웹링크 구조, 키워드, 사이트인기도 간의 관계성 분석에 관한 연구 : 관광산업을 중심으로

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ANALYZING RELATIONSHIPS THE AMONG WEB LINK STRUCTURE, WEBPAGE KEYWORD, AND POPULAR RANK : Travel Industry

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Abstract

Websites in the Internet are uncontrollable domain and various contents in websites lead people's activities and thoughts and new business paradigms for the future. These phenomena are from expanding the social network based on the endless growth of information technology. Websites are composed with many of links and communicating and expanding their virtual area by links; inbound, outbound, onsite, and offsite links. Research and practice in digital information on the web have focused on finding and measuring artifacts, factors and attributes of web structure and contents from the perspective that information is a resource and property of products and services. Websites links is one of the core artifacts for understanding the virtual area. This study identifies the role of web link structure and webpage keyword as artifacts and examines their relationships by webpage rank by a minimal hub as performance in the business websites that are serving tourism information. Discovering relationships of links provides managerial insights on organizations virtual activities and systematic understandings about digitalized organizational information in the information use environment.

Keywords : Web link Structure, Webpage, Keyword, link, Google PageRank

1. INTRODUCTION

The web presence of a company is based on the network of web pages, where information and contents are connected and delivered across internal and external players, agents, and other stakeholders. Websites represent the status and strategy of a company's communication and technology [1]. Information itself in the Internet has become the central part of values' creation for customers. Information and technology based on the web are also driving innovations in business processes intended to improve the possibility to survive, realize profit, and grow. In this sense, web strategies have led and been led by organizational activities, business processes and technology practices in the Internet age. Businesses use Internet (1) for intra organizational applications, communication, and information sharing within the organization, (2) for creating virtual presence of the organization and analyzing responses, and (3) for conducting business with customers and business partners [2].

Recently, there has been a considerable interest in the growth properties of human interaction networks such as the World Wide Web [3]. Widely spreading and evolving the webpages in the Internet have an interactive characteristic with the others. Much of these studies worked on Web links to reveal the structure and map of the World Wide Web. Link accessing by hypertext is a way of connecting pieces of text so that you can go quickly and directly from one to another. The emergence and widespread use of Internet created new business paradigm. Most of organizations have been opened their strategic channels for customers and suppliers through the Internet. A growing area of research in information science is the analysis of web based documents, often using quantitative techniques [4], commonly known as Webmetrics.

Link of the successful website has dynamic directions and relationships for serving and maintaining the information and contents quality. The relationships of components between website link structure and a rank of popularity as performance help to reveal a structural approach for managerial operation in the Internet business. In this research we attempted to conceptualize the characteristics and examine relationships of the link in perspective of network, websites' structure, and a rank of websites.

2. RESEARCH BACKGROUND

2.1 Web Structure and Link as Information Resource

Technology has always been a central variable in organizational theory and information systems research [5]. Successful websites provide new business values in response to present and future opportunities, especially within the domain of the web. New technologies and various application systems have been adopted to drive customer oriented information for successful business. The importance of information systems strategies

have been increasing as the role of technology becomes central to the competitiveness of enterprises' products and processes [6]. Hyperlink is a core of technology to evolving the Internet society and communicated with information and content user and integrated information and contents. Hypertext and hypermedia have emerged as primary means for structuring documents and for accessing the Web in content and information structural information [7].

The network structure of a hyperlinked environment can be a rich source of information about the content of the environment, provided we have effective means for understanding it [8, 9]. A growing area of research in information science is the analysis of Web based documents, often using quantitative research as Webmetrics [4]. Bibliometric finding relationships among documents such as hyperlinks or citations [10, 11] and computer science with graph theory as a graph collected dots [12, 13] is a theoretical and empirical root to understand the Internet. Despite the billion documents on the Web, nineteen degree of separation suggests that the Web is easily navigable. Big yet small. But the small world behind the Web is a bit misleading. To be sure, if there is a path between two documents, that path is typically short. But in the reality not all pages can be connected to each other. Starting for any page, we can reach about 24 percent of all documents. The rest are invisible to us, unreachable by surfing [14]. Most of all, the core for successful and retentive competitiveness with technology and information use environment need to under-

stand the structure and content of World Wide Web.

In viewing of the Internet world, Barabasi (2003) describes the Web consists of Central Core, IN continent, OUT Continent, Tendrils, Islands, and Tubes. This structure is direct path; link. Most of the Websites has structured the incoming and outgoing links and internal links [7, 9, 14]. In viewing of website, Central core is a domain website which has many documents and URLs linked with internal link, IN Continent consists of incoming links from search engine or authoritative web, and OUT Continent is target documents linked with outgoing link from Central Core. The Web site's structure based on link perspectives focuses on Central Core. It represents the domain and the characteristics of the website in the direct network.
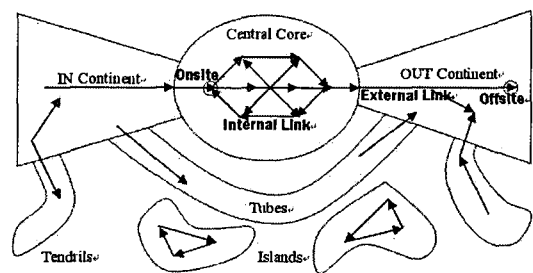
〈Figure 1〉 The Continents of a Directed network
(Source : Barabasi 2003)

Link popularity is a way of understanding the web structure and characteristics in serving information and contents. The link structure was obtained from a public available database created by crawler based search engine to measure link popularity and this is a

relatively mature Web using area [4, 15, 16]. To travel the web, following links, returning some sort of information about the pages visited or the pages themselves. They are also known as spiders and bots. Remote site mappers and link checkers are special purpose kinds of web crawlers. Crawlers that return HTML pages and the other files associated with web pages can be used for mirroring sites for archival purposes. As they download pages, they can also make the characteristics of the pages and files available for analysis <http://irisresearch.library.cornell.edu/VRC/cat crawl.html>.

In resource based view, Link is connected with information and contents, individuals and organization, tangible and intangible resource, and technology and human. Information is "administrative resource having both allocative and authoritative aspects, and capable of significantly influencing the manner and form of control employed in organizations" [17, 18]. Links include organization's resource and represent the organization's capability. Link resource is what and where to connect based on the direction network. There is a lot of links as structured properties of social systems in perspective of resource based view and structurational theory [17~21]. To conceptualize the structure of the Web focus on the direction. And the links of incoming and outgoing suggest the feature of web site; hubs, authority, and community [14]. Most of all, the WWW structure is from the website structure. Web document structure extracts tag attribute and tag information of document,

and link structure among web documents by using hyperlink data. The link information shows the source of collaboration of visiting linked documents. In addition, by using the link information of extracted hyperlinks, a hierarchical structure and site map can understand the website's structure and out feature.

The nature of link as information resource is interaction between the individual and the organization and integration of information and contents. Beyond technology, link is a representative artifact of web structure and understood the social network in the Internet [22]. In the WWW, the aggregation of link is a network as a technology oriented and a social community as a human oriented in the web link. Understanding human activities in the Internet, information system research widely studies a link structure in hubs and authorities.

2.2 RANK AND KEYWORD IN INTERNET

Within the Internet, the shape of electronic commerce has transformed form direct transaction between supplier and buyer to electronic transaction. Thus, we have to assess and restructure a web server to create a business site convenient for the users. Web evaluation sites that carry out evaluation by classifying the evaluation largely into content and system performance are spreading in worldwide [23]. Most analyses of the World Wide Web have focus on the connectivity or graph structure of the web [24].

Organization's website has been evolving from the outcomes in business activities and

business value of information technology toward information systems strategy for competitive advantage; organizational experience, customer and supplier relations, economics of production, marketing support, product & service enhancement, business innovation, and competition. Their websites in the Internet have been represented of the state of nowadays' business process and strategy for tomorrow's successful performances and outcomes using information technology based on the linkage between organizational internal and external resources. Links has considerable potential to provide further understanding of the structure and content of the World Wide Web [7, 8].

Despite its increasing role in communication, the World Wide Web remains uncontrolled: any individual or institution can create a website with any number of document and links[3]. Although much work has been done to map and characterize the Internet's infrastructure, little is known about what really matters in the search for information – the typology of the web [3, 25]. Web link plays a role of a communication and interaction among the players in the value chain and has been made by a hypertext written by websites' developers. Web links are divided with three types; outgoing link or hubs that have a lot of outgoing links and provide collections of links to authorities, incoming link or authorities that have a lot of incoming links and provide the best source of information on a given topic, and communities of thematically related information sources that can be characterized by the way in which it links and

refers to its most central, prominent members or information groups [3, 26, 8].

The structure of web has controlled minimal hubs with connectivity and there are authority web documents connected with hubs. Additionally, authorities consist of a lot of link structures. High ranked web pages are consisted of incoming and outgoing link and created business opportunities positioning high ranking in retrieval of hubs in the Internet environment.

A search engine is a crawler based website that has millions (even billions) of individual pages in its database. Search engines are the most frequently encountered web crawlers. Some examples of major search engines are: Google, Altavista, Excite, Lycos, and Hotbot. These kinds of search engines report the documents' popularity and accuracy. Internet users pursue to find the useful and fluent information through using Google, Altavista, Excite, Lycos, and Hotbot. The importance of target page by users is the result of search. The result of search is recommended pages or URL, favorite site, and popularity by rank. The rank is a promotional tools; alexa.com, Google page rank, and etc. Link based ranking schemes are customarily divided into two classes ; query specific and static. PageRank is a static ranking of web pages and used as the core of the Google search engine. It is the most visible link based analysis scheme, and its success has caused virtually every popular search engine to incorporate link based components into their ranking functions. Page Rank uses a Markov Chain model, assuming

that the probabilities of following the out links from a page is equal [24]. Tomlin [2003] pointed that the PageRank as a measure of the attractiveness and quality of the results arranging better than traffic rank in precision.

In order to measure the relative importance of web pages, Page et al [1999] proposed Page-Rank, a method for computing a ranking for every web page based on the graph of the web, PageRank has applications in search, browsing, and traffic estimation [27].

Google PageRank relies on the uniquely democratic nature of the web by using its vast link structure as an indicator of an individual page's value. In essence, Google interprets a link from page A to page B as a vote, by page A, for page B. But Google looks at more than the sheer volume of votes, or links a page receives, it also analyzes the page that casts the vote. Votes cast by pages that are themselves "important" weigh more heavily and help to make other pages "important" ranged from 0 to 10 grade (http://www.Google.com/technology/). Page Rank is a key topic by Search Engine Optimization (SEO) experts. At the heart of PageRank is a mathematical formula that seems scary to look at but is actually fairly simple to understand(http://www.iprcom.com/papers/pagerank).

Most of hubs and authorities sites have been developed and promoted to high rank position in portal website in the Internet business. As Google.com is one of huge hubs, their Search Engine Optimization (SEO) technology is forming the great flow of the web link strategy. PageRank represents the actual, real, page rank for each page as calculated by Google ranging from 0.15 to billions. The rank of a search results by keyword is the preference and priority of links by voting by users. The matching between webpages' title and contents and search method by keyword is evolving an important tool of search engine optimization. The structure of website contains the inbound and outbound link, onsite and offsite, and is evaluated by popularity as performance. Inbound/onsite is the number of links to it from within your site, and the number of links out of that page, and outbound/offsite is, For the outbound links, this view provides the number of links that are internal, and the number that are external.

3. RESEARCH METHODOLOGY

3.1 Method

In the social sciences, and information science in particular, links are used in an information centred way, to find out about the information on the web: its structure/inter-relationships and its value [28, 12, 29, 11, 30]. Links are also used from an actor centred perspective, to find out about the structure of networks of actors, whether individuals or organizations, including the importance of individual actors [30~33]. Suppose that an experimenter investigates a set of web sites and obtains a set of link counts, perhaps counts of links to each site, from each site, or between each pair of sites. In order to report the findings, the researcher needs to know what lan-

guage to use to describe the link counts, and what inference to make if, say, one count is double the size of another count. As the direct approach interpreting link counts, the most direct way of solving this problem is to ask a random selection of link creators why they authored their links. An alternative relatively direct method is to take a random sample of links and categories them in a way that is relevant and helpful for the research goals. Both of these approaches are direct in the sense of interpreting the links themselves [30].

The link structure was obtained from a public available database to measure link popularity [15, 16, 4]. Page Rank is an excellent way to prioritize the result of web keyword searches of its citation[35, 39]. Page Rank means the accuracy of correspondence.

This is used by Optitools 3.x in crawler based search engine as formative method. Each of the web sites analyzes Google PageRank, match, inbound, outbound, onsite, and offsite as variables by formative analysis in perspective of resource. As explained above, inbound, outbound, onsite and offsite is a set of link in a website in perspective of structure. Match is an indicator of how closely the topic and reputation of the page align.

3.2 Data Collection

Corporate cost management consultants have found that travel and entertainment expenses are the third largest controllable expense in business organizations [34, 36]. The tourism industry seeks to generate international demand for local product. Access to global market is critical. The tourism industry is an information intensive industry. The generation, gathering, processing, application and communication of information are important for the day to day operation of tourism businesses, making the effective use of information technology critical [37].

Analyzing the tourism industry presents various interesting aspects both academically and practically. The research samples are 190 (every third) of 697 travel agent companies chosen from favorite and top portal site (naver.com) in Korea. The available samples are 145 of 190 samples. The sampling used stratified sample method in business decision which user or surfer in the WWW searches and choose and click the URL in one of the search results[38].

The sample data divided three groups; Top Group is over 5 grade in Google PageRank, Growing Group is from 4 to 3 grade, and Immature Group is below 2 grade. Top group is a leading authority website ranked in 10^5 voting, Growing Group is from 10^4 to 10^3 voting, and Immature Group is below 10^2 voting in Google Toolbar.

3.3 Data Characteristics

<Table 1> as a result of descriptive analysis summarizes mean, numbers (N), and standard deviation (Std. Deviation) of Match, Inbound, outbound, onsite, and offsite links of 145 travel agencies websites. In the sampling, the

sampling group divided three groups ; Top_ Group consist of 16 websites, Growing_Group 102 websites, and Immature_Group 27 websites. The mean of link in the sample websites have 6,514 inbound links, 11,879 outbound links, 11,192 onsite links, 687 offsite links, and 668 matches. By groups, the mean of Top_ Group websites have 9,544 inbound links, 19,989 outbound links, 19,485 onsite links, 505 offsite links, and 843 matches. Secondly, the mean of Immature_Group websites have 6,681 inbound links, 11,832 outbound links, 11,083 onsite links, 749 offsite links, and 641 matches. Finally, the mean of Immature_Group websites have 4,087 inbound links, 7,252 outbound links, 6,691 onsite links, 561 offsite links, and 664 matches.

As a result, the outbound link represents the characteristics of the direct network in the Internet. It means most of the websites have information and content network structure in their owning information itself shown onsite link. Inbound links in one page is smaller than outbound links. This is an information network from page A to page B. Page A and B is connected with information and content to build a trust for users. On the other hand, offsite links in Top Group are smaller than the others groups. This means a role of information linkage between authorities and immature. Especially, Growing Group is more cooperated with Top_Group than Immature Group.
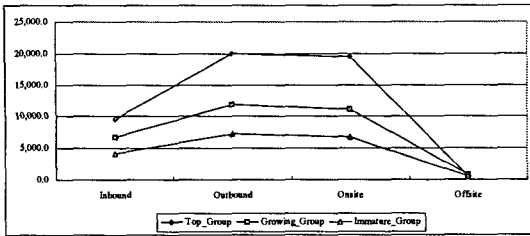
The web in the Internet has the minimum and infinitesimal authoritative site by Barabasi [2003]. As <Figure 2>, the characteristics of

links in websites have shown by groups. This has shown the frequency of Inbound, outbound, and onsite links is different by each of groups. But the pattern of offsite links is different from links of Inbound, outbound, and onsite. Links by three groups are contrasted <Figure 2> with <Figure 3>. Three groups in terms of links of inbound, outbound, and onsite are distinguishable in <Figure 2>. Links of offsite had higher frequency in Growing_ Group and Immature_Group than Top_group because websites of Growing_Group and Immature_Group are cooperated with websites of Top_Group to share information, supply chain based on web based technology through the web links. Therefore, in viewing of links, as Top_Group are a hub of information and content, they lead the links of direct network and create information and technology through the internet.
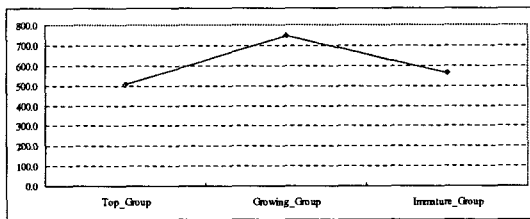
In <Table 2>, Relationship of web link structure

<Table 1> Descriptive Results for variables by three groups

Group		Inbound	Outbound	Onsite	Offsite	Match
Top_ Group	Mean	9,543.8	19,989.4	19,484.8	504.6	843.3
	N	16.0	16.0	16.0	16.0	16.0
	Std.	14,836.9	24,302.8	24,055.6	634.9	663.1
G_G	Mean	6,680.9	11,831.8	11,083.2	748.6	641.0
	N	102.0	102.0	102.0	102.0	102.0
	Std.	9,975.1	17,046.1	16,400.4	1,628.4	646.8
I_G.	Mean	4,086.9	7,251.9	6,690.7	561.1	664.1
	N	27.0	27.0	27.0	27.0	27.0
	Std.	6,093.4	9,854.2	9,207.4	899.8	736.5
Total	Mean	6,513.8	11,879.2	11,192.4	686.8	667.7
	N	145.0	145.0	145.0	145.0	145.0
	Std.	10,078.1	17,151.8	16,603.8	1,434.4	664.2

〈Figure 2〉 Links frequency by three groups

〈Figure 3〉 Offsite links frequency by three groups

and information based on direct network has been measured by the Pearson correlation coefficient (γ) which measures the strength of a linear relationship between two variables. Among the five variables selected, there are 10 pairs - thus 10 coefficients. In 10 coefficients, available coefficients are 10 pairs in $p < 0.01$.

In perspective of links and match of keyword, the correlation between Match and Inbound, Outbound, Onsite, and Offsite positive indicating that Match links increase so do a number of links.

〈Table 2〉 Pearson's Correlation Results

	1	2	3	4
1. Match	1.000			
2. Inbound	0.610(**)	1.000		
3. Outbound	0.692(**)	0.879(**)	1.000	
4. Onsite	0.677(**)	0.881(**)	0.997(**)	1.000
5. Offsite	0.438(**)	0.315(**)	0.418(**)	0.345(**)

** Correlation is significant at the 0.01 level

4. RESULTS AND IMPLICATIONS

〈Table 3〉 summarizes results of the regression analysis of relationships among Match of keyword and links of Inbound, Onsite, and Offsite. As results, regression model (0.506) of web structure showed higher explanation in p < 0.01. This means links match of keyword based searching behavior has been affected totally information linkage reducing uncertainty. In links of web structure, the links of offsite is important variable to inform the total information service to help to increase content quality. Successful web link structure could be a collection of links to be precise and good information links based on web structure. Secondly, the regression model of Top_Group explained 0.529 and showed higher explanation. Their web links structure focused on onsite links in internal web link structure in p < 0.05. Top_Group focused on their own creative information and content based on human resource, technology and infrastructure. Thirdly, regression model by Growing_Group explained 0.537 and showed higher explanation. Their web links structure linked on onsite and offsite links in web link structure in p < 0.01. Growing_Group are focusing on their own creative information and content and cooperation of hub such as Top_ group using the websites. Finally, regression model by Immature_ Group explained 0.562 and showed higher explanation in p < 0.01. But Immature_Group did not find the focused variables of the link strategy on their own creative information and content and cooperation of hub comparing

〈Table 3〉 Matching Regression by groups

		Beta	t value	Sig.	R Square	F	Sig.
Model : Web structure	(Constant)	325.222	6.692	0.000	0.506	48.086	0.000
	Inbound	0.003	0.393	0.695		(df 3, 141)	
	Onsite	0.022	4.374	0.000			
	Offsite	0.107	3.660	0.000			
Model : Top_Group	(Constant)	446.108	2.483	0.029	0.529	4.501	0.025
	Inbound	0.000	0.018	0.986		(df 3, 12)	
	Onsite	0.020	2.117	0.056			
	Offsite	0.021	0.093	0.928			
Model : Growing_Gro up	(Constant)	302.219	5.513	0.000	0.537	37.926	0.000
	Inbound	-0.001	-0.048	0.962		(df 3, 98)	
	Onsite	0.025	3.683	0.000			
	Offsite	0.094	3.224	0.002			
Model : Immature_Gro up	(Constant)	252.888	2.017	0.055	0.562	9.847	0.000
	Inbound	0.029	0.903	0.376		(df 3, 23)	
	Onsite	0.034	1.577	0.128			
	Offsite	0.117	0.711	0.484			

Note : Outbound is excluded variable in regression model.

with the other models. Outbound variable is excluded in four models.

As a result, there are relationships and differentiation by three groups among websites link strategy, web link structure, and matching of keyword. Further more, although the sample size is small in a part of million or billion web page, Google PageRank and Matching of keyword is positive indicating to understand the web link structure and ranking in one of website' performances.

In structuring process of information linkage, links of web link structure as web based technology to deliver link sources have focused on matching of keyword in each of webpages and websites. Additionally in direct network by information resource linkage, according to internal and external links sum-

ming of inbound, onsite, and offsite, links have an influence on keyword accuracy and PageRank by Google.

The roles of the Internet and websites in business area is growing and the complexity is higher and more. The link structure show the way of ongoing information and contents for customers and supplier in the business. But the complexity of approaching the web-business is how and what (or who) to connect the websites in business structure ; suppliers' and partners' websites.

The research of links shows the managing the connectivity and relationships between websites; trusts structure, the third party, and the small world of Internet. The web is the communications hub not only with the consumers but also with the web itself.

5. CONCLUSION AND FUTURE WORKS

The websites in the Internet have been represented of the state of nowadays' business process and strategy for tomorrow's successful performances and outcomes using information technology. The connection in the network structure of the Internet has shown the backbone and the relationship between websites shown the link in the web pages; internal and external link, inbound, onsite, and offsite. The link of web pages plays an important role of defining the characteristics of relationships in the websites.

Relationships of link affect the websites' and webpages' accuracy of keyword and the grade of page ranking as Google.com. In viewing of the web link structure, matching links of keyword are available to figure and form the web link structure as an artifact of direct network.

The limitation of this paper focused on not the hubs and communities but the authoritative website and a number of samples in Top_Group. It is a part of the commercial one and the minimum and infinitesimal authoritative site by Barabasi (2003). And links of information resource is not only the link but also the information and content chain strategy to product creative information.

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□ 저자소개 ─────────────────────

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광정책연구원 관광정책연구실
연구원으로 재직중이다. 주요
관심분야는 관광정보화, 링크,
정보 및 컨텐츠 품질, 정보서비스, e-비즈니스
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경영 연구센터소장 등을 수행하고 있다. 주요
관심분야는 전자상거래와 e-비즈니스, 지식경
영, 디지털 산업 전략 및 정책 등이다