# Hyperlink analysis of Iranian ministries websites

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## Abstract

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 ministries web sites are in fact an entrance into the virtual environment and valuable information concerning the staff, members of society. This research aims to investigate visibility, Web Impact Factor (WIF), and the collaboration rate of the websites of the Iranian government ministries. The current method applied in this type of research is the process of link analysis, which is a webometrics method. In this process, in – links, self-links and co-links of the websites under study were totalled and then cluster and multiple dimensional scaling were applied. There processes reduce the number of dimensions to a few fundamental and significant dimensions hence providing the opportunity for their investigation. All 20 websites belonging to the Iranian government ministries which were in a period of one month (January 10 – February 22, 2008) were reviewed through Yahoo. The research results indicated that Ministry of Cooperatives (MOC) websites with 282 in links, Ministry of Science, Research& technology (MSRT) with 126 and Ministry of Industry & Mimes (MIM) with 109 in links were the most visited sites, the websites belonging to Ministry of Defence (MOD) (0.27), Ministry of Cooperatives (MOC) (0.08) and Ministry of Housing and Urban Development (MHUD) (0.06) made the most RWIF, In-link analysis results indicated that websites under study had collaborated in 3 clusters. Multidimensional scale also illustrated the Collaboration of these websites in 3clusters. It is necessary that website managers and designers outline plans for the improvement of the quality and content of their websites, recognising 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 and should judgement be required extreme caution is advisable.

**Keywords**: Iran, Ministry, Government, web site, Webometrics, Web impact factor (WIF), Visibility, Link analysis

## 1. Introduction

The appearance of the World Wide Web (WWW) has seen the world confronted with a phenomenon called a website. Websites act as connection and communication points for the users with electronic information. Every corporation, organization or institute attempts to launch itself into the virtual world using this modern phenomenon. The WWW is 14 years old and this network today comprises one billion public pages and 3 million servers. The WWW is a decentralized environment constructed and controlled by various people and entrance to it is less restricted than entrance to the common information Medias (Brunn, 2001), the fact that anyone with the slightest computer knowledge

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can design a website has in itself resulted in the production of numerous websites with their own special users. With respect to the abundance and variety of websites, specialized and thematic sites enjoy great status on the WWW and recognition, ranking and evaluation of these types of websites are of immense importance to the researchers of those fields. As ministries' websites play a very important role in the advancement of E-government, most ministries have endeavoured to design websites in order to exchange information and improve comprehension of this new field and to present daily information.

## 1.1. Research background

In the mid 1990's, a new research field on the basis of informetrics methods was created with the purpose of researching the web's characteristics and nature. Since that time there have been ever – increasing endeavours to investigate the nature of the WWW through employing the informetrics methods for its content space, link structures, search engines. Ingwersen and Almind named this study of web in 1997 webometrics or in a journal of the same name, cybometrics (Ingwersen & Almind, 1997). In a section of a research undertaken by Smith (1999), 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 (Smith, 1999). Vaughan and Hysen (2002) 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 impact factor of the Library and Information Sciences journals. Journals with higher impact factor attract more external links onto their websites (Vaughan & Hysen, 2002). Vaughan (2004) in his research investigated the Meta links of the websites of the USA and China IT organizations. The number of in-links to the website of one organization indicted 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. (Vaughan**,** 2004). Noruzi (2005) using the search engine AltaVista investigated the rate of links to the Iranian Universities websites under the ministry science, research and technology. His research indicted that the number of links to these websites were insignificant. He didn't analyze the rate of links of Iranian Universities of Medical Sciences (Noruzi, 2005). The research undertaken by Vaughan and Thelwall in 2005 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 (Vaughan & Thelwall, 2005). Hagizeinolabedini, Maktabifard and Osareh (2006) undertook a study into the websites of the National Libraries of the world. The results indicated that the website belonging to the US Library of Congress is the strongest website in the world under the criterion of the above mentioned study. This website has the highest total number of links (596.000); highest number of in-links (249.000), highest number of self-links (89.600) and the highest rate of indexed pages in the AltaVista search engine (Hajizeynolabedini, Maktabifard & Osareh, 2006).

## 1.2. The aims of the research

Analysis of the Iranian government 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.

## 1.3. Research questions

The present research aims to answer the following questions in order to achieve the abovementioned aims

1-What is the visibility of the websites of the Iranian government ministries?

2-How are the websites of the Iranian government ministries ranked on the basis of the in- links?

3-How are the websites of the Iranian government ministries ranked on the basis of the quantity of web pages?

4-How are the websites of the Iranian government ministries ranked on the basis of WIF?

5-Using clustering analysis, how many clusters will be categorized in Iranian government ministries websites?

6-Using multi-dimensional scaling and drawing map of co-links Iranian government ministries websites, how many groups (clusters) will be identified?

## 2. Methods

The current method applied in this type of research is the process of link analysis, which is a webometrics method. In this process, in – links, self- links and co-links of the websites under study were totalled and then cluster and multiple dimensional scaling were applied. There processes reduce the number of dimensions to a few fundamental and significant dimensions hence providing the opportunity for their investigation **(**Osareh**,** 2003).

## 3. Data

All websites belonging to the Iranian government ministries, which total 20, were reviewed using Yahoo and downloaded onto a PC(after getting a authorization from Ministry of Health and Medical Education) in a period of one month (January 10 – February 22, 2008) in order to be analysed. At first in order to determine the total number of links to the websites of the Iranian government ministries, all addresses belonging to these sites was entered in the basic search section of Yahoo, using the following command:

(linkdomain:www.nanomedicine.com/ OR linkdomain.nanomedicine.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. The existence of co-links or co-citations between to 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. (. Soheili, 2006)

(Link: http://www.nanomedicine.com OR http://nanomedicine.com) AND

(host:http://www.nanomedicine.com OR host:http://nanomedicine.com)

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 (Soheili, 2006). In links can be seen as an indicator of the overall significance and importance of a site. The importances 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 (Vaughan & Thelwall, 2005).
(Link: http://www.nanomedicine.com OR link:http://nanomedicine.com) NOT (host:http://www.nanomedicine.com OR host:http://nanomedicine.com)

A 20x20 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 mechanised gaps. Next, the websites with higher frequency co-links were selected and those with lower frequency were eliminated. In order to analyse the matrix it was entered into SPSS using Microsoft Excel and this software was used for the multi dimensional analysis and cluster analysis. The following formula was used to determine the co-links of the websites of the Iranian government ministries:

www.nanomedicine.com
www.nanotechnology.net

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.

## 4. Results

### 4.1. What is the visibility of the websites of the Iranian government ministries?

The ranking of the websites of the Iranian government ministries on the basis of the self-links, are illustrated in table 1, in which Ministry of Cooperatives (MOC) with 282, Ministry of Science, Research& technology (MSRT) with 126 and Ministry of Industry & Mimes (MIM) with 109 in links occupy first three position, while the Ministry of Welfare and social Security (MWSS), Ministry of labor and social affair (MLSA), Ministry of culture and Islamic Guidance (MCIG), Ministry of Housing and Urban Development (MHUD), Ministry of Justice (MOJ), Ministry of Education (MEDU) and Ministry of Economic affairs and Finance (MEAF) with 21 in link occupy last place.

Table 1: ranking of the websites of the Iranian government ministries on the basis of in-links

| Name | URL | In-links | Tota l links | RWIF | WIF | Self-links | Web-page |
|---|---|---|---|---|---|---|---|
| MOC | http://www.icm.gov.ir | 282 | 1270 | 0.08 | 0.37 | 285 | 3400 |
| MSRT | http://www.msrt.ir | 126 | 3710 | 0.01 | 0.47 | 122 | 7770 |
| MIM | http://www.mim.gov.ir/ | 109 | 8840 | 0.004 | 0.38 | 798 | 23200 |
| MWSS | http://www.refah.gov | 21 | 235 | 0.06 | 0.71 | 223 | 330 |
| MLSA | http://www.irimlsa.ir | 21 | 1820 | 0.01 | 1.48 | 1030 | 1230 |
| MCIG | http://www.ershad.ir | 21 | 6490 | 0.003 | 0.97 | 4 | 6680 |
| MHUD | http://www.mhud.gov.ir/ | 21 | 572 | 0.068 | 1.85 | 1 | 308 |
| MOJ | http://www.justice.ir | 21 | 528 | 0.0004 | 0.011 | 1 | 45200 |
| MEDU | http://www.medu.ir/ | 21 | 876 | 1 | 0.067 | 2 | 12900 |
| MEAF | http://www.mefa.ir | 21 | 108 | 0.02 | 0.12 | 1 | 866 |

**4.2. How are the websites of the Iranian government ministries ranked in terms of the self- links?**

A self-link is a link where one web page in a website is linked to that same page or other existing pages of that website (Sohili, 2006). The ranking of the websites of the Iranian government ministries on the basis of the self-links, are illustrated in table 2, in which Ministry of Road & transportation (MRT)with 5440, Ministry of labor and social affair (MLSA) with 1030 and National Iranian Oil Company (NIOC) with 966 self-links occupy the first three positions, while Ministry of Housing and Urban Development (MHUD) and Ministry of Justice (MOJ) and Ministry of Economic affairs and Finance (MEAF) websites with 1 self-links occupy last place.

**4.3. How are the websites of the Iranian Universities of Medical Sciences ranked on the basis of the quantity of web pages?**

In table 3 the ranking websites of the Iranian government ministries websites on the basis of the quantity of web pages can be observed. As can be seen, Ministry of Justice (MOJ) website with 45200, Ministry of Interior (MOI) with 31600 and Ministry of Industry & Mimes (MIM) with 23200 has the highest web page quantity.

Table 2: Ranking of the websites of the Iranian government ministries on the basis of self-links

| Name | URL | In-links | Total links | RWIF | WIF | Self-links | Webpage |
|---|---|---|---|---|---|---|---|
| MRT | http://www.mrt.ir | 24 | 2450 | 0.001 | 0.12 | 5440 | 18000 |
| MLSA | http://www.irimlsa.ir | 21 | 1820 | 0.01 | 1.47 | 1030 | 1230 |
| NIOC | http://www.nioc.ir | 25 | 9820 | 0.002 | 0.79 | 966 | 12400 |
| MHUD | http://www.mhud.gov.ir | 21 | 572 | 0.06 | 1.85 | 1 | 308 |
| MOJ | http://www.justice.ir | 21 | 528 | 0.0004 | 0.01 | 1 | 45200 |
| MEAF | http://www.mefa.ir/ | 21 | 108 | 0.02 | 0.1 | 1 | 866 |

Table 3: ranking of the websites of the Iranian government ministries on the basis of the quantity of Yahoo indexed web pages

| Name | URL | IN-Link | Total link | RWIF | WIF | Self link | Web-page |
|---|---|---|---|---|---|---|---|
| MOJ | http://www.justice.ir | 21 | 528 | 0.0004 | 0.01 | 1 | 45200 |
| MOI | http://www.moi.ir | 29 | 3260 | 0.0009 | 0.1 | 9 | 31600 |
| MIM | http://www.mim.gov.ir/ | 109 | 8840 | 0.004 | 0.38 | 798 | 23200 |
| MOD | http://mod.ir | 26 | 282 | 0.27 | 3 | 4 | 94 |

**4.4 How are the websites of the Iranian government ministries ranked on the basis of 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 Ministry 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 revised impact factor of a website, 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:

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

$A_r$ = the revised impact factor

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 impact factor the following formula is used:

$$A_t = \frac{B'}{C'}$$

$A_t$ = the total impact factor

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 table 4 the ranking of the websites of the Iranian government ministries on the basis of the web impact factor can be observed. As can be seen the websites of the Ministry of Defense (MOD) with a WIF of 3, Ministry of Housing and Urban Development (MHUD) with 1.85 and Ministry of labor and social affair (MLSA) with 1.47 have the highest WIF respectively and Ministry of Justice (MOJ) with 0.01 has the lowest. The Revised web impact factor was also determined, where respectively Ministry of Defense (MOD) with RWIF 0.27, Ministry of Housing and Urban Development (MHUD) with 0.06 and Ministry of labor and social affair (MLSA) with 0.01 were found to have the highest frequency with respect to the Revised web impact factor, and the Website of Ministry of Justice with 0.0004 had the lowest (Table 5)

Table 4: Ranking of the websites of the Iranian government ministries on the basis of the total WIF

| Name | URL | In-links | Tota l links | RWIF | WIF | Self-links | Webpage |
|---|---|---|---|---|---|---|---|
| MOD | http://mod.ir | 26 | 282 | 0.27 | 3 | 4 | 94 |
| MHUD | http://www.mhud.gov.ir | 21 | 572 | 0.06 | 1.85 | 1 | 308 |
| MLSA | http://www.irimlsa.ir | 21 | 1820 | 0.01 | 1.47 | 1030 | 1230 |
| MOE | http://www.moe.org.ir | 42 | 1340 | 0.002 | 0.08 | 136 | 16100 |
| MEDU | http://www.medu.ir/ | 21 | 876 | 0.001 | 0.06 | 2 | 12900 |
| MOJ | http://www.justice.ir | 21 | 528 | 0.0004 | 0.01 | 1 | 45200 |

Table 5: Classification of the websites of the Iranian government ministries on the basis of RWIF.

| Name | URL | In-links | Total links | RWIF | WIF Total | Self-links | Web-page |
|---|---|---|---|---|---|---|---|
| MOD | http://mod.ir | 26 | 282 | 0.27 | 3 | 4 | 94 |
| MOC | http://www.icm.gov.ir | 282 | 1270 | 0.08 | 0.37 | 258 | 3400 |
| MHUD | http://www.mhud.gov.ir | 21 | 572 | 0.08 | 1.85 | 1 | 308 |
| MRT | http://www.mrt.ir | 24 | 2450 | 0.001 | 0.13 | 5440 | 18000 |
| MOI | http://www.moi.ir | 29 | 3260 | 0.0009 | 0.1 | 9 | 31600 |
| MOJ | http://www.justice.ir | 21 | 528 | 0.0004 | 0.01 | 1 | 45200 |

**4.5. Using clustering analysis, how many clusters will be categorized in Iranian government ministries websites?**

In order to determine the relationship among the Iranian government ministries websites, the clustering method of ranking s a multi Dimensional analysis system is used, and an effort is made to concentrate on the principal Dimensions through reducing the number of dimensional used. Therefore 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 to 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 20 websites belonging to the government ministries were selected for the purpose of gathering all information required for the determination of co-links. All 20sites were searched one website at a time using a formula and the number of co-links recorded in a matrix. Next a 20x20 matrix containing linking and receiving websites and was formed in Microsoft excel. After that data was transferred from excel to the SPSS so that it could be analysed using cluster and multi dimensional scaling.

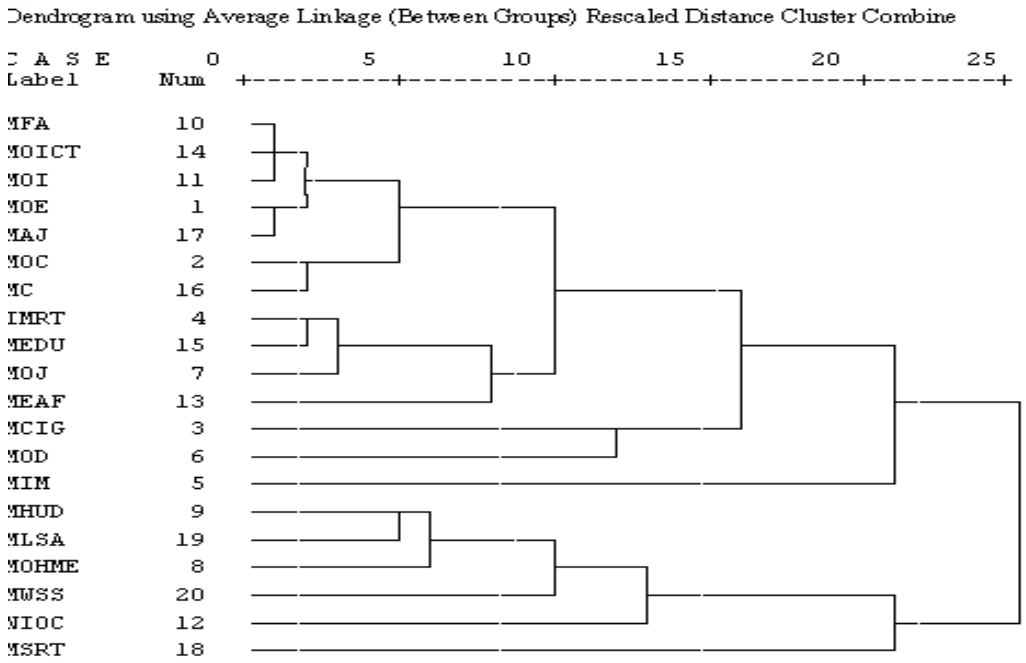


Figure 1: The categorization of the Iranian government ministries websites based on clustering

In the above figure the clusters of the websites of the Iranian government ministries websites can be observed. As can be seen in figure1 they are categorized into three groups as follows: First cluster includes seven websites: Ministry of foreign affairs (MFA), Ministry of I.C.T. (MOICT), Ministry of JIHAD-E-Agriculture (MAJ), Ministry of Energy (MOE), Ministry of Cooperatives (MOC), Ministry of Commerce (MOC) and Ministry of Interior (MOI). Second Cluster: Ministry of Road & Transportation (MRT), Ministry of Justice (MOJ) and Ministry of Education (MEDU). Third cluster: Ministry of Housing and Urban Development (MHUD), Ministry of labor and social affair (MLSA) and Ministry of Health and medical Education (MOHME). The websites of Ministry of Science, Research& Technology (MSRT), National Iranian Oil Company (NIOC), Ministry of Welfare and social Security (MWSS), Ministry of Industry & Mimes (MIM), Ministry of Defense (MOD), ministry of culture and Islamic Guidance (MCIG) and Ministry of Economic affairs and Finance (MEAF) have weaker collaboration and therefore have not been clustered with the other websites.

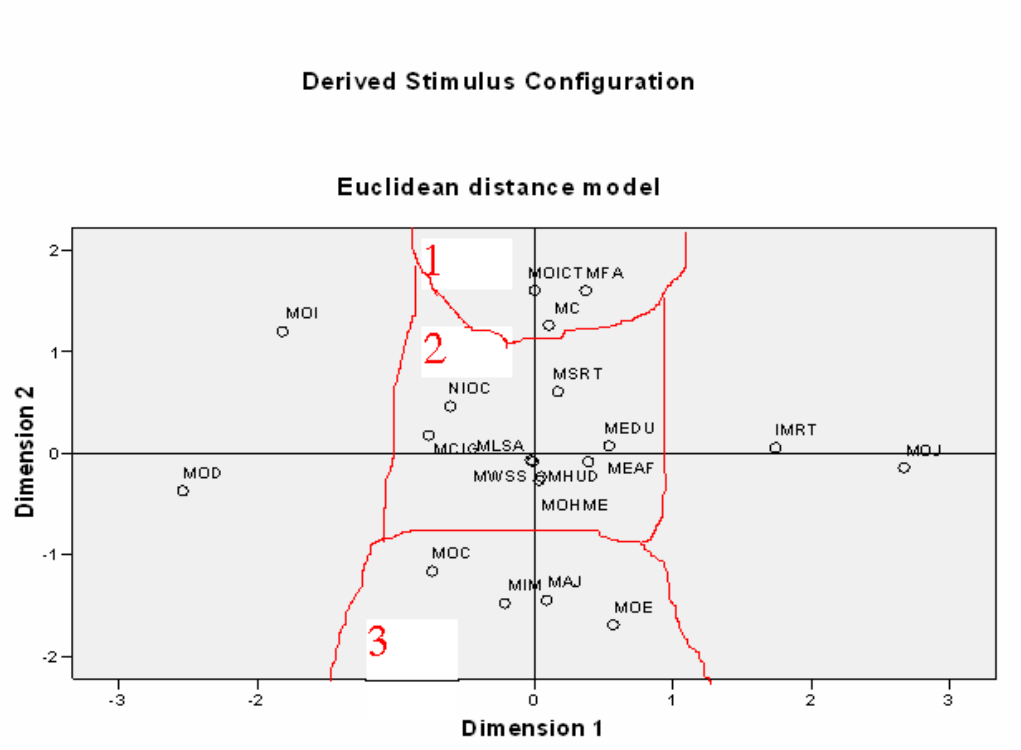


Figure 2: The categorization of the Iranian government ministries websites based on multiple dimensional scaling

As can be seen in figure 2, the results of the multiple dimension analyses indicated that the websites of the Iranian government ministries collaborate in 3 groups which are as follows: Cluster 1: Ministry of foreign affairs (MFA), Ministry of I.C.T (MOICT) and Ministry of Commerce (MOC). Cluster 2: Ministry of Science, Research& Technology (MSRT), Ministry of Education (MEDU), Ministry of Health and Medical Education (MOHME), Ministry of Housing and Urban Development (MHUD), Ministry of Welfare and social Security (MWSS), Ministry of labor and social affair (MLSA), National Iranian Oil Company (NIOC), Ministry of Economic affairs and Finance (MEAF) and Ministry of Culture and Islamic Guidance (MCIG). Cluster 3: Ministry of Energy (MOE), Ministry of Cooperatives (MOC), Ministry of JIHAD-E-Agriculture (MAJ) and Ministry of Industry & Mimes (MIM). The websites of the Ministry of Defense (MOD), Ministry of Interior (MOI), Ministry of Justice (MOJ) and Ministry of Road & transportation (MRT) were not categorized in any groups and do not collaborate as strongly as the other websites.

## 5. Discussion

This research indicates a general analysis of the various links among the websites of the Iranian government ministries. The results indicated that the websites of the Ministry of Cooperatives (MOC) with 282, Ministry of Science, Research& Technology (MSRT) with 126 and Ministry of Industry & Mimes (MIM) with 109 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; valuable and varied information components; updating of the information; long history; easy navigation; applicability; world expansion; existence of electronic journal and comprehensive articles. The results of the self – link analysis indicated that Ministry of Road & Transportation (MRT) with 5440, Ministry of labor and social affair (MLSA) with 1030 and National Iranian Oil Company (NIOC) with 966 self-links occupy the first three positions, while Ministry of Housing and Urban Development (MHUD) and Ministry of Justice (MOJ) and Ministry of Economic affairs and Finance (MEAF) websites

with 1 self-links self-link 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 the Iranian Government Ministries based on the revised impact factor indicated that the websites of the Ministry of Defense (MOD) with RWIF 0.27, Ministry of Housing and Urban Development (MHUD) with 0.06 and Ministry of labor and social affair (MLSA) with 0.01 were found to have the highest frequency with respect to the Revised web impact factor, and the Website of Ministry of Justice with 0.0004 had the lowest. As the WIF of a website is only a momentary image of the impact of that website, it can not be a complete tool for its assessment. No replacement exists at present and its benefits are the 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 (Noruzi, 2005). Many factors can affect the web impact factor 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 3 clusters. The results of the multi dimensional scaling techniques indicated that collaboration among the websites of the Iranian Universities of Medical Science exists in 3 groups. As far as co-links are concerned, a definite view cannot be expressed. Thelwall (2003) 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." The presentation of the articles of scientific journals, 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. The existence of weblogs on some sites is the reason for frequency links due to the rapid daily updating of the weblogs. 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, recognising 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 (Noruzi, 2005). Therefore any research in this field must consider all factors and should judgement be required extreme caution is advisable.

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