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LINK ANALYSIS OF IRANIAN STEEL INDUSTRY (ISI), USING WEB IMPACT FACTOR (WIF) AND CLUSTERING METHOD

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ABSTRACT

In this paper, ISI Websites are identified and they studied based on the Webometrics methods. The survey aimed to investigate visibility, WIF and the collaboration rate of ISI Websites. In this process in-links, self-links and co-links of the Websites were studied and after analysis the Websites clustered and categorized. Webometric methods are applied and all of the links were analyzed including in-links, Self-links, co-links, number of each Web pages, total WIF and Revised WIF (RWIF). Data collection of 47 ISI Websites was done during March 29 to April 17. The results show that Esfahan Steel Company (ESCo.) Website with 2346 in links was the most visited Website and Shahrood Steel Company (ShSCo.) Website, with 1 in-link had the lowest rate of visibility. Also, Azarbaijan Steel Company (ASCo.) Website, with 143 total WIF had the highest rate and Meybod Steel Company (MSCo.) Website with 0.31 total WIF had the lowest rate. On the other hand, ASCo. Website, with 143 rate in this case made the most RWIF and ShSCo. Website, with 0.05 was the last one. In this study 11 Websites were declared as the core Websites. Also co-link analysis results indicated that Websites under study had collaborated in 8 clusters. It is concluded that Website managers and designers outline plans need to improve the quality and content of their Websites and recognizing the factors required by the Website in order to attract links. The final success of a Website is dependent on factors such as quality, size, language, history, content and some other factors and one or two restricted factors cannot be declared as sole reasons for its success. Therefore any research in this field must consider all factors.

1. Introduction

The Web is an enormous source of information, both of a visible kind in the form of the content of Web pages, and also of a more hidden kind, for example through the connections that hyperlinks create between different Web sites and the organizations they represent. The research field of Webometrics tries, among other things, to create new knowledge from this hidden information and to understand what kinds of real world phenomena it may represent. Now, Websites become appropriate tools for

presenting professional information in different fields. Websites implement their mission truly which is providing adequate information and performing information services role by providing higher quality information and using easier techniques of informing. Basically it's expected that, the latest information and news of each carrier, profession or organization appear on its Website; of course the way of spreading their information, which with links to other Websites related to the profession or organization emerge, is very important. So, as a result, if the content of Websites be rich and properly distribute the information, it may find a particular place in their

specialized field and be effective. "Websites are the connection points between users and electronic information. Each company, organization or institute tries to develop a position for itself through this new instrument in the virtual world. Due to the intensity and types of Websites, topical and specialized Websites possess a particular place and also the identification, ranking and evaluation of these kinds of Websites has its special importance for the researchers in these areas" [1]. Also Websites form an essential part of today's communication and are used as an apparatus by individuals, organizations etc. not only to promote their capabilities and competences but also to provide services to their clients. There is a mass of information available on Websites nowadays and these Websites are entrances to the virtual world and exits from the actual and objective world. Thematic and specialized Websites as an informative and communicational instrument containing valuable and updated information act as an information transfer channel. Specialists and other individuals can access to the daily information available on these Websites and use them efficiently in their work. The industrial's companies' Websites are in fact an entrance into the virtual environment and valuable information concerning their activities, production also the staff and members of society.

Nowadays, in the most of countries, Steel Industry is the commercial, industrial and economic development stimulus. According to the capabilities, potentials and direct impacts of Steel Industry on the other industries, it has known as the mother industry. Production and especially consumption of Steel is considered as one of the important indicator of countries development. Therefore, serious attention toward the steel industry, as the industrial infrastructure of present civilization as well as the existence of an effective flow in the field of presenting information, expanding knowledge about the latest developments and creation the fields of capabilities emergence, orientations and Steel Industry programs makes this matter important more than ever. After the Islamic Revolution in 1979, fundamental changes took place in ISI Organization. Different companies were merged and National Iranian Steel Company (NISCO) affiliated to the former Ministry of Mine and Metals and Ministry of Industry and mine was established. NISCO is directing and supervising ISI from exploration stage of its relevant raw materials up to marketing its products in domestic and international markets. NISCO established an integrated steel mill, the Ahvaz Steel Complex, and a hot rolled plate producer, the Kavian Heavy Plate Mill, Ahvaz, Khuzestan province in the south west of Iran. By year 1994, 2 companies had merged to form "Khuzestan Steel Company (KhSCO)". In order to satisfy the demand in hot and cold rolled coils, NISCO established an integrated steel complex, the Mobarakeh Steel Company, in Isfahan which started production in year 1992 with an annual capacity of raw steel of 2.5 million tons. Mobarakeh's capacity stands today at close to 4.5 million tons per year and is expected to reach 5.5 mil-

lion tons once all the expansion projects are in place. "Today, Iran's steel output stands the current steel production capacity in the country is 17.5 million tones. By the yearend (March 20th 2011), this figure will improve to 20 million tones with the inauguration of two new projects and steel production capacity is to increase to 46 million tons in the next 4 years" [2].

The aim of this study was link analysis of ISI, using WIF and clustering method in order to rank ISI Websites based on their rate of visibility and Impact Factor (IF). In addition, core Websites and significant clusters are identified and introduced. Results of the study revealed the rate of visibility of ISI Websites and ranking this Websites based on total links, in-links, self-links, total Web pages, the WIF, determination of core Websites and important categories of these Websites.

2. Literature Review

Webometrics has a short and relatively new background. In the mid 1990's, a new research field on the basis of info-metrics methods was created with the purpose of researching the Web's characteristics and nature. Since that time there have been ever increasing endeavors to investigate the nature of the WWW through employing the info-metrics methods for its content space, link structures, and search engines. and Almind [3] named this study of Web in 1997 Webometrics or in a journal of the same name, cybo-metrics. In a section of a research undertaken by Smith [4], the WIF of the Websites of the National Libraries of Australia and New Zealand were compared. Smith in his article concluded that the Australian National Library Website is not only larger but receives more links. Chu [5] has analyzed the in-links of 12 websites affiliated to librarianship schools which are approved by ALA. Methodology of his research which has examined in-links of these 12 Websites via clustering method and multi-dimensional scaling is partly similar to ours. One of his research findings is that providing Websites with various issues leads to more in-links and visibility. Vaughan and Hysen [6] in their research studied the relations between the in-links and the WIF of the Websites belonging to journals. Their research indicated that there is significant correlation between out links and the IF of the Library and Information Sciences journals. Journals with higher IF attract more external links onto their Websites. Using clustering method and multi-dimensional scaling, Osareh [7] analyzed structure of 95 Websites of library and information science schools from 18 countries. Among them 70 sites were active which formed sample of her research. She concluded that Websites examined are categorized in 7 groups including 2 national and 5 international ones. Also, two-dimensional map showed 5 relevant clusters. Among these 5 clusters, 2 cases (one from USA and the other from Canada) were national and 3 cases were international. Vaughan [8] in his research investigated the Meta links of the Websites of the USA and China IT or-

ganizations. The number of in links to the Website of one organization indicated a significant correlation with the company's revenue and profit. Although the two sets of Websites have different specifications, the total correlation coefficient for the two countries was significantly similar. By comparing reasons of citation and link, in addition to past findings Chu [9] offered 3 main reasons for creating hyperlinks in the Web environment. These include: first, in linking a site, links are primarily created to sites which somehow have relation to it. Second, link are mainly created in Web page or Website, while in citation, reference is made to sentence, paragraph or a part of one document. And third, in citation we encounter negative references which have no compatibility with research but link is typically created to positive, relevant and valuable issues. Noruzi [10] using the search engine AltaVista investigated the rate of links to the Iranian Universities Websites under the ministry science, research and technology. His research indicated that the number of links to these Websites were insignificant. He didn't analyze the rate of links of Iranian Universities of Medical Sciences. The research undertaken by Vaughan and Thelwall [11] concerning Canadian Universities, indicated that the quality of the faculty's scientific knowledge and the language used at the university were two essential or fundamental factors in providing links to the University's Website. University Websites available in French had received fewer links in comparison to those available in English. Observations indicate that Websites with greater content and higher visibility attract a larger number of links. Link analysis, like citation analysis in bibliometrics, has emerged as a research area of Webometrics in recent years. Hyperlinks to and from other Websites have been analyzed in different ways for different research objectives. For instance, in-links are counted as a measure of visibility on the Web [3]. Out-links, on the other hand, are an indicator of Website luminosity or connectivity with the outside world [12]. The WIF or Web-IF, a cousin of journal IF, is calculated by treating Websites as another type of publication to assess institutions [13] & [14] or journals [15]. Research is also conducted when articles in the hyper linking environment constitute the subjects of analysis [16]. As shown, hyperlinks are the central data elements in link studies regardless of the variety in the techniques applied and implications suggested.

Obviously, links are largely treated as an evaluative measure for Web sites in link-based research. The assumption for this practice appears similar to that for evaluative citation analysis. Also, in the field of link analysis via Webometric method, Noruzi [10] in his study evaluated Iran State and Azad Universities Websites. Ortega, Augillo, Cothey, and Scharenhorest [17] in their study showed maps of the Web presence of the European Higher Education Area (EHEA) on the level of universities using hyperlinks and analyses the topology of the European academic network. Xian-huang [18] has done a link analysis on Websites of universities libraries in USA. He took Websites of thirty universi-

ties libraries in USA as an example. In the similar study, Jalal, Biswas, and Mukhopadhyay [19] investigated the effectiveness and relevance of WIFs for Indian universities' websites. Reviews WIF as to how this link-based metrics is developed and is applied. Reports a case study on universities in West Bengal. SocSciBot 3.0 is used to generate link data in order to develop/form micro-link topology under study. Result shows that all the NITs are closely related in the topology framework/their activities whereas nodes are not linked significantly for the case of state universities and central universities. Ming-dong [20] researched on Chinese University Archive Websites Based on Link Analysis and the Measure of WIF. The method of link analysis and WIF has used. He chose the archives websites of the top 30 university in China as research sample and used AltaVista as a research tool. The findings show that university strength has correlation with the dimensions of university archives website in China and no inevitable association with the web impact of university archives website. Finally, to provide helpful reference for the construction of university archives website, this paper discussed the construction situations of university archives website in China. Maharana, Panda, and Sahoo [21] have done a Webometric Study. They examined and explored the WIF through a webometric study of the present 16 Indian Institute of Technology (IIT) of India. Identified the domain systems of the websites; analyzes the number of web pages and link pages, and calculates the simple WIF, self-link WIF and external web impact factor of all the IIT. Also reflects that some IIT have higher number of web pages, but correspondingly their link pages are very small in number and websites fall behind in their simple, self-link and external link WIF. Jeyshankar [22] had a link analysis and WIF of Indian Nationalised Banks and in the similar research Alizadeh Zavarem and Pooya [23] Evaluated and clustered the Iranian banks and financial institutions based on website traffic indicators. They were evaluated 31 banks and financial institutions in the form of 6 of the most important website traffic indicators include the average number of pages visited, average time to browse the site, the percentage of visitors within the country, the percentage of visitors from abroad, the number of links, and the speed of loading, based on the Alexa website and search engine. Then, the similar banks and institutions were classified in the form of homogeneous groups using by the Hierarchical Clustering Analysis (HCA). The findings show that there is not a significant difference in terms of speed of loading between the clusters, but in other indexes, the difference between clusters is significant. Wimaladharma and Herath [24] in their study were compared the significance of web impact of the state university websites in Sri Lanka based on the link analysis statistics obtained from well-known search engines, Google and Yahoo!. In this analysis the RWIF, the ratio between the number of inlinks (external back links) and the number of web pages published in the website which are indexed by the search engines

(not all pages of the website), was taken into account. The correlation coefficient between the rank of resultant RWIF and IFs taken from the Webometrics website derived by Cybermetrics Lab was calculated with the ninety percent of inference level. If an academic website increases its link density via Yahoo! Search engine, it is relatively significance for its WIF whereas Google indexing expresses less relevance for the WIF. Verma and Brahma [25] have done a webometric analysis of National Libraries' (NLs) websites in South Asia. The study analyses the number of web pages, link pages and calculates the WIF i.e., Simple WIF, Internal Link WIF and External Link WIF of NLs in South Asian countries and ranks the websites as per the WIF. The study used Open Site Explorer optimization tool and search engine for links. The result visualized that NL of India leads with highest Domain Authority (15.27%) and Page Authority (14.48%), the NL of Sri Lanka (88.65%) got the highest Internal Equity-Passing Links, NL of India (84.96%) has the highest External Equity-Passing Links and Total Equity-Passing Links with 83.69%. The NL of Sri Lanka has the highest (88.65%) Total Internal Links and NL, India has the highest Total External Links (84.04%) and Total Links (82.80%). The WIF of NL of India is the highest followed by NL of Sri Lanka and NL of Bhutan among the other NLs websites.

By reviewing the various studies in the field of Webometric, the importance of link analysis of Websites will be appeared for us. Determining the rate of visibility, collaboration, Websites impact and most effective core Websites in each filed, are amongst the most of these studies aims. This study, evaluated the rate of effectiveness and collaboration of Iranian's Steel Industry Websites; due to the lack of attention toward this case of subject.

3. Research objective and questions

This research aims at examining visibility of ISI Websites as well as their IF and determining collaboration rate among these Websites. In other words, Analysis of ISI Websites' links the main aim of this research. This is so as to enable us to rank the aforementioned Websites on the basis of visibility and their rate of WIF and at the same time to identify the significant clusters in these Websites and by mapping these Websites, present the most significant Websites. The present research aims to answer the following questions in order to achieve the abovementioned aims:

1. How is the visibility of the ISI Websites?
2. How is the rank of ISI Websites based on the in-links, total links, and self-links?
3. How the rank of ISI Websites based on the quantity of Web pages?
4. How the rank of ISI Websites based on WIF?
5. How the rank of ISI Websites based on RWIF?
6. Which are the ISI core Websites?
7. How many clusters will be categorize for the ISI Websites?

4. Methodology

This is an applied research which is done via Webometric method. It is based on a process of link analysis which is one of the Webometric methods. In this process all kinds of in-links, self-links and co-links of the Websites under study were computed through using Yahoo directory. Then, cluster categories of co-links were applied. This process reduces the number of dimensions to a few fundamental and significant dimensions hence providing the opportunity for their investigation [7]. The society of present study composed of all of ISI Websites which include 47 Websites. In order to determine the society of the research two Websites, i.e. (<http://www.iran.ir/Web> and <http://parsindex.com.w3snoop.com>), as well as Google search engine was used. In the **tab. 1**, the discussed subjects in the field of link analysis and their retrieving order were presented in Yahoo directory. In order to determine the number of total links, in-links and number of Web pages; at first the Web address of these Websites were entered in the search section of "site explorer" of Yahoo directory then, using the following rules obtain the self-links, co-links, core Websites, total Impact and RWIF. (In the co-link formula, for example; "IR-steel" and "Iran Steel Industry Databank" Websites were calculated). Afterward the obtained data transferred to the statistical software in order to be analyzed.

To determine the most significant clusters of ISI Websites, the co-links Websites of this field should be clarified at first. Co-link is equal to co-citation in the printing environment. The existence of co-links or co-citations between two pieces of writing is an indicator of a subject relationship, methodology, etc. between these sites or documents. In other words they have common interest in the subject field, methods applied and the information they are interested in which has resulted in their appearance on a third site or document [7]. In order to calculate the co-links of Websites, 47–47 matrix including link-giver and link-receiver Websites was prepared and the revised Websites placed in this matrix. Then Websites by using the rule of co-link, one by one, were measured with each other. Afterward, the Websites which didn't have any co-links with other Websites were excluded from the final analysis. As a result, the total number of 47 Websites reduced to 42 Websites. The co-links of these Websites were evaluated via cluster analysis method. For data analyzing, matrix was entered the SPSS software through Microsoft Excel program and for analyzing the results, the clustering classification part of SPSS statistical software was applied. The co-links of these Websites were evaluated from March 29 to April 17. All Websites belonging to the ISI, which total 47, were reviewed using Yahoo and downloaded onto a PC in a period of twenty days (March 29 – April 17, 2010) in order to be analyzed. At first in order to determine the total number of links to

¹ The subsidiaries of Yazd Steel Alloy Industries Co. are: Cylinder Steel Development Company & Yazd Maftool-Karan Co.

Table 1. Retrieval Formula of Link Analysis Topics in Yahoo Directory

Link Analysis Topics	Retrieval Formula
Total links : Total number of links to one site means, the sum of links which is devoted to the website	Searching site in the Yahoo site explorer section
In-links : The link which a Webpage received it from other Webpages, is called in-link	Searching site in the Yahoo site explorer section
Self-link: It's a link which from one Web Page of the website is given to the same page or other pages in the same website	Self-links= Total links-In-links
Number of Webpages	Searching site in the Yahoo site explorer section
WIF : It's a kind of evaluation for determining the web sites relative position in a specific area or country	$A_t = B/C$ A_t = Total Web Impact Factor (WIF) B = Total number of website's link C = Total published pages in the website which is presented by search engine
RWIF	$A_r = B/C$ A_r = Revised Web Impact Factor (RWIF) B = Total In-links C = Total published pages in the website which is presented by search engine
Core Websites	$A_u = t/n$ A_u = index determination of core website t = Total number of In-links to the favorites websites n = number of favorites websites
Co-links: It means that the link of two websites appeared beside each other and also in the third website	(Link domain: irsteel.com and link domain: iransteel.net)

the Websites of the ISI, all addresses belonging to these sites was entered in the basic search section of Yahoo, using the following command :`(linkdomain:www.irsteel.com/ OR linkdomain.irsteel.com /)`

In order to retrieve the co-links, the command **AND** was used as follows: Co-links: co-links of these Websites, which is the concept of the co-citation expression in the printing environment.

(Link: ? OR `http://?`) AND (Host: ? OR `host:http://?`)

	Company Name	URL	In- Links
The most	Esfahan Steel Company (ESCO)	www.esfahansteel.com	2346
	Iran Steel Industry Information	www.iransteel.net	1444
	Esfahan's Mobarake Steel Company (EMSCO)	www.mobarakeh-steel.ir	1411
The lowest	Hadid Steel Company (HSCO)	www.fhy.ir	2
	Tabriz Azaran Kooreh Engineering Company (TAKECO)	www.azaran-co.com	1
	Shahrood Steel Company (SHSCO)	www.shahroodsteel.com	1

And the command **NOT** was used for in-links as follows:

In-links: Links coming into a site from other sites. This concept exactly equal with "Citation" in printed works [1]. In links can be seen as an indicator of the overall significance and importance of a site. The importance of in links are threefold: (i) more visibility on the Web and potentially more traffic to the site; (ii) better coverage by search engines and (iii) higher ranking in search results [11].

(Link: `/?` OR `link:http://?`) NOT (host:`http://www.?` OR `host:http://?`)

A 47×47 matrix was produced in order to count the co-links of the Websites, and to place these Websites in that matrix. Then each Website was assessed using the co-link command. The procedure was as follows: First the name of a Website was inserted in the Yahoo search area and then the subsequent Websites followed one at a time in mechanized gaps. Next, the Websites with higher frequency co-links were selected and those with lower frequency were eliminated. As a result, 47Websites mentioned earlier reduced to 42 ones because we omitted 5 cases from companies including. In order to analyze the matrix it was entered into SPSS using Microsoft Excel and this software was used for the cluster analysis. The following formula was used to determine the co-links of the Websites of the ISI:

`http://? www.?`

And in order to determine the WIF of a Website the following command was used: `Link: Host Name. Domain` OR `link: WWW. Host Name. Domain.`

5. Findings

5-1. How is the visibility of the ISI Websites?

The ranking ISI Websites based on the In-links, are illustrated in **tab. 2**, in which ESCo. with 2346, Iran Steel Industry Databank with 1444 and Esfahan's Mobarake Steel Company (EMSCO) with 1411 in-links occupy first three position, while Hadid Steel Company (HSCO), Tabriz Azaran Kooreh Engineering Company (TAKECO) and ShSCo. obtained the lowest rate of visibility and In-links.

5-2. How is the rank of ISI Websites based on the total links?

Total number of links to one site means, the sum of links which is devoted to the Website. The ranking ISI Websites based on the Total links, are illustrated in **tab. 3**, in which ESCo. with 8883, IR-Steel with 6108 and Iran Steel Industry Databank with 1595 Total links occupy first three position, while Gostaresh Khadamat Website, Tabriz Azaran Kooreh Engineering Company

	Company Name	URL	Total links
The most	Esfahan Steel Company (ESCO)	www.esfahansteel.com	8883
	IR-Steel	www.irsteel.com	6108
	Iran Steel Industry Information	www.mobarakeh-steel.ir	1595
The lowest	Gostaresh Khadamat	www.fts.ir	16
	Tabriz Azaran Kooreh Engineering Company (TAKECO)	www.azaran-co.com	11
	Hadid Steel Company (HSCO)	www.fhy.ir	3

	Company Name	URL	Self-Links
The most	Esfahan Steel Company (ESCO)	www.esfahansteel.com	6537
	IR-Steel	www.irsteel.com	4971
	Sima Steel Company	www.sfststeel.com	645
The lowest	Azərbayjan Steel Company (ASCO)	www.azarbajjan-steel.com	1
	Maftoolkaran Yazd	www.yasico.com	1
	Alborz-e-Takestan Steel	www.alborzsteel.com	0

	Company Name	URL	Web pages
The most	Esfahan Steel Company (ESCO)	www.esfahansteel.com	7146
	IR-Steel	www.irsteel.com	5178
	Sima Steel Company	www.sfststeel.com	843
The lowest	Gostaresh Khadamat	www.fts.ir	1
	Maftoolkaran Yazd	www.yasico.com	1
	Azərbayjan Steel Company(ASCO)	www.azarbajjan-steel.com	1

(TAKECO) and Hadid Steel Company (HSCO) with 16, 11 and 3 Total links respectively obtained the lowest rate of visibility and In-links.

5-3. How is the ranking the ISI Websites, based on self-links?

A self-link is a link where one Web page in a Website linked to that same page or other existing pages of that Website [1]. The ranking ISI Websites based on self-links, are illustrated in **tab. 4**, in which ESCo. with 6537, IR-Steel with 4971 and Sima Steel Company with 645 self-links occupy the first three positions, while ASCO and Maftoolkar and Alborz-e-Takestan Steel Websites with 1-1-0 self-links respectively occupy last places.

5-4. How is the rank of the ISI Websites based on the quantity of Web pages?

In **tab. 5** the ranking Websites of ISI Websites on the basis of the quantity of Web pages can be observed. As can

be seen, ESCo. Website with 7146, IR-Steel with 5178 and Sima Steel Company with 843 have the highest Web page quantity.

5-5. How is the rank of the ISI Websites based on WIF?

The WIF is a form of assessment, which is applied in the identification of the relative location of Websites in a special field or country. For instance the academic Websites of a country; the WIF of a Website; its reputation and review capability are identified on a national and international scale. In fact any increase in the number of links will result in a higher Website WIF, which is an indication of its increased impact on the Web environment. The WIF in most situations is a reflection of its worldwide recognition and to a great extent of the quality of the existing information sources of that Website. Therefore it is possible to compare and classify Websites in accordance with their WIF in various fields. The visibility of a Website is dependent on the number of in-links provided for this Website. The greater the number of in-links of a Website, the greater visiting opportunity for the operators and hence increases its impact among the research community. In order to determine the RWIF, the number of its in-links is divided by its Web page quantity or the number of pages indexed by search engines or internet guides and is calculated using the following formula:

$$A_r = \frac{B}{C},$$

where A_r — the revised IF; B — the number of in-links; C — the number of pages published in the Website indexed by the search engine, not all existing pages on the Website

Also for the total IF the following formula is used:

At — the total IF; B' — the total number of links; C' — the number of pages published in the Website indexed by the search engine, not all existing pages on the Website.

In **tab. 6** the ranking ISI Websites based on the WIF can be observed. As can be seen the Websites of ASCO with a WIF of 143, EMSCO with 83.52 and Toos Steel and Iron Industry Company with 83 have the highest WIF respectively and MSCO. with 0.31 has the lowest.

	Company Name	URL	Total of IF
The most	Azərbayjan Steel company (ASCO)	www.azarbajjan-steel.com	143
	Esfahan's Mobarake Steel Company (EMSCO)	www.mobarakeh-steel.ir	83.52
	Toos Steel and Iron Industry Company	www.toossteel.com	83
The lowest	Kavyan Steel Company	www.fooladkaviyan.com	0.88
	Gilan Green Steel Company	www.ferrogilan.com	0.74
	Meybod Steel Company	www.meybodsteelco.com	0.31

	Company Name	URL	RWIF
The most	Azərbayjan Steel company(ASCO)	www.azarbajian-steel.com	143
	Esfahan's Mobarake Steel Company (EMSCO)	www.mobarakeh-steel.ir	83
	Toos Steel and Iron Industry Company	www.toossteel.com	82
The lowest	Tabriz Azaran kooreh Engineering Company	www.azaran-co.com	0.1
	Meybod Steel Company	www.meybodsteelco.com	0.05
	Shahrood Steel Company (SHSCO)	www.shahroodsteel.com	0.05

5-6. How is the rank of ISI Websites based on RWIF?

The RWIF was also determined, where respectively ASCO with RWIF 143, EMSCO with 83 and Toos Steel and Iron Industry Company with 82 were found to have the highest frequency with respect to the RWIF, and ShSCo. as well as MSCo. had the lowest (**tab. 7**).

5-7. Which are ISI Core Websites?

In order to determining the core Websites, whole of the in-links of all revised Websites was calculated which was 12989 links. Due to 47 survived Websites,

	Name	Total Links	In-links	Self-links	Web-page	W1F	RWIF
1	Esfahan Steel Company (ESCO)	8883	2346	6537	7146	1.24	0.32
2	Iran Steel Industry Infcrniation	1595	1444	151	238	6.67	6.04
3	Isfahan's Mobarake Steel Company (EMSCO)	1420	1411	9	17	83.52	83
4	Ir Steel	6108	1209	4871	5178	1.17	0.23
5	Iron and Steel Society of Iran	1116	1105	11	81	13.64	13.15
6	Steel Center	875	858	17	39	22.43	22
7	National Iranian Steel Co.	923	789	134	196	4.70	4.02
8	Foulad Technic'e	470	443	27	39	12.05	11.35
9	Khoozestan Steel Co	532	377	155	153	3.47	2.2
10	Sima Felez	982	337	645	843	1.16	0.39
11	National Iranian Steel Industrial Group	506	306	200	221	2.28	1.38

Clusters	ISI Websites
1th cluster	Yazd Pipe and Azar Refractories Co.
2th cluster	Esfahan Alloy Steel Company, Kaviyan Steel Co., Iran Alloy Steel Co. and State Steel Co.
3rd cluster	Khorasan Steel Co., Khoozestan Steel Co., Mobarake Steel Co, National Iranian Steel Industrial Group, Irteek International Engineering Co., Esfahan Steel Co., Kerman Coal Co. and Aliwaz Pipe Co.
4th cluster	Tbriz Pure Steel Co., Shahrood Steel Co., Takestan Alborz Steel Co., Azerbaijan Industrial Complex and Siyadan Steel
5th cluster	IraSteel Co., ban Steel Co., Ayyaran Tarde Co., Toos Steel and Iron Industry, ban Steel Center, Sima Steel Co and Iranian Industry and Steel Information Center
6th cluster	Faratarh Steel Expanding Services Co. and Roll Machine Co.
7th cluster	Gharb Steel Co., Iran Steel Blade Co., Khorasan Rahvard Co., Ravanshir Steel Co., Nasir-e-Fars Steel Co., Seven Diamond Industry Co., Asia Fooladrizan Co., Tabarsan Steel casting Co., Steel Balls Co.
8th cluster	Yazd Hadid Steel Co., Maybood Steel Co., Iranian Steel and Iron Association, Fajr-e-Sepahan Galvanized Co.

in this study the core Websites determination index is equal to:

$$Au = 12,989/47 = 276$$

Tab. 8 provided the information of core Websites of this study which indicates that 11 Websites from 47 Websites of ISI are among the core Websites of this field.

5-8. How many clusters will be categorized for ISI Websites?

In order to identify the relationship of ISI Websites an attempt was made to calculate the co-links of these Websites, which is the concept of the co-citation expression in the printing environment. The existence of co-links or co-citations between two pieces of writing is an indication of a subject relationship, methodology, etc. between these sites or documents. In other words they have common interest in the subject field, methods applied and the information they are interested in which has resulted in their appearance on a third site or document. The study of co-links is essential in the Webometrics research because it contributes to the identification of the twin of the high frequency Websites of each field. All 47 Websites belonging to ISI were selected for the purpose of gathering all information required for the determination of co-links

and all 47sites were searched one Website at a time using a formula and the number of co-links recorded in a matrix. Next a 47×47 matrix containing linking and receiving Websites and was formed in Microsoft excel. The Websites with higher frequency co-links were selected and those with lower frequency were eliminated. As a result, 47 Websites mentioned earlier reduced to 42 ones because we omitted 5 cases. After that data was transferred from Excel to the SPSS so that it could be analyzed using cluster analysis.

In the **fig. 1** the clusters of the Websites of ISI Websites can be observed. As can be seen in figure 1 they are categorized into 8 groups as follows: (**tab. 9**)

It should be mentioned that Iron and Steel Society of Iran and Fajr-e-Sepahan Galvanizing Co. have weaker collaboration and therefore have not been clustered with the other Websites.

6. Conclusion

This research indicated a general analysis of the various links among the Websites of the ISI.

The results indicated that the Websites of ESCo. with 2346, Iran Steel Industry Databank with 1444 and EMSCO with 1411 links had the highest number of in-links and the highest visibility. The attainment of top places by these Website can be attributed to reasons such as the large number of pages on the Website; language, valuable and varied information components; updating of the information; long history; easy navigation; applicability; world expansion; existence of electronic journal and comprehensive articles. The language factor is very important in receiving links from out of country, so Websites should be presented in both Persian and English and provided with useful news and information resources in order to be considered. The results of the self-link analysis indicated that ESCo., with 6537, Ira Steel with 4971 and Sima Steel Company with 645 self-links occupy the first three positions, while ASCO, Maftoolkar and Alborz-e-Takestan Steel Websites with 1-1-0 self-links respectively occupy last places. The greater the number of self-links in a Website the better the relationship between the information and pages within the Website will be. It should be

noted that greater number of self-links is an indication of the improved linking between its existing sources and proper guidance of the users. The search engines also would provide a more precise index of a Website. The greater the number of self-links of a Website, the better the quality of the information and the number of pages presented to the search engines and subsequently indexed and hence the improvement of the review of the content of that Website. The ranking of the Websites of ISI based on the RWIF indicated that the Websites of ASCO with RWIF 143, EMSCO with 83 and Toos Steel and Iron Industry Company with 82 were found to have the highest frequency with respect to the RWIF, and the Website of ShSCo. As well as MSCo. had the lowest. As the WIF of a Website is only a momentary image of the impact of that Website, it cannot be a complete tool for its assessment. No replacement exists at present and its benefits are the

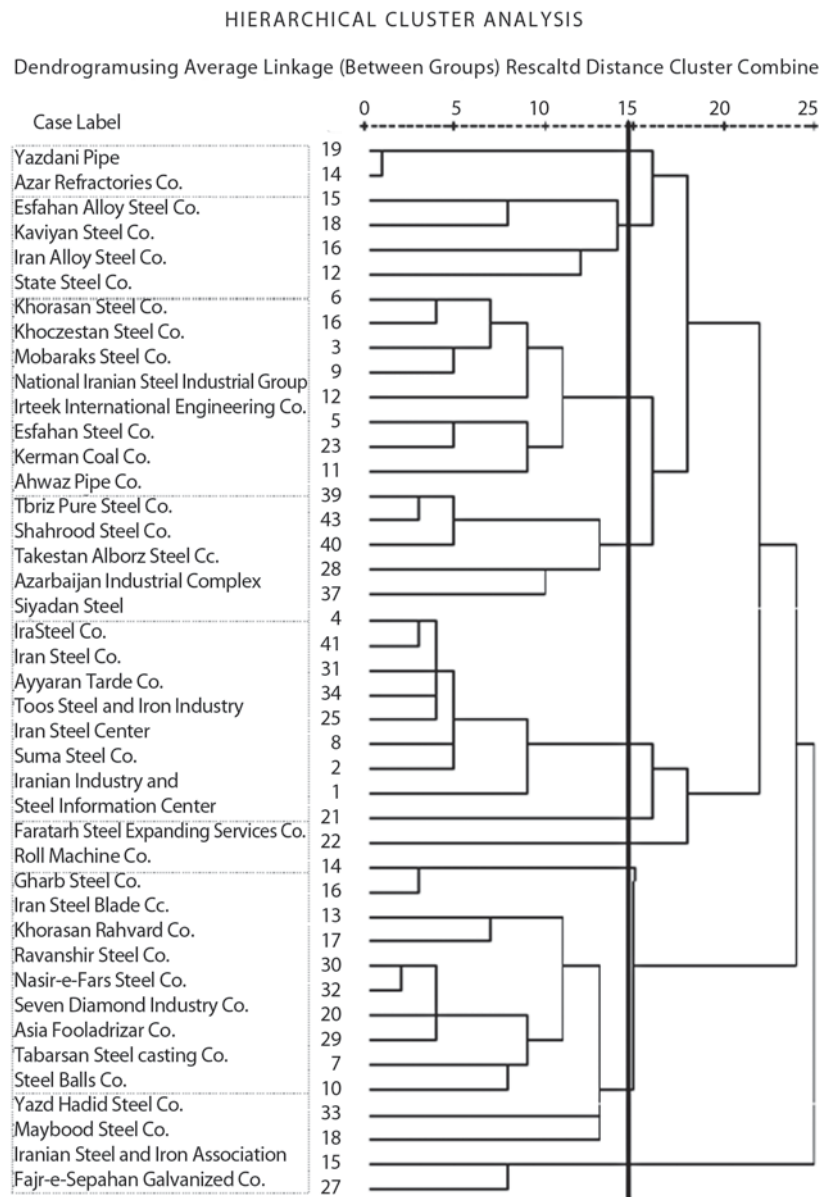


Fig. 1. The categorization of ISI Websites based on clustering

reasons for its survival to the present. The WIF is a method for quantifying the assessment of the Websites, but like any other method it has its failings [10]. Many factors can affect the WIF for instance: easy access to the Website, its rapid distribution, its language, daily updates and the type of material available on the Website such as publication of electronic journals, newsletters and Web logs. The results of co-link analysis indicated that these Websites comprise 8 clusters. The results of the cluster categorizing indicated that collaboration among the Websites of ISI exists in 8 groups'. As far as co-links are concerned, a definite view cannot be expressed. Thelwall [26] on the same subject believes: "There are a few theoretical reasons for the possibility comparing the establishment or non-establishment of links, but the models and the grounds required for the instigation of the evaluation of the related debate are not sufficiently recognized." Organization of

numerous related conferences and the availability of the material debated in these conferences on the Website; significant information sources, work programs, and full electronic sources are some of the reasons for co-linking. Restrictions, language recognition problems, Geographic proximity, cultural matters, sectarian and race related matters, the technical problems of the Websites, alteration to their address or their content, inadequacy of the content and ineffectual management of the Websites are some of the reasons for the non-establishment of co-links. It is necessary that Website managers and designers outline plans for the improvement of the quality and content of their Websites, recognizing the factors required by the Website in order to attract links. The final success of a Website is dependent on factors such as quality, size, language, history, content and some other factors and one or two restricted factors cannot be declared as sole reasons for its success [10]. Therefore any research in this field must consider all factors.

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