics and informetrics are well-known. The recent years have witnessed the emergence of another metric study called 'webometrics'or 'cybermetrics'. Almind and Ingwersen (1997) stated that webometrics is a quantitative study of web-related phenomena and webometrics studies could be applied to web with commercial search engines providing the raw data.

1.2 World Wide Web

The World Wide Web or simply the web is a reflection of human culture, a massive socio-cultural network of web resources authored by millions of people and organizations around the world. Today, the web is one of the main sources of information and the major showcase for everyone (institutions, business enterprises, individuals, etc.) who wants to be recognized on in the 'real world' (Aguillo, Ortega, and Ferna´ndez, 2008). It is simply a collection of linked documents stored on millions of computers and spread over the information superhighway. The web allows a user-friendly way to search for information on the internet (Using the World Wide Web, 2009).

The term 'World Wide Web' comes from the notion that individual nodes of information are linked with hypertexts and this creates a 'web' of information. 'World Wide' signifies that www browsers speak not one, but multiple protocols and retrieve information from distant machines around the globe over the internet. The documents on the web are generally written in HTML

(Hypertext Markup Language) that defines their appearance and layout, and create the links to other documents. These links appear in text as underlined word or phrase, usually coloured in blue called hypertext link or hyperlink. These hyperlinks when attached to images or any other kinds of media are called hypermedia. The most important thing about the web is that it includes an easy-to-use standard interface. It is a global, seamless environment in which all information (text, images, audio, video services) that is accessible from the internet.

1.3 Metrics on the web

One of the concepts within the field of quantitative assessment is 'metrics'. Metrics define what is to be measured. Metrics are usually special to the subject area in question, so that they are valid only within that domain and cannot be directly benchmarked or interpreted outside it. Generic metrics, however, can be aggregated across subject areas or even business units of an enterprise (Wikipedia, 2005).

The result of applying metrics in LIS research is the coining of new concepts which therefore creates potentially attractive new research domains, including bibliometrics, scientometrics, informetrics and more recently, webometrics (Alimohammadi, 2005). Metrics sciences such as bibliometrics first came in existence in 1969. It is the statistical analysis method of publication pattern and the like. The other metric sciences such as informetrics, scientometrics, cybermetrics and webometrics, are also statistical methods and having their origin on the basis of bibliometrics. The metric studies in LIS is typically used to measure scholarly communication; identify research trends and growth of knowledge; identify users of different subjects; estimate comprehensiveness of secondary periodicals; forecast past, present and future publishing trends; identify authorship and its trends in documents on various subjects; measure productivity of publishers, individual authors, organizations, country or that of an entire discipline (Kumar, 2003).

Webometric covers research of all network-based communication using informetric or other quantitative measures. Webometrics has become one of the interesting research areas for the vast collection of electronic information available on the publicly indexable web. Paisley (1999), more than a decade ago, rightly pointed this area as the future domain of bibliometric research.

1.4 Concept of Website Design:

A website is a collection of information about a particular topic or subject. Designing a website is defined as the arrangement and creation of web pages that in turn make up a website. A web page consists of information for which the website is developed. A website might be compared to a book, where each page of the book is a web page. A website typically consists of text and images. The first page of a website is known as the home page or index. Some websites use what is commonly called a splash page. Splash pages might include a welcome message, language, region selection, or disclaimer.

Each web page within a website is an HTML file which has its own URL. After each web page is created, they are typically linked together using a navigation menu composed of hyperlinks. There are many aspects of design concerns in this process, and due to the rapid development of the internet, new aspects may emerge.

For typical websites, the basic aspects of design are (Jeyshankar, 2010):

- The content: The substance and information on the site should be relevant to the site and should target the area of the public that the website is concerned with;
- The usability: The site should be user-friendly, with the interface and navigation simple and reliable;
- The appearance: The graphics and text should include a single style that flows throughout, to show consistency. The style should be professional, appealing and relevant; and
- The visibility: The site must also be easy to find via most, if not all, major search engines and advertisement media.

Once a website is completed, it must be uploaded in order to be viewable to the public over the internet. This may be done using an FTP (File Transfer Protocol) client. Once published, the web master may use a variety of techniques to increase the traffic, or hits, that a website receives. This may include submitting the website to search engine such as Google or Yahoo!, exchanging links with other websites, creating affiliations with similar websites and so on.

1.4.1 Website Design

Web design is a process of conceptualization, planning, modelling and execution of electronic media content delivery via internet in the form of markup language suitable for interpretation by web browser and display as Graphical User Interface (GUI). The intent of web design is to create a website, a collection of electronic files that reside on web server(s) and present content and interactive interfaces to the end user in form of web pages once requested. Such elements as text, bit-mapped images (GIFs, JPEGs, PNGs, etc.), and forms can be placed on the page using HTML/XHTML/XML tags. Displaying more complex media, such as vector graphics, animations, videos, and sounds, requires plug-ins such as Flash, QuickTime, Java Runtime Environment, and so on. Plug-ins is also embedded into web page by using HTML/XHTML tags.

Website design is an art of writing codes and creating web pages using various languages such as HTML, XML and so on. More specifically, they translate it into five principles of website design which determines the credibility of a website. It includes:

- Building a dialogic loop between the organization and its audiences;
- Providing useful information;
- Generating return visits;
- Making the interface intuitive and easy to use; and
- Eliminating unnecessary links and to retain visitors (Geest, 2001).

The criteria for the foundation of good web design can be stated in an acronym 'HOME-RUN' (Nielson, 2000), which stand as:

- High-quality content;
- Often updated;
- Minimal download time;
- Ease of use;
- Relevant to user needs; and
- Unique to the online medium.

The objectives of website design for an educational institution are to (Jeyshankar, 2010):

- publish online information about the library-collections, activities;
- provide extension services-user education, reference services, tutorials;

- act as a gateway to local and external information resources on the web library catalogue, online databases, e-journals;
- serve as a communication tool-through e-mail, instant messaging and other similar software;
- promote library use;
- provide integrated web access to different library and information services; and
- integrate local and remote information sources.

1.5 Private Universities in Bangladesh: an overview

1.5.1 Introduction

Since that enactment of the Private Universities Act of 1992, Bangladesh has seen a tremendous growth in the number of private educational platforms over the recent years, mainly through the emergence of a large number of universities in the private sector. Yet, this growth also has a downside to it, as rapid expansion entails a risk of compromise on quality and expenses. However, the combined effect is a vibrant education sector with a healthy rivalry among the competing institutions. Undoubtedly, the main beneficiary is the student community, which gains access to a wider platform of selection with the comparative cost advantage of domestic study over studying abroad. Thus, the society and the nation are the ultimate gainers (Chowdhury, 2004).

Private universities are playing a vital role in promoting productivity, innovation, entrepreneurship, gender mainstreaming and overall socio-cultural advancement in Bangladesh. Private universities are also making praiseworthy contributions in the development of ICT in Bangladesh (Miyan, 2008). There is huge competition among most of the top universities in Bangladesh to produce graduate of international standard and to cope with the overwhelming local and global challenges (Sobhan and Dey, 2007). To keep the universities in the race of higher education and scholarly communication, almost all the universities have Information and Communication Technologies (ICT) facilities. Some of the leading private universities are well supported by ICT. It is found out from different reports (see, for example, Ashraf, Ibrahim and Joarder 2009) that the number of private universities in Bangladesh is increasing and the leading private universities have more ICT facilities than some public universities.

Surprisingly, about 95% of the private universities are located in Dhaka's metropolitan areas. While in the year 2000 there were only 17 of these universities, the number has reached 72 in 2013 (UGC 2013). The University Grants Commission (UGC) of Bangladesh is the statutory apex body in the field of higher education in Bangladesh. The primary objectives of the UGC are to supervise, maintain, promote and coordinate university education. It is also responsible for maintaining standard and quality in all the public and private universities in Bangladesh. This growth rate seems unhealthy in consideration of the per capita income of the country and also in terms of quality assurance in higher education, as education at these universities is much more expensive than at the public universities of Bangladesh. One very familiar feature of these universities is the way they follow the American method of education rather than the British model. They offer four-year bachelor degree programmes with credit-based courses. This system has also created popular appeal in Bangladesh. Still, regulators and consumers have concerns about service quality, design and costs (Haque, 2004). As of today, there is nobody to regulate private universities and to assure the quality of education other than through the weak supervision of the University Grant Commission (UGC). Since private universities receive no funding from the UGC, there is little that the UGC can do except report some facts for the government (Alam *et al.*, 2007). The issue is, therefore, an important variable for higher educational private institutes that aspire to that degree of excellence.

1.5.2 Growth patterns of private universities in Bangladesh

The spectacular growth and expansion of the private universities in Bangladesh is depicted in Figure 1.1. The First private university, namely the North South University (NSU), was approved by the Government of Bangladesh on 5 November 1992 (Alam *et al*., 2007).

Figure 1.1 shows that during the period of 1991-1995, ten private universities (mostly in metropolitan Dhaka, with only two in Chittagong) were opened. During 1996-2000, the government was not favourably disposed toward the concept of private sector of education. Data show that only eight new universities were added to the list during 1996-2000. Figure 1.1 shows that the private university concept got a significant boost again after 2001.

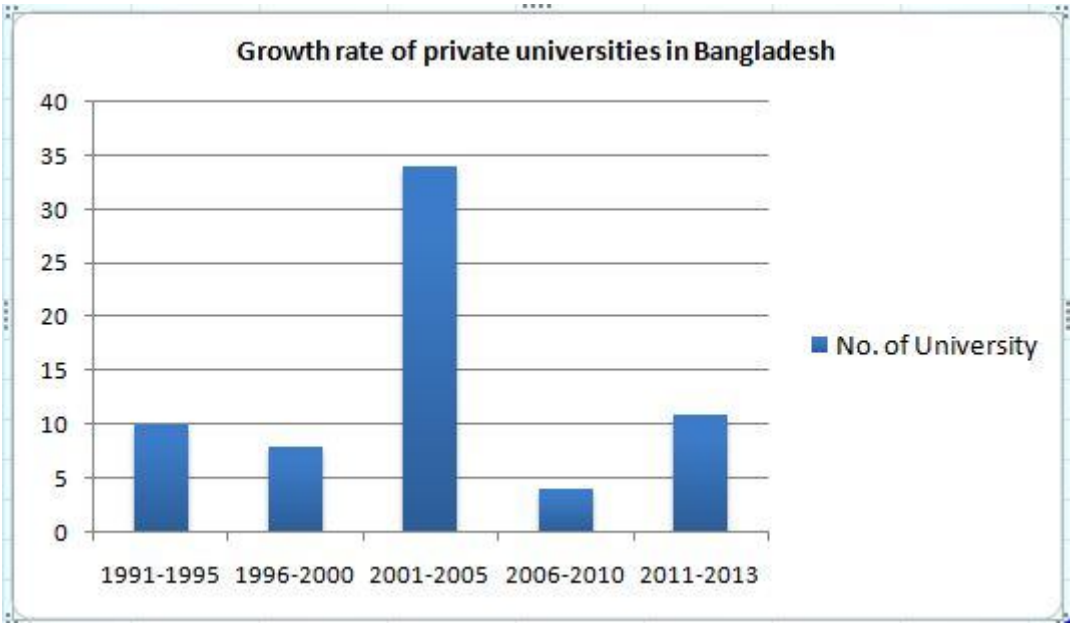

Figure 1.1: Growth of private universities in Bangladesh

1.6 Need for the study

The academic web is a global source of expertise, and also a means to communicate scientific and cultural achievements (Aguillo, *et al*. 2005). Websites are the most efficient and cheapest way for boosting all three academic missions: teaching, research and transfer. Application of ICT and web hosting in an academic environment has increased gradually in the recent decades.

Nowadays, the success of a university largely depends on its web visibility. That is why it is important to evaluate their presence on the web as it is to evaluate the educational and research performance of the universities. It is generally required by the academic community in ranking of the educational institutions for different purposes. Such ranking can be used as national measure of research productivity and facilitate to establish a kind of academic ranking by arriving at the Web Impact Factor (WIF). Therefore, it is necessary to rank the educational institutions websites in the context of competition among them due to privatization of education. On the review of literature (see Chapter 2), it is found that a number of studies in the different countries were conducted on certain parameters of websites such as link structure analysis which includes the analysis of self-links, external links, inlinks, co-links, etc. There are studies on Web Impact Factor (WIF), search engine performances, web page content analysis and web usage analysis. In Bangladesh, the concept is almost unfamiliar as only one research

study has been conducted on this area (Islam, 2011). Therefore, it is thought appropriate and necessary to conduct a webometric study of the private university websites. This research explored the issues relating to webometrics for assessing the performance of Bangladesh private university websites by evaluating their WIFs.

1.7 Objectives

The main aims of the study are to:

- identify and analyze the websites of private universities in Bangladesh;
- calculate the number of web pages, number of link pages, number of self-link pages and external link pages of the university websites in Bangladesh and rank them;
- calculate the Simple Web Impact Factor (WIF), Self-link Web Impact Factor and external web impact factor of the university websites in Bangladesh and rank them as per the WIF;
- generate micro-link topology among of the private universities using appropriate webometric tools; and
- find out the influence level of each independent variables (LWP, SLWP, ELWP) with the dependent variable (NWP) and the difference between search results obtained at various times.

1.8 Scope of the study

The present research examines and explores through webometric study the websites of private universities in Bangladesh. There are 71 private Universities as per UGC (2013) in Bangladesh. The research studied all the private universities of Bangladesh that have websites. The research aimed to establish a kind of academic ranking of websites of private universities in Bangladesh by evaluating their WIF. This research also analyzed the web pages of private university websites retrieved by commercial search engine and personal web crawler SocSciBot, tested by histogram, scatter plot and the line of best fit for its reliability and then by Regression Analysis with the help of SPSS.

1.9 Conclusion

This is an introductory Chapter of this research. It explained the concepts around web, webometrics and other metric indicators. The next Chapter will review the literature relevant to this research.

Chapter 2:
Literature Review

2.1 Introduction

Literature review is an attempt to identify, locate and synthesize research reports, articles, books and other relevant materials related to the specific problem of research. The review may be done on the published sources, such as journal articles, conference papers, research abstracts, book chapters, and research institutions' websites and so on, or on unpublished sources such as thesis, dissertations, etc. By reviewing the literature, a researcher can exploit the previous investigations and findings done by the experts for the maximum benefit of the research in hand.

The review literature is an essential component of any research investigation, which gives necessary input to the investigator to frame the research study on the chosen topic. It sets an investigation in the right direction which would keep abreast of the latest development of the subject.

2.2 Growth and Development of Webometrics

Bossy (1995) examined the effect of internet repercussion on scientific communities and consequently on scientometrics. According to this study, Internet mediated scientific interaction was not an object of systematic observation by scientometricians at that time.

Bjorneborn and Ingwersen (2001) pointed out the selected areas of webometrics research. They reviewed the search engine coverage and performance as a framework for selected quality and content analysis. The problems associated with measuring Web Impact Factors (Web-IF) were also discussed. The authors outlined new directions of webometrics for performing knowledge discovery on the web, partly based on bibliometric methodologies used in bibliographic and citation databases.

Thelwall *et al*. (2002) reported the results of a survey of 670 websites of higher education institutions in countries associated with the European Union, as estimated by AltaVista. The study found that there were enormous national differences of up to three orders of magnitude. It also addressed the extent to which AltaVista's coverage of university websites is reliable and consistent across Europe.

Thelwall and Wilkinson (2003) introduced three new metrics to measure the range of use of a university website by its peers through different heuristics for counting links targeted at its pages. These metrics provide results that correlate significantly with the research productivity of the target institution. The directory range model, which is based upon summing the number of distinct directories targeted by each university, produces the most promising results of any link metric. Based upon an analysis of changes between models, it was suggested that range models measure essentially the same quantity as their predecessors but they were less susceptible to spurious causes of multiple links and therefore considered more robust.

Webometrics, the quantitative study of web phenomena, is a field encompassing contributions from information science, computer science, and statistical physics as stated by Thelwall and Vaughan (2004). They noted that the webometrics methodology has been drawn especially from bibliometrics.

Bjorneborn and Ingwersen (2004) defined webometrics within the framework of informetric studies and bibliometrics, as belonging to library and information science, and as associated with cybermetrics as a generic subfield. They developed a consistent and detailed link typology and terminology and made explicit the distinction among different web node levels when using the proposed conceptual framework.

According to Ingwersen (2006)**,** the study of webometrics has increased dramatically, not only is the term used more often, there are more articles and even monographs on the topic and at least one professor has been appointed in the field.

Thelwell (2008a) reviewed the distance that bibliometrics has travelled since 1958 by comparing early bibliometrics with current practice, and by giving an overview of recent developments. The

concept of webometrics was discussed in detail. Thelwall *et al*. (2008) conducted a webometric study to assess the web connectivity of European life sciences research groups as a case study. A commercial search engine was harnessed to deliver hyperlink data via its automatic query submission interface. A special purpose link analysis tool, LexiURL then summarized and graphed the link data in appropriate ways. According to Thelwall, this was the First paper to make a case for the value of using a range of webometric techniques to evaluate the web presences of research groups within a field, and possibly the First "applied" webometrics study that has been produced for an external contract.

Samir, Subal and Mukhopadhyay (2009) traced the development from bibliometrics to webometrics. They reviewed the application areas of webometrics research, the methodology adopted for data collection, techniques and tools of web analysis and the problems encountered in web research. A webometric study of 13 Indian Institutes of Technology (IITs) and Indian Institutes of Management (IIMs) was presented in this paper.

2.3 Web Content Analysis

Thelwall (2003) introduced two web link count metrics to complement the existing Web Impact Factor. The first is provisionally cast as an indicator of the average degree of online informal scholarly communication and information use by the academics in a given university. The second has a similar construction use by the academics in a given university. The second has a similar construction but focuses on the degree of web interconnection in terms of both inlinks and outlinks. The latter metric is based upon a more elaborate mechanism than raw link counts: totalling the minimum number of links between universities over all distinct pairs in the chosen set that include the given institution.

Thelwall (2004a) explained that nature of the contents of academic websites is of direct relevance to the new field of scientific web intelligence, and for search engine and topic-specific crawler designers. The author analyzed word frequencies in nation's academic webs using the websites of three English-speaking nations: Australia, New Zealand and the UK. He found at least 26 % of pages contained no words. High frequency words included university names and acronyms, internet terminology, and computing product names: not always words in common usage away from the web. A minority of low frequency were spelling mistakes, with other

common types including non-words, proper names, foreign language terms or computer science variable names.

Thanuskodi (2012) focused on the web page content analysis of institutes of national importance libraries in India and moreover study concentrates evaluation of contents not on the link structures and other research area in webometrics. The study claimed that webometric techniques are still in experimental stage in testing whether the classical bibliometric methods applied to the web are reliable and feasible means of comparing the analysis of websites.

2.4 Web Link Analysis

Rousseau (1997a) investigated the distribution of domain names and distribution of links between websites. It was found that the Lotka function provides an adequate description.

Thelwall (2001a) attempted to provide an evidence through an evaluation of Ingwersen's proposed external Web Impact Factor for the original use of the web: the interlinking of academic research. In particular, it studies the case of the relationship between academic hyperlinks and research activity for universities in Britain, a country chosen for its variety of institutions and the existence of an official government rating exercise for research.

Further, Thelwall (2001b) noted that web log files are the useful source of information about visitor site use, navigation behaviour, and to some extent, demographics. But he proposed that log files can also reveal the existence of both web pages and search engine queries that are sources of new visitors.

A significant correlation between the number of external links and the journal impact factor for LIS journals has been studied by Vaughan and Hysen (2002) Journals with higher journal impact factor scores tend to attract more links to their websites.

Thelwall (2002a) developed a methodology to analyze the patterns of interlinking between university websites and uses it to indicate that the degree of interlinking decreases with distance, at least in the UK.

A free set of databases of the link structures of the university websites from a selection of countries, as created by a specialist information science web crawler has been analyzed by Thelwall (2002b). The key issues concerning running an accurate web crawler are also discussed in this study. It is concluded that fully automatic crawling is not socially or empirically desirable because of the existence of database-generated areas of the web and the proliferation of the phenomenon of mirroring.

Wilkinson, Thelwall and Li (2003) reviewed recent progress from the information science approach and summaries current techniques for extracting usable information from web links. The description is particularly aimed at those who are unfamiliar with the literature but who nevertheless wish to use web links to investigate some aspect of online behaviour, particularly informal scholarly communication.

Li *et al*. (2003) found that web link based metrics can correlate with traditional research assessment at the university level. In this study, the author tested whether the same is true for the computer science departments in the UK. The relevant Web Impact Factors (WIFs) were calculated from the link data collected both from AltaVista and the special academic crawler of the University of Wolver Hampton. The numbers of staff members and web pages in each computer science department were used as denominators for the WIFs calculation. The number of inlinks to the computer science departments correlated significantly with their research productivities, and WIFs with numbers of staff members as denominators correlated significantly with their Research Assessment Exercise (RAE) ratings. The number of staff members was confirmed to be a better indicator of departmental size than the number of web pages within the department's domain.

Thelwall (2004b) stated that link analysis in various forms is an established technique in many different subjects, reflecting the perceived importance of links and that of the web. It is argued that the dynamic nature of the web, its lack of quality control and the online proliferation of copying and imitation mean that methodologies operating within a highly positivist, quantitative frameworks with which to guide research are appropriate, a theory of Link Analysis is not possible.

Payne and Thelwall (2004) presented the results of statistical analysis carried out on the web link structure text files of 111 UK universities. Mathematical linear relationships were observed between certain bivariate data with subsequent Pearson correlation analysis revealing a number of very strong correlation relationships, particularly between site size and number of source/target directories and pages.

Vaughan and Wu (2004) examined the websites of China's top 100 information technology (IT) companies. They found that link count to a company's website was correlated with the company's revenue, profit, and research and development expenses. This suggested that web hyperlinks to commercial sites can be a business performance indicator and thus a source of business information. As a comparison to IT companies, China's top 100 privately owned companies were also studied. The study found no relationship between link count and the business performance measure for these companies due probably to the heterogeneous nature of this group.

Vaughan (2004a) stated that the earlier webometrics studies found a relationship between the number of inlinks to a commercial site and the company's business performance measures. However, those studies examined top-ranking information technology companies in the USA and China. The study included all information technology companies in the USA and Canada and gathered both business performance data and website data for these companies. The study found significant correlation between business performance measures and inlinks to the company websites.

Park (2004) traced South Korean web pages hyperlinking pages hosted in Taiwan, using a search engine. The context in which Taiwan appeared in South Korean pages was also examined. Specifically, the structure of hyperlink connectivity from South Korea and Taiwan was analyzed. It was found that the hyperlink network was very sparsely connected in terms of the number of South Korean web pages hyper linking to the pages of the other country.

Thelwall (2006) explained that the order of the links in a search results page is often decided upon by an algorithm that takes into account the number and quality of links to all matching pages. The results indicated that around 66 percent of websites carried external links, most of

which were targeted at a specific purpose, but that about 17 percent published general links, with implications for those designing and marketing websites.

Vaughan and You (2006) examined the feasibility of using web co-link data to compare business competitive positions. They hypothesized that the number of co-links to a pair of business websites is a measure of the similarity between the two companies. They selected 32 telecommunications companies for the study and collected co-link data to these companies from Yahoo! Multi-dimensional Scaling (MDS) analysis on the co-link data currently mapped these companies into telecommunication industry sectors. This proved their hypothesis and further confirmed the theory that links to business websites can be objects for web data mining.

Vaughan, Kipp and Gaon (2007) examined the reasons for the creation of co-links between pairs of business websites to determine whether co-linked business websites are really related. The study found that 61.4 percent of co-links were created to connect pairs of highly related businesses (related companies, related products and related services). Only 14.7 percent of co-links were created for non-business reasons. The remaining 23.8 per cent of co-linked sites showed a loose or marginal business relationship. The study also found that co-links targeting home pages (as opposed to non-homepages) were more likely to connect related businesses. Furthermore, co-links coming from commercial sites (as opposed to other sites such as educational sites) are more likely to link related businesses.

The potential of web links to act as an indicator of collaboration through a detailed classification of 2600 links from universities to government, commercial and other domains was investigated by David, Thelwall and Harried (2007). Whilst there were significant differences in the proportion of web links that reflect collaboration, depending on the source page owner and the target page top-level domain, a majority of web links on a university web page did not reflect collaboration between the web page owner and the target web page owner.

Ortega and Aguillo (2007) studied the link relationships in the Nordic academic web comprised of 23 Finnish, 11 Danish and 28 Swedish academic web domains with the European one. The results showed that the Nordic network is a cohesive network, set up by three well-defined sub-networks and it rests on the Finnish and Swedish sub-networks. They concluded that the Danish

network had less visibility than other Nordic countries. The Swedish one is the principal Nordic sub-network and the Finland network was slightly isolated from Europe, with the exception of the University of Helsinki.

Thelwall and Wilkinson (2008) stated that large sets of web page links, colinks, or URLs sometimes need to be counted or otherwise summarized by researchers to analyze web growth or publishing, and by computing professionals for website evaluation or search engine optimization. This article proposed a generic lexical framework to unify and extend existing methods through abstract notions of link lists and URL lists.

The study of web impact as a measure for testing the effectiveness of academic institute was studied by Shukla and Tripathi (2009). The study reported the backlink structure of institutes of national importance from India. Percentage of Deep Link Ratio, pattern of page pointing and pattern of link type relationship were also examined. Data were collected using software program called 'backlink analyzer'. Rankings of institutes of national importance were made on two different bases: which was discussed in the study. The study revealed that on average technical institutes had higher backlinks than any other. They also found that Indian institutional websites attracted more citations from commercial web domains than educational or any other web domains.

Jalal, Biswas and Mukhopadhyay (2010a) investigated the effectiveness and relevance of Web Impact Factors (WIFs) for Indian universities' websites. They reviewed the web impact factor as to how this link-based metrics is developed and is applied. They also reported a case study on universities in West Bengal. SocSciBot was used to generate link data in order to develop micro-link topology under study. The result of the study showed that all the NITs were closely related in the topology framework whereas nodes were not linked significantly in the case of state universities and central universities.

Shukla and Poluru (2012) analyzed the web presence of 173 Indian state universities. This study showed that some state universities had more visibility compared with their counterparts. The data of was collected from Yahoo Site Explorer and Google Scholar. Web Indicators for Science, Technology and Innovation Research (WISER) ranking method was applied to see the visibility

and connectivity of universities on the web. The study recommended the use of tools like blogs, social networking sites for scholarly and scientific communication of universities to increase the use of websites. Additionally, maintaining institutional repositories, open access and collaboration with other universities, online communication, etc. can help to increase the visibility of the website.

Sujithai, Maria and Jeyshankar (2013) analyzed the web pages of Indian Institute of Technology websites retrieved by commercial search engine and tested by Histogram, Scatter Plot and the Line of Best Fit for its reliability and then by Regression Analysis with the help of SPSS package, and it was found that External link web pages provided more than other link pages.

2.5 Web Technology Analysis

Smith (1999a) reviewed the literature in the emerging field of webometrics and reports on the author's ongoing research into the viability and reliability of existing internet search engines for webometric research, and the development of appropriate methodology. The aim of the study was to measure the impact of the Australasian websites. Vaughan (2004b) proposed a set of measurements for evaluating the web search engine performance. He conducted an experiment to test these new measurements by applying them to a performance comparison of three commercial search engines: Google, AltaVista and Teoma.

Mayr and Walter (2007) showed deficiencies in the coverage and up-to-dateness of the Google Scholar index. Furthermore, the study pointed out which web servers are the most important data providers for this search service and which information sources are highly represented. The study found that there was a relatively large gap in Google Scholar's coverage of German literature as well as weaknesses in the accessibility of open access content.

Vaughan and Zhang (2007) examined the search engine coverage of websites across countries and domains. Websites in four domains (commercial, educational, governmental and organizational) from four countries (U.S., China, Singapore, and Taiwan) were randomly sampled by custom-built computer programs and then manually filtered for their suitability for the study. They examined the representation of the 1,664 sampled sites in four major search engines (Google, Yahoo, MSN, and Yahoo! China) in terms of whether the site was covered and the

number of pages indexed by the search engines. This study found that U.S. sites received higher coverage rates than their counterparts in other countries. Yahoo! China provided better coverage of sites from China and surrounding regions than its global counterpart, Yahoo! The poor coverage of Chinese commercial and governmental sites is noted and the implications are discussed in light of the tremendous development of the Web in China.

Bar-Ilan (2008) introduced methods for evaluating search engine performance over a time period. The set of measures introduced may serve as a guideline for the search engines for testing and improving their functionality.

Thelwall (2008b) compared the applications programming interfaces of Google, Yahoo! And Live Search for 1587 single word searches. The hit count estimates were broadly consistent but with Yahoo! and Google reporting 5-6 times more hits than Live Search. Yahoo! tended to return slightly more matching URLs than Google, with Live Search reporting significantly fewer. Yahoo!'s result URLs included a significantly wider range of domains and site than the other two and there was little consistency between the three engines in the number of different domains. Concluded that quantitative results from the three search engines are mostly consistent but with unexpected types of inconsistency that users should be aware of.

2.6 Web Impact Factor

Ingwersen (1998) analyzed a selection of seven small and medium scale national and four large web domains as well as six institutional websites over a series of snapshots taken of the web during a month. The data isolation and calculation methods are described and the tests discussed. The results demonstrate that Web-IFs should be approached with caution. The data isolation method makes use of sets of inverted but logically identical Boolean set operations and their mean values in order to generate the impact factors associated with internal-self-link web pages and external-link web pages.

Smith (1999b) explained the WIF for comparing the relative attractiveness or influence of web spaces, where the WIF is the number of pages linking to a web space divided by the number of pages in the web space. He compared WIFs for Australasian universities and for Australasian electronic journals.

Thelwall (2000) conducted a survey in order test the coverage of search engines and to decide whether their partial coverage is indeed an obstacle to using them to calculate WIF. The results indicated that search engine coverage, even of large national domains was extremely uneven which may lead to misleading calculations.

Thelwall (2001c) explained the WIFs, the proposed web equivalent of Impact Factors for Journals, can be calculated by using search engines. The author presented a bespoke web crawler designed specifically for the calculation of reliable WIFs is presented. This crawler was used to calculate WIFs for a number of UK universities, and the results of these calculations are discussed.

Thelwall (2002c) addressed the question of which is the best possible domain to count backlinks from, if research is the focus of interest. WIFs for British Universities calculated from several different source domains are compared, primarily the .edu, .ac.uk and .uk domains, and the entire web. The results showed that all four areas produce WIFs that correlate strongly with research ratings, but that none produce incontestably superior figures.

Smith and Thelwall (2002) reported the results of an exploratory study of knowledge exchange between disciplines and subfields of science, based on bibliometric methods. The authors considered knowledge exchange between disciplines at a global level, by analyzing cross-disciplinary citations in journal articles, based on the world publication output in 1999.

Smith (2002) investigated the effectiveness of metadata on websites. Specifically, the study investigated whether the extent of metadata use by a site influences the WIF of the site. He has calculated the WIF of electronic journals and NZ University websites. The most positive correlation was found between the substantive WIF of the electronic journal sites and the extent of Dublin Core metadata use.

Thelwall *et al*. (2003) investigated the subjects that have the most impact on the web, and look for national differences in online subject visibility. The authors use link counts to identify the highest impact websites from the universities in Taiwan and Australia and classified them by domain type and by subject content. The highest impact sites were from computing, but there

were major national differences in the impact of engineering and technology sites. Another difference was that Taiwan had more high impact non-academic sites hosted by universities.

Vaughan and Show (2003) compared bibliographic and web citations to articles in 46 journals in library and information science. For most journals (57%), web citations correlated significantly with both bibliographic citations listed in the Social Sciences Citation Index and the ISI's Journal Impact Factor. Web citation counts were typically higher than bibliographic citation counts for the same article. Journals with more web citations tended to have websites that provided tables of contents on the web, while less cited journals did not have such publicity from 1992-1997.

Noruzi (2005) investigated the WIFs for Iranian universities and introduced a new system of measurement. Counts of links to the websites of Iranian universities were calculated from the output of AltaVista search engine. Overall, Iranian university websites have a low inlink WIF. While specific features of sites may affect an institution's WIF, there is a significant correlation between the proportion of English-language pages at an institution's site and the institution's backlink counts.

Barjak, Li, and Thelwall (2006) analyzed data concerning 456 scientists from five scientific disciplines in six European countries and showed that both homepage content and personal and institutional characteristics of the homepage owners had significant relationships with inlink counts. Notable differences between the total inlinks to scientists' homepages existed between the scientific disciplines and the countries in the sample. There are also both gender and age effects: fewer external inlinks (links from other web domains) to the homepages of female and of older scientists.

Noruzi (2006a) analyzed the web presence and Web Impact Factor for country code top-level domains of Middle-Eastern countries, and sub-level domains related to education and academic institutions in these countries. The results showed that the Middle-Eastern countries, apart from Turkey, Israel and Iran, have a low web presence. On the other hand, their websites have a low inlink WIF. The study concluded that specific features of sites may affect a country's WIF. For linguistic reasons, Middle-Eastern websites (Persian, Kurdish, Turkish, Arabic, and Hebrew

languages) may not receive and attract the attention that they deserve from the www community.

Noruzi (2006b) suggested that Web Impact Factors can be calculated as a way of comparing the attractiveness of websites or domains on the web. He concluded that while the WIF is arguably useful for quantitative intra-country comparison, application beyond this (i.e., to inter-country assessment) has little value.

Webometric investigation on the websites of selected Library Association websites in India have been studied by Walia and Kaur (2008) based on the analysis of hyperlinks. It included the calculation of the web Impact Factor (WIF) for these websites. The website with the maximum web impact factor was found to be that the library associations' can best boost their web visibility by hosting a wide range of material as much as possible and increase the number of links from other similar websites.

Babu, Jayshankar and Rao (2009) analyzed the link-based website impact measure known as the web impact factor (WIF). This study examined 34 state agricultural universities websites in India. Investigates domain systems of the websites, analyzes the number of web pages and link pages and calculated the Simple Web Impact Factor, Self-link Web Impact Factor, External link Web Impact Factor and Revised Web Impact Factor of state agricultural universities in India and ranks the websites as per the WIF. It has been suggested that web impact factors can be calculated as a way of comparing the attractiveness of websites or domains on the web. As a consequence, proposed a novel network diagram notation to fully appreciate and investigate link structures between web nodes in webometric analysis. This study cautioned against taking the analogy between citation analysis and link analysis too far.

Jayshankar and Babu (2009) examined and explored through a webometric study the websites of 45 universities in Tamil Nadu comprising of 27 state and 18 private universities. They identified the domain systems of the websites; analyzed the number of web pages and link pages, and calculated the Simple Web Impact Factor (WIF), Self-link Web Impact Factor and external Web Impact Factor of the University websites in Tamil Nadu and ranks the websites as per the WIF. The study found that some universities in Tamil Nadu had higher number of web

pages but correspondingly their link pages were very small in number and websites fell behind in their simple, self-link and external link Web Impact Factor.

Jalal, Biswas and Mukhopadhyay (2010b) analyzed the web presence using popular search engines like AltaVista, Google, Yahoo and MSN. An attempt has also been made to find out the Web Impact Factor (WIF) for selected Asian countries. The result shows that China (43.7%), Japan (16.2%) and India (10.4%) occupy highest web presence amongst Asian countries based on the total number of effective internet users. China being the second highest number of internet users having 11.8% after USA (19.7%) followed by India with 4.9% of world internet Users and Japan is having the highest number of web pages followed by China and South Korea.

Babu, Jayshankar and Rao (2010) examined 40 central universities websites in India. They investigated domain systems of the websites, analyzed the number of web pages and link pages and calculated the Simple Web Impact Factor, Self-link Web Impact Factor, External link Web Impact Factor and revised web impact factor for central universities in India and ranked the websites as per the WIF. They also developed a novel network diagram showing link structures between web nodes in webometric analysis.

Thanuskodi (2011) conducted a study on webometrics analysis which calculated and compared the number of web pages, in links, external in links and also the overall and absolute WIF of private engineering colleges in Tamil Nadu. The study covered the active exclusive websites, compared and then ranked these universities according to webometric indicators. The study used AltaVista because of its ability to cover a broader range of the web as opposed to the other commercial search engines.

Islam (2011) conducted a webometric study of all university websites in Bangladesh. Data for the study, obtained using AltaVista search engine was used to rank the websites based on webometric indicators. It is found that some universities in Bangladesh have higher number of web pages but their link pages are fewer and websites fall behind in their web impact factor. Some suggestions to improve the WIF of the university websites in Bangladesh are given.

Islam and Alam (2011) conducted a study on webometrics, especially on the impact of websites and the web impact factor. The study analyzed the websites of private universities in Bangladesh according to the webometrics indicator. It examines and explores the 44 private university websites in Bangladesh and identifies the number of web pages and link pages, and calculates the Overall Web Impact Factor (WIF) and Absolute Web Impact Factor (WIF). In a cross sectional study, all the websites were analyzed and compared using AltaVista search engine. The websites were then ranked based on these webometric indicators. The study revealed that some private universities in Bangladesh have higher number of web pages but their link pages are very small in number, thus the websites fall behind in their Overall WIF, self-link, external links and Absolute WIF. Finally, it is showed that these universities did not have much impact factor on the web and were not known internationally.

2.7 Conclusion

From the above review, it can be concluded that the researchers from different countries have contributed to webometrics research, especially on the impact of websites and the web impact factor. This Chapter briefly reviewed these research studies. The next Chapter will discuss an overview of webometrics and its various indicators.

Chapter 3:

An overview of Webometrics

3.1 Introduction

The internet is one of the most important and complicated inventions in the history of mankind. Millions of users access the internet every day for various beneficial purposes from hobby and communications to research and learning (Germain, 2000; Maharana *et al.* 2006). Internet has become an important information resource in various fields of knowledge especially in science and technology including Library and Information Science. Library and Information Science is concerned with how different information resources and information structures (interrelated of information resources) are generated, organized, distributed and utilized by different users in different contexts. Core research areas in Library and Information Science are concerned with documents (broadly defined as information carries containing texts, graphics, audio, video, and so on), document represents (for example bibliographic data metadata), and relations between the documents or document representations (for instance, link, cross-references, citations, co-citations and bibliographic couplings) (Mark 2004).

Library and information science (LIS) and related fields in the sociology of science and science and technology studies have developed a range of theories and methodologies including webometrics concerning quantitative aspects of how different types of information are generated, organized, disseminated and used by different users in different contexts. Historically, this development arose during the first half of the twentieth century from statistical studies of bibliographies and scientific journals (Hertzel, 1987).

3.2 Webology

Webology is the "the study of the web". According to Berners-Lee (1989), web is a **"**hypertext system" for the purpose of enabling efficient and easy information sharing among geographically separated teams of researchers. He proposed the following components of web:

- consistent user interface;
- ability to incorporate a wide range of technologies and document types; and
- universal readership.

Webology is a compound noun coming from two words, 'Web' and the suffix '-logy' as a word ending. Web means "World Wide Web", and the suffix -ology means "the study of". Webology as an emerging and developing field encompasses all studies of web-related phenomena. In other words, Webology or Web Science is the study of the web including its structure, organization, topology, functions, characteristics, interconnections, and development. It should be mentioned that the definition and boundaries of webology as a scientific or academic field are yet to be defined. It includes the study of the content, structure, constitution, function, characteristics, phenomena, development and interconnection of the World Wide Web. It is also the systematic and scientific study of relationship among websites (Wikipedia, 2005).

3.3 Development of Librametrics to Webometrics

Being a global document network initially developed for scholarly use (Berners-Lee and Chilliau, 1990), and inhabited by a diversity of users, the web constitutes an obvious research field for bibliometrics, scientometrics and informetrics.

Statistical Analysis

Cole and Eale's (1917) study entitled "The History of Comparative Anatomy, Pt. 1: A statistical Analysis" is considered to be the first bibliometrics study, where for the first time they expressed the term 'Statistical Analysis'.

Hulme (1923) introduced the term 'Statistical Bibliography'. He defined it as the application of mathematical and statistical methods to books and other means of printed communication. This term continued to be used for statistical measures till the end of 1960s.

Librametrics

In 1948, Ranganathan (1949) coined the term 'Librametry' to connote the use of statistics to evaluate an existing or proposed library service and resources. Gopinath (1991) explained that the term librametry includes the concept of bibliometrics. Sengupta (1986) noted that librametry is more or less analogues and synonyms to bibliometrics.

Bibliometrics

Bibliometrics is a set of methods used to study or measure texts and information. While bibliometric methods are most often used in the field of library and information science, bibliometrics have wide applications in other areas. In fact, many research fields use bibliometric methods to explore the impact of their field, the impact of a set of researchers, or the impact of a particular paper.

White (1985) stated that "bibliometrics is a measurement of books or compositional entities according to methods that yields comparable result"

Pritchard (cited in David and Maureen, 1975) in his book Literature and Bibliometrics defines bibliometrics as "the application of mathematical and statistical method to books and other media of communication".

Rajgopalan (1986) defined bibliometrics as "quantitative analysis of bibliographic study interpreted bibliometrics as quantitative analysis of the bibliographics of a body literature". In general, 'Bibliometrics' therefore may be defined as the quantitative analysis of the characteristics, behaviour and productivity of all aspects of written communication of library staff and information users. Panda (1997) explained bibliometric Laws are statistical expression, which seek to describe the working of science by mathematical mean. Some authors even have shown that these three laws are related to each other under certain conditions or assumptions. Many of the bibliometric studies are based on relatively small set of data. However, these studies are found most helpful in the library field. The three basic laws in bibliometrics are:

1. Lotka's law
2. Bradford's law
3. Zipf's law

1. **Lotka's Law:** This law emphasis the productivity of authors in a discipline or other field;
2. **Bradford's Law:** This law emphasis the pattern of scattering of literature in various periodicals; and
3. **Zipf's Law:** This law emphasis the frequency of occurrence of the word distribution.

The bibliometrics studies are used to identify the pattern of publications, authorship, and secondary journal coverage in the hope that such studies can give an insight into the dynamics area under consideration. This consequently leads to better organization of information resources which is essential for their effective and efficient use.

In bibliometrics, the principal objectives of measurement are scientific publications. They contain a treasure of quantifiable elements pertaining to some main aspects of scientific activities such as, (1) The size of scientific activities as reflected in the output of research publication (the products); (2) The transfer of knowledge (the process); and (3) The social and cognitive networks of science (the structure) (Pianta and Archibugi, 1991).

Scientometrics

The term 'Scientometrics' is very popular in the countries of continental Europe. The term gained prominence with the publication of journal namely *Scientometrics* by T. Braun, initially published in Hungary and then in Amsterdam (Devaranjan, 1997).

According to Nalimov and Mulchenko, scientometrics is the application of quantitative methods, which deals with the analysis of science (Glanzel, 2003). It is used to mean communication process in scientific articles including socio-cultural aspects and appears to be almost similar to science, the more stress on quantitative aspects. Scientometrics is the quantitative aspects of science as a discipline or economic activity. Scientometrics involves quantitative studies of scientific activities, including, among others, publication and so overlaps bibliometrics to some extent (Tague-Sutcliffe, 1992).

Informetrics

In the 1980s, the term informetrics was proposed for research in a broad sense. According to Tague-Sutcliffe (1992), informetrics is the study of the quantitative aspects of information in any

form, not just records or bibliographies, and in any social group, not just scientists …. It can incorporate, utilize, and extend the many studies of the measurement of information that lie outside the boundaries of both bibliometrics and scientometrics. Informetrics means very broad sense and it covered the definition and measurement of information and types and characteristics of retrieval performance measures.

According to Wilson (1999), "informetrics is the quantitative study of collections of moderate sized units of potentially informative text, directed to the scientific understanding of information process at the social level". Wilson's units of text should also include digital collections of images, videos, spoken documents and music.

Egghe (2005) also defined informetrics in a very broad sense. He stated that informetrics comprised of "all-metrics studies related to information science, including bibliometrics (bibliographies, libraries,..), scientometrics (science policy, citation analysis, research evaluation,..), webometrics (metrics of the web, the internet or other social networks such as citation or collaboration networks), …"

Informetrics therefore includes all quantitative studies in information science. If a scientist performs scientific investigations empirically, e.g. on information users' behaviour, on scientific impact of academic journals, on the development of the patent application activity of a company, on links of websites, and so on, he or she contributes to informetrics. Informetrics covered three subject areas in information science in which such quantitative research takes place:

- Information users and information usage;
- Evaluation of information systems; and
- Information itself.

While bibliometrics and scientometrics refer to all quantitative aspects and models of printed media and sciences, informetrics is not limited to media or scientific communication. Informetrics is, thus, an emerging subfield in information sciences, which is based on the contribution of advances of information retrieval and quantitative studies of information flows.

Cybermetrics

Cybermetrics is the study of the quantitative analysis of scholarly and scientific communications in the internet.

Cybermetrics Vis-à-vis Webometrics

Cybermetrics has been proposed for analysis of web documents before the term Webometrics. Cybermetrics is "the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the whole internet, drawing on bibliometric and informetric approaches". Cybermetrics thus encompasses statistical studies of discussion groups, mailing lists and other computer mediated communication on the internet including the web. The breadth of coverage of cybermetric is limited and where as webometrics implies large overlaps with proliferating computer science based approaches in analysis of web contents, link structures and web usage and web usage and web technologies.

Webometrics

In recent years, however, the number of 'electronic' activities has increased drastically. The emergence of a new field that applies the well-established research techniques from another field, known variously as bibliometrics, scientometrics, informetrics, to rapidly developing environment, the World Wide Web. This new field is called as webometrics or Cybermetrics.

Since the mid-1990s, the nature and properties of the World Wide Web have been increasingly investigated by applying modern informetric methodologies. The term webometrics is a coinage from 'web' and 'metric'. The word web means World Wide Web. The Dictionary of Science defined web as "a hypermedia system that allows users to view and retrieve information from 'documents' containing links". On other hand, metrics has to do with counting or measurement. Webster's Comprehensive Dictionary of English Language defined metrics as "the mathematical theory of measurement".

Webometrics is the new discipline that intends to apply bibliometrics, scientometrics, informetrics and cybermetric techniques to the process of scientific communication, which takes place on the internet in order to know and describe them from a quantitative point of view.

Webometrics describes counting or measuring web resources in mathematical value. It defines the extent of web usage for research. Since the web allows documents to be linked together, the measurement of these links forms the fabric of webometrics. Therefore, webometrics is based on two indicators:

- volume of published materials of institutions/individuals on the web; and
- visibility and impact of the web pages measured by the citation (site citations or links they receive).

Quantitative studies of the web have been named webometric by Almind and Ingwersen (1997), and defined the discipline and gave its name as webometrics, although the basic issue had been identified simultaneously by Rodríguez and Gairín (1997) and Larson (1996) is also a pioneer with his early exploratory link structure analysis with the First pure informetric analysis of the Web. Bjorneborne and Ingwersen (2004) defined webometric 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 informetric approaches". Mayr and Tosques (2005) stated that the web has own citation indexes in the form of commercial search engine, and so it is ready for researchers to exploit. In fact, several major search engines can also deliver their results automatically to investigators' computer program, allowing large-scale investigations. Aguillo (2006) noted that one of the most visible outputs of webometric is the ranking of world universities based upon their websites and online impact. This definition covers the construction side and usage side of the web which embrace the four main areas of webometrics study. They are:

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

3.4 Relationship between 5 Metric Sciences (IBSCW)

Between these five metrics sciences, bibliometrics first came in existence in 1969. It is the statistical analysis method of publication pattern and the like. The other metric sciences:

informetrics, scientometrics, cybermetrics and webometrics, are also statistical methods and have their origin on the basis of bibliometrics. But all of them have their different subject areas.

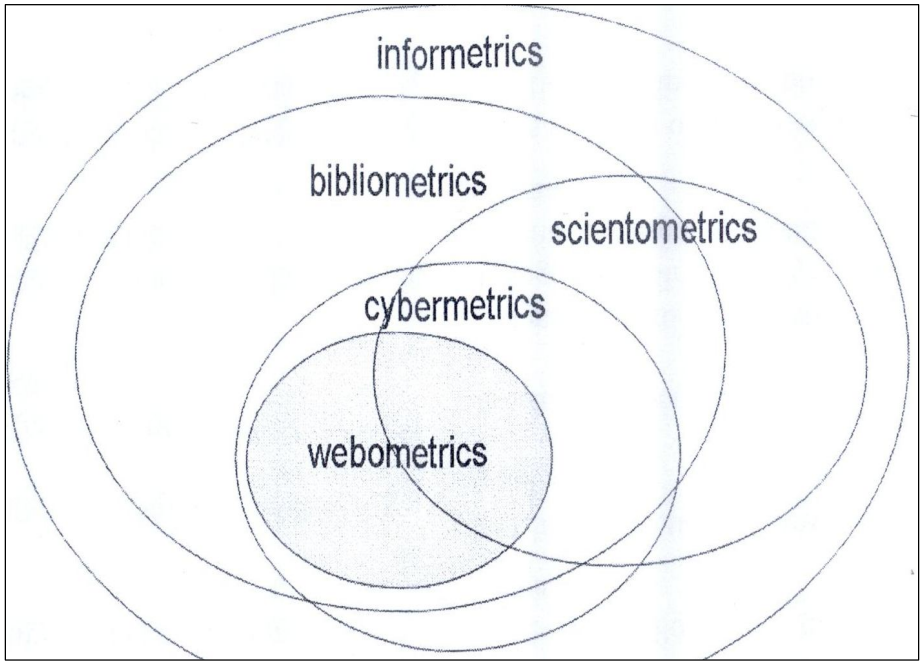

Figure 3.1: Relationship diagrams of 5 metrics-Infor/biblio/sciento/cyber/webometrics. Walia (2008)

In the Figure 3.1, the circle of informetrics covers all other metrics circles, because according to stub (given above), it is a quantitative aspect of any type of information. The part, which overlaps the circle of bibliometrics, of scientometrics, shows the politico-economical aspects of scientometrics. The economic aspect of science shows the impact of scientific research over the society. Bjorneborn and Ingwersen (2004) have proposed a differentiated terminology distinguishing between studies of the web and studies of all internet applications. They use 'webo-metrics' for study of web and 'cybermetrics' for study of internet applications. Some part of cybermetrics ellipse lie outside the bibliometrics. It is because some activities in cybermetrics normally are not recorded, but communicated synchronously as in chat rooms. In figure 3.1 the circles of webometrics overlap the circle of bibliometrics, but within the boundaries of cybermetrics. Webometrics circle can't overlap the circle of cybermetrics because of web is a part of cyberspace. But in Figure 3.1 the circle of webometrics ellipse lying outside the

bibliometrics, because some aspect of webometrics (link structure, technologies and so on), is not included in bibliometrics or it is beyond the boundaries of bibliometrics.

3.5 Methods of webometrics

3.5.1 Web page content analysis

A number of webometrics investigations have focused not on websites but on academic publications; using the web to count how often journal articles are cited. Vaughan and Shaw (2003) discussed online citations are relatively trivial, for example appearing in journal contents lists rather than in the reference sections of academic articles. If this can be automated then it would give an interesting alternative to the ISI citation Indexes.

- The web page content analysis can be used to analyze content of the websites;
- It provides hits on the systematic organization of web based information sources;
- It enables the users to reduce their time in the choice of right sources;
- It compares the efficiency of search engines in retrieving the required information sources;
- It will be useful for students, researchers, scientists who seek information through WWW; and
- Simplistic counts and content analysis of web pages are like traditional publication analysis.

3.5.2 Web link structure analysis

Link analysis has been used successfully for deciding which web pages add to the documents (i.e., which pages to crawl), and how to order the documents matching a user query (i.e., how to rank pages). It has also been to categories web pages, to find pages that are related to given pages, to find duplicated websites, and various other problems related to web information retrieval.

The web link structure analysis provides **hyperlinks or self-links** between documents and records of user behaviour. To be precise, hypertexts (i.e. collections of documents connected by hyperlinks) could provide analysis of the following:

i) count and analysis of outgoing links from web pages, here named called **outlinks or external links;**

ii) link to web pages or links coming from the other websites called **inlinks or incoming links**. It covers all links from other websites pointing to a certain web page or website. An incoming link is similar to receiving a citation in a document. These links also known as backward links or ingoing links; and

iii) **Reciprocal Link:** If two web pages or two websites both have a link pointing to each other, the link is named as a reciprocal link.

3.5.3 Web usage analysis

The following component covers the web usage analysis:

- Log files for users searching;
- Browsing behaviour;
- Log analysis for security applications;
- Web usage pre-processing;
- Novel techniques for discovery and analysis of web usage patterns;
- Integrating semantics and domain knowledge in web usage mining and analysis;
- Reliability and consistency of webometrics;
- Integration of click stream data with back-end data and related metrics; and
- Intelligent summarization/explanation of changes in web usage metrics (Thelwall, Vaughan, and Bjorneborn, 2005).

3.5.4 Web technology analysis: search engine performance

The 'Web Technology Analysis' (search engine performance) has been explained by Thelwall, Vaughan and Bjorneborn (2005) as:

A significant of amount of webometrics research has evaluated commercial search engines. Technology is a term, which denotes the quality. It includes different search engine performances (for example, Google, Blekko, Bing and so on), because search engines are such type of websites, which incorporates more technology than other websites. The result of search engine comes as the big list of URL's of different websites of a particular subject. In short, it can

be said that technology itself is a very broad phenomenon but as for as webometrics study is concerned, it is measurable and a useful study tool for web based study.

The search engines performance determines the following aspects:

- Measuring the search engines performances;
- Total number of hits retrieved;
- Number of relevant hits retrieved;
- The content of the page like what is the page all about and so on; and
- Ranking of search engines.

3.6 Web Impact Factor (WIF)

Web Impact factors (WIFs) are part of the methodology of webometrics. WIFs are web versions of the Impact Factors (IF) published by the Institute of Scientific Information for scientific journals (Thelwall, 2000). A WIF is essentially the number of pages linking to a site or area of the internet, divided by the number of pages in that site or area Ingwersen (1998). The idea of measuring average link frequencies, that is, the WIF, as one of the quantitative indicators or the average link frequencies has been developed by (Ingwersen, 1998)**.** The feasibility and reliability of calculating impact factors for websites, called Web Impact Factors. WIF is a 'snapshot' of a search engine database at a specific time. The WIF was based on an analogy between hyperlinks and citations and was the adaptation of the "Journal Impact Factor" for the web. However, the time periods for WIF and the Journal Impact Factor (JIF) are different. The JIF measures citations made in journals published during one time period to articles published in another time period while the WIF is a 'snapshot' of a search engine database at a specific time of the websites. The WIF is therefore not exactly the equivalent of the JIF. However, the WIF was inspired by the JIF.

WIF is a relatively new measure of the extent to which a site is linked to by other sites, and is analogous to a citation count in the print environment. Broadly, it is a measure of the extent to which it is linked to and recognized by other site.

The WIF provides quantitative tools for ranking, evaluating, categorizing, and comparing websites by top-level domains and sub-domains. The following types of links are identified:

i. **External links**: links from web pages are here named outlinks, the impact factor is called external web impact factor.
ii. **Inlink**: links coming into a site from other sites are named inlinks (backlinks), this impact factor is called revised web impact factor and
iii. **Self-links**: links within the same site (from one page to another page) are named self-links, the impact factor is called Self-link Web Impact Factor Noruzi (2006b).

Mukhopadhyay (2005) studied the Web Impact Factor as the ratio of number of links to the total number of web pages. WIF is essentially the number of pages linking to a site or area of internet, divided by the number of pages in that site or area at a given point of times. Therefore Web Impact Factors may be computed at three levels- top-level domains, sub-level domains and host level domains or site-level domains.

The idea of applying bibliometric techniques to the web was proposed by (Almind and Ingwersen, 1997). According to them, WIF should be defined as the ratio links made to a website, to the number of pages at the website.

- The simple WIF, the ratio of all links to the number of pages.
- The internal or Self WIF, the ratio of internal links within the site to number of pages.
- The external WIF, the ratio of links made from external sites to the target site, to the number of pages at the site.

3.6.1 WIF advantages and utilities

The major advantages and utilities of the WIF are identified by Noruzi (2006b):

1. The WIF analysis method presents a methodology for evaluating "international visibility" and impact of institutional and academic websites, as well as their competitive relations to other websites. The WIF can be regarded as a useful tool to measure the relative visibility of a company, organization, or country on the web. It must be noted that the WIF is not the only indicator of the use, visibility, and popularity of a website.

2. The WIF provides a way to evaluate a website's relative importance, especially when we compare it to others in the same field or a country's domains. Therefore, to compare websites we should stick to a particular category. We do not compare websites in

different research fields. So, the WIF measures the success and relative influence of similar websites.

3. The WIFs of national, sector, and larger web segments or top-level domains are calculable. Comparisons should be performed with caution, and preferably be carried out limited to comparable within the same snapshot, and also comparisons should be units. The variation of the WIF over different snapshots taken within short intervals does exist.

4. The WIF provides a quantitative indicator of websites long-term influence. In the final analysis, impact simply reflects the ability of websites and webmasters to attract users and cybercitizens, and consequently backlinks. We nevertheless warn against the indiscriminate use of WIF data.

5. The WIF may in turn provide novel insights into the retrieval process on the web. For instance, clusters of websites can be detected by means of link page co-occurrence. Moreover, The WIF can be regarded as a tool for measuring the accuracy of web search engine performance and website organization, linking, and structuring of pages (Ingwersen, 1998; Wormell, 2001).

3.6.2 WIF misuses and incorrect applications

The WIFs can be influenced and biased (intentionally or otherwise) by many factors and variables. However, when using them for evaluation, it is important to realize that WIFs are influenced by other factors, (Noruzi, 2006b) such as:

1. The WIF depends on the search engines' web coverage. The coverage varies considerably between countries. Therefore, the impact factor of any website will be proportional to the search engines' coverage. Furthermore, the website sets in search engines' databases are not constant but may vary in composition from month to month. So, the results of analyzes of the web by search engines can only be regarded as rough indications rather than definite conclusions.

2. Assume that there are only two websites in an area of interest: website A and website B. Assume that website A was linked ten times and published ten web resources over the time period being examined. Similarly, website B was linked 100 times and published 100 web resources over the same time period. Both websites have the same impact factor, but can it be said that the two websites have had the same influence on the literature? It would be appropriate to suggest that both websites are equally efficient in attracting links, but website B has had a greater contribution to the current literature by a factor of ten times. Therefore, large websites that publish many web resources may not have as high an impact as smaller scientific and research websites, because the high web resources rate counteracts the high inlinks rate (Noruzi, 2005b).

3. The page inlink rates determine the website impact factor, but not vice versa. In other words, the impact factor of a website is not statistically representative of its web pages**.** The WIF is a function of the number of inlinks per website not per web page. For the website's impact factor to be reasonably representative of its web pages, the inlink rate of individual web pages in the website should show a narrow distribution. Assigning the same score (the WIF) to all web pages masks this tremendous difference – which is the exact opposite of what an evaluation is meant to achieve. Inlinks frequencies for individual web pages are quite varied. Even the unlinked web pages are then given full credit for the impact of the few highly linked web pages that predominantly determine the value of the WIF.

4. The international language bias extends further than simply the language of publication. English-speaking webmasters and authors rarely link non-English language literature, regardless of the otherwise implicit appropriateness of the link itself. Several earlier publications have raised this concern and discussed its indirectly negative effect on the impact factor standing of non-English language websites. This problem has been compounded by the fact that webmasters from non-English-speaking environments seek to publish their works in English. For example, Japanese websites may not be as highly linked to due to language differences. "One may note that the current Japanese WIF is far below the expected mean value for countries and sectors. This situation leads to considerations about the influence of language as well as of national cultural and

social factors on the meaning and interpretation of WIFs in general" (Ingwersen, 1998)**.** One might argue that English-speaking webmasters may not link to the Japanese, Chinese, or Persian websites, but today the use of English documents the web impact factor 495 means that few important resources are missed. According to (Li, 2003) English is the dominant language on the web in Western Europe. Countries sharing the same language tend to link more than those that do not. Websites in the English language may have higher impact factors. Search engines' databases have an English language bias. They are dominated by English websites. The preference of the search engines' databases for English language websites will contribute to a low WIF for the few non-English websites that are included, since most links to websites in languages other than English are given by other websites in the same language. Links in the national language of the website are preferred by the website's webmasters and web bloggers. Previous studies have shown that sites tend to link more within their own country than outside Bharat *et al*. (2001); Thelwall (2002a); Vaughan and Thelwall (2004) have shown that sites tend to link more within their own country than outside.

5. The original intention for the use of the WIF was to allow comparison between the link rates of websites. The application of this tool evolved into a means with which to assess the quality of the websites themselves, on the basis of the premise that a higher rate of link indicated higher website quality. Furthermore, the misuse of this calculation has, in recent years, widened to include evaluation of the quality of world university websites ranking, it is not meaningful, it is dangerous. The frequency of link has been adopted as a rough indicator of quality. However, a high link rate may not always be associated with high quality. In addressing the extension of this tool to academic evaluation, while the WIF may provide a gross approximation of the prestige of websites, it does not advise using this value as the sole means of comparative evaluation. It should be apparent that the ranking relationship between quality and link is not absolute. We can mainly judge the quantity and quality of websites. Quantity is easily evaluated, involving counting the number of web pages, whereas quality is a notoriously difficult aspect to appraise, in that subjectivity and bias frequently overshadow the process. Evaluating website quality is a notoriously difficult problem, which has no standard solution. Even citations and

journal impact factors can only measure the impact of research rather than its quality (Seglen, 1997); (Moed, 2002).

6. Relations between fields strongly determine the WIF. Therefore, interdisciplinary websites attract more inlinks and websites in the fields with a high turnover of research or developing technology usually have larger impact factors. Extension of the WIF to cross-discipline website comparison is also inappropriate. Different disciplines and specialties exhibit a different impact factor range. In this way, websites may be viewed in the context of their specific field. It is rare to find that the ranking of a website will change significantly unless the website's influence has indeed changed. The WIF is dependent on the research field; topics that are currently trendier are therefore more likely to be linked. Many factors contribute to the number of inlinks per website, including the science; the nature of the research; the style of the communication; language; readership and diffusion (more readers equals more inlinks); conformism (webmasters often link those websites that are currently linked). Thelwall (2001a) showed that WIFs correlated significantly with the research rating and quantity.

7. Unlike scientific citations to journals, institutions or individuals, which may be stable or may constantly increase, the number of pages linking up to a particular web resource may indeed decrease or disappear over time, for example, due to closedowns or restructuring of websites. Thus, in contrast to the common citation impact factor calculation a retrospective WIF is not reproducible. Therefore, the WIF depends on dynamics (expansion or contraction) of the website.

8. In comparison between the WIF and the JIF, it is clear that some journals have been accused of trying to manipulate their impact factors by asking the authors to increase the number of references to papers published in them. It is a distortion of the scientific process, and also some webmasters are asking others to link to their sites. It should also be pointed out that should backlink analyzes be used for studies that have a real impact upon universities, they would be extremely vulnerable to manipulation. This stems from the unrefereed nature of the medium (web) and from the ease by which large numbers

of web pages can be generated automatically by those with programming skills (Thelwall, 2001a).

9. Websites introducing a new technique, a new computer program, a new model, a new test, diagnostic or outcome criteria, reviews and controversies, also garner their share of links, and these vary among areas and with different stages of development of a discipline. The WIF rankings within a field or a country are more meaningful than between fields or countries. The WIFs have some value as relative measures in closely related defined categories but do not have validity as absolute or relative measures across categories.

Webometrics techniques are still in their experimental stage in testing whether the classical bibliometric methods applied to the web are reliable and feasible means of comparing and analyzing websites.

3.7 Conclusion

This Chapter gave an overview of webometrics and its indicators. The next Chapter will discuss the methodology used in this research.

Chapter 4:

Research Methodology

4.1 Introduction

This Chapter discusses different webometric indicators applied in this research. In this research, two search engines and one personal web crawler were utilized for data collection. Then, Microsoft Excel and SPSS were used for data analysis. The instability of the web and its content, the increasing number of web pages and also the continuous changes in the number of links, the data was gathered within a short period of time to make the results more reliable.

4.2 Quantum of web pages and link pages of websites of private universities

4.2.1 Data collection

The webometric analysis was based on the data collected from the web using two search engines, Google and Blekko. In 2012, there were 54 private university websites. It is clear from Table 5.2.3 that Google added 11 new universities in 2013, which were included for analysis in a later part of this study.

4.2.2 Data collection method

The data collection methods extensively made use of keywords like domain, linkdomain, linkdomain AND domain and linkdomain AND NOT domain for Google. For Blekko, entering URL in the query box showed all inlink, self-link and external link pages through Blekko SEO service. A series of online searches was conducted over a month on the selected search engines by keeping the various search queries constant.

The following query statements were used as the basis for data collection:

Domain: Extracted the number of web pages on the website;

Linkdomain: Revealed the number of link web pages to the website. It is called hyperlink pages;

Linkdomain: **AND domain:** It provided a complete report of number of web pages which provided hyperlinks within the website. It is called self-link pages (link from the same website); and

Linkdomain: **AND NOT domain**: It provided the report of number of pages not under the particular website. It is called external link pages.

The command 'domain' indicates the website address which plays an important role in this study, as it extracts the number of web pages for each website.

4.3 Link Structure Analysis (WIF) of websites of private universities

4.3.1 Data collection

The link structure analysis was conducted using Google and Blekko search engines because of convenience in using Boolean operators AND, OR and NOT.

4.3.2 Data analysis technique

4.3.2.1 Calculating Web Impact Factor

The link structure analysis covered Simple Web Impact Factor, Self-link Web Impact Factor and External link Web Impact Factor and then ranked them by their WIF. The methods of calculating these WIFs are explained below:

$$\text{Simple of Overall WIF} = \frac{\text{Number of link pages}}{\text{Number of web pages that are indexed by the search engine}}$$

$$\text{Self} - \text{link WIF} = \frac{\text{Number of self} \quad \text{link pages}}{\text{Number of web pages that are indexed by the search engine}}$$

$$\text{External link WIF} = \frac{\text{Number of external link pages}}{\text{Number of web pages that are indexed by the search engine}}$$

These three methods of link structure analysis (WIF) were utilized for analyzing data.

4.4 Private Universities Link Network

4.4.1 Web crawling: SocScibot

In this research, personal web crawler SocSciBot (available at: socscibot.wlv.ac.uk) was used for creating network diagrams of private university websites. SocSciBot software can download and process a set of websites in order to extract key summary statistics or to visualize any interlinking between the sites. Moreover, the data from SocSciBot is designed to be as accurate as possible for webometric purposes. Another tool, called Pajek was used for visualization of the links relationship. This powerful visualization tool is embedded in SocScoBot. The information flow for visualizing the network diagram can be explained as in Figure 5.4.1.1.

4.4.2 Data collection and analysis procedure

SocSciBot has been widely used by researchers to collect and analyze data on sets of websites. SocSciBot has three main features: a crawler, a link analyzer, and a text analyzer. In earlier versions, these three features operated as separate programs but they were combined in version 4. SocSciBot must be used in two separate phases for any research project: crawling and analysis. The two phases were run concurrently because data from the crawling can interfere with the results of the analysis. The following illustrates the four stage process involved in any SocSciBot investigation.

- **Create a new project and give it a name.** SocSciBot can crawl multiple websites and analyze them together but the websites must be collected into the same project in order for this to be possible. Hence, the First step with using SocSciBot, once it has been downloaded, is to create and name an empty project to contain all of the crawls. New projects can be created by entering a name in the SocSciBot that appears when SocSciBot starts.

- **Crawl all the websites to be analyzed together**. Once the project has been created, it can be populated by crawling the websites to be analyzed within the project. New crawls can be added to a project by First selecting the project by name in SocSciBot Wizard Step 1 and then following the instructions in to register the website to be crawled.

- **Analyze the crawled websites.** Once the crawls of all the websites are complete, the downloaded data can be analyzed through the link analyzer, the text analyzer or both. The links from websites in a project can be analyzed by First selecting the project by name in SocSciBot Wizard Step 1 and then choosing the link analysis option in to access a standard set of reports on the links.

- **Analyze the ADM report:** The impact of each website created by links within the websites crawled can be seen in the link counts report. This is accessible via the Main Reports tab in the SocSciBot Tools Main Reports screen and the information is in the Alternative Document Model (ADM) count summary report. This report contains the number of links to and from each site to and from each other site, as counted by page, directory, domain name or website.

4.5 Regression Analysis of Variance

The studies of webometrics make use of the Number of Web pages (NWP) as a vital part for calculating WIF. In this research, NWP was taken as dependent variable and other indicators such as LWP, SLWP and ELWP were treated as independent variables. This study analyzed the relationship between independent variables and dependent variable by regression analysis.

4.6 Tests for Statistical Significance

4.6.1 The related *t*-test

The related *t*-test is used to take a measurement from a sample and then take the same measurement again at a later time from the same sample. It compares the means of two related samples of scores to see whether the means of two samples differ significantly. The test was carried out to see the differences between Google 2012 and 2013 search results in terms of Simple WIF, Self-link WIF and External link WIF. The same test was conducted for Blekko data.

4.7 Conclusion

This Chapter described the research methodology for webometric analysis of private university websites. The next Chapter will discuss the data analysis on the basis of various webometric indicators.

Chapter 5:

Data Analysis and Interpretation

5.1 Introduction

In this Chapter, the data collected from the websites of private universities of Bangladesh are analyzed and interpreted. The following webometric techniques, indicators and statistical methods were utilized:

- Quantum of web pages and link pages of websites;
- Link Structure Analysis (WIF) of websites and ranking of websites by their WIF;
- Private university websites link network;
- Regression of variance; and
- Test of statistical significance.

5.2 Quantum of web pages and link pages of websites of private universities

5.2.1 Introduction

In this section, an analysis was made with regard to number of link pages, self-link pages and external link pages of each private university website. The data collected through Google and Blekko over several time periods are presented in Table 5.2.2, 5.2.3, 5.2.4 and 5.2.5.

5.2.2 Distribution of web and link pages: Google (July 2012)

University Name	NWP	%	LWP	%	SLWP	%	ELWP	%
AUST	192	2.77	256	5.55	126	2.7	185	3.52
ABU	12	0.17	36	0.78	9	0.19	3	0.06
AIUB	56	0.81	125	2.71	41	0.88	51	0.97
ASAUB	192	2.77	5	0.11	145	3.1	138	2.62
AUB	229	3.31	175	3.79	189	4.05	244	4.64
ADUST	13	0.19	12	0.26	9	0.19	7	0.13
BIU	215	3.11	12	0.26	175	3.75	198	3.76
BU	16	0.23	156	3.38	14	0.3	15	0.29
BUBT	229	3.31	144	3.12	153	3.27	162	3.08
BCGTUB	44	0.64	32	0.69	39	0.83	27	0.51
BRACU	139	2.01	112	2.43	126	2.7	121	2.3
CWU	34	0.49	13	0.28	9	0.19	31	0.59
CUB	95	1.37	51	1.11	63	1.35	71	1.35
DIU	490	7.08	385	8.35	312	6.68	332	6.31
DIUBD	18	0.26	7	0.15	11	0.24	12	0.23
DhIU	124	1.79	52	1.13	81	1.73	76	1.44
EDU	75	1.08	62	1.34	55	1.18	49	0.93
EWU	212	3.06	124	2.69	143	3.06	128	2.43
EU	164	2.37	47	1.02	58	1.24	132	2.51
GB	58	0.84	32	0.69	29	0.62	25	0.48
GUB	19	0.27	17	0.37	15	0.32	13	0.25
IBAIS	57	0.82	32	0.69	31	0.66	29	0.55
IUB	486	7.02	312	6.76	385	8.24	396	7.53
IIUC	239	3.45	145	3.14	141	3.02	142	2.7
IUBAT	89	1.29	56	1.21	91	1.95	67	1.27
LU	162	2.34	92	1.99	86	1.84	151	2.87
MIU	128	1.85	112	2.43	95	2.03	78	1.48
MU	76	1.1	62	1.34	51	1.09	71	1.35
NSU	230	3.32	40	0.87	73	1.56	146	2.77
NUB	53	0.77	32	0.69	47	1.01	29	0.55
PUC	188	2.72	132	2.86	91	1.95	141	2.68
PU	121	1.75	24	0.52	47	1.01	92	1.75
Prime	19	0.27	14	0.3	16	0.34	9	0.17
Primeasia	86	1.24	62	1.34	57	1.22	74	1.41
QU	55	0.79	31	0.67	23	0.49	38	0.72
RUD	11	0.16	8	0.17	9	0.19	8	0.15
SMUCT	107	1.55	72	1.56	87	1.86	91	1.73
SEU	187	2.7	125	2.71	121	2.59	152	2.89
SU	145	2.09	57	1.24	78	1.67	83	1.58
SUB	345	4.98	312	6.76	225	4.82	258	4.9
SUBD	238	3.44	156	3.38	162	3.47	197	3.74
SIU	44	0.64	27	0.59	38	0.81	41	0.78
TMU	27	0.39	11	0.24	14	0.3	9	0.17
PUB	177	2.56	142	3.08	152	3.25	187	3.55
UAP	344	4.97	221	4.79	242	5.18	238	4.52
UIU	49	0.71	35	0.76	26	0.56	38	0.72
UODA	77	1.11	62	1.34	69	1.48	71	1.35
UITS	99	1.43	35	0.76	42	0.9	73	1.39

Table 5.2.2 (Continued)

ULAB	156	2.25	133	2.88	111	2.38	107	2.03
USTC	139	2.01	122	2.65	141	3.02	113	2.15
UniSA	13	0.19	11	0.24	10	0.21	8	0.15
UU	31	0.45	9	0.2	11	0.24	7	0.13
VUB	43	0.62	22	0.48	33	0.71	37	0.7
WUB	77	1.11	51	1.11	65	1.39	61	1.16
Total	**6924**	**100.00**	**4612**	**100.00**	**4672**	**100.00**	**5262**	**100.00**

Here, NWP= Number of web pages

LWP= Link web pages

SLWP= Self-link web pages

ELWP= External link web pages

Table 5.2.2 Distribution of web pages of private university sites in Bangladesh (Google, July 2012)

The following inferences were drawn from Table 5.2.2:

NWP is the number of web pages for each private university website in Bangladesh. It was observed that Daffodil International University (DIU) ranked 1st (490, 7.08%) in terms of total number of web pages. The least number of pages was noted against Royal University of Dhaka (11, 0.16%).

LWP is the link web pages of private university sites in Bangladesh. It was evident from the Table 5.2.2 that Daffodil International University (DIU) again ranked 1st (385 8.35%) in terms of total number of link web pages. The lowest number of pages was noted against ASA University Bangladesh (5, 0.11%).

SLWP is the self-link web pages of private university sites in Bangladesh. It was noted from the Table 5.2.2 that Independent University, Bangladesh (IUB) ranked 1st (385, 8.24%) in terms of total number of self-link web pages. The lowest number of pages was recorded for four universities, i.e. America Bangladesh University (ABU), Atish Dipankar University of Science & Technology (ADUST), Central Women's University (CWU) and Royal University of Dhaka (RUD).

ELWP is the external link web pages of private university sites in Bangladesh. It was observed from the Table 5.2.2 that Independent University, Bangladesh (IUB) again ranked 1st (396, 7.53%) in terms of total number of external link web pages. The lowest number of external link pages was recorded for America Bangladesh University (3, 0.06%).

5.2.3 Distribution of web and link pages: Google (August 2013)

University	NWP	%	LWP	%	SLWP	%	ELWP	%
AUST	208	1.35	232	1.88	246	1.60	275	1.88
ABU	188	1.22	104	0.84	99	0.64	98	0.67
AIUB	279	1.82	3	0.02	283	1.84	265	1.81
ASAUB	316	2.06	247	2.00	247	1.61	232	1.59
AUB	187	1.22	234	1.89	237	1.54	219	1.50
ADUST	328	2.13	223	1.80	216	1.41	190	1.30
BIU	168	1.09	168	1.36	299	1.95	240	1.64
BU	153	1.00	23	0.19	197	1.28	211	1.44
BUBT	312	2.03	289	2.34	262	1.71	268	1.83
BCGTUB	201	1.31	152	1.23	153	1.00	129	0.88
BUFT	297	1.93	296	2.39	335	2.18	385	2.63
BRACU	185	1.20	191	1.55	202	1.31	174	1.19
Britannia	249	1.62	50	0.40	317	2.06	298	2.04
CWU	201	1.31	218	1.76	300	1.95	247	1.69
CUB	194	1.26	183	1.48	179	1.17	172	1.18
DIU	285	1.85	216	1.75	231	1.50	202	1.38
DIUBD	285	1.85	156	1.26	214	1.39	201	1.37
DhIU	298	1.94	162	1.31	183	1.19	185	1.27
EDU	287	1.87	227	1.84	238	1.55	218	1.49
EWU	399	2.60	292	2.36	300	1.95	254	1.74
EU	192	1.25	256	2.07	223	1.45	193	1.32
EUB	222	1.44	151	1.22	328	2.14	197	1.35
FU	16	0.10	23	0.19	19	0.12	21	0.14
FCUB	53	0.34	32	0.26	52	0.34	101	0.69
GB	118	0.77	75	0.61	32	0.21	11	0.08
GUB	206	1.34	176	1.42	182	1.18	260	1.78
HUB	212	1.38	149	1.21	214	1.39	214	1.46
IBAIS	337	2.19	237	1.92	239	1.56	221	1.51
IUB	196	1.28	226	1.83	297	1.93	258	1.76
IIUC	398	2.59	271	2.19	262	1.71	240	1.64
IUBAT	442	2.88	355	2.87	374	2.43	345	2.36
IIU	87	0.57	168	1.36	160	1.04	139	0.95
KYAU	115	0.75	201	1.63	219	1.43	189	1.29
LU	222	1.44	188	1.52	277	1.80	240	1.64
MIU	276	1.80	194	1.57	192	1.25	181	1.24
MU	262	1.71	275	2.22	263	1.71	256	1.75
NEUB	217	1.41	199	1.61	165	1.07	170	1.16
NSU	380	2.47	27	0.22	240	1.56	401	2.74
NUB	319	2.08	135	1.09	219	1.43	192	1.31
PCIU	213	1.39	369	2.99	343	2.23	259	1.77
PUC	262	1.71	204	1.65	298	1.94	218	1.49
PU	255	1.66	21	0.17	258	1.68	243	1.66
Prime	222	1.44	143	1.16	157	1.02	123	0.84
Primeasia	181	1.18	229	1.85	229	1.49	218	1.49
QU	271	1.76	343	2.78	348	2.27	220	1.50
RUD	145	0.94	295	2.39	260	1.69	360	2.46
SMUCT	262	1.71	214	1.73	217	1.41	225	1.54

Table 5.2.3 (Continued)

SEU	215	1.40	171	1.38	338	2.20	291	1.99
SU	246	1.60	83	0.67	204	1.33	162	1.11
SUB	222	1.44	227	1.84	245	1.59	227	1.55
SUBD	200	1.30	286	2.31	238	1.55	287	1.96
SIU	192	1.25	187	1.51	315	2.05	336	2.30
TMU	99	0.64	52	0.42	51	0.33	45	0.31
PUB	111	0.72	120	0.97	310	2.02	295	2.02
UAP	415	2.70	291	2.35	312	2.03	298	2.04
UIU	207	1.35	284	2.30	297	1.93	259	1.77
UODA	283	1.84	321	2.60	312	2.03	269	1.84
UITS	269	1.75	148	1.20	352	2.29	372	2.54
ULAB	333	2.17	260	2.10	264	1.72	253	1.73
USTC	245	1.59	312	2.52	252	1.64	215	1.47
UniSA	206	1.34	159	1.29	213	1.39	168	1.15
UU	230	1.50	189	1.53	179	1.17	129	0.88
VU	230	1.50	40	0.32	40	0.26	288	1.97
VUB	239	1.56	200	1.62	338	2.20	302	2.07
WUB	321	2.09	208	1.68	297	1.93	265	1.81
Total	**15364**	**100.00**	**12360**	**100.00**	**15362**	**100.00**	**14619**	**100.00**

Here, NWP= Number of web pages

LWP= Link web pages

SLWP= Self-link web pages

ELWP= External link web pages

Table 5.2.3 Distribution of web pages of private university sites in Bangladesh (Google, August 2013)

The following inferences were drawn from Table 5.2.3:

It was observed that International University of Business Agriculture & Technology (IUBAT) ranked 1st (442, 2.88%) in terms of total number of web pages. The least number of pages was noted against Feni University (16, 0.10%).

It was observed from the Table 5.2.3 that Port City International University (PCIU) ranked 1st (369, 2.99%) in terms of total number of link web pages. The least number of link pages was reported against American International University Bangladesh (3, 0.02%).

It was noted from the Table 5.2.3 that International University of Business Agriculture & Technology (IUBAT) ranked 1st (374, 2.43%) in terms of total number of self-link web pages. The lowest number self-link pages were reported for Feni University (19, 0.12%).

It was observed from the Table 5.2.3 that North South University (NSU) ranked 1st (401, 2.74%) in terms of total number of external link web pages. The lowest number external link pages were noted for Gono Bishwabidyalay (11, 0.08%).

5.2.4 Distribution of web and link pages: Blekko (April 2012)

University	NWP	%	LWP	%	SLWP	%	ELWP	%
AUST	821	6.18	225	7.18	77	3.14	6	4.08
ABU	×	0.00	×	0.00		0.00	×	0.00
AIUB	2,420	18.22	362	11.55	78	3.18	1	0.68
ASAUB	198	1.49	59	1.88	73	2.98	8	5.44
AUB	196	1.48	46	1.47	83	3.38	2	1.36
ADUST	16	0.12	1	0.03	14	0.57	0	0.00
BIU	80	0.60	38	1.21	77	3.14	3	2.04
BU	×	0.00	×	0.00	×	0.00	×	0.00
BUBT	×	0.00	×	0.00	×	0.00	×	0.00
BCGTUB	37	0.28	22	0.70	54	2.20	2	1.36
BRACU	841	6.33	152	4.85	149	6.08	4	2.72
CWU	39	0.29	11	0.35	16	0.65	3	2.04
CUB	31	0.23	11	0.35	56	2.28	5	3.40
DIU	1051	7.91	190	6.06	252	10.28	25	17.01
DIUBD	198	1.49	61	1.95	92	3.75	5	3.40
DhIU	107	0.81	45	1.44	104	4.24	1	0.68
EDU	73	0.55	20	0.64	57	2.32	2	1.36
EWU	2,152	16.20	192	6.13	0	0.00	0	0.00
EU	18	0.14	52	1.66	69	2.81	2	1.36
GB	12	0.09	12	0.38	14	0.57	2	1.36
GUB	136	1.02	28	0.89	0	0.00	2	1.36
IBAIS	×	0.00		0.00		0.00	×	0.00
IUB	191	1.44	152	4.85	147	6.00	3	2.04
IIUC	361	2.72	139	4.44	96	3.92	5	3.40
IUBAT	174	1.31	181	5.78	73	2.98	2	1.36
LU	×	0.00		0.00		0.00	×	0.00
MIU	66	0.50	57	1.82	43	1.75	1	0.68
MU	3	0.02	55	1.75	21	0.86	35	23.81
NSU	2448	18.43	339	10.82	0	0.00	0	0.00
NUB	×	0.00	×	0.00	×	0.00	×	0.00
PUC	×	0.00	×	0.00	×	0.00	×	0.00
PU	40	0.30	0	0.00	0	0.00	0	0.00
Prime	118	0.89	19	0.61	56	2.28	3	2.04
Primeasia	×	0.00	×	0.00	×	0.00	×	0.00
QU	54	0.41	33	1.05	87	3.55	0	0.00
RUD	8	0.06	0	0.00	0	0.00	0	0.00
SMUCT	×	0.00	×	0.00	×	0.00	×	0.00
SEU	42	0.32	96	3.06	104	4.24	0	0.00
SU	×	0.00	×	0.00	×	0.00	×	0.00
SUB	321	2.42	83	2.65	93	3.79	4	2.72
SUBD	94	0.71	36	1.15	62	2.53	4	2.72

Table 5.2.4 (Continued)

SIU	23	0.17	0	0.00	0	0.00	0	0.00
TMU	×	0.00	×	0.00	×	0.00	×	0.00
PUB	×	0.00	×	0.00	×	0.00	×	0.00
UAP	94	0.71	136	4.34	11	0.45	1	0.68
UIU	×	0.00	×	0.00	×	0.00	×	0.00
UODA	88	0.66	30	0.96	0	0.00	0	0.00
UITS	85	0.64	25	0.80	71	2.90	2	1.36
ULAB	495	3.73	67	2.14	83	3.38	5	3.40
USTC	43	0.32	0	0.00	0	0.00	0	0.00
UniSA	19	0.14	54	1.72	49	2.00	1	0.68
UU	×	0.00	×	0.00	×	0.00	×	0.00
VUB	24	0.18	54	1.72	78	3.18	3	2.04
WUB	66	0.50	51	1.63	113	4.61	5	3.40
Total	**13283**	**100.00**	**3134**	**100.00**	**2452**	**100.00**	**147**	**100.00**

Here, NWP= Number of web pages

LWP= Link web pages

SLWP= Self-link web pages

ELWP= External link web pages

Table 5.2.4 Distribution of web pages of private university sites in Bangladesh (Blekko, April 2012)

The following conclusions were drawn from Table 5.2.4:

It was observed that North South University (NSU) ranked 1st (2448, 18.43%) in terms of total number of web pages. The least number of web pages was noted against Metropolitan University, Sylhet (3, 0.02%).

It was witnessed from the Table 5.2.4 that American International University Bangladesh (AIUB) ranked 1st (362, 11.55%) in terms of total number of link web pages. The lowest number link web pages were noted against Atish Dipankar University of Science & Technology (1, 0.03%).

It was perceived from the Table 5.2.4 that Daffodil International University (DIU) ranked 1st (252, 10.28%) in terms of total number of self-link web pages. The lowest number of pages was recorded for The University of Asia Pacific (11, 0.45%).

It was observed from the Table 5.2.4 that Metropolitan University, Sylhet (MU) ranked 1st (35, 23.81%) in terms of total number of external link web pages. The lowest number of external pages was reported against five universities, i.e. American International University Bangladesh (AIUB), Dhaka International University (DhIU), Manarat International University (MIU).

5.2.5 Distribution of web and link pages: Blekko (July 2012)

University	NWP	%	LWP	%	SLWP	%	ELWP	%
AUST	902	6.92	315	10.17	79	3.07	8	4.82
ABU	×	0.00	×	0.00	×	0.00	×	0.00
AIUB	2438	18.70	317	10.24	88	3.42	2	1.20
ASAUB	188	1.44	71	2.29	61	2.37	6	3.61
AUB	195	1.50	48	1.55	81	3.15	2	1.20
ADUST	21	0.16	26	0.84	29	1.13	2	1.20
BIU	72	0.55	41	1.32	84	3.26	2	1.20
BU	×	0.00	×	0.00	×	0.00	×	0.00
BUBT	×	0.00	×	0.00	×	0.00	×	0.00
BCGTUB	42	0.32	29	0.94	51	1.98	3	1.81
BRACU	712	5.46	158	5.10	178	6.92	8	4.82
CWU	41	0.31	13	0.42	11	0.43	2	1.20
CUB	38	0.29	9	0.29	55	2.14	5	3.01
DIU	812	6.23	187	6.04	244	9.48	28	16.87
DIUBD	202	1.55	69	2.23	102	3.96	5	3.01
DhIU	104	0.80	49	1.58	98	3.81	2	1.20
EDU	82	0.63	19	0.61	55	2.14	2	1.20
EWU	2124	16.29	22	0.71	0	0.00	0	0.00
EU	15	0.12	64	2.07	72	2.80	3	1.81
GB	18	0.14	15	0.48	22	0.85	2	1.20
GUB	141	1.08	31	1.00	2	0.08	1	0.60
IBAIS	×	0.00	×	0.00	×	0.00	×	0.00
IUB	182	1.40	161	5.20	162	6.29	3	1.81
IIUC	337	2.58	142	4.59	93	3.61	5	3.01
IUBAT	176	1.35	185	5.97	61	2.37	2	1.20
LU	×	0.00	×	0.00	×	0.00	×	0.00
MIU	61	0.47	48	1.55	52	2.02	2	1.20
MU	5	0.04	56	1.81	29	1.13	31	18.67
NSU	2488	19.08	335	10.82	1	0.04	0	0.00
NUB	×	0.00	×	0.00	×	0.00	×	0.00
PUC	×	0.00	×	0.00	×	0.00	×	0.00
PU	39	0.30	0	0.00	0	0.00	0	0.00
Prime	122	0.94	20	0.65	56	2.18	3	1.81
Primeasia	×	0.00	×	0.00	×	0.00	×	0.00
QU	61	0.47	36	1.16	93	3.61	3	1.81
RUD	12	0.09	0	0.00	0	0.00	0	0.00
SMUCT	×	0.00	×	0.00	×	0.00	×	0.00
SEU	39	0.30	98	3.16	115	4.47	1	0.60
SU	×	0.00	×	0.00	×	0.00	×	0.00
SUB	335	2.57	88	2.84	82	3.19	5	3.01
SUBD	97	0.74	42	1.36	74	2.87	5	3.01
SIU	21	0.16	0	0.00	0	0.00	0	0.00
TMU	×	0.00	×	0.00	×	0.00	×	0.00
PUB	×	0.00	×	0.00	×	0.00	×	0.00
UAP	89	0.68	137	4.42	22	0.85	2	1.20
UIU	×	0.00	×	0.00	×	0.00	×	0.00
UODA	121	0.93	22	0.71	3	0.12	0	0.00
UITS	88	0.67	25	0.81	94	3.65	3	1.81

Table 5.2.5 (Continued)

ULAB	464	3.56	52	1.68	79	3.07	7	4.22
USTC	48	0.37	0	0.00	1	0.04	2	1.20
UniSA	11	0.08	49	1.58	45	1.75	2	1.20
UU	×	0.00	×	0.00	×	0.00	×	0.00
VUB	28	0.21	59	1.91	81	3.15	3	1.81
WUB	68	0.52	59	1.91	119	4.62	4	2.41
Total	**13039**	**100.00**	**3097**	**100.00**	**2574**	**100.00**	**166**	**100.00**

Here, NWP= Number of web pages

LWP= Link web pages

SLWP= Self-link web pages

ELWP= External link web pages

Table 5.2.5 Distribution of web pages of private university sites in Bangladesh (Blekko, July 2012)

The following inferences were drawn from Table 5.2.5:

It was observed that North South University (NSU) ranked 1st (2488, 19.08%) in terms of total number of web pages. The lowest number of pages was recorded against Metropolitan University, Sylhet (5, 0.04%).

It was witnessed from the Table 5.2.5 that North South University (NSU) ranked 1st (335, 10.82%) in terms of total number of link web pages. The least number of link pages was noted against City University (9, 0.29%).

It was perceived from the Table 5.2.5 that Daffodil International University (DIU) ranked 1st (244, 9.48%) in terms of total number of self-link web pages. The lowest number of self-link pages was recorded for North South University (NSU) and University of Science & Technology, Chittagong (USTC).

It was observed from the Table 5.2.5 that Metropolitan University, Sylhet (MU) ranked 1st (31, 18.67%) In terms of total number of external link web pages. The lowest number of external link pages was noticed for Green University of Bangladesh (GUB) and Southeast University (SEU).

5.3 Link Structure Analysis (WIF) of websites of private universities

5.3.1 Introduction

In this section, the link structure analysis of websites of private universities in Bangladesh is presented. The link structure analysis covers Simple Web Impact Factor, Self-link Web Impact Factor and External link Web Impact Factor to rank them by their respective WIFs. The method for calculating these web impact factors was explained in Chapter 4.

5.3.2 Web Impact Factor (WIF) - Blekko, April 2012

5.3.2.1 University Ranking based on Simple WIF

Rank distribution of universities in Bangladesh according to their Simple Web Impact Factor (SWIF) is shown in Table 5.3.2.1. The SWIF for each university was calculated by dividing the number of link pages (B) with the number of web pages (A). Metropolitan University, Sylhet occupied the 1st place with a score of 18.33. Eastern University and University of South Asia were at the 2nd and 3rd positions respectively. Although North South University (2448) had more number of web pages than the top three universities, it occupied 33rd position because the number of link pages was less compared to its number of web pages. American International University Bangladesh (2420) and East West University (2152) had more number of web pages among the universities; they were ranked 32nd and 35th respectively.

5.3.2.2 University Ranking based on Self-link WIF

The self-link WIF of private universities in Bangladesh is shown in Table 5.3.2.2. Metropolitan University, Sylhet again occupied the 1st place with a score of 7.00 SLWIF. Eastern University, Victoria University of Bangladesh and University of South Asia were ranked 2nd, 3rd and 4th with SLWIF of 3.83, 3.25 and 2.58 respectively. American International University Bangladesh occupied the lowest position with SLWIF score of only 0.03.

5.3.2.3 University Ranking based on External link WIF

Table 5.3.2.3 illustrates the rank distribution of the private universities websites of Bangladesh according to their External Web Impact Factor. Metropolitan University, Sylhet again occupied the top-ranked position with external web impact factor of 11.76. Gono Bishwabidyalay, City

University and Victoria University of Bangladesh occupied the 2nd, 3rd and 4th positions with the external WIF of 0.17, 0.16 and 0.13 respectively.

5.3.3 Web Impact Factor (WIF) - Blekko, July 2012

5.3.3.1 University Ranking based on Simple WIF

Rank distribution of universities in Bangladesh according to their Simple Web Impact Factor (SWIF) is shown in Table 5.3.3.1. The SWIF for each university was calculated by dividing the number of link pages (B) with the number of web pages (A). Metropolitan University, Sylhet occupied the 1st place with a SWIF of 11.20. University of South Asia and Eastern University were at 2nd and 3rd positions respectively. Although North South University of (2488) had more number of web pages than the top-three websites, it occupied 33rd position because the number of link pages was lower compared to its number of web pages. Similarly, University of Liberal Arts (464) and East West University (2124) had more number of web pages than other university websites but they ranked 35th and 36th respectively.

5.3.3.2 University Ranking based on Self-link WIF

The self-link WIF of private universities in Bangladesh is shown in Table 5.3.3.2. Metropolitan University, Sylhet occupied the 1st place with SLWIF score of 5.80. Eastern University, Southeast University and Victoria University of Bangladesh were ranked at 2nd, 3rd and 4th with SLWIF of 4.80, 2.95 and 2.89 respectively. Furthermore, University of Science & Technology, Chittagong and Green University of Bangladesh occupied lowest rank positions with SLWIF as 0.02 and 0.01 respectively.

5.3.3.3 University Ranking based on External link WIF

Table 5.3.3.3 illustrates the rank distribution of the private universities websites of Bangladesh according to their external Web Impact Factor. Metropolitan University, Sylhet occupied the 1st place with external web impact factor of 6.20. Eastern University, City University and University of South Asia occupied the 2nd, 3rd and 4th positions with the external WIF of 0.20, 0.13 and 0.12 respectively.

5.3.4 Web Impact Factor (WIF) - Google, July 2012

5.3.4.1 University Ranking based on Simple WIF

Rank distribution of universities in Bangladesh according to their Simple Web Impact Factor (SWIF) is shown in Table 5.3.4.1. The SWIF for each university was calculated by dividing the number of link pages (B) with the number of web pages (A). Ahsanullah University of Science & Technology occupied the 1st place with 1.33 SWIF score. Atish Dipankar University of Science & Technology and Stamford University were at 2nd and 3rd positions with 0.92 and 0.90 SWIF scores. Although Daffodil International University (490) had more number of web pages than the top-three websites, it occupied 14th position due to its number of link pages was less compared to number of web pages. The University of Asia Pacific (344) and Independent University Bangladesh (486) had more number of web pages than other university websites but they ranked at 30th and 31th places accordingly.

5.3.4.2 University Ranking based on Self-link WIF

The self-link WIF of private universities in Bangladesh is shown in Table 5.3.4.2. International University of Business and Technology occupied the 1st place with 1.02 SLWIF score. University of Science & Technology, Chittagong, BRAC University and University of Development Alternative were ranked at 2nd, 3rd and 4th places with SLWIF of 1.01, 0.91, and 0.90 respectively. Furthermore, Central Women's University and North South Universities occupied the lower positions with SLWIF as 0.26 and 0.32 respectively.

5.3.4.3 University Ranking based on External link WIF

Table 5.3.4.3 illustrates the rank distribution of the private universities websites of Bangladesh according to their external Web Impact Factor. Asian University of Bangladesh occupied the top place with external web impact factor of 1.07. The Peoples University of Bangladesh, Ahsanullah University of Science and Technology and Bangladesh University occupied the 2nd, 3rd and 4th positions with external WIF of 1.06, 0.96 and 0.94 respectively.

5.3.5 Web Impact Factor (WIF) - Google, August 2013

5.3.5.1 University Ranking based on Simple WIF

Rank distribution of universities in Bangladesh according to their Simple Web Impact Factor (SWIF) is shown in Table 5.3.5.1. In 2013, 12 new private universities were added for analysis. The SWIF for each university was calculated by dividing the number of link pages (B) with the number of web pages (A). Royal University of Dhaka occupied the 1st place with a SWIF score of 2.03. Ishakha International University and Khwaja Yunus Ali University were at 2nd and 3rd positions. It was observed that although International University of Business Agriculture & Technology (442) had more number of web pages than top-ranked websites, it occupied 33rd position because the number of link pages was less compared to its number of web pages. East West University (399) and The University of Asia Pacific (415) had more number of web pages than all the other universities websites but paced 42nd and 46th positions respectively.

5.3.5.2 University Ranking based on Self-link WIF

The self-link WIF of private universities in Bangladesh is shown in Table 5.3.5.2. The Peoples University of Bangladesh occupied the 1st place with 2.79 SLWIF score. Khwaja Yunus Ali University, Ishakha International University and Royal University of Dhaka were ranked at 2nd, 3rd and 4th with SLWIF of 1.90, 1.84 and 1.79 respectively. Furthermore, The Millenium University and Varendra University occupied lowest positions with SLWIF as 0.52 and 0.17 accordingly.

5.3.5.3 University Ranking based on External link WIF

Table 5.3.5.3 illustrates the rank distribution of the private universities websites of Bangladesh according to their external Web Impact Factor. The Peoples University of Bangladesh occupied the top place with external web impact factor of 2.66. The Royal University of Dhaka, First Capital University of the Bangladesh and Sylhet International University occupied 2nd, 3rd and 4th positions with the External link WIF of 2.48, 1.91 and 1.75 respectively.

University Name	NWP (A)	LWP (B)	SWIF (B/A)	Rank
Metropolitan University, Sylhet	3	55	18.33	1
Eastern University	18	52	2.89	2
University of South Asia	19	54	2.84	3
Southeast University	42	96	2.28	4
Victoria University of Bangladesh	24	54	2.25	5
The University of Asia Pacific	94	136	1.45	6
International Univ. of Business Agriculture & Tech.	174	181	1.04	7
Gono Bishwabidyalay	12	12	1.00	8
Manarat International University	66	57	0.86	9
Independent University, Bangladesh	191	152	0.79	10
World University of Bangladesh	66	51	0.77	11
Queens University	54	33	0.61	12
BGC Trust University Bangladesh, Chittagong	37	22	0.59	13
Bangladesh Islami University	80	38	0.47	14
Dhaka International University	107	45	0.42	15
State University of Bangladesh	94	36	0.38	16
International Islamic University, Chittagong	361	139	0.38	17
City University	31	11	0.35	18
University of Development Alternative	88	30	0.34	19
Darul Ihsan University	198	61	0.31	20
ASA University Bangladesh	198	59	0.29	21
University of Information Technology & Sciences	85	25	0.29	22
Central Women's University*	39	11	0.28	23
Ahsanullah University of Science and Technology	821	225	0.27	24
East Delta University	73	20	0.27	25
Stamford University, Bangladesh	321	83	0.26	26
Asian University of Bangladesh	196	46	0.23	27
Green University of Bangladesh	136	28	0.21	28
Daffodil International University	1051	190	0.18	29
BRAC University	841	152	0.18	30
Prime University	118	19	0.16	31
American International University Bangladesh	2,420	362	0.15	32
North South University	2448	339	0.14	33
University of Liberal Arts Bangladesh	495	67	0.13	34
Atish Dipankar University of Science & Technology	16	1	0.12	35
East West University	2,152	192	0.10	36
Royal University of Dhaka	8	0	0	37
Sylhet International University	23	0	0	38
University of Science & Technology, Chittagong	43	0	0	39
Presidency University	40	0	0	40
Bangladesh University*	×	×	×	×
Primeasia University (test) *	×	×	×	×
Shanto Mariam University of Creative Technology*	×	×	×	×
Uttara University*	×	×	×	×
Southern University of Bangladesh*	×	×	×	×
The Peoples University of Bangladesh*	×	×	×	×
Bangladesh University of Business & Technology*	×	×	×	×
Premier University, Chittagong*	×	×	×	×
Northern University Bangladesh*	×	×	×	×

Table 5.3.2.1 (Continued)

IBAIS University*	×	×	×	×
The Millenium University*	×	×	×	×
American Bangladesh University*	×	×	×	×
Leading University*	×	×	×	×
United International University*	×	×	×	×

Note: * The University website was showed no result due to some problem on the time of study.

Table 5.3.2.1 Simple Web Impact Factor for private universities in Bangladesh (Blekko, April 2012)

University Name	NWP (A)	SLWP(C)	SLWIF (C/A)	Rank
Metropolitan University, Sylhet	3	21	7.00	1
Eastern University	18	69	3.83	2
Victoria University of Bangladesh	24	78	3.25	3
University of South Asia	19	49	2.58	4
Southeast University	42	104	2.48	5
City University	31	56	1.81	6
World University of Bangladesh	66	113	1.71	7
Queens University	54	87	1.61	8
BGC Trust University Bangladesh, Chittagong	37	54	1.46	9
Gono Bishwabidyalay	12	14	1.26	10
Dhaka International University	107	104	0.97	11
Bangladesh Islami University	80	77	0.96	12
Atish Dipankar University of Science & Technology	16	14	0.87	13
University of Information Technology & Sciences	85	71	0.83	14
East Delta University	73	57	0.78	15
Independent University, Bangladesh	191	147	0.77	16
State University of Bangladesh	94	62	0.66	17
Manarat International University	66	43	0.65	18
Prime University	118	56	0.47	19
Darul Ihsan University	198	92	0.46	20
International Univ of Business Agriculture & Tech.	174	73	0.42	21
Asian University of Bangladesh	196	83	0.42	22
Central Women's University	39	16	0.41	23
ASA University Bangladesh	198	73	0.37	24
Stamford University, Bangladesh	321	93	0.29	25
International Islamic University, Chittagong	361	96	0.26	26
Daffodil International University	1051	252	0.24	27
BRAC University	841	149	0.18	28
University of Liberal Arts Bangladesh	495	83	0.17	29
The University of Asia Pacific	94	11	0.12	30
Ahsanullah University of Science and Technology	821	77	0.09	31
American International University Bangladesh	2,420	78	0.03	32
East West University	2,152	0	0	33
Royal University of Dhaka	8	0	0	34
Sylhet International University	23	0	0	35
University of Science & Technology, Chittagong	43	0	0	36
Presidency University	40	0	0	37
University of Development Alternative	88	0	0	38
North South University	2448	0	0	39
Green University of Bangladesh	136	0	0	40
Bangladesh University*	×	×	×	×
Primeasia University (test) *	×	×	×	×
Shanto Mariam University of Creative Technology*	×	×	×	×
Uttara University*	×	×	×	×
Southern University of Bangladesh*	×	×	×	×
The Peoples University of Bangladesh*	×	×	×	×
Bangladesh University of Business & Technology*	×	×	×	×
Premier University, Chittagong*	×	×	×	×
Northern University Bangladesh*	×	×	×	×

Table 5.3.2.2 (Continued)

IBAIS University*	×	×	×	×
The Millenium University*	×	×	×	×
American Bangladesh University*	×	×	×	×
Leading University*	×	×	×	×
United International University*	×	×	×	×

Note: *The University website was showed no result due to some problem on the time of study.

Table 5.3.2.2 Self-link Web Impact Factor for private universities in Bangladesh (Blekko, April 2012)

University Name	NWP (A)	ELWP (D)	ELWIF (D/A)	Rank
Metropolitan University, Sylhet	3	35	11.67	1
Gono Bishwabidyalay	12	2	0.17	2
City University	31	5	0.16	3
Victoria University of Bangladesh	24	3	0.13	4
Eastern University	18	2	0.11	5
Green University of Bangladesh	18	2	0.11	6
Central Women's University	39	3	0.08	7
World University of Bangladesh	66	5	0.08	8
BGC Trust University Bangladesh, Chittagong	37	2	0.05	9
University of South Asia	19	1	0.05	10
State University of Bangladesh	94	4	0.04	11
ASA University Bangladesh	198	8	0.04	12
Bangladesh Islami University	88	3	0.03	13
East Delta University	73	2	0.03	14
Prime University	118	3	0.03	15
Darul Ihsan University	198	5	0.03	16
Daffodil International University	1051	25	0.02	17
University of Information Technology & Sciences	85	2	0.02	18
Independent University, Bangladesh	191	3	0.02	19
Manarat International University	66	1	0.02	20
International Islamic University, Chittagong	361	5	0.01	21
Stamford University, Bangladesh	321	4	0.01	22
International Univ. of Business Agriculture & Tech.	174	2	0.01	23
The University of Asia Pacific	94	1	0.01	24
Asian University of Bangladesh	196	2	0.01	25
University of Liberal Arts Bangladesh	495	5	0.01	26
Dhaka International University	107	1	0.01	27
Ahsanullah University of Science and Technology	821	6	0.01	28
BRAC University	841	4	0.00	29
American International University Bangladesh	2,420	1	0.00	30
Queens University	54	0	0.00	31
Royal University of Dhaka	8	0	0.00	32
University of Development Alternative	88	0	0.00	33
North South University	2448	0	0.00	34
East West University	2,152	0	0.00	35
Presidency University	40	0	0.00	36
Sylhet International University	23	0	0.00	37
Atish Dipankar University of Science & Technology	16	0	0.00	38
Southeast University	42	0	0.00	39
University of Science & Technology, Chittagong	43	0	0.00	40
Premier University, Chittagong*	×	×	×	×
American Bangladesh University*	×	×	×	×
Primeasia University (test) *	×	×	×	×
IBAIS University*	×	×	×	×
Bangladesh University of Business & Technology*	×	×	×	×
Leading University*	×	×	×	×
Shanto Mariam University of Creative Technology*	×	×	×	×
The Peoples University of Bangladesh*	×	×	×	×
Bangladesh University*	×	×	×	×

Table 5.3.2.3 (Continued)

Northern University Bangladesh*	×	×	×	×
Southern University of Bangladesh*	×	×	×	×
United International University*	×	×	×	×
Uttara University*	×	×	×	×
The Millenium University*	×	×	×	×

Note: * The University website was showed no result due to some problem on the time of study.

Table 5.3.2.3 External link Web Impact Factor for private universities in Bangladesh (Blekko, April 2012)

University Name	NWP (A)	LWP (B)	SWIF (B/A)	Rank
Metropolitan University, Sylhet	5	56	11.2	1
University of South Asia	11	49	4.45	2
Eastern University	15	64	4.27	3
Southeast University	39	98	2.51	4
Victoria University of Bangladesh	28	59	2.11	5
The University of Asia Pacific	89	137	1.54	6
Atish Dipankar University of Science & Technology	21	26	1.24	7
International Univ. of Business Agriculture & Tech.	176	185	1.05	8
Independent University, Bangladesh	182	161	0.88	9
World University of Bangladesh	68	59	0.87	10
Gono Bishwabidyalay	18	15	0.83	11
Manarat International University	61	48	0.78	12
BGC Trust University Bangladesh, Chittagong	42	29	0.69	13
Queens University	61	36	0.59	14
Bangladesh Islami University	72	41	0.57	15
Dhaka International University	104	49	0.47	16
State University of Bangladesh	97	42	0.43	17
International Islamic University, Chittagong	337	142	0.42	18
ASA University Bangladesh	188	71	0.38	19
Ahsanullah University of Science and Technology	902	315	0.35	20
Darul Ihsan University	202	69	0.34	21
Central Women's University	41	13	0.32	22
University of Information Technology & Sciences	88	25	0.28	23
Stamford University, Bangladesh	335	88	0.26	24
Asian University of Bangladesh	195	48	0.25	25
City University	38	9	0.24	26
Daffodil International University	812	187	0.23	27
East Delta University	82	19	0.23	28
BRAC University	712	158	0.22	29
Green University of Bangladesh	141	31	0.22	30
University of Development Alternative	121	22	0.18	31
Prime University	122	20	0.16	32
American International University Bangladesh	2438	317	0.13	33
North South University	2488	335	0.13	34
University of Liberal Arts Bangladesh	464	52	0.11	35
East West University	2124	22	0.01	36
Royal University of Dhaka	12	0	0	37
Sylhet International University	21	0	0	38
University of Science & Technology, Chittagong	48	0	0	39
Presidency University	39	0	0	40
Bangladesh University*	×	×	×	×
Primeasia University (test)	×	×	×	×
Shanto Mariam University of Creative Technology*	×	×	×	×
Uttara University*	×	×	×	×
Southern University of Bangladesh*	×	×	×	×
The Peoples University of Bangladesh*	×	×	×	×
Bangladesh University of Business & Technology*	×	×	×	×
Premier University, Chittagong*	×	×	×	×
Northern University Bangladesh*	×	×	×	×

Table 5.3.3.1 (Contitued)

IBAIS University*	×	×	×	×
The Millenium University*	×	×	×	×
American Bangladesh University*	×	×	×	×
Leading University*	×	×	×	×
United International University*	×	×	×	×

Note: *The University website was showed no result due to some problem on the time of study.

Table 5.3.3.1 Simple Web Impact Factor for private universities in Bangladesh (Blekko, July 2012)

University Name	NWP (A)	SLWP(C)	SLWIF (C/A)	Rank
Metropolitan University, Sylhet	5	29	5.80	1
Eastern University	15	72	4.80	2
Southeast University	39	115	2.95	3
Victoria University of Bangladesh	28	81	2.89	4
University of South Asia	17	45	2.65	5
World University of Bangladesh	68	119	1.75	6
Queens University	61	93	1.52	7
City University	38	55	1.45	8
Atish Dipankar University of Science & Technology	21	29	1.38	9
Gono Bishwabidyalay	18	22	1.22	10
BGC Trust University Bangladesh, Chittagong	42	51	1.21	11
Bangladesh Islami University	72	84	1.17	12
University of Information Technology & Sciences	88	94	1.07	13
Dhaka International University	104	98	0.94	14
Independent University, Bangladesh	182	162	0.89	15
Manarat International University	61	52	0.85	16
State University of Bangladesh	97	74	0.76	17
East Delta University	82	55	0.67	18
Darul Ihsan University	202	102	0.50	19
Prime University	122	56	0.46	20
Asian University of Bangladesh	195	81	0.42	21
International Univ of Business Agriculture & Tech.	176	61	0.35	22
ASA University Bangladesh	188	61	0.32	23
Daffodil International University	812	244	0.30	24
International Islamic University, Chittagong	337	93	0.28	25
Central Women's University	41	11	0.27	26
BRAC University	712	178	0.25	27
The University of Asia Pacific	89	22	0.25	28
Stamford University, Bangladesh	335	82	0.24	29
University of Liberal Arts Bangladesh	464	79	0.17	30
Ahsanullah University of Science and Technology	902	79	0.09	31
American International University Bangladesh	2438	88	0.04	32
University of Development Alternative	121	3	0.02	33
University of Science & Technology, Chittagong	48	1	0.02	34
Green University of Bangladesh	141	2	0.01	35
North South University	2488	1	0.00	0
East West University	2541	0	0.00	0
Presidency University	39	0	0.00	0
Royal University of Dhaka	12	0	0.00	0
Sylhet International University	21	0	0.00	0
Bangladesh University*	×	×	×	×
Primeasia University (test) *	×	×	×	×
Shanto Mariam University of Creative Technology*	×	×	×	×
Uttara University*	×	×	×	×
Southern University of Bangladesh*	×	×	×	×
The Peoples University of Bangladesh*	×	×	×	×
Bangladesh University of Business & Technology*	×	×	×	×
Premier University, Chittagong*	×	×	×	×

Table 5.3.3.2 (Continued)

Northern University Bangladesh*	×	×	×	×
IBAIS University*	×	×	×	×
The Millenium University*	×	×	×	×
American Bangladesh University*	×	×	×	×
Leading University*	×	×	×	×
United International University*	×	×	×	×

Note * The University website showed no result at the time of this study.

Table 5.3.3.2 Self-link Web Impact Factor for private universities in Bangladesh (Blekko, July 2012)

University Name	NWP (A)	ELWP (D)	ELWIF (D/A)	Rank
Metropolitan University, Sylhet	5	31	6.20	1
Eastern University	15	3	0.20	2
City University	38	5	0.13	3
University of South Asia	17	2	0.12	4
Gono Bishwabidyalay	18	2	0.11	5
Victoria University of Bangladesh	28	3	0.11	6
Atish Dipankar University of Science & Technology	21	2	0.10	7
BGC Trust University Bangladesh, Chittagong	42	3	0.07	8
World University of Bangladesh	68	4	0.06	9
State University of Bangladesh	97	5	0.05	10
Queens University	61	3	0.05	11
Central Women's University	41	2	0.05	12
University of Science & Technology, Chittagong	48	2	0.04	13
Daffodil International University	812	28	0.03	14
University of Information Technology & Sciences	88	3	0.03	15
Manarat International University	61	2	0.03	16
ASA University Bangladesh	188	6	0.03	17
Bangladesh Islami University	72	2	0.03	18
Southeast University	39	1	0.03	19
Darul Ihsan University	202	5	0.02	20
Prime University	122	3	0.02	21
East Delta University	82	2	0.02	22
The University of Asia Pacific	89	2	0.02	23
Dhaka International University	104	2	0.02	24
Independent University, Bangladesh	182	3	0.02	25
University of Liberal Arts Bangladesh	464	7	0.02	26
Stamford University, Bangladesh	335	5	0.01	27
International Islamic University, Chittagong	337	5	0.01	28
International Univ. of Business Agriculture & Tech.	176	2	0.01	29
BRAC University	712	8	0.01	30
Asian University of Bangladesh	195	2	0.01	31
Ahsanullah University of Science and Technology	902	8	0.01	32
Green University of Bangladesh	141	1	0.01	33
American International University Bangladesh	2438	2	0.00	0
East West University	2541	0	0.00	0
North South University	2488	0	0.00	0
Presidency University	39	0	0.00	0
Royal University of Dhaka	12	0	0.00	0
Sylhet International University	21	0	0.00	0
University of Development Alternative	121	0	0.00	0
Premier University, Chittagong*	×	×	×	×
American Bangladesh University*	×	×	×	×
Primeasia University (test) *	×	×	×	×
IBAIS University*	×	×	×	×
Bangladesh University of Business & Technology*	×	×	×	×
Leading University*	×	×	×	×
Shanto Mariam University of Creative Technology*	×	×	×	×
The Peoples University of Bangladesh*	×	×	×	×
Bangladesh University*	×	×	×	×

Table 5.3.3.3 (Continued)

Northern University Bangladesh*	×	×	×	×
Southern University of Bangladesh*	×	×	×	×
United International University*	×	×	×	×
Uttara University*	×	×	×	×
The Millenium University*	×	×	×	×

Note: * The University website showed no result at the time of this study.

Table 5.3.3.3 External link Web Impact Factor for private universities in Bangladesh (Blekko, July 2012)

University Name	NWP (A)	LWP(B)	SWIF (B/A)	Rank
Ahsanullah University of Science and Technology	192	256	1.33	1
Atish Dipankar University of Science & Technology	13	12	0.92	2
Stamford University, Bangladesh	345	312	0.90	3
Green University of Bangladesh	19	17	0.89	4
University of Science & Technology, Chittagong	139	122	0.88	5
Manarat International University	128	112	0.88	6
University of Liberal Arts Bangladesh	156	133	0.85	7
University of South Asia	13	11	0.85	8
East Delta University	75	62	0.83	9
Metropolitan University, Sylhet	76	62	0.82	10
BRAC University	139	112	0.81	11
University of Development Alternative	77	62	0.81	12
The Peoples University of Bangladesh	177	142	0.80	13
Daffodil International University	490	385	0.79	14
Asian University of Bangladesh	229	175	0.76	15
Bangladesh University	16	12	0.75	16
Prime University	19	14	0.74	17
BGC Trust University Bangladesh, Chittagong	44	32	0.73	18
Royal University of Dhaka	11	8	0.73	19
Bangladesh Islami University	215	156	0.73	20
Primeasia University (test)	86	62	0.72	21
United International University	49	35	0.71	22
Premier University, Chittagong	188	132	0.70	23
Shanto Mariam University of Creative Technology	107	72	0.67	24
Southeast University	187	125	0.67	25
World University of Bangladesh	77	51	0.66	26
State University of Bangladesh	238	156	0.66	27
ASA University Bangladesh	192	125	0.65	28
American International University Bangladesh	56	36	0.64	29
The University of Asia Pacific	344	221	0.64	30
Independent University, Bangladesh	486	312	0.64	31
International Univ. of Business Agriculture & Tech.	89	56	0.63	32
Bangladesh University of Business & Technology	229	144	0.63	33
Sylhet International University	44	27	0.61	34
International Islamic University, Chittagong	239	145	0.61	35
Northern University Bangladesh	53	32	0.60	36
East West University	212	124	0.58	37
Leading University	162	92	0.57	38
Queens University	55	31	0.56	39
IBAIS University	57	32	0.56	40
Gono Bishwabidyalay	58	32	0.55	41
City University	95	51	0.54	42
Victoria University of Bangladesh	43	22	0.51	43
Dhaka International University	124	52	0.42	44
America Bangladesh University	12	5	0.42	45
The Millenium University	27	11	0.41	46
Southern University of Bangladesh	145	57	0.39	47
Darul Ihsan University	18	7	0.39	48
Central Women's University	34	13	0.38	49

Table 5.3.4.1 (Continued)

University of Information Technology & Sciences	99	35	0.35	50
Uttara University	31	9	0.29	51
Eastern University	164	47	0.29	52
Presidency University	121	24	0.20	53
North South University	230	40	0.17	54

Table 5.3.4.1 Simple Web Impact Factor for private universities in Bangladesh (Google, July 2012)

University Name	NWP (A)	SLWP (C)	SLWIF (C/A)	Rank
International Univ of Business Agriculture & Tech	89	91	1.02	1
University of Science & Technology, Chittagong	139	141	1.01	2
BRAC University	139	126	0.91	3
University of Development Alternative	77	69	0.90	4
Northern University Bangladesh	53	47	0.89	5
BGC Trust University Bangladesh, Chittagong	44	39	0.89	6
Bangladesh University	16	14	0.88	7
Sylhet International University	44	38	0.86	8
The Peoples University of Bangladesh	177	152	0.86	9
World University of Bangladesh	77	65	0.84	10
Prime University	19	16	0.84	11
Asian University of Bangladesh	229	189	0.83	12
Royal University of Dhaka	11	9	0.82	13
Bangladesh Islami University	215	175	0.81	14
Shanto Mariam University of Creative Technology	107	87	0.81	15
Independent University, Bangladesh	486	385	0.79	16
Green University of Bangladesh	19	15	0.79	17
University of South Asia	13	10	0.77	18
Victoria University of Bangladesh	43	33	0.77	19
ASA University Bangladesh	192	145	0.76	20
American Bangladesh University	12	9	0.75	21
Manarat International University	128	95	0.74	22
East Delta University	75	55	0.73	23
American International University Bangladesh	56	41	0.73	24
University of Liberal Arts Bangladesh	156	111	0.71	25
The University of Asia Pacific	344	242	0.70	26
Atish Dipankar University of Science & Technology	13	9	0.69	27
State University of Bangladesh	238	162	0.68	28
East West University	212	143	0.67	29
Metropolitan University, Sylhet	76	51	0.67	30
Bangladesh University of Business & Technology	229	153	0.67	31
City University	95	63	0.66	32
Primeasia University	86	57	0.66	33
Ahsanullah University of Science and Technology	192	126	0.66	34
Dhaka International University	124	81	0.65	35
Stamford University, Bangladesh	345	225	0.65	36
Southeast University	187	121	0.65	37
Daffodil International University	490	312	0.64	38
Darul Ihsan University	18	11	0.61	39
International Islamic University, Chittagong	239	141	0.59	40
IBAIS University	57	31	0.54	41
Southern University of Bangladesh	145	78	0.54	42
Leading University	162	86	0.53	43
United International University	49	26	0.53	44
The Millenium University	27	14	0.52	45
Gono Bishwabidyalay	58	29	0.50	46
Premier University, Chittagong	188	91	0.48	47
University of Information Technology & Sciences	99	42	0.42	48

Table 5.3.4.2 (Continued)

Queens University	55	23	0.42	49
Presidency University	121	47	0.39	50
Uttara University	31	11	0.35	51
Eastern University	164	58	0.35	52
North South University	230	73	0.32	53
Central Women's University	34	9	0.26	54

Table 5.3.4.2 Self-link Web Impact Factor for private universities in Bangladesh (Google, July 2012)

University Name	NWP (A)	ELWP (D)	ELWIF (D/A)	Rank
Asian University of Bangladesh	229	244	1.07	1
The Peoples University of Bangladesh	177	187	1.06	2
Ahsanullah University of Science and Technology	192	185	0.96	3
Bangladesh University	16	15	0.94	4
Metropolitan University, Sylhet	76	71	0.93	5
Leading University	162	151	0.93	6
Sylhet International University	44	41	0.93	7
University of Development Alternative	77	71	0.92	8
Bangladesh Islami University	215	198	0.92	9
Central Women's University	34	31	0.91	10
American International University Bangladesh	56	51	0.91	11
BRAC University	139	121	0.87	12
Primeasia University (test)	86	74	0.86	13
Victoria University of Bangladesh	43	37	0.86	14
Shanto Mariam University of Creative Technology	107	91	0.85	15
State University of Bangladesh	238	197	0.83	16
Independent University, Bangladesh	486	396	0.81	17
University of Science & Technology, Chittagong	139	113	0.81	18
Southeast University	187	152	0.81	19
Eastern University	164	132	0.80	20
World University of Bangladesh	77	61	0.79	21
United International University	49	38	0.78	22
Presidency University	121	92	0.76	23
International Univ. of Business Agriculture & Tech.	89	67	0.75	24
Premier University, Chittagong	188	141	0.75	25
Stamford University, Bangladesh	345	258	0.75	26
City University	95	71	0.75	27
University of Information Technology & Sciences	99	73	0.74	28
Royal University of Dhaka	11	8	0.73	29
ASA University Bangladesh	192	138	0.72	30
Bangladesh University of Business & Technology	229	162	0.71	31
The University of Asia Pacific	344	238	0.69	32
Queens University	55	38	0.69	33
University of Liberal Arts Bangladesh	156	107	0.69	34
Green University of Bangladesh	19	13	0.68	35
Daffodil International University	490	332	0.68	36
Darul Ihsan University	18	12	0.67	37
East Delta University	75	49	0.65	38
North South University	230	146	0.63	39
University of South Asia	13	8	0.62	40
BGC Trust University Bangladesh, Chittagong	44	27	0.61	41
Dhaka International University	124	76	0.61	42
Manarat International University	128	78	0.61	43
East West University	212	128	0.60	44
International Islamic University, Chittagong	239	142	0.59	45
Southern University of Bangladesh	145	83	0.57	46
Northern University Bangladesh	53	29	0.55	47
Atish Dipankar University of Science & Technology	13	7	0.54	48
IBAIS University	57	29	0.51	49

Table 5.3.4.3 (Continued)

Prime University	19	9	0.47	50
Gono Bishwabidyalay	58	25	0.43	51
The Millenium University	27	9	0.33	52
American Bangladesh University	12	3	0.25	53
Uttara University	31	7	0.23	54

Table 5.3.4.3 External link Web Impact Factor for private universities in Bangladesh (Google, July 2012)

University Name	NWP(A)	LWP(B)	SWIF (B/A)	Rank
Royal University of Dhaka	145	295	2.03	1
Ishakha International University	87	168	1.93	2
Khwaja Yunus Ali University	115	201	1.75	3
Port City International University	213	369	1.73	4
Feni University	16	23	1.44	5
State University of Bangladesh	200	286	1.43	6
United International University	207	284	1.37	7
Eastern University	192	256	1.33	8
University of Science & Technology, Chittagong	245	312	1.27	9
Queens University	271	343	1.27	10
Primeasia University (test)	181	229	1.27	11
Asian University of Bangladesh	187	234	1.25	12
Independent University, Bangladesh	196	226	1.15	13
University of Development Alternative	283	321	1.13	14
Ahsanullah University of Science and Technology	208	232	1.12	15
Central Women's University	201	218	1.08	16
The Peoples University of Bangladesh	111	120	1.08	17
Metropolitan University, Sylhet	262	275	1.05	18
BRAC University	185	191	1.03	19
Stamford University, Bangladesh	222	227	1.02	20
Bangladesh Islami University	168	168	1.00	21
BGMEA Univ. of Fashion & Technology (BUFT)	297	296	1.00	22
Sylhet International University	192	187	0.97	23
City University	194	183	0.94	24
Bangladesh University of Business & Technology	312	289	0.93	25
North East University Bangladesh	217	199	0.92	26
Green University of Bangladesh	206	176	0.85	27
Leading University	222	188	0.85	28
Victoria University of Bangladesh	239	200	0.84	29
Uttara University	230	189	0.82	30
Shanto Mariam University of Creative Technology	262	214	0.82	31
International Univ. of Business Agriculture & Tech.	442	355	0.80	32
Southeast University	215	171	0.80	33
East Delta University	287	227	0.79	34
ASA University Bangladesh	316	247	0.78	35
University of Liberal Arts Bangladesh	333	260	0.78	36
Premier University, Chittagong	262	204	0.78	37
University of South Asia	206	159	0.77	38
Daffodil International University	285	216	0.76	39
BGC Trust University Bangladesh, Chittagong	201	152	0.76	40
East West University	399	292	0.73	41
IBAIS University	337	237	0.70	42
Manarat International University	276	194	0.70	43
Hamdard University Bangladesh	212	149	0.70	44
The University of Asia Pacific	415	291	0.70	45
International Islamic University, Chittagong	398	271	0.68	46
European University of Bangladesh	222	151	0.68	47
Atish Dipankar University of Science & Technology	328	223	0.68	48
World University of Bangladesh	321	208	0.65	49

Table 5.3.5.1 (Continued)

Prime University	222	143	0.64	50
Gono Bishwabidyalay	118	75	0.64	51
First Capital University of the Bangladesh	53	32	0.60	52
America Bangladesh University	188	104	0.55	53
University of Information Technology & Sciences	269	148	0.55	54
Darul Ihsan University	285	156	0.55	55
Dhaka International University	298	162	0.54	56
The Millenium University	99	52	0.53	57
Northern University Bangladesh	319	135	0.42	58
Southern University of Bangladesh	246	83	0.34	59
Britania University	249	50	0.20	60
Varendra University	230	40	0.17	61
Bangladesh University	153	23	0.15	62
Presidency University	255	21	0.08	63
North South University	380	27	0.07	64
American International University Bangladesh	279	3	0.01	65

Table 5.3.5.1 Simple Web Impact Factor for private universities in Bangladesh

(Google, August 2013)

University Name	NWP (A)	SLWP (C)	SLWIF (C/A)	Rank
The Peoples University of Bangladesh	111	310	2.79	1
Khwaja Yunus Ali University	115	219	1.90	2
Ishakha International University	87	160	1.84	3
Royal University of Dhaka	145	260	1.79	4
Bangladesh Islami University	168	299	1.78	5
Sylhet International University	192	315	1.64	6
Port City International University	213	343	1.61	7
Southeast University	215	338	1.57	8
Independent University, Bangladesh	196	297	1.52	9
Central Women's University	201	300	1.49	10
European University of Bangladesh	222	328	1.48	11
United International University	207	297	1.43	12
Victoria University of Bangladesh	239	338	1.41	13
University of Information Technology & Sciences	269	352	1.31	14
Bangladesh University	153	197	1.29	15
Queens University	271	348	1.28	16
Britania University	249	317	1.27	17
Asian University of Bangladesh	187	237	1.27	18
Primeasia University	181	229	1.27	19
Leading University	222	277	1.25	20
State University of Bangladesh	200	238	1.19	21
Feni University	16	19	1.19	22
Ahsanullah University of Science and Technology	208	246	1.18	23
Eastern University	192	223	1.16	24
Premier University, Chittagong	262	298	1.14	25
BGMEA Univ. of Fashion & Technology (BUFT)	297	335	1.13	26
Stamford University, Bangladesh	222	245	1.10	27
University of Development Alternative	283	312	1.10	28
BRAC University	185	202	1.09	29
University of South Asia	206	213	1.03	30
University of Science & Technology, Chittagong	245	252	1.03	31
American International University Bangladesh	279	283	1.01	32
Presidency University	255	258	1.01	33
Hamdard University Bangladesh	212	214	1.01	34
Metropolitan University, Sylhet	262	263	1.00	35
First Capital University of the Bangladesh	53	52	0.98	36
World University of Bangladesh	321	297	0.93	37
City University	194	179	0.92	38
Green University of Bangladesh	206	182	0.88	39
International Univ. of Business Agriculture & Tech.	442	374	0.85	40
Bangladesh University of Business & Technology	312	262	0.84	41
East Delta University	287	238	0.83	42
Southern University of Bangladesh	246	204	0.83	43
Shanto Mariam University of Creative Technology	262	217	0.83	44
Daffodil International University	285	231	0.81	45
University of Liberal Arts Bangladesh	333	264	0.79	46
ASA University Bangladesh	316	247	0.78	47
Uttara University	230	179	0.78	48
BGC Trust University Bangladesh, Chittagong	201	153	0.76	49

Table 5.3.5.2 (Continued)

North East University Bangladesh	217	165	0.76	50
East West University	399	300	0.75	51
The University of Asia Pacific	415	312	0.75	52
Darul Ihsan University	285	214	0.75	53
IBAIS University	337	239	0.71	54
Prime University	222	157	0.71	55
Manarat International University	276	192	0.70	56
Northern University Bangladesh	319	219	0.69	57
Atish Dipankar University of Science & Technology	328	216	0.66	58
International Islamic University Chittagong	398	262	0.66	59
North South University	380	240	0.63	60
Gono Bishwabidyalay	118	74	0.63	61
Dhaka International University	298	183	0.61	62
America Bangladesh University	188	99	0.53	63
The Millenium University	99	51	0.52	64
Varendra University	230	40	0.17	65

Table 5.3.5.2 Self-link Web Impact Factor for private universities in Bangladesh

(Google, August 2013)

University Name	NWP (A)	EWP(D)	ELWIF (D/A)	Rank
The Peoples University of Bangladesh	111	295	2.66	1
Royal University of Dhaka	145	360	2.48	2
First Capital University of the Bangladesh	53	101	1.91	3
Sylhet International University	192	336	1.75	4
Khwaja Yunus Ali University	115	189	1.64	5
Ishakha International University	87	139	1.60	6
State University of Bangladesh	200	287	1.44	7
Bangladesh Islami University	168	240	1.43	8
University of Information Technology & Sciences	269	372	1.38	9
Bangladesh University	153	211	1.38	10
Southeast University	215	291	1.35	11
Ahsanullah University of Science and Technology	208	275	1.32	12
Independent University, Bangladesh	196	258	1.32	13
Feni University	16	21	1.31	14
BGMEA Univ. of Fashion & Technology (BUFT)	297	385	1.30	15
Victoria University of Bangladesh	239	302	1.26	16
Green University of Bangladesh	206	260	1.26	17
Varendra University	230	288	1.25	18
United International University	207	259	1.25	19
Central Women's University*	201	247	1.23	20
Port City International University	213	259	1.22	21
Primeasia University (test)	181	218	1.20	22
Britania University	249	298	1.20	23
Asian University of Bangladesh	187	219	1.17	24
Leading University	222	240	1.08	25
North South University	380	401	1.06	26
Stamford University, Bangladesh	222	227	1.02	27
Hamdard University Bangladesh	212	214	1.01	28
Eastern University	192	193	1.01	29
Metropolitan University, Sylhet	262	256	0.98	30
Presidency University	255	243	0.95	31
University of Development Alternative	283	269	0.95	32
American International University Bangladesh	279	265	0.95	33
BRAC University	185	174	0.94	34
European University of Bangladesh	222	197	0.89	35
City University	194	172	0.89	36
University of Science & Technology, Chittagong	245	215	0.88	37
Bangladesh University of Business & Technology	312	268	0.86	38
Shanto Mariam University of Creative Technology	262	225	0.86	39
Premier University, Chittagong	262	218	0.83	40
World University of Bangladesh	321	265	0.83	41
University of South Asia	206	168	0.82	42
Queens University	271	220	0.81	43
North East University Bangladesh	217	170	0.78	44
International Univ. of Business Agriculture & Tech.	442	345	0.78	45
University of Liberal Arts Bangladesh	333	253	0.76	46
East Delta University	287	218	0.76	47
ASA University Bangladesh	316	232	0.73	48
The University of Asia Pacific	415	298	0.72	49

Table 5.3.5.3 (Continued)

Daffodil International University	285	202	0.71	50
Darul Ihsan University	285	201	0.71	51
Southern University of Bangladesh	246	162	0.66	52
Manarat International University	276	181	0.66	53
IBAIS University	337	221	0.66	54
BGC Trust University Bangladesh, Chittagong	201	129	0.64	55
East West University	399	254	0.64	56
Dhaka International University	298	185	0.62	57
International Islamic University, Chittagong	398	240	0.60	58
Northern University Bangladesh	319	192	0.60	59
Atish Dipankar University of Science & Technology	328	190	0.58	60
Uttara University	230	129	0.56	61
Prime University	222	123	0.55	62
America Bangladesh University	188	98	0.52	63
Gono Bishwabidyalay	118	54	0.46	64
The Millenium University	99	45	0.45	65

Table 5.3.5.3 External link Web Impact Factor for private universities in Bangladesh (Google, August 2013)

5.4 Private Universities Link Network

5.4.1 Introduction

In this section, the relationships among universities were measured and visualized from the webometric point of view. These relationships may be measured through hyperlink flows that point from one university to another. The overall network diagram of the universities is shown in Figures 5.4.1.1. The individual network diagrams for selected six universities are shown separately.

5.4.2 The academic web crawler

Thelwall (2001d, e) designed an academic crawler to overcome the problems of using search engines in collecting data on web links. Essentially, the crawler starts from the home page of a university website, extracts all links and then downloads the pages found that are on the same site. This process is repeated until all links have been followed. Through the use of the data collected in this way, the researcher has more control over the extent of coverage of sites, and can be in control of the algorithm used to count links from the database. The academic crawler can only crawl publicly indexable web pages that can be accessed by following the links (Lawrence and Giles, 1999). Web pages which are not linked (directly or indirectly) by the home

page of a university will not be covered, even if they are linked to by the Web pages outside the university. If the priority of a study is to achieve accurate link counts, the special academic crawler is a better choice than a search engine. In order to get rid of link anomalies, Alternative Document Models (ADMs) were used to count the number of links at different levels, for example, directory, domain or whole university site.

Alternative Document Model (ADM)

The advantage of academic web crawler is that it is a more scientific approach. There is a need for collecting data not only through commercial search engines but also academic web crawlers to overcome any biases. The advantage of academic crawler is that it is possible to cover individual website comprehensively within specified parameters (Thelwall, 2002d). It is not possible for web crawlers to cover large web areas for which search engines are most appropriate. With much criticism for the data collected from search engines, Thewall suggested using Alternative Document Model (ADM) to collect the link data for universities.

5.4.3 ADM and Link Analysis for Private Universities of Bangladesh (July 2012)

The raw data were collected using personal web crawler, i.e., SocSciBot 4.1 for private universities and ADM counts summary for private universities in Bangladesh during July 2012 is reflected in Table 5.4.3.1. Another ADM counts summary after three month in September 2012 is shown in Table 5.4.4.1.

The ADMs have four parts generally:

- Page level: original link data is transformed into page link data by truncating the URLs;
- Directory level: original link data is transformed into directory link data by truncating before the last slash of the URLs of all pages;
- Domain level: link data is transformed into domain link data by truncating the page and link URLs after the First slash following the domain name; and
- Whole university model: whole university will be regarded as the unit to count the links.

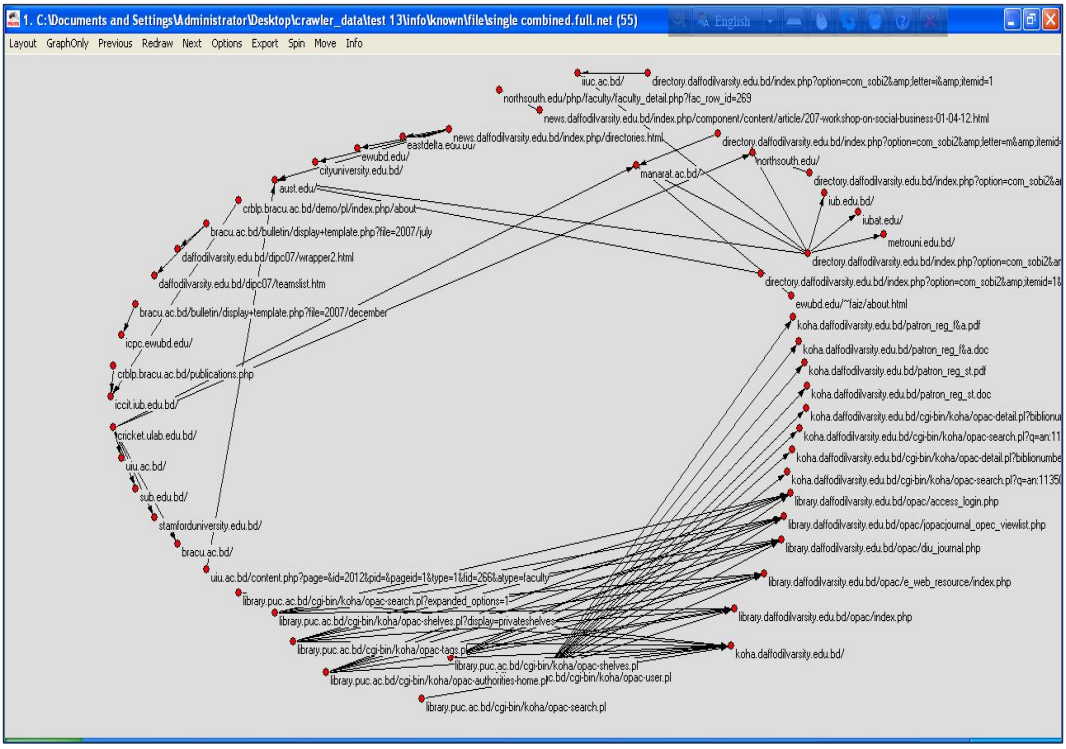

Figure: 5.4.1.1- Link topology for all private universities in Bangladesh in July - August 2012.

SocSciBot was used to extract the link data for the purpose of constructing link topology formed for private universities in Bangladesh as shown in Figure 5.4.1.1. It clearly indicates that the websites of private universities in Bangladesh are not well connected. Few bilateral links were observed from the Figure 5.4.1.1 but only 17 universities were connected to each other. For example, there were inlink between East West University and Manarat International University shown in Figure 5.4.1.2. BRAC University was connected with East West University, Daffodil International University and Independent University, Bangladesh, shown in Figure 5.4.1.3. Daffodil International University (DIU), as shown in Figure 5.4.1.4, had links with more than three universities. DIU had the highest number of inlinks with East West University, followed by City University, East Delta University, Ahsanullah University of Science & Technology, Manarat University, North South University, Independent University, International University of Business Agriculture & Technology, Metropolitan University and International Islamic University.

Figure 5.4.1.5 clearly that there was much closeness between Premier University, Chittagong and Daffodil International University.

Figure 5.4.1.6 shows that United International University had only Inlink with Ahsanullah University of Science & Technology (AUST). It was found that University of Liberal Arts Bangladesh (ULAB) had a large number of inlink with BRAC University, Manarat University, North South University, United International University, Stamford University Bangladesh and Southeast University Bangladesh as shown in Figure 5.4.1.7

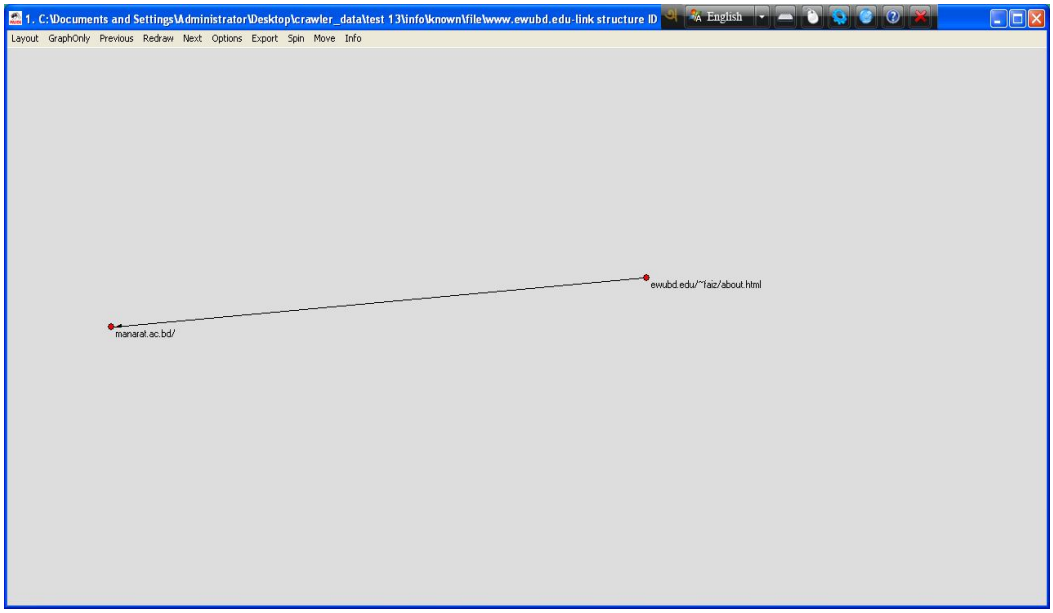

Figure: 5.4.1.2 –Link analysis for East West University

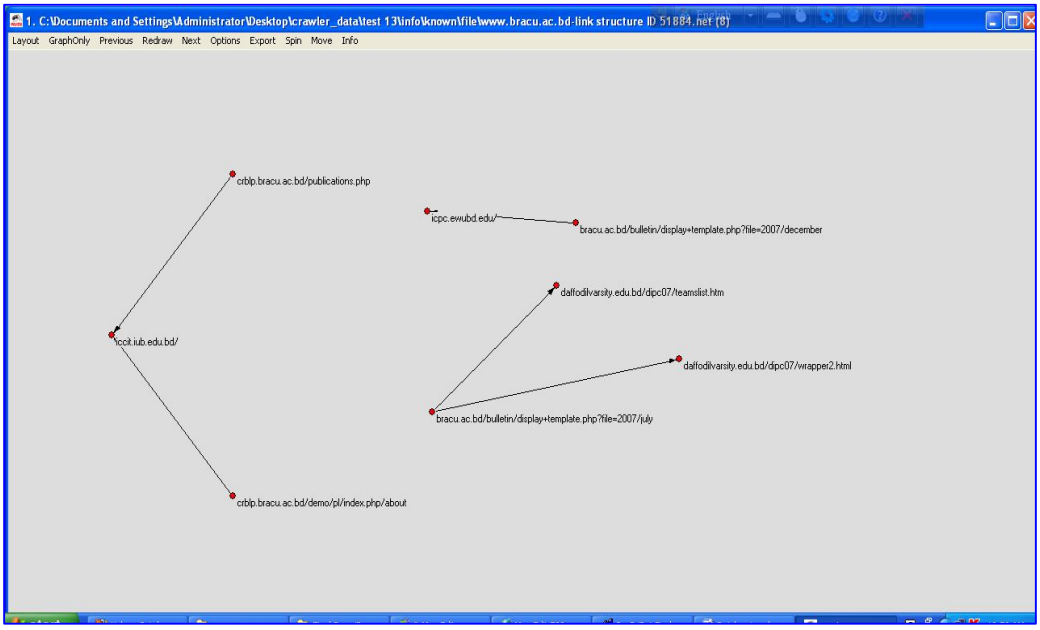

Figure 5.4.1.3—Link analysis for BRAC University

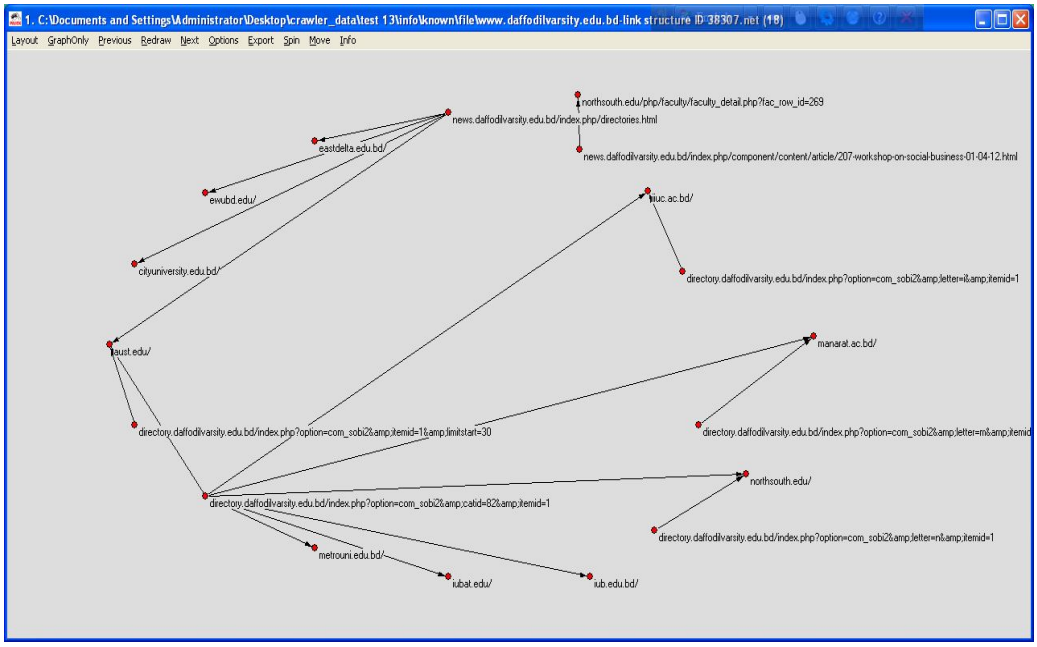

Figure 5.4.1.4—Link analysis for Daffodil International University

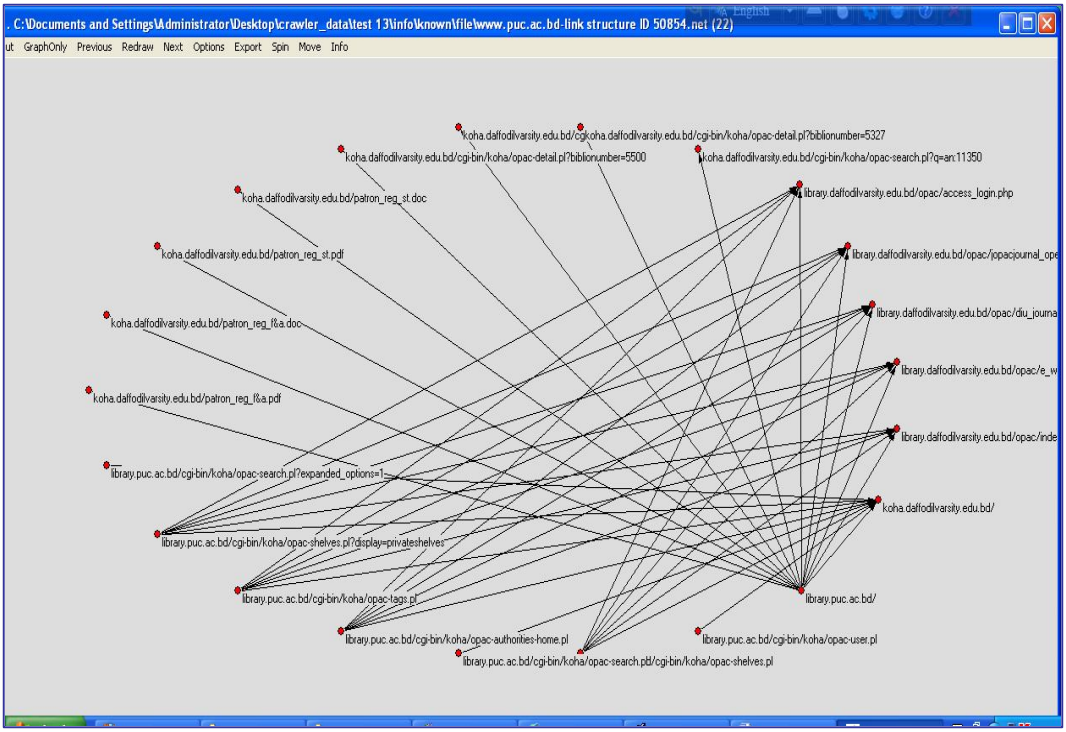

Figure 5.4.1.5—Link analysis for Premier University, Chittagong

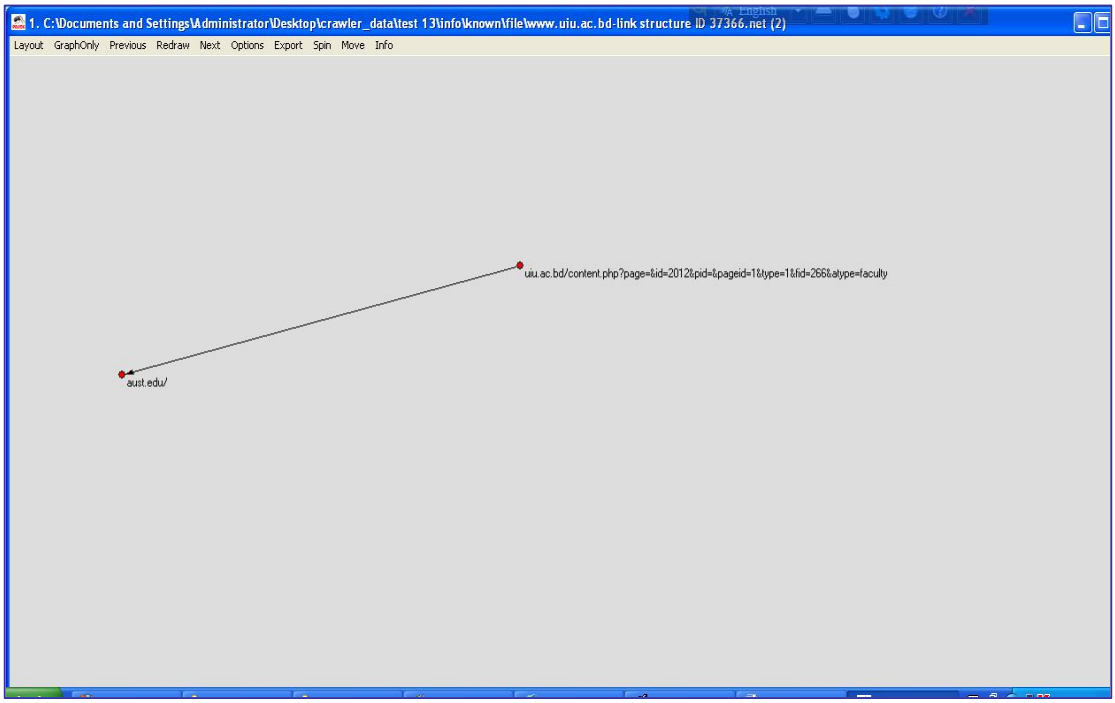

Figure 5.4.1.6—Link analysis for United International University

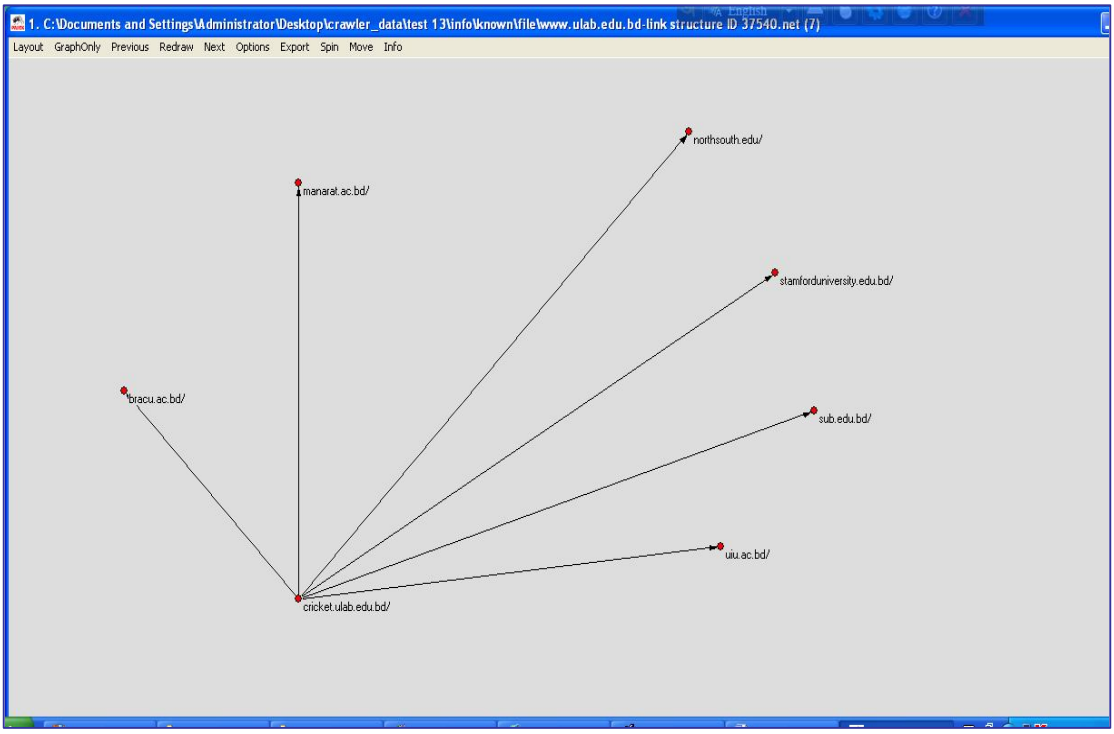

Figure 5.4.1.7—Link analysis for University of Liberal Arts Bangladesh

5.4.4 ADM and Link Analysis for Private Universities of Bangladesh (September 2012)

It is clear from Figure 5.4.4.1 that the private university websites were not well connected with each other. In July 2012, only 17 universities were linked with each other but this number rose to 27 in September. In September 2012, East West University was not only connected to Manarat International University but also to BRAC University and Daffodil International University. On the other hand, BRAC University and Daffodil University also increased their Inlink with more sites. Figure 5.4.4.1 and Figure 5.4.4.2 show the network topologies of the private university websites using Webometric Analyst Network software.

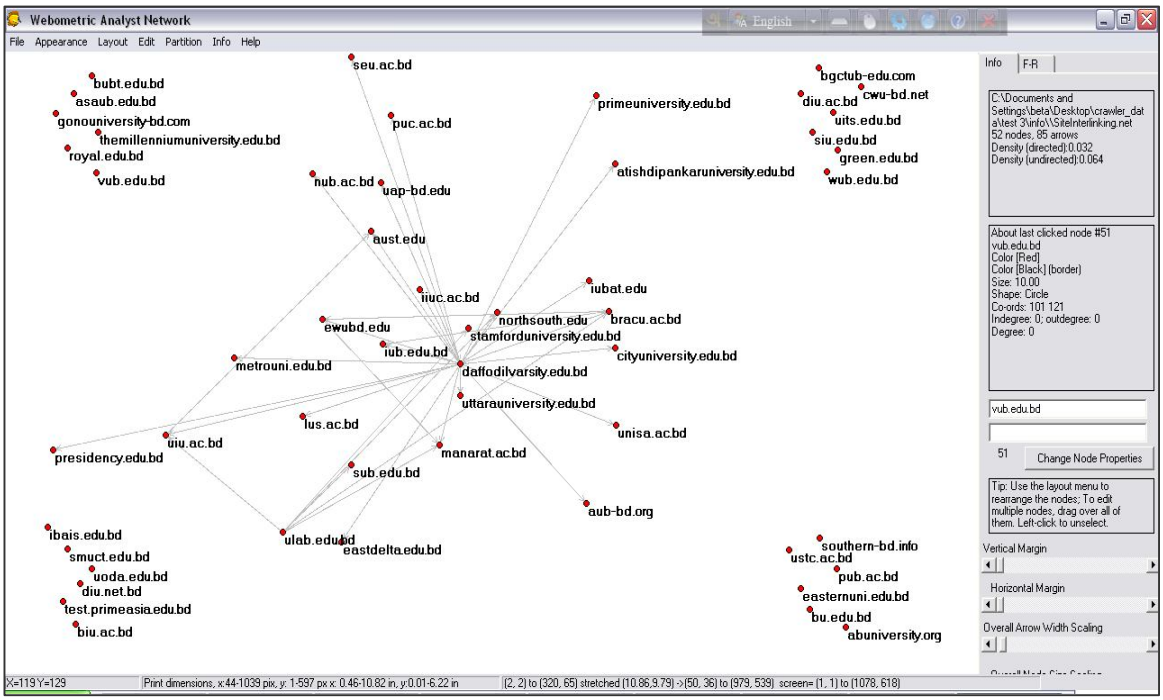

Figure 5.4.4.1—Link topology for all private university sites in Bangladesh using Webometric Analyst Network (September 2012)

University URL	Page inlinks	Directory inlinks	Domain inlinks	Site inlinks	Page outlinks	Directory outlinks	Domain outlinks	Site outlinks
ewuBangladesh .edu	2	2	2	2	1	1	1	1
bracu.ac. Bangladesh	1	1	1	1	5	4	3	3
northsouth.edu	4	3	3	2	0	0	0	0
aust.edu	4	3	3	2	0	0	0	0
iub.edu. Bangladesh	3	3	2	2	0	0	0	0
cityuniversity. edu.Bangladesh	1	1	1	1	0	0	0	0
daffodilvarsity. edu.Bangladesh	43	8	3	2	16	12	12	10
eastdelta.edu. Bangladesh	1	1	1	1	0	0	0	0
iiuc.ac. Bangladesh	2	1	1	1	0	0	0	0
iubat.edu	1	1	1	1	0	0	0	0
manarat.ac. Bangladesh	4	3	3	3	0	0	0	0
metrouni.edu. Bangladesh	1	1	1	1	0	0	0	0
puc.ac. Bangladesh	0	0	0	0	41	7	2	1
Stamford university. edu.Bangladesh	1	1	1	1	0	0	0	0
sub.edu. Bangladesh	1	1	1	1	0	0	0	0
uiu.ac. Bangladesh	1	1	1	1	1	1	1	1
ulab.edu. Bangladesh	0	0	0	0	6	6	6	6

Table: 5.4.3.1 ADM counts summary for private university sites in Bangladesh during (July 2012)

University URL	Page inlinks	Directory inlinks	Domain inlinks	Site inlinks	Page outlinks	Directory outlinks	Domain outlinks	Site outlinks
ewuBangladesh .edu	14	6	3	2	1	1	1	1
daffodilvarsity. edu.Bangladesh	43	8	3	2	90	49	34	23
northsouth.edu	10	7	4	2	0	0	0	0
aust.edu	19	7	4	2	0	0	0	0
iub.edu .Bangladesh	4	4	3	2	0	0	0	0
bracu.ac. Bangladesh	2	2	2	2	5	4	3	3
cityuniversity.edu. Bangladesh	13	5	2	1	0	0	0	0
eastdelta.edu. Bangladesh	12	4	1	1	0	0	0	0
iiuc.ac.Bangladesh	3	2	2	1	0	0	0	0
iubat.edu	2	2	2	1	0	0	0	0
manarat.ac. Bangladesh	4	3	3	3	0	0	0	0
metrouni.edu. Bangladesh	1	1	1	1	0	0	0	0
puc.ac.Bangladesh	1	1	1	1	41	7	2	1
Stamforduniversity. edu.Bangladesh	1	1	1	1	0	0	0	0
sub.edu. Bangladesh	1	1	1	1	0	0	0	0
uiu.ac. Bangladesh	2	2	2	2	1	1	1	1
ulab.edu. Bangladesh	0	0	0	0	6	6	6	6
Atishdipankar university.edu. Bangladesh	1	1	1	1	0	0	0	0
nub.ac. Bangladesh	1	1	1	1	0	0	0	0
abuniversity.org	0	0	0	0	0	0	0	0
asaub.edu. Bangladesh	0	0	0	0	0	0	0	0
aub-Bangladesh .org	1	1	1	1	0	0	0	0
biu.ac. Bangladesh	0	0	0	0	0	0	0	0
bu.edu. Bangladesh	0	0	0	0	0	0	0	0
bubt.edu. Bangladesh	0	0	0	0	0	0	0	0
bgctub-edu.com	0	0	0	0	0	0	0	0
cwu-Bangladesh .net	0	0	0	0	0	0	0	0
diu.ac.Bangladesh	0	0	0	0	0	0	0	0

Table: 5.4.4.1 (Continued)

diu.net. Bangladesh	0	0	0	0	0	0	0	0
easternuni.edu .Bangladesh	0	0	0	0	0	0	0	0
Gonouniversity -Bangladesh.com	0	0	0	0	0	0	0	0
green.edu. Bangladesh	0	0	0	0	0	0	0	0
ibais.edu. Bangladesh	0	0	0	0	0	0	0	0
lus.ac.Bangladesh	2	2	2	1	0	0	0	0
presidency.edu .Bangladesh	2	2	2	1	0	0	0	0
Primeuniversity. edu.Bangladesh	1	1	1	1	0	0	0	0
test.primeasia. edu.Bangladesh	0	0	0	0	0	0	0	0
royal.edu. Bangladesh	0	0	0	0	0	0	0	0
smuct.edu. Bangladesh	0	0	0	0	0	0	0	0
seu.ac.Bangladesh	1	1	1	1	0	0	0	0
southern-Bangladesh .info	0	0	0	0	0	0	0	0
siu.edu.Bangladesh	0	0	0	0	0	0	0	0
Themillennium university.edu .Bangladesh	0	0	0	0	0	0	0	0
pub.ac.Bangladesh	0	0	0	0	0	0	0	0
uap-Bangladesh .edu	1	1	1	1	0	0	0	0
uoda.edu. Bangladesh	0	0	0	0	0	0	0	0
uits.edu. Bangladesh	0	0	0	0	0	0	0	0
ustc.ac. Bangladesh	0	0	0	0	0	0	0	0
unisa.ac. Bangladesh	1	1	1	1	0	0	0	0
uttarauniversity. edu.Bangladesh	1	1	1	1	0	0	0	0
vub.edu. Bangladesh	0	0	0	0	0	0	0	0

Table: 5.4.4.1 ADM counts summary for private university sites in Bangladesh during September 2012

5.5 Regression Analysis of Variance

5.5.1 Introduction:

Regression analysis is a statistical measure to the average relationship between two or more variables in terms of original units of the data. The relationship between the number of web pages (dependent variable) and LWP, SLWP and ELWP (independent variables) was analyzed by using regression analysis. Fitness of data was studied using Histogram and Scatter Plot and the Line of Best Fit for the regression analysis.

In histogram, a study about the normal curve shaped like a bell that peaks in the middle is expected and is said perfectly symmetrical of the data. The Histograms, presented in Appendix C, generally showed bell shaped curves for all search results indicating the data hold normality assumption.

In scatter plot and line of best fit, the data appear as scatter points, each point representing a pair of X (independent variables LWP, SLWP and ELWP) and Y (dependent variable NWP) values. This gives the spread of variables showing the nature of relationship. From the Scatter Plot and the Line of Best Fit, shown in Appendix D, it is evident that the numbers of web pages found in different search sessions were linearly related with corresponding LWP, SLWP and ELWP.

Four regression analyses were conducted independently.

5.5.2 Regression Analysis of Variance: Google (July 2012)

The websites including their number of pages were entered into SPSS for regression analysis. The first table of interest is the Model Summary table. This table provides the R and R Square values. The R value is 0.976, which indicates a high degree of correlation. The R Square value indicates how much of the dependent variable NWP can be explained by the independent variables ELWP, LWP and SLWP. In this case, 95.2% can be explained, which is very large.

Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.976[a]	.952	.949	24.80497
a) Predictors: (Constant), ELWP, LWP, SLWP				
b) Dependent Variable: NWP				

The next table is the ANOVA table. This table indicates that the regression model predicts the outcome variable significantly well. Here, $p < 0.05$, suggests the overall statistical significance of the regression model that was applied.

ANOVA [b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	614019.005	3	204673.002	332.647	.000[a]
	Residual	30764.328	50	615.287		
	Total	644783.333	53			
a) Predictors: (Constant), ELWP, LWP, SLWP						
b) Dependent Variable: NWP						

The table below, Coefficients, provides the information about each predictor variable. It can be seen that both SLWP and ELWP contribute significantly to the model by looking at the Sig. column ($p < 0.05$).

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.519	5.132		1.270	.210
	LWP	.066	.074	.051	.898	.373
	SLWP	.401	.162	.287	2.473	.017
	ELWP	.835	.146	.653	5.712	.000

a. Dependent Variable: NWP

5.5.3 Regression Analysis of Variance: Google (August 2013)

The correlation coefficient (R) for the relationship between the independent variables and the dependent variable is 0.561, which can be characterized as a moderate relationship (the rule thumb: a correlation less than or equal to 0.20 is characterized as very weak; >0.20 but < 0.40 is weak; >0.40 but < 0.60 is moderate; >0.60 but < 0.80 is strong and >0.80 is very strong).

Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.561[a]	.315	.282	70.47361
a) Predictors: (Constant), ELWP, LWP, SLWP				
b) Dependent Variable: NWP				

The ANOVA table below indicates the overall statistical significance of the regression model that was applied.

ANOVA [b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	139454.854	3	46484.951	9.360	.000[a]
	Residual	302958.284	61	4966.529		
	Total	442413.138	64			
a) Predictors: (Constant), ELWP, LWP, SLWP						
b) Dependent Variable: NWP						

The table below, Coefficients, provides the information about each predictor variable. It can be seen that the dependent variable (NWP) was significantly related to independent variables such as ELWP, LWP and SLWP.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	88.424	29.331		3.015	.004
	LWP	.194	.119	.209	1.627	.109
	SLWP	.162	.191	.158	.848	.400
	ELWP	.324	.177	.304	1.830	.072

a. Dependent Variable: NWP

5.5.4 Regression Analysis of Variance: Blekko (April 2012)

The correlation coefficient (R) for the relationship between the independent variables and the dependent variable is 0.883, which can be characterized as a very strong relationship.

Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	883[a]	.780	.762	305.85716
a) Predictors: (Constant), ELWP, LWP, SLWP				
b) Dependent Variable: NWP				

The ANOVA indicates that the regression model predicts the outcome variable significantly well. Here, again $p < 0.05$, suggests the overall statistical significance of the regression model that was applied.

ANOVA [b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11960591.030	3	3986863.677	42.618	.000[a]
	Residual	3367749.745	36	93548.604		
	Total	15328340.775	39			
a) Predictors: (Constant), ELWP, LWP, SLWP						
b) Dependent Variable: NWP						

The Coefficients table provides the information about each predictor variable. It can be seen that both LWP and SLWP contribute significantly to the model (Sig. $p < 0.05$).

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-44.463	81.021		-.549	.587
	LWP	6.581	.584	.917	11.264	.000
	SLWP	-2.193	1.048	-.182	-2.092	.044
	ELWP	-1.271	8.028	-.013	-.158	.875

a. Dependent Variable: NWP

5.5.5 Regression Analysis of Variance: Blekko (July 2012)

Accordingly, the Model Summary table provides the R and R Square values. It suggests that the correlation coefficient (R) for the relationship between the independent variables and the dependent variable is 0.726, which can be characterized as a strong relationship.

Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	726[a]	.527	.488	445.56481
a) Predictors: (Constant), ELWP, LWP, SLWP				
b) Dependent Variable: NWP				

The following table indicates that the $p < 0.05$, which suggests the model applied can statistically significantly, predict the outcome variable.

ANOVA [b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7969233.079	3	2656411.026	13.381	.000[a]
	Residual	7147007.896	36	198527.997		
	Total	15116240.975	39			
a) Predictors: (Constant), ELWP, LWP, SLWP						
b) Dependent Variable: NWP						

The Coefficients table indicates that the independent variable LWP contributed more to the dependent variable NWP amongst all links of university websites.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	87.433	117.234		.746	.461
	LWP	5.565	.879	.777	6.330	.000
	SLWP	-2.739	1.581	-.234	-1.733	.092
	ELWP	-3.875	12.741	-.039	-.304	.763

5.6 Tests for Statistical Significance

5.6.1 Test hypotheses

In order to see the differences between Google July 2012 and August 2013 results and between Blekko April 2012 and July 2012 search results, related *t*-tests were carried out. The tests were conducted to find out the differences in term of Simple Web Impact Factor (SWIF), Self-link Web Impact Factor (SLWIF), and External link Web Impact Factor (ELWIF).

The following null hypotheses were explored:

H1 There was no significant difference in SWIF between Google July 2012 and August 2013 results;

H2 There was no significant difference in SLWIF between Google July 2012 and August 2013 results;

H3 There was no significant difference in ELWIF between Google July 2012 and August 2013 results;

H4 There was no significant difference in SWIF between Blekko April 2012 and July 2012 results;

H5 There was no significant difference in SWIF between Blekko April 2012 and July 2012 results; and

H6 There was no significant difference in SWIF between Blekko April 2012 and July 2012 results.

5.6.2 The Related *t*-test for Google

5.6.2.1 The related t-test for Simple WIF between Google July 2012 and August 2013

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Google SWIF (July 2012)	.5357	65	.30835	.03825
	Google SWIF (August 2013)	.8608	65	.41762	.05180

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Google SWIF (July 2012) & Google SWIF (August 2013)	65	.050	.690

The Table 5.6.2.1 shows the summary of the results of the comparison between Google SWIF 2012 and 2013 sessions in terms of total simple WIF.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Google SWIF (July 2012) – Google SWIF (August 2013)	-.32508	.50648	.06282	-.45058	-.19958	-5.175	64	.000

Table: 5.6.2.1 The related *t*-test for Google SWIF

The results indicate that there was significant difference in SWIF count between Google July 2012 and August 2013 results. Thus, the null hypothesis (H1) is rejected.

5.6.2.2 The related t-test for Self-link WIF between Google July 2012 and August 2013

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Google SLWIF (July 2012)	.5648	65	.30298	.03758
	Google SLWIF (August 2013)	1.0708	65	.42123	.05225

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Google SLWIF (July 2012) & Google SLWIF (August 2013)	65	-.074	.560

The Table 5.6.2.2 shows the summary of the results of the comparison between Google SLWIF 2012 and 2013 sessions in terms of total Self-link WIF Google.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Google SLWIF (July 2012) – Google SLWIF (August 2013)	-.50600	.53669	.06657	.63899	-.37301	-7.601	64	.000

Table 5.6.2.2 The related *t*-test for Google SLWIF

There was significant difference in SLWIF between Google July 2012 and August 2013 results. Thus, the null hypothesis (H2) is rejected.

5.6.2.3 The related t-test for External link WIF between Google July 2012 and August 2013

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Google ELWIF (July 2012)	.6017	65	.31975	.03966
Google ELWIF (August 2013)	1.0320	65	.43149	.05352

Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 Google ELWIF (July 2012) & Google ELWIF (August 2013)	65	.078	.537

This Table shows the summary of the results of the comparison between Google ELWIF 2012 and 2013 sessions in terms of total ELWIF Google.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Google ELWIF (July 2012) – Google ELWIF (August 2013)	-.43031	.51662	.06408	-.55832	-.30230	-6.715	64	.000

Table 5.6.2.3 The related *t*-test for Google ELWIF

There was significant difference in ELWIF between Google July 2012 and August 2013 results. Thus, the null hypothesis (H3) is rejected.

5.6.3 The Related *t*-test for Blekko

5.6.3.1 The related t-test for Simple WIF between Blekko April 2012 and July 2012

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Blekko SWIF (April 2012)	. 6400	65	2.32086	.28787
	Blekko SWIF (July 2012)	.5992	65	1.58869	.19705

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Blekko SWIF (April 2012) & Blekko SWIF (July 2012)	65	.952	.000

This Table shows the summary of the results of the comparison between Blekko SWIF April 2012 and July 2012 sessions in terms of total SWIF Blekko.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Blekko SWIF (April 2012) – Blekko SWIF (July 2012)	.04077	.94237	.11689	-.19274	.27428	.349	64	.728

Table 5.6.3.1 The related *t*-test for Blekko SWIF

There was no significant difference in SWIF between Blekko April 2012 and July 2012 search results. Thus, the null hypothesis (H4) is accepted.

5.6.3.2 The related t-test for Self-link WIF between Blekko April 2012 and July 2012.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Blekko SLWIF (April 2012)	.5746	65	1.15014	.14266
	Blekko SLWIF (July 2012)	. 5840	65	1.10528	.13709

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Blekko SLWIF (April 2012) & Blekko SLWIF (July 2012)	65	.980	.000

This Table shows the summary of the results of the comparison between Blekko SLWIF April 2012 and July 2012 sessions in terms of total SLWIF Blekko.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Blekko SLWIF (April 2012) – Blekko SLWIF (July 2012)	-.00938	.23106	.02866	-.06664	.04787	-.327	64	.744

Table 5.6.3.2 The related t-test for Blekko SLWIF

There was no significant difference in SLWIF between Blekko April 2012 and July 2012 results. Thus, the null hypothesis (H5) is accepted.

5.6.3.3 The related t-test for External link WIF between Blekko April 2012 and July 2012.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Blekko ELWIF (April 2012)	.1995	65	1.44549	.17929
	Blekko ELWIF (July 2012)	.1182	65	.76714	.09515

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Blekko ELWIF (April 2012) & Blekko ELWIF (July 2012)	65	.999	.000

This Table shows the summary of the results of the comparison between Blekko ELWIF April 2012 and July 2012 sessions in terms of total ELWIF Blekko.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Blekko ELWIF (April 2012) – Blekko ELWIF (July 2012)	.08138	.67934	.08426	-.08695	.24972	.966	64	.338

Table 5.6.3.3 The related *t*-test for Blekko ELWIF

There was no significant difference in ELWIF between Blekko April 2012 and July 2012 results. Thus, the null hypothesis (H6) is accepted.

5.7 Conclusion:

This Chapter analyzed the data on the basis of various webometric indicators. The next Chapter will summarize the findings of this research.

Chapter 6:

Discussions and Results

6.1 Introduction

In this Chapter, the major findings of this research are discussed based on the analysis and interpretation of data presented in Chapter 5.

6.2 Discussions of the result

6.2.1 Quantum of Web Pages and Link Pages

6.2.1.1 Google Search (July 2012)

The findings with regard to web pages and link pages (Table 5.2.2) are:

- Among all private universities, Daffodil International University (DIU) ranked 1st with regard to number of web pages, link pages. DIU also ranked 2nd regarding self-link and external link web pages.

- Independent University Bangladesh (IUB) ranked 2nd with regards to number of web pages, link web pages. IUB also ranked 1st with regard to its self-link and external link web pages.

6.2.1.2 Google Search (August 2013)

The findings with regard to web pages and link pages (Table 5.2.3) are:

- International University of Business Agricultural and Technology (IUBAT) ranked 1st with regard to number of web pages and in the quantum of self-link web pages. IUBAT ranked 5th in terms of external link web pages.

- The University of Asia Pacific ranked 2nd with regard to number of web pages. However, it occupied 8th position in the quantum of external link web pages.

- It is also noticed that that the eleven new universities added in the list (Table 5.4.3) did well in terms of rank positions on the basis of number of web pages and link pages.

6.2.1.3 Blekko Search (April 2012)

The findings with regard to web pages and link pages (Table 5.2.4) are:

- North South University (NSU) ranked 1st with regard to number of web pages, but ranked 2nd in terms of link web pages.

- American International University Bangladesh (AIUB) ranked 2nd with regard to number of web pages and ranked 1st in the quantum of link web pages.

- It is observed that among 54 Universities, 14 had no web pages and link pages (Table 5.2.4). It is also noticed that five universities had only web pages but they had no link pages.

6.2.1.4 Blekko Search (July 2012)

The findings with regard to web pages and link pages (Table 5.2.5) are:

- Among all private universities, North South University (NSU) ranked 1st not only in terms of number of web pages but also with regard to link web pages.

- American International University Bangladesh (AIUB) ranked 2nd with regard to number of web pages and was placed 2nd in connection with link web pages.

- It is also noticed that among 54 universities, 14 universities had no web pages or link pages (Table 5.2.5) at the time of the study.

6.2.2 Link Structure Analysis (WIF) of websites of private universities

6.2.2.1 Blekko Search (April 2012)

The following are the findings from Blekko with regard to the Simple Web Impact Factor, Self-link Web Impact Factor and External link Web Impact Factor:

- Among 54 universities, Metropolitan university, Sylhet ranked 1st with regard to Simple Web Impact Factor (Table 5.3.2.1), Self-link Web Impact Factor (Table 5.3.2.2) and External link Web Impact Factor (Table 5.3.2.3).

- Eastern University (Table 5.3.2.1 and 5.3.2.2) ranked 2nd with regard to both Simple Web Impact Factor and Self-link Web Impact Factor. However, EU ranked 5th (Table 5.3.2.3) in terms of External link Web Impact Factor.

- It is observed that out of 54 universities, only 40 universities had web pages and the remaining 14 universities had no web pages or link pages at the time of this study (see Table 5.3.2.1, 5.3.2.2 and 5.3.2.3).

6.2.2.2 Blekko Search (July 2012)

The following are the findings from Blekko with regard to the Simple Web Impact Factor, Self-link Web Impact Factor and External link Web Impact Factor:

- Metropolitan university, Sylhet ranked 1st with regard to Simple Web Impact Factor (Table 5.3.3.1), Self-link Web Impact Factor (Table 5.3.3.2) and External link Web Impact Factor (Table 5.3.3.3).

- University of South Asia ranked 2nd with regard to Simple Web Impact Factor (Table 5.3.3.1). The University ranked 5th with regard to Self-link Web Impact Factor (Table 5.3.3.2) and ranked 4th in terms of External link Web Impact Factor (Table 5.3.3.3) .

- It is also observed that Eastern University ranked 3rd with regard to Simple Web Impact Factor (Table 5.3.3.1). However, EU ranked 2nd in terms of both Self-link Web Impact Factor and External link Web Impact Factor (Table 5.3.3.2 and Table 5.3.3.3).

6.2.2.3 Google Search (July 2012)

The following are the findings from Google with regard to the Simple Web Impact Factor, Self-link Web Impact Factor and External link Web Impact Factor:

- Ahsanullah University of Science and Technology ranked 1st regard to Simple Web Impact Factor (Table 5.3.4.1), but it occupied 34th position with regard to Self-link Web Impact Factor (Table 5.3.4.2) and 3rd with regard to External link Web Impact Factor (Table 5.3.4.3).

- Atish Dipankar University of Science & Technology ranked 2nd with regard to Simple Web Impact Factor (Table 5.3.4.1), but it ranked 27th with regard to Self-link Web Impact Factor (Table 5.3.4.2) and 48th out of 54 universities with regard to External link Web Impact Factor (Table 5.3.4.3).

6.2.2.4 Google Search (August 2013)

The following are the findings from Google with regard to the Simple Web Impact Factor, Self-link Web Impact Factor, External link Web Impact Factor:

- Royal University of Dhaka ranked 1st with regard to Simple Web Impact Factor (Table 5.3.5.1), but it occupied 3rd position with regard to Self-link Web Impact Factor (Table 5.3.5.2) and 2nd in terms of External link Web Impact Factor (Table 5.3.5.3).

- Ishakha International University ranked 2nd with regard to Simple Web Impact Factor (Table 5.3.5.1), but the University ranked 3rd with regard to Self-link Web Impact Factor (Table 5.3.5.2) and placed 6th in terms of External link Web Impact Factor (Table 5.3.5.3).

- It is also noticed that most of the new universities, added in Google 2013 study, ranked well (Table 5.3.5.1, 5.3.5.2 and Table 5.3.5.3).

This research found that some private universities had relatively higher number of web pages but correspondingly their link pages were lower and the websites fell behind in their simple, self-link and external link WIF.

6.2.3 Network Link among all Private Universities in Bangladesh

SocSciBot showed the link network among various private university websites in Bangladesh (Figure 5.4.1.1 to 5.4.1.7).

6.2.4 Regression Analysis of Variance

The website plays a powerful role for the parent institution as it is an important communication tool. The number of web pages is taken as dependent variable for regression analysis because the other web pages like LWP, SLWP and ELWP were retrieved from NWP. Moreover, the calculation of Web Impact Factor has given weightage to NWP among all links. Google and Blekko may use different algorithms to calculate the number of web pages, but the reliability can be tested by Histogram and by Scatter Plot and Line of Best Fit. After normality test of data, separate regression analyses were carried out. The result of the analyses showed that among the calculation of three web pages LWP, SLWP and ELWP of private university websites, the external link pages stand-in important position to increase the number of web pages.

6.2.5 The Related *t*-test

The related *t*-test results indicate that there were significant differences between Google July 2012 and August 2013 serach results across all webometric indicators. However, no significant differences were found between Blekko April 2012 and July 2013 results.

6.2.6 Search Engine Performance

Among 54 universities, Google found all universities had web pages and link pages (Table 5.2.2), but Blekko results indicated that 14 had no web and link pages at the time of the study (Table 5.2.4).

6.3 Conclusion:

The overall result of the study showed that the private universities in Bangladesh did not have much impact on the web and were not much known at the international level, evident by the

webometrics indicators. It is evident from the earlier studies that the top-ranked universities are those that facilitate access to a wide range of information through their websites. There might be a number of issues involved in such poor WIF ratings of private university websites in Bangladesh. Studies indicated time and time again that websites which provided non-English web pages attracted fewer visitors and received less inlinks and therefore obtained lower WIFs. According to the Ranking Web of World Universities (2013), only two public universities were in the list of top-100 South Asian Universities. University of Dhaka's Department of Economics and Bangladesh University of Engineering and Technology (BUET) were in 43rd and 52nd positions in the list respectively. Although University of Dhaka is the largest and oldest university in Bangladesh, it ranked 174th place among the top South Asian universities. However, global rankings of some private universities in Bangladesh were as follows: East-West University 154th, BRAC University 208th and North South University 199th. No private university was able to take its position in the top-100 South Asian Universities.

The policy makers of the private universities in Bangladesh and also the managers of their websites are not paying attention to such poor results. They are not familiar with webometric studies and benefits of improving web ranking. Almost all the private universities of Bangladesh use ICT for managing the administrative processes and some are using ICT at a moderate level (Huda, Tabassum and Ahmed 2009). As they are not aware of web ranking, they do not perceive its necessity to make websites active and rich in a way to be attractive and usable for students, faculty members, both home and abroad.It is found from different reports, observations and by personal visit to websites that some of the reasons for the lower presence of the private universities in Bangladesh on the web are as follows: structural problems in web designing, providing few English web pages, limited access to scholarly resources, the instability of web servers and inefficient web designs. The Open Access movement has not been openly embraced by most of the private universities, where the researchers probably have well-established routines of publication in prestigious journals and see little benefit in alternative methods of access to the same material. As indicated by the Cybermetrics Laboratory (Ranking Web of World Repositories, 2013), this research also felt that if the web performance of an institution is below the expected level according to their academic excellence, university authority should reconsider its web policy by substantially increasing the volume and quality of university intellectual output online.

Chapter 7:
Limitations, Recommendations, Directions for Further Research and Conclusion

7.1 Introduction

This Chapter discusses the limitations of the current research and the directions for future webometrics research. Additionally, several recommendations have been made which may help the designer to make their websites more visible on the web.

7.2 Limitations

Since its inception in 1996, webometrics has become a promising and exciting new area of research. However, despite recent advancements in techniques for collecting, processing and interpreting the link data, there are still problems with data reliability and the interpretation of the results which may provide significant challenges for future researchers. This research had several limitations of its own.

1. Selecting the universities was the first limitation. This research covered only the private universities in Bangladesh, public universities were not included in this study.

2. In this research, Google and Blekko search engines were used. Use of Google is free but Blekko SEO introduced a subscription model for the services in August 2012. This hindered the use of Blekko at a later stage in this research.

3. There were some difficulties in operating SocSciBot for website crawls as it required high internet bandwidth. Future research in this area should keep a note of this limitations.

7.3 Recommendations

Based on the findings of the research, an attempt has been made to suggest few measures which will help the designer to make their website interactive, attractive and thereby more visible on the web. As the universities of Bangladesh do not have much web presence, these universities need to focus on the following issues to increase the visibility of their websites. These are:

1. Important institutional announcements, changes in polices, launching of new courses and services, setting up of new facilities, etc. are to be quickly brought to the notice of the users through the university websites.

2. In order to enhance quality and relevance of web page, it is recommended to provide required information and external links for better communications for the users.

3. The university websites should facilitate all users to access the academic and scientific resources as well as to up-to-date information and news in both local language and in English.

4. In the internet, there are provisions for using graphics, and hence it is suggested that while designing a website the designers should ensure the quality of graphics so that aesthetic quality of the web page could be enhanced.

5. The web designs and the links between pages need to be updated constantly so that the search engines can easily access and index the latest materials uploaded on the websites, and the users can easily find their relevant information in quickest possible time.

6. It is recommended that librarians should also be involved in the construction of their respective university websites.

7. It was observed that only a few websites had date of updation information. The date of updation speaks about the currency of websites and thus, every websites need to add the date of last update. This is important particularly for an individual citing the web page as a source of information. It also lets users know the currency of information they are using.

8. Providing a site map for the university website could help search engines index all the pages related to the institute such as institutes, faculties, programme, research centres, etc. A site map is a useful tool to make web pages easily accessible to both users and search engines, which leads to increase the visibility of the website. Also, allocating special directories to each school, educational groups and department of the university will help this purpose.

9. The universities should provide some space for the faculty members, staff and graduate students to develop their own web pages to showcase their professional and scholarly activities on the university website.

10. The search engines index Open Access (OA) resources to add to the richness of the website content. Open access repositories through institutional repositories can thus transform the research scene from one of isolation and marginalization, to one of inclusion and international cooperation (Abrizah, Noorhidawati and Kiran 2010). It will help the main goal of the websites which is facilitation of access to reliable as well as up-to-date resources. Providing a variety of information and a broad collection of professional up-to-date resources in universities will attract more users and visitors, increase the visibility and number of Inlinks and as a result lead to a bigger WIF. Studies have indicated that high WIF ranking are probably correlated with higher number of potential authors who self-archive (scholars and postgraduates) and the effort made by the academic library to collect and disseminate the university's intellectual output.

11. The university website should go to a deeper extent to make maximum number of its pages indexed by the search engines. Use of search engine optimization techniques could improve the quality and appearance of the content of a website..

12. The faculty members should be encouraged to upload their course syllabus, course resources (if possible), and the content of their courses on the university website and they should encourage students to use these resources provided for them.

13. To increase visibility and the number of Inlinks, websites should provide English language contents on the web pages to attract users around the world.

14. An option for feedback should be added to get feedbacks from the prospective users.

15. The universities should provide special budget for the web design, and to support and update the contents.

16. The private universities in Bangladesh have to do a lot for publicizing themselves on web to attain a greater number of hits from their users. If these websites are visited more often, it would lead to fulfilling of the 'third Law of Library Science', i.e. "Every book its reader" or rather "Every website its user".

7.4 Directions for Further Research

There have been many research studies conducted on webometrics worldwide. In Bangladesh, only one study was reported before this in-depth research. This research, however, was based on private universities in Bangladesh. There is a wide scope for researchers to incorporate public universities, research organizations and commercial websites for such research.

This research cover only Google and Blekko search engines for data collection. Researchers can also explore the use of other search engines like Alta Vista, Bing, HotBot, Alltheweb, etc. for data collecting and calculating WIF. Additionally, researcher can explore the impact of institutional repositories and open access archives using webometric indicators.

7.5 Conclusion

The growing use of internet and the advent of web technologies have revolutionized the process of a university's visibility, publicity and dissemination of information pertaining to its courses, infrastructures, libraries, alumni, students, and so on. A well-designed university website can help to project the image of the university. It can be used to disseminate a wide range of information to the academic community community worldwide.

Webometrics is an unexplored area concerned with web pages, contents of web pages, link structure of websites and so on. This research used webometric indicators to rank the private universities in Bangladesh. It also applied link data to develop a network topology of the university websites. It is evident that some universities in Bangladesh had higher number of web pages but their link pages were fewer and websites fell behind in their web impact factor. Considering the benefits that can be extracted from the analysis of university websites, more webometric research needs to be conducted in Bangladesh.

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Appendix - A

List of Private Universities and their year of establishment

No	List of Private Universities	Year of Establishment	Location
1	International University of Business Agriculture & Technology (IUBAT)	1991	Dhaka
2	North South University (NSU)	1992	Dhaka
3	University of Science & Technology, Chittagong (USTC)	1992	Chittagong
4	Darul Ihsan University (DIUBD)	1993	Dhaka
5	Central Women's University (CWU)	1993	Dhaka
6	Independent University, Bangladesh (IUB)	1993	Dhaka
7	American International University Bangladesh (AIUB)	1994	Dhaka
8	Ahsanullah University of Science and Technology (AUST)	1995	Dhaka
9	Dhaka International University (DhIU)	1995	Dhaka
10	International Islamic University, Chittagong (IIUC)	1995	Chittagong
11	Asian University of Bangladesh (AUB)	1996	Dhaka
12	East West University (EWU)	1996	Dhaka
13	Gono Bishwabidyalay (GB)	1996	Dhaka
14	Queens University (QU)	1996	Dhaka
15	The Peoples University of Bangladesh (PUB)	1996	Dhaka
16	The University of Asia Pacific (UAP)	1996	Dhaka
17	America Bangladesh University (ABU)	1997	Dhaka
18	BGMEA University of Fashion & Technology (BUFT)	1999	Dhaka
19	Bangladesh University (BU)	2001	Dhaka
20	BRAC University (BRACU)	2001	Dhaka
21	Manarat International University (MIU)	2001	Dhaka
22	Southern University of Bangladesh , Chittagong (SUB)	2001	Chittagong
23	Sylhet International University, Sylhet (SIU)	2001	Sylhet
24	BGC Trust University Bangladesh, Chittagong (BGTU)	2002	Chittagong
25	City University Bangladesh (CUB)	2002	Dhaka
26	Daffodil International University (DIU)	2002	Dhaka
27	Green University of Bangladesh (GUB)	2002	Dhaka
28	IBAIS University (IU)	2002	Dhaka
29	Leading University, Sylhet (LU)	2002	Sylhet
30	Northern University Bangladesh (NUB)	2002	Dhaka

Appendix - A (Continued)

31	Premier University, Chittagong (PUC)	2002	Chittagong
32	Prime University (Prime)	2002	Dhaka
33	Southeast University (SEU)	2002	Dhaka
34	Stamford University, Bangladesh (SU)	2002	Dhaka
35	State University Of Bangladesh (SUB)	2002	Dhaka
36	University of Development Alternative (UODA)	2002	Dhaka
37	Bangladesh University of Business & Technology (BUBT)	2003	Dhaka
38	Eastern University (EU)	2003	Dhaka
39	Metropolitan University, Sylhet (MU)	2003	Sylhet
40	Presidency University (PU)	2003	Dhaka
41	Primeasia University (Primeasia)	2003	Dhaka
42	Royal University of Dhaka (RUD)	2003	Dhaka
43	Shanto Mariam University of Creative Technology (SMUCT)	2003	Dhaka
44	The Millenium University (MU)	2003	Dhaka
45	United International University (UIU)	2003	Dhaka
46	University of Information Technology & Sciences (UITS)	2003	Dhaka
47	University of South Asia (USAB)	2003	Dhaka
48	Uttara University (UU)	2003	Dhaka
49	Victoria University of Bangladesh (VUB)	2003	Dhaka
50	World University of Bangladesh (WUB)	2003	Dhaka
51	Atish Dipankar University of Science & Technology (ADUST)	2004	Dhaka
52	University of Liberal Arts Bangladesh (ULAB)	2004	Dhaka
53	ASA University Bangladesh (ASAUB)	2006	Dhaka
54	Bangladesh Islami University (BIU)	2006	Dhaka
55	East Delta University , Chittagong (EDU)	2006	Chittagong
56	Ishakha International University (IIU)	2010	Dhaka
57	Britania University (BU)	2012	Dhaka
58	European University of Bangladesh (EUB)	2012	Dhaka
59	Feni University (FU)	2012	Feni
60	1stCapital University of Bangladesh (FCUB)	2012	Khulna
61	Khwaja Yunus Ali University (KYAU)	2012	Sirajgonj
62	Port City International University (PCIU)	2012	Chittagong
63	Varendra university (VU)	2012	Rajshahi
64	Exim Bank Agricultural University, Bangladesh (EBAUB)	Unknown	Chapainababgonj
65	Bangladesh University of Health Science (BUHS)	2010	Dhaka

Appendix - A (Continued)

66	Hamdard University Bangladesh (HUB)	2011	Dhaka
67	North East University Bangladesh (NEUB)	2012	Sylhet
68	North Western University (NWU)	Unknown	Khulna
69	Sonargaon University (SU)	Unknown	Dhaka
70	University of South Asia (USA)	Unknown	Dhaka
71	Z.H. Sikder University of Science & Technology (ZHSUST)	2011	Shariaitpur

Appendix - B

List of Private Universities and their websites (2013)

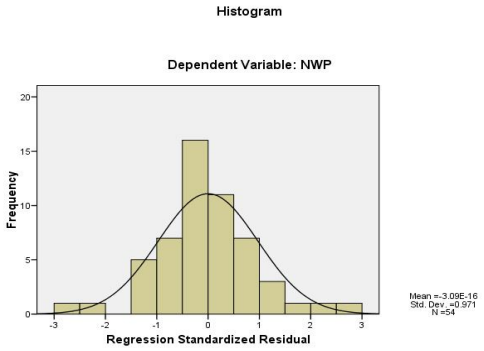
No	List of Private Universities	Website
01.	Ahsanullah University of Science and Technology	http://www.aust.edu
02.	America Bangladesh University	http://www.abuniversity.edu.Bangladesh
03.	American International University Bangladesh	http://www.aiub.edu
04.	ASA University Bangladesh	http://www.asaub.edu.Bangladesh
05.	Asian University of Bangladesh	http:// www.aub-Bangladesh .org
06.	Atish Dipankar University of Science & Technology	http://www.atishdipankaruniversity.edu. Bangladesh
07.	Bangladesh Islami University	http://www.biu.ac.Bangladesh
08.	Bangladesh University	http://www.bu.edu.Bangladesh
09.	Bangladesh University of Business & Technology	http://www.bubt.edu.Bangladesh
10.	BGC Trust University Bangladesh, Chittagong	http://www.bgctub-edu.com
11.	BRAC University	http://www.bracu.ac.Bangladesh
12.	Central Women's University	http://cwu-Bangladesh .net
13.	City University	http://www.cityuniversity.edu.Banglades h
14.	Daffodil International University	http://www.daffodilvarsity.edu.Banglade sh
15.	Darul Ihsan University	http://www.diu.ac.Bangladesh
16.	Dhaka International University	http://www.diu.net.Bangladesh
17.	East Delta University , Chittagong	http://www.eastdelta.edu.Bangladesh
18.	East West University	http://www.ewuBangladesh .edu
19.	Eastern University	http://www.easternuni.edu.Bangladesh
20.	Gono Bishwabidyalay	http://www.gonouniversity-Bangladesh .com
21.	Green University of Bangladesh	http://green.edu.Bangladesh
22.	IBAIS University	http://www.ibais.edu.Bangladesh
23.	Independent University, Bangladesh	http://www.iub.edu.Bangladesh
24.	International Islamic University Chittagong	http://www.iiuc.ac.Bangladesh
25.	International University of Business Agriculture & Technology	http://www.iubat.edu
26.	Leading University, Sylhet	http://www.lus.ac.Bangladesh
27.	Manarat International University	http://www.manarat.ac.Bangladesh
28.	Metropolitan University, Sylhet	http://www.metrouni.edu.Bangladesh
29.	North South University	http://www.northsouth.edu
30.	Northern University Bangladesh	http://www.nub.ac.Bangladesh
31.	Premier University, Chittagong	http://www.puc.ac.Bangladesh
32.	Presidency University	http://www.presidency.edu.Bangladesh
33.	Prime University	http://www.primeuniversity.edu. Bangladesh
34.	Primeasia University	http://www.primeasia.edu.Bangladesh

Appendix - B (Continued)

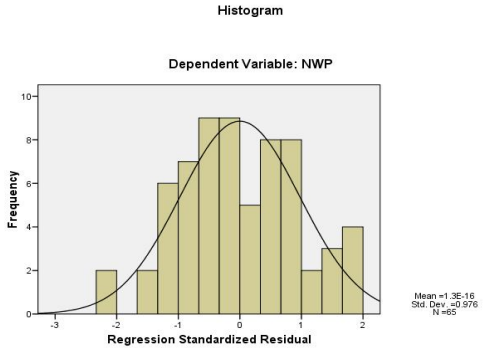
35.	Queens University	http ://www.queensuniversity.edu. Bangladesh
36.	Royal University of Dhaka	http://www.royal.edu.Bangladesh
37.	Shanto Mariam University of Creative Technology	http://www.smuct.edu.Bangladesh
38.	Southeast University	http://www.seu.ac.Bangladesh
39.	Southern University of Bangladesh, Chittagong	http://www.southern-Bangladesh .info
40.	Stamford University, Bangladesh	http://www.stamforduniversity.edu.Bangladesh
41.	State University Of Bangladesh	http://www.sub.edu.Bangladesh
42.	Sylhet International University, Sylhet	http://www.siu.edu.Bangladesh
43.	The Millenium University	http://www.themillenniumuniversity.edu. Bangladesh
44.	The Peoples University of Bangladesh	http://www.pub.ac.Bangladesh
45.	The University of Asia Pacific	http://www.uap-Bangladesh .edu
46.	United International University	http://www.uiu.ac.Bangladesh
47.	University of Development Alternative	http://www.uoda.edu.Bangladesh
48.	University of Information Technology & Sciences	http://www.uits.edu.Bangladesh
49.	University of Liberal Arts Bangladesh	http://www.ulab.edu.Bangladesh
50.	University of Science & Technology, Chittagong	http://www.ustc.ac.Bangladesh
51.	University of South Asia	http://www.unisa.ac.Bangladesh
52.	Uttara University	http://www.uttarauniversity.edu.Bangladesh
53.	Victoria University of Bangladesh	http://www.vub.edu.Bangladesh
54.	World University of Bangladesh	http://www.wub.edu.Bangladesh
56.	BGMEA University of Fashion & Technology (BUFT)	http://www.bift.info
57.	Britania University	http://www.britannia.ac
58	European University of Bangladesh	http://www.eub.edu.Bangladesh
59.	Exim Bank Agricultural University, Bangladesh	Not Website yet
60.	Feni University	http://www.feniuniversity.edu.Bangladesh
61.	Bangladesh University of Health Science	http://www.bihs.edu.Bangladesh
62.	First Capital University of Bangladesh	http://fcuBangladesh .net
63.	Hamdard University Bangladesh	http://hamdarduniversity.edu.Bangladesh
64.	Ishakha International University	http://www.ishakha.edu.Bangladesh
65.	Khwaja Yunus Ali University	http://www.kyau.edu.Bangladesh
66.	North East University Bangladesh	http://www.neub.edu.Bangladesh
67.	North Western University	http://nwu.edu.Bangladesh
68.	Port City International University	http://www.portcity.edu.Bangladesh
69.	Sonargaon University	Under development
70.	University of South Asia	http://www.unisa.ac.Bangladesh
71.	Varendra university	http://www.vu.edu.Bangladesh
72.	Z.H. Sikder University of Science & Technology	http://zhsust.edu.Bangladesh

Appendix - C

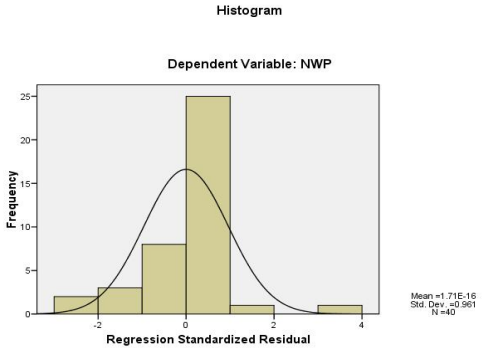
Fitness of Data of University Websites by Histogram



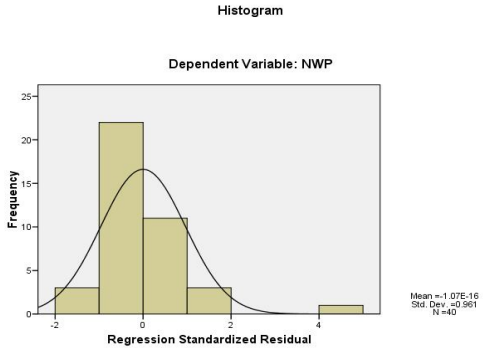
Google (July 2012)



Google (August 2013)



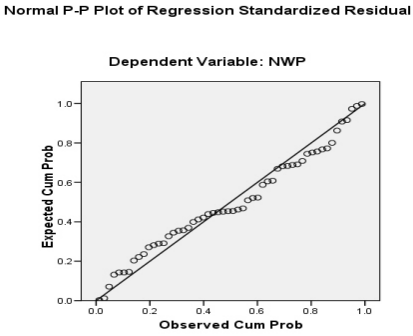
Blekko (April 2012)



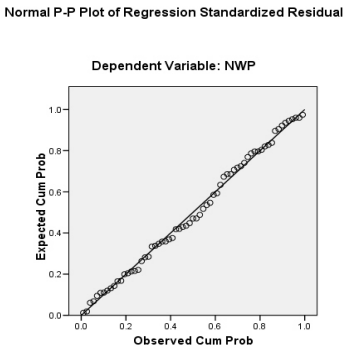
Blekko (July 2012)

Appendix - D

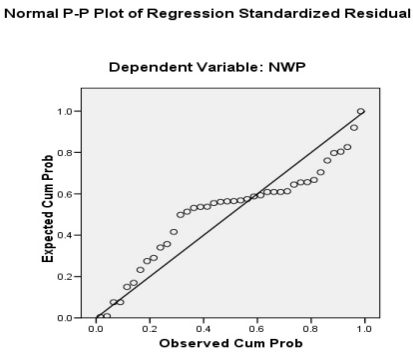
Fitness of Data of University Websites by Scatter Plot and Line of Best Fit



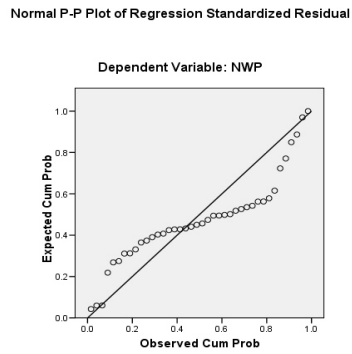
Google (July 2012)



Google (August 2013)



Blekko (April 2012)



Blekko (July 2012)