Postprint: Current Application Status of Link Analysis Methods in Empirical Research on Domestic Websites

Authors: Lu Wenhui, Ye Jiyuan

Date: 2023-07-26T00:00:00+00:00

Abstract

[Purpose/Significance] This study explores the application status of link analysis method in empirical research on domestic websites, and analyzes the progress achieved and existing deficiencies in related research. [Method/Process] Combining quantitative and qualitative analysis methods, a multi-dimensional analysis of previous studies is conducted from seven perspectives: research purpose, research object, research indicators, research tools, research methods, research conclusions, and research recommendations. [Results/Conclusions] The study finds that related research has developed rapidly and exhibits certain characteristics, such as research purposes generally being limited to 1-2, with content focusing primarily on evaluating website influence and analyzing website status quo; the scope of research objects continues to expand, with increased attention to some new types of websites, yet still concentrating mainly on university websites, enterprise websites, and government websites. Meanwhile, certain deficiencies exist in some studies, including mostly repetitive research methods, insufficient innovation in research indicator settings, and limitations in research tool performance. Based on these findings, relevant recommendations are proposed from seven aspects including research purpose and research object.

Full Text

Preamble

Analysis of the Application Status of Link Analysis Method in Domestic Website Empirical Research

Lu Wenhui, Ye Jiyuan
School of Information Management, Nanjing University, Nanjing 210023

Abstract

[**Purpose/Significance**] This paper explores the application of link analysis in domestic website empirical research and analyzes the progress and shortcomings of relevant studies. [**Method/Process**] Combining quantitative and qualitative analysis, this paper conducts a comprehensive analysis of previous research from seven perspectives: research purpose, research object, research indicators, research tools, research methods, research conclusions, and research suggestions. [**Result/Conclusion**] The study finds that relevant research has developed rapidly and exhibits certain characteristics. For instance, most studies have 1-2 research purposes, focusing primarily on evaluating website influence and analyzing website status; the scope of research objects continues to expand, with increased attention to some new types of websites, though university websites, enterprise websites, and government websites remain the main focus. Meanwhile, some studies also have shortcomings, such as largely repetitive research methods, insufficient innovation in indicator settings, and limited performance of research tools. Based on these findings, relevant suggestions are proposed from seven aspects including research purpose and research object.

Keywords: link analysis; website evaluation; website influence; network impact factor; enterprise website; university website; government website
Classification Number: G250
DOI: 10.13266/j.issn.0252-3116.2019.18.014

Link analysis refers to a research method that draws on traditional citation analysis and utilizes tools and methods such as search engines, web crawlers, link databases, and mathematical statistical analysis to analyze website link characteristics and object attributes, thereby revealing their quantitative features and inherent patterns. The concept of link analysis was first proposed by foreign scholar G. McKiernan [1]. After T.C. Almind [2] and P. Ingwersen [3] proposed concepts such as webometrics and network impact factor in 1997 and 1998, link analysis gained attention from scholars both domestically and internationally and has been applied and studied in many fields. Among these, website research is closely related to link analysis. Website research refers to the analysis and evaluation of website form, content, utility, and its construction and development. Website research can be mainly divided into theoretical research and empirical research, with link analysis primarily applied in website empirical research. Website empirical research refers to the specific analysis or evaluation of one or more particular websites and constitutes an important component of website research.

Link analysis holds an important position in website empirical research. Currently, the research team and research output using link analysis for website empirical research are increasingly large and abundant. Meanwhile, with the continuous development of research, many scholars in the domestic library and information science field, such as Qiang Zili [4], Huang Qi [5], Liu Yanshu [6], and Qiu Junping [7], have applied link analysis to study websites from differ-

ent perspectives and have achieved many research results. Review of previous studies reveals that there are many primary literature using link analysis for website empirical research, but relatively few tertiary literature such as reviews. Furthermore, analyzing existing tertiary literature that reviews link analysis shows that these papers mostly adopt a holistic, macro perspective. For example, some scholars have analyzed and sorted out research literature using link analysis from 2001-2010 in terms of published journals and authors [8-9]; some scholars have argued from a research perspective that link analysis research can be divided into eight perspectives including retrieval optimization, webometrics and evaluation, and competitive intelligence [10]; and some scholars have analyzed the application fields of link analysis, arguing that it is mainly applied in network information resource evaluation, website influence evaluation, university evaluation, and core website discovery [11]. Although some of these studies analyzed the application of link analysis in website empirical research [11], the relevant discussions were relatively brief and insufficient. Currently, there is no systematic and comprehensive analysis of the application of link analysis in website empirical research.

With the continuous development of research, some problems such as repetitive research objects have begun to emerge. Therefore, from a micro perspective, timely and systematic analysis of research using link analysis for website empirical analysis, summarizing the shortcomings and progress of current research, is of great significance for promoting the application of link analysis in website empirical research and further improving the website research system.

In view of this, this paper takes domestic empirical research using link analysis for website analysis as its object, combines quantitative and qualitative analysis methods, and intends to analyze relevant research from seven angles: research purpose, research object, research indicators, research tools, research methods, research conclusions, and research suggestions. The purpose of this paper is to analyze the application status of link analysis in domestic website empirical research and to review the progress and shortcomings of relevant studies.

2. Research Plan

2.1 Data Sources

Using the CNKI China Academic Journal Network Publishing Database as the retrieval source, the search was conducted on July 15, 2018, with the search formula “theme/title/keywords = link analysis AND website/portal/network platform/Web/website influence/influence” without limiting the time range. After deduplication, a total of 258 research documents were retrieved. After reading these documents and filtering out literature such as reviews or theoretical discussions, 112 documents that applied link analysis to conduct empirical research on specific websites were finally obtained.

2.2 Analysis Methods

After reading the relevant research literature, it was found that existing research has a relatively uniform structure and has formed a certain research paradigm. Each study basically includes seven elements: research purpose, research object, research indicators, research tools, research methods, research conclusions, and research suggestions. Therefore, this paper chooses to analyze relevant research from these seven elements.

Quantitative analysis is used to statistically analyze the quantitative characteristics and changes of research purposes, research objects, research indicators, research tools, and research methods in relevant studies. Meanwhile, since research conclusions and suggestions are difficult to quantify, qualitative analysis is selected to analyze the research conclusions and suggestions of relevant studies.

3. Research Results

3.1 Research Purpose

Research purpose is the fundamental reason for conducting research, reflecting the research problems that researchers aim to solve. Analyzing research purposes can both understand the significance and value of research and provide reference and guidance for future research. Statistical analysis of the research purposes of current relevant literature (see) reveals three characteristics:

First, most literature clearly states the research purpose, which is relatively explicit and shows a certain distribution pattern in quantity. Most studies have more than one research purpose, accounting for 63%. Among them, studies with two research purposes are the most numerous, with 54 studies, accounting for 48.21%. There are 41 studies with only one research purpose, accounting for 37%. Studies with three and four research purposes are relatively few, with 15 and 2 studies respectively.

Second, the research purposes can be roughly divided into five types in terms of specific content: The first type is evaluating website influence, including website influence evaluation and network influence evaluation; the second type is analyzing website status and shortcomings and providing suggestions; the third type aims to analyze the feasibility and practicality of link analysis in website research, mainly including the effectiveness analysis of link indicators, correlation between various link indicators, and correlation between link analysis results and results obtained by other methods; the fourth type is analyzing the performance of link analysis tools, including comparing the accuracy of data obtained by different link analysis tools such as Google and AltaVista, and analyzing the consistency of results obtained by different tools; the fifth type takes analyzing website link structure and characteristics as the research purpose, such as analyzing website external link types and co-links. In addition, some studies aim to verify the feasibility of certain algorithms and explore the

establishment of website evaluation systems. Currently, relevant research mainly focuses on evaluating website influence and analyzing website status, and these two purposes are generally adopted simultaneously, while other purposes are rarely analyzed alone, usually combined with one or both of these two purposes.

Finally, with the continuous deepening of research, research purposes have also undergone certain changes and show certain characteristics and trends. In current research, evaluating website influence, analyzing website status, shortcomings, and providing suggestions, and studying website link structure and characteristics remain the main purposes. However, research analyzing the feasibility of link analysis in evaluating website influence and the usability and effectiveness of link analysis tools has become relatively rare. As link analysis continues to develop and its application scope continues to expand, research on the usability of link analysis methods and tools is actually still necessary. In addition, in studies that aim to evaluate website influence and analyze website status and provide suggestions, some research has misunderstandings about conceptual connotations, and the analysis is too general and vague.

3.2 Research Object

With the rapid development of the Internet and its technology, the number of websites is increasing, and website types are becoming more diverse. The impact on website research is mainly reflected in the increasing diversity of website types studied. Statistical analysis of research objects in relevant studies (see [Figure 1: see original paper]) can reveal which types of websites current research mainly focuses on and provide references for which types of websites future research should strengthen.

The analysis shows that current relevant research mainly presents three characteristics in terms of research objects:

First, in terms of website types, current research mainly takes enterprise websites [15,31], library websites [32], university websites [26,33], and government websites [18,24] as research objects. Some studies use link analysis to analyze archive websites [34], think tank websites [35-36], agricultural websites [37], journal websites [38], and hospital websites [39-40]. Other studies use link analysis to analyze websites such as major international environmental NGOs [41], intangible cultural heritage websites [42-43], China Association for Science and Technology websites [42-43], and migrant worker websites [44].

Second, in terms of type, the scope of research objects is continuously expanding. For example, research on think tank websites and domestic live streaming platforms [15] has emerged in recent years. In terms of content, following the changes in website development, research on certain types of websites is also continuously refined and deepened. For example, research on university websites includes studies on university websites in certain provinces or regions [12,45], “211 Project” university websites [33], and higher vocational college websites [46].

Finally, from recent years' research, although the research objects of current studies are still mainly university websites, enterprise websites, and government websites, it is worth noting that research using link analysis to study other website types has increased in recent years and continues to grow. However, research on hospital websites, agricultural websites, and library websites has weakened, and archive websites and journal websites have received no attention at all.

3.3 Research Indicators

The scientificity and applicability of research indicator selection and setting are important bases for judging whether research is innovative. Statistics are conducted on the research indicators mentioned and for which exact data were obtained in each study, with results shown in . It should be noted that "other indicators" in refer to indicators that appear only once, such as 360 Index, which are difficult to categorize and are collectively called "other indicators." "Subjective indicators" and "comparative indicators" are treated similarly. In addition, since some indicators have different names in different studies, for the convenience of statistics, relevant terms have been unified. For example, external link count includes off-site link count, external link count, etc.

First, sorted by frequency of adoption, the top 10 indicators used in previous research are external link count, webpage count, total link count, total network impact factor, external network impact factor, internal link count, user indicators, internal network impact factor, PR value, and backlink count. Therefore, based on frequency data, these 10 indicators can be considered the basic indicators for website empirical research using link analysis.

Second, most current studies set 5 or more research indicators, accounting for 81.3% of the total research, with an average of 7.45 indicators per study. Among them, studies using 8, 9, and 6 indicators are more numerous, with 19, 18, and 12 studies respectively. This is consistent with the general evaluation system having 5-9 indicators, indicating that the number of research indicators set in relevant studies is relatively appropriate [64]. Analyzing the changing trend of research indicator numbers reveals that the number of research indicators set in current relevant studies is continuously increasing, from initially 2 or 3 to mostly stabilizing at 8-9.

Finally, the research indicators set in relevant studies can be roughly divided into three categories: link indicators, user indicators, and other types of indicators. Link indicators refer to typical indicators that reflect website link characteristics, such as external link count, webpage count, total link count, internal link count, total network impact factor, and external network impact factor. User indicators refer to indicators related to users, such as average daily website visits, page views, and user attention. Other types of indicators refer to indicators other than the above two categories, such as content richness, website response speed, and website age.

In terms of research quantity, among the three categories, studies setting link indicators are the most numerous, basically every study has them; studies setting user indicators are the second most numerous, but have increased in recent years; studies setting other indicators are the least numerous, but overall are also continuously increasing.

3.4 Research Tools

Research tools refer to the tools used to conduct research. For studies applying link analysis to website analysis, research tools include data acquisition tools and data analysis tools. However, since the latter are not explicitly stated in many studies and are difficult to accurately count, this paper only statistically analyzes data acquisition tools, and the term "research tools" specifically refers to data acquisition tools. The statistical analysis of research tools is based on the tools explicitly mentioned and actually used in each study, with results shown in . In , research tools used only once, such as Qingbo Data Platform and 7c.com, are difficult to categorize and are uniformly recorded as "others."

First, the statistics show that 112 relevant studies used a total of 231 research tools, with an average of 2.06 tools per study. The study using the most tools selected 8, while the least used only 1. 76% of studies selected 1-2 research tools, while only 24% used 3 or more tools. In recent years, more studies have adopted 2 or 3 research tools, and overall, there is a continuing trend of increasing the number of tools used in relevant studies. On the one hand, this indicates that the scientificity and accuracy of research are increasing; on the other hand, it reflects that the development of research tools is relatively rapid.

Second, the top 10 most frequently used research tools in previous research are Google, Webmaster Tools, Alexa, AltaVista, Baidu, AllTheWeb, Yahoo! Site Explorer, crawler tools, Baidu Index, and website traffic tools. These research tools have their own characteristics and play different roles in research. For example, search engines like Google and crawler tools are often used to obtain main link indicator data including webpage count and total link count. Webmaster Tools, Baidu Index, and website traffic tools are used to obtain indicator data such as PR value, user visits, user attention, and backlink count. The selection of research tools is mostly based on the indicators set in each study, but more studies comprehensively consider both, that is, indicator settings are also based on the availability of research tools.

Finally, with the development of research, the usage of specific research tools has also changed. Tools such as AltaVista and AllTheWeb, which were widely used in early research, have basically not been used by any current research due to discontinued services. With Google's withdrawal from the Chinese market, the frequency of Google's use has also declined, but statistics show that Google is still the main research tool. Baidu has been used by many researchers when foreign search engines are difficult to use and has become a major research tool. Webmaster Tools, since 2010, has been used by many studies due to

its convenience and comprehensiveness and is currently the most important research tool. Alexa Internet, which can provide website visit queries, page view queries, and ranking trend data queries, is mainly used to collect data for evaluating the Alexa ranking indicator of a website's visits and has also received attention in recent years. In addition, some new tools such as Baidu News Platform, Baidu Index, and social media statistics platforms have also begun to attract researchers' attention.

3.5 Research Methods

Research methods refer to the methods adopted in research, including both the basic methods for conducting research, such as link analysis, and the methods for analyzing research data. The term "research methods" in this paper specifically refers to data analysis methods. Data analysis methods are related to the correctness of research conclusions. Statistical analysis of them can both understand which data analysis methods have been used in previous research and analyze the role of these methods and their impact on research results. There are two ways to count data analysis methods: first, if a study directly states the analysis method used, it is counted as stated; second, if a study actually uses a certain analysis method but does not directly state it, it is summarized and supplemented according to the specific situation. The results are shown in .

First, sorted by frequency of use, the top 8 data analysis methods used in previous research are simple statistical analysis, correlation analysis, grey relational analysis, descriptive statistical analysis, principal component analysis, factor analysis, visual analysis, and social network analysis. There are 46 studies using simple statistical analysis methods, which generally only conduct simple comparative analysis of research data and summarize based on this. There are 38 studies using correlation analysis, including Pearson correlation analysis and Spearman correlation analysis. The purposes of using correlation analysis are mainly two: first, to analyze the correlation between various link indicators and their correlation with evaluation results; second, to analyze the correlation between evaluation results obtained by link analysis and results obtained by other methods. Grey relational analysis is also a commonly used data analysis method currently. It is a method used to determine the main influencing factors, secondary influencing factors, and comprehensively evaluate uncertain systems. There are two types of applications of grey relational analysis in previous research: one is traditional grey relational analysis; the other is grey relational analysis using different weight assignment methods, such as based on information entropy [13]. Descriptive statistical analysis refers to statistically analyzing the mean, variance, standard deviation, median, etc. of data and comparing them. The difference between it and simple statistical analysis methods is that the latter generally conducts simple comparative analysis of original data, while descriptive statistical analysis begins analysis after calculating the data. Principal component analysis and factor analysis are also mathematical statistical analysis methods, both of which are commonly used in previous research. Princi-

pal component analysis mainly combines original variables into several principal components through linear combinations, using fewer comprehensive indicators to replace the original numerous indicators. Factor analysis is an extension of principal component analysis and is also a multivariate analysis method that transforms multiple variables into a few comprehensive variables. Its purpose is to use a few factors to describe the connections between many indicators or factors. Visual analysis and social network analysis are generally used when analyzing networks formed by website links. Most of the above data analysis methods are used alone, but a few studies simultaneously adopt two or more data analysis methods, such as combining principal component analysis with social network analysis [21,48].

Second, analyzing the data analysis methods used in relevant studies between 2013-2018 reveals that the most used data analysis method in recent years is grey relational analysis, followed by simple statistical analysis, correlation analysis, principal component analysis, descriptive statistical analysis, etc., with little change. Among them, principal component analysis, social network analysis, and visual analysis have only begun to be applied in relevant research in recent years. On the one hand, this indicates that current data analysis methods have gradually formed a system and become relatively mature; on the other hand, it reflects that current research analysis perspectives are limited and innovation needs to be improved.

3.6 Research Conclusions and Suggestions

Analyzing research conclusions and suggestions is the best way to understand the results and contributions of previous research. However, unlike research tools and indicators that can be statistically analyzed, research conclusions and suggestions are difficult to quantitatively analyze. But it is feasible to qualitatively analyze the research conclusions and suggestions of each study from a macro perspective. After analysis, relevant research mainly has three characteristics in terms of research conclusions and suggestions.

First, most studies have basically achieved their research purposes in their conclusions or results, either understanding and analyzing website status, evaluating website influence, comparing website link characteristics, or exploring the correlation between website analysis results and other results. In short, the research conclusions or results of each study basically closely revolve around their research purposes.

Second, most studies propose relevant suggestions based on their research conclusions, but a few studies only briefly elaborate on the research results without detailed analysis of the problems found or providing suggestions.

Finally, further analysis of those studies that provide suggestions reveals that relevant suggestions are mainly developed from six perspectives: website responsible institutions, website content construction, website promotion, website funding investment, website users, and website industry cooperation. Website

responsible institutions include the main institutions and builders of websites, and relevant discussions generally emphasize that website responsible institutions should enhance website construction awareness and attach importance to website construction [12]. Website content construction includes website interface design, structural layout, and content organization. Such suggestions mainly emphasize that improving website influence should start from improving the quality of website construction itself, such as strengthening homepage construction, optimizing website structure, and increasing information volume and information update speed [12]. Website promotion emphasizes that for websites to realize their value, they must first make users aware of their existence and understand their value, and increase promotion [13]. Website funding investment requires website subjects or responsible institutions to attach importance to website construction, make adequate budgets, and provide sufficient financial support [65]. Suggestions from the website user perspective are mainly user-centered, emphasizing that website builders should fully understand website user needs and improve user satisfaction [37]. Website industry cooperation refers to websites actively cooperating with other peer websites or even websites or network platforms in different industries, such as cooperation between library websites and social platforms like WeChat and Weibo [14]. Current research suggestions are mostly developed from these six perspectives, but not all studies provide suggestions from all six perspectives. Most studies only provide 3-4 suggestions, so they only choose 3-4 perspectives.

4. Analysis and Discussion

Based on the above analysis, we can understand the current application status of link analysis in website empirical research. Further analysis of the progress and shortcomings of relevant research from the seven perspectives of research purpose, etc., is discussed below.

4.1 Research Purposes Are Relatively Clear and Content Has Expanded, but Diversity Has Decreased and Attention Is Unbalanced

In terms of research purpose form, current relevant research has relatively clear statements of purpose, generally with 1-2 research purposes, which is fewer than in early research. In terms of research purpose content, current research focuses more on using link analysis for website influence evaluation and analyzing website status. In terms of content types, compared with early research, although diversity has decreased, research depth has increased. Among them, the analysis of website link structure, types, and characteristics is an important sign. Analyzing website link structure and types means analyzing the specific relationships between websites and linked websites, including the types of linked websites, co-links, and inter-links, which is of great significance for understanding the position of websites in the network and guiding their further development and construction.

However, current research also has certain limitations in research purposes. One

of them is the decreased attention to basic issues of link analysis, such as the usability and effectiveness analysis of link analysis methods and tools. Link analysis is still continuously developing, and its application scope continues to expand. Research on the usability of link analysis methods and tools is actually still necessary. In addition, in studies aiming to evaluate website influence and analyze website status and provide suggestions, some research has misunderstandings about conceptual connotations, and the analysis is too general and vague. For example, some scholars do not distinguish between website influence and network influence. Library website influence and library network influence are not the same concept, and using methods to evaluate website influence to evaluate network influence is incomplete and inaccurate. Some scholars claim to evaluate website influence, but their discussions actually focus on analyzing the effectiveness, feasibility, and correlation of link indicators, with little discussion on influence evaluation. If this were the research theme, it would be fine, but neither the text nor the title clearly states this theme, making it confusing. Some scholars have conducted influence evaluation but only list results and briefly describe them without in-depth analysis of the phenomena or problems they represent. Such research discussions are relatively superficial and need improvement.

4.2 Research Object Types Are Increasingly Rich and Analysis Is More In-Depth, but Repetitive Research and Insufficient Attention to Emerging Websites Still Exist

Research objects are the subjects of research. Current research objects are increasingly rich in type, forming core research objects mainly consisting of enterprise websites, library websites, university websites, and government websites. At the same time, the content of research on various types of websites is also continuously deepening. In addition, it is worth noting that research using link analysis to study other website types has also increased in recent years. Although current research has made certain progress in research objects, it must be acknowledged that there are still some shortcomings, mainly including two points: First, there is repetitive research on website objects with low innovation. For example, in research on provincial government websites, some scholars basically have no difference in research methods except for changing the province. Although such research has certain practical significance, its academic value is not necessarily high. Second, although the types of websites studied have expanded, attention to emerging websites is relatively low, and the emphasis on different types of websites is not balanced, with too much attention to some types and too little to others.

4.3 Research Indicator System Is Increasingly Perfected, but Innovative Indicators Are Still Few, Related Terminology Use Is Also Chaotic, and Applicability and Effectiveness Still Need to Be Verified

First, current research has made some progress in research indicator settings, specifically manifested in three aspects: First, research indicator types are increasingly diverse, and the indicator system is increasingly perfected. The current research indicator system basically consists of three types: link indicators, user indicators, and other types of indicators. Link indicators are basic indicators, while user indicators and other types of indicators are expansion indicators. The increase in expansion indicators in recent years has promoted the improvement of the research indicator system. Second, the number of research indicators is increasing, and the indicator system is more comprehensive and balanced. In terms of research development trends, currently most studies set 8-9 research indicators, and there is still an upward trend. The increase in the number of research indicators is more helpful for comprehensive website analysis. Third, the core indicator system is gradually maturing, innovative indicators have increased, and user indicators have become key indicators. First, with the development of research, these 10 indicators—external link count, webpage count, total link count, total network impact factor, external network impact factor, user indicators, internal link count, internal network impact factor, PR value, and backlink count—constitute the core indicator system of relevant research. Second, with the deepening of research, a certain number of innovative indicators have also been developed and proposed. For example, the improved network impact factor was developed based on the traditional network impact factor, including non-government network impact factor, university department network impact factor, hospital bed network impact factor, etc. Update coefficient and website age are indicators based on website content update speed and website construction time, which are also innovative to a certain extent. Finally, the user-centered concept has deeply influenced the application of link analysis in websites, and user-related indicators such as page views, user visits, and user attention have become the focus of indicator settings in relevant research. In short, current research has formed certain patterns in research indicator settings, using some innovative indicators and user indicators on the basis of core indicators to improve research scientificity.

However, previous research also has three shortcomings in research indicators: First, the phenomenon of similar indicator settings is relatively serious, with low innovation in indicator settings. Some studies basically use the same research indicators as others. This is not to say that the same indicators cannot be used, but they cannot be applied without thinking. Second, the expression and understanding of indicator names and definitions are relatively chaotic. Many studies use different names for the same indicator, and relevant terminology needs to be standardized and unified. For example, external link count is also called external chain count, off-site link count, etc. In addition, some stud-

ies have relatively vague understanding and recognition of indicator definitions and connotations. For example, some studies have confused understanding of concepts such as backlink count and external link count, outbound link and inbound link, or have misapplied them. In link analysis theory, terms such as outbound link and inbound link and their connotations have gradually formed a consensus. However, in the practical application of link analysis, terms such as internal link count are used more frequently, and the reasons are worth exploring. Finally, the setting of research indicators does not fully consider their applicability or effectiveness, with serious "takeism" and lack of questioning and critical spirit. Different research website types, different research tools, and different research purposes should have different indicator settings and should be verified. However, current research, especially recent research, has neglected this point, following others blindly, and its scientificity needs to be strengthened.

4.4 Research Tool Use Shows Certain Characteristics, but Its Usability and Innovation Still Have Controversies

Similar to research indicators, current research tools also have three characteristics: First, the number of research tools used is concentrated in 1-3, with studies using 1 tool being the most numerous, followed by those using 2 tools and those using 3 tools. Current research has a trend of continuing to increase the number of research tools used. Second, research tools can be roughly divided into three categories: the first category is search engines, the second category is self-made tools, and the third category is SEO tools or websites. The first category of search engines is used the most, specifically including Google, AltaVista, Baidu, AllTheWeb, Bing, etc. Among them, Google, AltaVista, Baidu, and AllTheWeb have been used more than 10 times. Google and Baidu are the main research tools currently used, while AltaVista and AllTheWeb have basically not been used by any current research due to discontinued services. The second category of self-made tools mainly includes web crawler tools and Java-based targeted crawling algorithms. Currently, the number of studies using them is relatively small, mainly because these tools have high usage requirements and are generally specifically made for certain website types or research, with poor universality. The third category of SEO tools or websites is used by many current studies, specifically including Webmaster Tools, Alexa Internet, Baidu Index, Majestic SEO, Offline Explorer, etc. Due to their simple operation and low usage threshold, many studies adopt such tools. Third, with the usability of several major foreign search engines in China being restricted, domestic research tool development and application have been promoted to a certain extent. Some new usable research tools have been developed and widely applied, such as Baidu News Platform, Baidu Index, and social media statistics platforms. In short, with research development, relevant research has not only used more research tools but also increasingly rich types. The comprehensive use of various types of research tools has become one of the current research development trends, and the development of new research tools has also become a basic requirement for current research to continue.

However, like research indicators, research tools also have some shortcomings while making progress, mainly including three points: First, the problem of inaccurate and incomplete data acquisition by research tools still exists, and due to restrictions on tool usability, related controversies are increasing. For example, whether Google can distinguish between internal and external links is still debated among scholars. Second, the phenomenon of copying research tool selection is relatively serious, with a tendency to follow others blindly. Some researchers do not carefully verify the applicability of research tools when selecting them, and relevant explanations are relatively vague. Some researchers even directly copy others' discussions about research tools in their own research without changing a word. This not only reflects that some researchers have improper and unrigorous attitudes but also greatly reduces the credibility of research results. Third, no credible and authoritative conclusions have been reached on the performance advantages and disadvantages of various research tools in data acquisition, and no unified understanding has been formed. Although most studies weigh and consider research indicators and other factors when selecting research tools, overall, when multiple tools are available, the specific choice of which research tool to use is still based entirely on personal subjective opinions, without much scientific basis to support it, and explanations are relatively broad. In addition, there are different views on the methods and approaches for using the same research tool to obtain data in some studies. Using Google to obtain data can be said to be a typical case. There are two main controversies over the use of Google: First, there is controversy over the usability of Google. Some scholars believe that Google can be used as a research tool based on its good stability and consistency, large search coverage, and large database capacity. Other scholars analyze the actual usage of Google domestically and internationally and believe that its incomplete inclusion of Chinese webpages will affect results and it is not suitable as a research tool. Second, there is controversy over the method of obtaining data from Google, that is, different views on the setting of search formulas. For example, for the search formula to obtain total link count, some studies directly use the website URL as the search formula, some add double quotes to the website URL, some add "link:" before the URL, and others add "allinanchor.", etc. However, although scholars have controversies over the use of Google, existing research shows that many current studies still use Google to obtain data, but some of these studies do not specifically explain how they obtained data, which to some extent weakens the credibility of their results. Therefore, future research should strengthen relevant explanations and provide sufficient explanations for research tool selection and usage methods to improve research result credibility. In addition, research on research tool performance should be strengthened to strive to form a unified understanding.

4.5 Research Method Use Is Increasingly Diversified, but Its Rationality and Innovation Need to Be Strengthened, and Application Accuracy Needs to Be Improved

The selection of data analysis methods determines the scientificity and accuracy of research results. Reviewing previous research reveals that simple statistical analysis, correlation analysis, grey relational analysis, descriptive statistical analysis, principal component analysis, factor analysis, visual analysis, and social network analysis are currently the more commonly used data analysis methods. Overall, compared with early research, current research methods are increasingly diverse, from simple statistical analysis to visual analysis, with methods becoming more specific and visual, and the readability and accuracy of results have also greatly improved. However, data analysis methods still have some shortcomings. First, data analysis methods are still mainly mathematical statistical analysis. This is not to say that mathematical statistical analysis is unnecessary or meaningless, but the innovation of single, repetitive use of mathematical statistical analysis is limited. Second, method usability and rationality are insufficient, and some studies use methods that deviate from research purposes. For example, in studies evaluating website influence, whether it is necessary to consider using correlation analysis to analyze indicator correlation is questionable. The use of methods is to achieve research purposes, and achieving purposes is the core of research. Finally, many current studies overemphasize the introduction of methods while neglecting the analysis and discussion of research conclusions, resulting in a phenomenon of putting the cart before the horse, which is worth vigilance. In addition, regarding method application, some researchers have not mastered and understood the usage principles of methods. Taking the application of grey relational analysis as an example, grey relational analysis was proposed by Mr. Deng Julong [74], and Nanjing University of Aeronautics and Astronautics developed professional software for calculation. However, many previous studies have abandoned it. One reason may be that they have not systematically understood the origin and development of this method, but only cited the method described in others' research, with inadequate understanding, leading to errors in application and affecting research scientificity. Researchers should fully understand the usage principles of data analysis methods and fully demonstrate their scientificity and applicability before using them.

4.6 Research Conclusions and Suggestions: Description-Without-Evaluation Phenomenon Has Decreased, but Some Discussions Are Still Too Brief and Content Has Repetitive Patching and Similar Analysis

Many current studies generally discuss research conclusions and suggestions, and the phenomenon of description without evaluation is rare. However, overall, the discussion of research conclusions and suggestions is still a weak point in many previous studies, specifically manifested in two points: First, in terms

of form, some studies have relatively brief discussions on research conclusions and suggestions, but relatively long discussions on research indicator determination, research tool selection, and research method use, showing a tendency of not distinguishing between primary and secondary issues. Second, in terms of content, previous research conclusions and suggestions have the problem of being stereotyped, with most statements being "old wine in new bottles." Some scholars' discussions on conclusions basically repeat others' discussions, with similar research analysis and discussion, only describing their own data in some data statements. How authentic such conclusions are is questionable. Some literature even copies relevant discussions word for word or patches them together from various sources without specific analysis of specific objects, which to some extent constitutes academic misconduct. In addition, some studies simply have no conclusions at all, only simple data explanations, and the significance and value of such research are also worth pondering. As for research suggestions, like research conclusions, many studies' suggestions are also stereotyped, mostly repetitive patching. Although some studies have relatively sufficient discussions and relatively novel perspectives, most research suggestions are within the six perspectives of website responsible institutions, website self-construction, website promotion, website funding investment, website users, and website industry cooperation, with relatively broad discussions.

5. Recommendations

Reviewing previous research and analyzing from perspectives such as research purpose, research object, and research indicators reveals that relevant research has made certain progress and shown certain development trends and characteristics, but also has some shortcomings that urgently need improvement. This paper has conducted a detailed analysis, but the discussion is not comprehensive. For example, the application of link analysis in website research itself has certain limitations, including incomplete link analysis theory, complex link motivations, and link hypothesis conditions that still need to be examined. This paper has not elaborated on such issues. This paper mainly reviews previous research from the seven perspectives of research purpose, etc., and therefore mainly provides relevant suggestions for the development of future research from these seven perspectives.

5.1 Clarify Research Purposes and Enrich Research Purpose Content

Current research has shortcomings such as overly general and vague research purpose statements, unclear understanding of relevant concepts, and single research purposes. Therefore, future research should first clarify research purposes and express them clearly and concisely. This is not only a basic requirement for ensuring smooth research but also key to academic communication. Only by clarifying the problems to be solved in one's own research can research be conducted systematically and scientifically, and can others understand the significance of the research and judge its value. Second, future research should

enrich research purpose content. Current research shows a trend of having only 1 or 2 research purposes, and the basic similarity of research significance is somewhat thin. There are still many problems in the website research field, and the application of link analysis still has great potential. Future research should enrich research purposes, focusing not only on hot issues in website development and timely using link analysis to study websites but also on exploring and solving new perspectives and new problems while giving sufficient attention to unresolved issues in previous research, timely providing new discussions and analyses of seemingly outdated research issues, and re-measuring their development. Researchers should neither avoid difficulties nor deliberately ignore them, nor underestimate the importance of these issues.

5.2 Appropriately Expand Research Scope, Considering Website Actual Development While Also Balancing Attention

This is mainly proposed in response to the problems of repetitive research objects and neglect of some research objects in current research. Website technology is developing rapidly, and the number and types of websites are also continuously increasing. Expanding the scope of website research objects is inevitable. However, some research disregards website development realities and still takes website types that many people have studied as their research objects. Although such research is not undesirable and has certain significance, it should be noted that research should also consider the actual development of research objects. Currently, various new types of websites are constantly emerging, and many types of websites are gradually maturing. These all require researchers to maintain sufficient curiosity and thirst for knowledge to conduct relevant research and provide guidance for their construction and development. In short, future research should not only conduct further analysis of certain types of websites but also appropriately expand research on different types of websites, maintaining focus while also considering website actual development and ensuring balanced attention.

5.3 Perfect the Indicator System, Balancing Indicator Applicability and Innovation

The construction of the indicator system is paramount in website research applying link analysis. How to perfect the indicator system is still a question that needs continuous exploration. First, future research should attach importance to indicator settings and the innovation and rationality of indicators. At the same time, the number of research indicators should also be adjusted. The most appropriate number of indicators is around 7, which can ensure relatively comprehensive analysis without being too cumbersome, leading to reduced applicability and practicality. Second, future research should meet the requirements of being objective, scientific, and effective when setting research indicators. Researchers should neither rely entirely on their own opinions without scientific basis nor follow others blindly without verification. Finally, the applicability

of research indicators is still an important issue worth considering in future research. If research purposes differ, research tools differ, and research objects differ, then indicator settings should also be carefully considered. Researchers cannot assume that others' research indicators are applicable to all studies.

5.4 Reasonably Select Tools and Develop Professional Research Tools

The selection and development of research tools are key to future research. Currently, there are many research tools, but several problems still exist, such as inaccurate and incomplete data acquisition. In addition, although the phenomenon of over-reliance on foreign research tools has been alleviated to some extent, the development level of domestic research tools still needs to be further improved. Like research indicators, research tool selection must also pay attention to rationality and usability. On the one hand, the number of research tools used in research should be appropriately increased. The comprehensive use of 2-3 research tools is more appropriate, especially when using some tools with limitations. Adding complementary or comparable tools will improve research quality and make research more persuasive to a certain extent. On the other hand, most current research uses search engines such as Google as research tools. Although these search engines have certain scientificity for research data acquisition, it should be noted that the main function of search engines is not for obtaining link indicator data. They are not professional research tools. Relying on non-professional tools for research, the scientificity, authority, and professionalism of research results are worth pondering. Therefore, future research should increase development efforts, try to develop new professional research tools to conduct research. This is a necessary requirement for scientific research and is also worth in-depth discussion by researchers. Currently, some studies using self-made tools to obtain data can be said to be an attempt. Can we go further in the future to develop and design a research tool specifically for obtaining relevant data? This is worth looking forward to. In short, future research should strengthen research tool development, focusing on improving tool professionalism and usability.

5.5 Comprehensively Use Multiple Methods to Ensure Result Scientificity

The excessive repetition and singularization of research methods are current shortcomings, which also affect the accuracy of research results to a certain extent. Future research should comprehensively use multiple data analysis methods, compare and analyze research results obtained by different methods, and strive for objectivity and scientificity. In addition, understanding of various data analysis methods should also be comprehensive and thorough. Some studies misuse data analysis methods or have problems understanding the methods, resulting in low authority and reliability of research results. Future research should fully learn and master the usage principles of data analysis methods before using them, and fully demonstrate their scientificity and applicability.

5.6 Summarize Research from Multiple Perspectives and Provide Suggestions with Multi-Party Consideration

Currently, many studies overemphasize the elaboration of research processes while neglecting the discussion of research conclusions, or due to limited professional understanding, discussions on conclusions are mostly relatively superficial. Future research should strengthen discussions on research conclusions. In addition, future research should also have more comprehensive and objective discussions on research suggestions, and suggestion perspectives also need to be expanded. Researchers should not only analyze specific issues specifically and provide specific suggestions but also be innovative in suggestions and discuss them from different perspectives. Finally, many current studies only show results and suggestions but not actual effects. How many people have adopted the results? Have the results been verified for accuracy? Are the results supervised? What is the follow-up feedback? Such evaluations of results are rarely seen, and future research needs to strengthen analysis in this area.

In short, link analysis has been applied in domestic website empirical research for many years, has made certain progress, and shown certain characteristics. However, at the same time, due to the limitations of link analysis itself, it also has certain shortcomings in specific applied research. This paper analyzes relevant research from seven perspectives including research purpose, research object, and research indicators, and elaborates in detail on its progress and limitations, hoping to provide references for future scholars conducting relevant research.

References

[1] MCKIERNAN G. Automated categorisation of web resources: a profile of selected projects, research, products, and services[J]. New review of information networking, 1996, 2(1): 15-40.

[2] ALMIND TC, INGWERSEN P. Informetric analyses on the world wide web: methodological approaches to 'webometrics'[J]. Journal of documentation, 1997, 53(4): 404-426.

[3] INGWERSEN P. The calculation of web impact factors[J]. Journal of documentation, 1998, 54(2): 236-243.

[4] QIANG ZL. Using search engine advanced retrieval functions to evaluate university library Web sites[J]. Journal of academic libraries, 2000(4): 53-54, 64.

[5] HUANG Q, LI W. Academic WWW network resource evaluation and classification method based on link analysis[J]. Journal of the China Society for Scientific and Technical Information, 2001(2): 186-192.

[6] LIU YS, FANG P. Investigation of external link types and characteristics of Web sites: feasibility study of link analysis[J]. Journal of academic libraries,

2001(5): 65-68, 72.

[7] QIU JP, CHEN JQ, DUAN YF. Link analysis of Chinese university websites and exploration of network impact factors[J]. China soft science, 2003(6): 151-155.

[8] WANG CL, WANG T, WANG RZ, et al. Bibliometric study of link analysis literature (2001-2010)[J]. Journal of Jishou University (Natural Sciences Edition), 2012, 33(1): 120-125.

[9] WEI RB. Bibliometric analysis of domestic link analysis research[J]. Library and information service, 2012, 56(2): 40-45.

[10] SUN JJ, HU ZW, JIANG T. Review of link analysis research hotspots and frontiers[J]. Journal of the China Society for Scientific and Technical Information, 2016, 35(4): 432-441.

[11] WEN TX, WANG Y, YANG YW, et al. Review of web link analysis application research[J]. Library and information knowledge, 2011(4): 84-91, 96.

[12] DU YL, LI HY, CHENG KM, et al. Link analysis and influence evaluation of university websites in Jiangsu, Anhui, Zhejiang, and Shanghai[J]. Journal of Hefei University of Technology (Social Sciences), 2018, 32(1): 130-137.

[13] CHEN XW, SUN JJ, TANG ZW, et al. Research on the network structure and influence of China's red tourism websites from the perspective of link analysis[J]. Information science, 2018, 36(1): 152-157.

[14] FU P. Research on library network influence: taking "985 Project" university libraries as examples[J]. Information science, 2017, 35(10): 103-108, 119.

[15] SHI YT, ZHU QH, ZHAO YX, et al. Comprehensive influence evaluation of domestic webcast platforms based on link analysis[J]. Data analysis and knowledge discovery, 2017, 1(9): 40-48.

[16] ZHAO CL, LI HX, JIANG ZH. Analysis and enlightenment of the construction status of MOOC platforms at home and abroad: from the perspective of link analysis[J]. Journal of Guangxi Radio and TV University, 2016, 27(2): 10-14.

[17] CHENG HP. Effectiveness analysis of link analysis indicators in university website ranking evaluation[J]. Journal of information resources management, 2012, 2(3): 46-51.

[18] YAN EJ. Link analysis of Chinese provincial capital city government websites[J]. Information science, 2008(2): 218-223.

[19] HUANG XB, GE R. Comparative analysis of links to national library websites[J]. Research on library science, 2004(8): 32-35.

[20] YANG MR. Research on network link analysis of core journals in electronic information[J]. Chinese journal of scientific and technical periodicals, 2007, 18(3): 449-452.

[21] YANG SS, SUN JJ. Comparative study on link structure of university library websites in China and the United States[J]. Information science, 2011, 29(7): 971-974, 1103.

[22] YUE ZH, ZHENG CH, WANG ZB. Comparative study on link characteristics of university library cyberspace in China and the United States[J]. Information science, 2011, 29(9): 1363-1369.

[23] DU YL, WU YQ, DAI Y, et al. Research on influence evaluation of public university websites based on link analysis: taking Anhui Province as an example[J]. Information research, 2017(8): 6-11.

[24] SHA YZ, OUYANG X. Influence evaluation of Chinese provincial government websites: website link analysis and network impact factor measurement[J]. Information and documentation services, 2004(6): 17-22.

[25] WANG CL, ZHANG LL, HU XX. Analysis of Anhui Province A-level logistics enterprise websites based on link analysis[J]. Logistics engineering and management, 2012, 34(2): 15-17, 21.

[26] CHEN TY. Empirical analysis of university library website links in China: taking "211 Project" universities as examples[J]. Library journal, 2007(3): 43-49.

[27] ZHAO FZ. Research on network community influence based on link analysis: taking 30 domestic network community websites as examples[J]. Modern information, 2013, 33(6): 91-95.

[28] CHEN TY, REN QE. Link analysis and network influence evaluation of Chinese and foreign enterprise websites[J]. Information studies: theory & application, 2008(4): 614-619.

[29] WANG JD, SUN HM. Empirical research on ranking of "211 Project" universities based on website link analysis[J]. New technology of library and information service, 2008(9): 64-69.

[30] YU XP, YAN XY. Application of link analysis in information science: taking 10 universities in western China as research objects[J]. Modern information, 2009, 29(1): 184-186.

[31] NIE J, HU LS. Evaluation of P2P online lending platforms based on link analysis[J]. Research on library science, 2015(13): 37-45.

[32] LIU WY, ZHAI YJ, WANG WY. Influence evaluation of university library websites based on link analysis[J]. Information science, 2013, 31(6): 99-102, 106.

[33] DUAN YF. Quantitative research on website characteristics (II): exploration of university website influence[J]. Information studies: theory & application, 2005(2): 191-194, 175.

[34] LI ZF, ZHANG XQ. Influence evaluation of provincial archives bureau websites in China based on link analysis[J]. Information science, 2016, 34(5): 142-

147.

[35] YANG SL, FENG Y. Comparative evaluation of network influence of Chinese think tanks[J]. Journal of Chongqing University (Social Science Edition), 2017, 23(2): 68-78.

[36] CHEN YY, LI G. Research on think tank website influence evaluation indicator system[J]. Library tribune, 2016, 36(5): 25-33, 62.

[37] WANG YD. Research on influence evaluation and promotion strategies of government agricultural information websites: empirical analysis based on provincial government agricultural information websites[J]. Library and information service, 2015, 59(16): 102-109.

[38] LIU H, SUN JJ, ZHENG YN, et al. Website influence analysis of CSSCI source journals[J]. New technology of library and information service, 2006(3): 64-67, 81.

[39] HOU SC, ZOU LJ, HU H. Comparative analysis of network influence of hospitals in China[J]. Chinese journal of medical library and information science, 2014, 23(4): 24-28.

[40] ZHU L. Comparative evaluation of network influence indicators of hospital websites in China and the United States[J]. Chinese journal of medical library and information science, 2012, 31(8): 129-133.

[41] JI WJ, QU JS, ZENG JJ. Network influence analysis of major international environmental NGOs[J]. Information science, 2012, 30(4): 5-8, 4.

[42] CHANG YL. Network influence analysis of intangible cultural heritage websites[J]. Modern information, 2013, 33(9): 90-94.

[43] WANG M. Influence evaluation of China Association for Science and Technology website based on link analysis[J]. China science and technology resources review, 2017, 49(1): 102-108.

[44] HUANG LX, ZOU CL. Influence evaluation of migrant worker websites based on fuzzy comprehensive evaluation method[J]. Information science, 2016, 34(11): 75-79.

[45] FU YY, DENG SH, LU YF. Construction and communication research of Jiangsu university websites based on link analysis[J]. Research on library science, 2015(14): 43-50.

[46] LIN JN. Exploration of the relationship between competitiveness and website influence of higher vocational colleges in Henan Province[J]. Communication world, 2016(13): 248-249.

[47] SHA YZ, NIU CH. Link analysis and network impact factor measurement of outstanding Chinese informatization enterprise websites[J]. Journal of Lanzhou University, 2004(5): 99-107.

[48] XIONG J, ZHU L. Evaluation research of Zhejiang university library websites based on link analysis[J]. Research on library science, 2012(3): 45-51.

[49] CHEN CQ, DENG SH, WANG H. Analysis of 211 university website influence based on entropy-weight TOPSIS[J]. Information science, 2017, 35(9): 146-152.

[50] LI CL, YUAN QJ. Research on influence of domestic museum websites based on link relationships[J]. Southeast culture, 2016(3): 110-116.

[51] DU YL, PAN YG, ZHOU YY, et al. Influence evaluation of university websites in Jiangsu, Anhui, and Zhejiang based on traffic and weight[J]. Agricultural library and information, 2017, 29(12): 51-55.

[52] HUANG KM, FAN ZJ, LU SJ, et al. Comparative study of Chinese and American think tank websites based on link analysis[J]. Information studies: theory & application, 2014, 37(11): 129-133.

[53] ZHAO NX, ZHANG RR. Research on network influence evaluation of cross-system regional library alliances[J]. Library and information service, 2017, 61(7): 28-33.

[54] QIU JP, LIU N. Evaluation analysis of think tank website influence[J]. Journal of Chongqing University (Social Science Edition), 2016, 22(3): 109-114.

[55] LU JX, HUANG YY, CHEN YM. Correlation analysis of influence factors of domestic science popularization websites[J]. Science popularization, 2015, 10(2): 69-77.

[56] SUN YM, ZHU XF. Analysis and evaluation of influence of China's online retail malls based on external link analysis[J]. Modern information, 2011, 31(4): 165-169, 173.

[57] LIU WY, ZHOU TB. Research on network influence evaluation of provincial public libraries in China[J]. Library development, 2011(3): 85-89.

[58] CHEN YY. Empirical research on the relationship between website visits and link counts: taking Chinese e-commerce websites as examples[J]. Journal of Sun Yat-sen University (Social Science Edition), 2005(4): 121-129.

[59] MA XH. Link analysis of American university library websites: taking 30 American university library websites as examples[J]. Jiangxi library journal, 2008(2): 119-123.

[60] WU LL, YANG XJ. Analysis of influence of foreign language portal websites of Chinese universities: taking Peking University as an example[J]. Sci-tech information development & economy, 2013, 23(18): 113-116.

[61] WANG HX. Link analysis of provincial and above public library websites in China[J]. Journal of library science in China, 2005(3): 86-89, 97.

[62] GU DL, YANG P, ZHU JM. Comparative study on network influence of global official patent websites[J]. Sci-tech information development & economy,

2009, 19(31): 52-54.

[63] MA HL, SI HK, MIAO J. Comparison of link characteristics of library websites of sports universities in China and Japan[J]. Journal of Capital University of Physical Education and Sports, 2012, 24(3): 229-233.

[64] YU LP, PAN YT, WU YS. Thoughts on several issues in selecting evaluation indicators for academic journals[J]. Journal of intelligence, 2009, 28(3): 75-77, 100.

[65] YUE ZH, ZHENG CH, FU WF. Comparative cluster analysis of university library website links in China and the United States[J]. Information science, 2011, 29(1): 62-67.

[66] ZHOU TT, JIA WK. Empirical analysis of website links of agricultural and forestry universities in China[J]. Agricultural network information, 2015(1): 30-32.

[67] HE Y, HU R. Research on influence evaluation of independent college websites in Shaanxi based on link analysis[J]. Journal of Northwestern Polytechnical University (Social Sciences), 2017, 37(3): 47-50, 56.

[68] SI HK, MA HL, ZHOU DM, et al. Measurement distribution of link characteristics of sports university library websites[J]. Sports science research, 2009, 30(2): 33-38.

[69] ZHANG XL, WEI QS. Research and thinking on network influence of university institutional repositories[J]. Library theory and practice, 2016(7): 61-65, 100.

[70] YU CH, YUAN QJ. Link analysis of China's online bookstores[J]. Journal of intelligence, 2011, 30(2): 203-207.

[71] SONG D, GAO F. Grey relational evaluation of China's provincial government portal websites based on link analysis[J]. Knowledge management forum, 2013(4): 20-26.

[72] ZHAO YX, PENG XX, SUN JJ. Comprehensive influence evaluation of domestic NGO websites from the perspective of link analysis[J]. Journal of the China Society for Scientific and Technical Information, 2014, 33(5): 549-560.

[73] WANG H, YANG SL. Application exploration of link analysis in evaluation of well-known Chinese enterprises[J]. Journal of intelligence, 2010, 29(3): 48-52.

[74] DENG JL. Theory and method of social-economic grey systems[J]. Social sciences in China, 1984(6): 47-60.

Author Contributions:

Lu Wenhui: Responsible for overall framework design, data analysis, and paper writing

Ye Jiyuan: Responsible for research guidance and paper revision

Received Date: 2018-11-08
Revised Date: 2019-02-22
Page Range: 119-130
Responsible Editor: Wang Chuanqing

Analysis of the Application Status of Link Analysis Method in Domestic Empirical Research of Websites

Lu Wenhui, Ye Jiyuan
School of Information Management, Nanjing University, Nanjing 210023

Abstract: [Purpose/Significance] The purpose of this paper is to explore the application of link analysis in domestic website empirical research and to analyze the progress and shortcomings of relevant research. [Method/Process] Combining quantitative analysis with qualitative analysis, this paper makes a comprehensive analysis of previous studies from seven perspectives: research purposes, research objects, research indicators, research tools, research methods, research conclusions, and research suggestions. [Result/Conclusion] The study found that relevant research developed rapidly and showed certain characteristics, such as many papers having 1-2 research purposes, with content focusing on evaluating website influence and analyzing website status; the scope of research objects is expanding, attention to some new websites has increased, but university websites, enterprise websites, and government websites are still the main ones. At the same time, some studies also have some shortcomings, such as mostly duplicated research methods, insufficient innovation in research indicators, and limited performance of research tools. Based on the above findings, relevant suggestions are put forward from seven aspects such as research purposes and research objects.

Keywords: link analysis; website evaluation; website influence; network impact factor; enterprise website; university website; government website

---

Academic Integrity Statement for Authors of *Library and Information Service*

Library and Information Service has always adhered to the mission of publishing excellent academic paper results and promoting industry academic exchanges, and is committed to purifying the academic publishing environment and creating a good academic ecology. In 2013, it took the lead in formulating, publishing, and implementing the "Joint Statement of Library Science Journals on Abiding by Academic Ethics and Purifying the Academic Environment" (hereinafter referred to as the "Statement") (see: http://www.lis.ac.cn/CN/column/item202.shtml), and subsequently took the lead in formulating and publishing the "Joint Action Plan of

Chinese Library and Information Science Journals to Resist Academic Misconduct" (hereinafter referred to as the "Joint Action Plan") (see: http://www.lis.ac.cn/CN/column/item247.shtml). To implement and implement this concept, this journal solemnly declares that from now on, all submitting authors must promise that papers submitted to this journal must comply with the above "Statement" and "Joint Action Plan," consciously abide by academic ethics, and resolutely resist academic misconduct. *Library and Information Service* has zero tolerance for all papers suspected of plagiarism, 剽窃, and other academic misconduct, and adopts corresponding punitive measures.

Library and Information Service Magazine

Note: Figure translations are in progress. See original paper for figures.