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Bibliometric Analysis and Mapping of Management Information Systems Field

Hakan ÖZKÖSE*, Cevriye GENCER[2]

[1]*Bartın University, Faculty of Economics and Administrative Science, Department of Management Information Systems, Bartın, Turkey*

[2]*Gazi University, Faculty of Engineering, Department of Industrial Engineering, Ankara, Turkey*

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Abstract

The main aim of this study was to widely analyze Management Information Systems (MIS) field using bibliometric mapping. For this purpose, 222 journals, indexed in Science Citation Index Expanded (SCI-E) and Social Science Citation Index (SSCI), were selected from Web of Science and Scopus. To determine a journal corpus, expert opinions were taken to interpret the field better. After taking expert opinions, 24 journals were chosen and analyses were done over these journals. Firstly, 20497 articles in English were collected in these journals from Web of Science (WoS) Core Collection during the period of 1980-2015. After text mining process, effective organizations, authors and countries were shown on graphs by statistical analysis using BibExcel. Also, annual evolution of published papers was illustrated and trend analysis of these articles was interpreted. In addition to this, most cited articles were given. After that, by using VosViewer, the most related terms in this field were obtained by co-occurrence analysis from abstracts and keywords. The terms and its clusters were illustrated on a graph. Also, density maps were utilized. The graphs and density maps were interpreted respectively in details.

1. INTRODUCTION

MIS is a multi-disciplinary science field which hosts a lot of different fields. It interconnects with various fields from industry to health sciences, from computer sciences to business / management, etc. For this reason, it is very difficult to determine its general frame. That is why there are varied explanations about MIS. MIS is an organizational method of providing past, present and projected information related to internal operations and external intelligence. It supports the planning, control and operation functions of an organization by furnishing uniform information in the proper time frame to assist the decision makers [1]. Some other definitions about MIS are given below;

MIS transform data into information and then help managers transform information into knowledge and knowledge into action [2].

MIS is a term given to the discipline focused on the integration of computer systems with the aims and objectives of an organization [3].

MIS is a system which enables the processing and communication of information, which is used in the management of the organization [4].

MIS refers to a system that uses the information required by the organization's management at every level in making operational, tactical, and strategic decisions. Its main objective is to design and implement procedures, processes, and routines that provide suitably detailed reports in an accurate, consistent, and timely manner [5].

Some terms are derived from MIS like Energy Management Information Systems (EMIS) [6], Farm Management Information Systems (FMIS) [7], Health Management Information Systems (HMIS) [8],

*Corresponding author, e-mail: hozkose@bartin.edu.tr

Project Management Information Systems (PMIS) [9], etc. As it is seen, management information systems interact with many fields.

Purpose of this study is to describe MIS field better by using bibliometric analysis. Bibliometrics is a quantitative evaluation of publication patterns of all macro and micro communication along with their authorship by mathematical and statistical calculation [10]. According to Pitchard, the purpose of bibliometrics is to increase understanding of the process of written communication and of the nature and course of a discipline [11].

Using bibliometric analyses, effective researchers, organizations, countries and their connections can be determined and/or illustrated. Also, it provides comparisons of them. Koehler expressed that people who study bibliometrics can be divided into 4 groups [12]. These groups are;

- Studies on citation analysis,
- Studies focused on co-citation analysis,
- Interests in efficiency of individuals, organizations or countries,
- Studies on information products such as books, articles and patents.

In this part of the study, we are mainly interested in efficiency of individuals, organizations and countries in parallel with the third group stated above. In addition, most cited articles were shown using citation analysis. Also, annual evolution of published papers and trend analysis of these articles were illustrated and interpreted.

Bibliometric mapping is a powerful tool for studying the structure and the dynamics of scientific fields. Researchers can utilize bibliometric maps to obtain a better understanding of the field in which they are working [13, 14, 15].

There are a lot of studies on bibliometric mapping. For example, Cui Huang and colleagues, Jose Luis Aleixandre and colleagues and Chunmei Gan and Weijun Wang studied on China's science and technology policies from 1949 to 2010 [16], organic farming for the period of 1954-2013 [17], social media research from 2006 to 2013 [18], respectively, etc. Also, there are some studies which have drawn attention on developing a software for bibliometric mapping like VosViewer [19].

In this study, we used VosViewer for term extraction from abstracts and keywords. Also, we benefited from density maps to describe the field better. Briefly, this part of the study aims to map the whole structure and correlations among terms in MIS field using co-word analyses for better understanding of the field.

This article is organized as follows; firstly, the methodology of the study was mentioned. In this section, how to choose journals were explained. Then, data collection and analysis methods were expressed. Secondly, results were given in two parts. In the first part, effective organizations, authors and countries were shown on graphs. Also, changings in the number of publications according to years were given. Additionally, top cited articles in MIS field were demonstrated. In the second part, structure and correlations among terms in MIS field were illustrated by the help of VosViwer. Besides, we benefited from density maps to clarify the terms and field better. Lastly, brief history of the study and future studies were given in the conclusion.

2. METHODOLOGY

2.1. Journal Selection

MIS, which interconnects with a lot of fields like computer science, industrial engineering, business / management, etc., is a multidisciplinary field. This makes it hard to determine related journals in this field. There are four sub-categories which can be related to MIS in Scopus database. These were Information Systems and Management, Management of Technology and Innovation, Management

Information Systems and Information Technology. All journals in these categories were obtained with their Source Normalized Impact per Paper (SNIP), Impact per Publication (IPP) and SCImago Journal Rank (SJR) values. On the other hand, there was no related sub-category in WoS. Therefore, all journals' information in WoS were obtained with their total cites, impact factors, 5-year impact factors, immediacy indexes, article amounts of previous year, cited half-life, eigenfactor score, article influence score, publisher and publishing country from Journal Citation Reports (JCR). These are briefly explained below.

Total cites mean that "The total number of times that a journal has been cited by all journals included in the database in the JCR year" [20].

"Impact factor measures the number of times an average paper in a particular journal has been referred to. The Impact Factor of journal J in the calendar year X is the number of citations received by J in X to any item published in J in (X-1) or (X-2), divided by the number of source items published in J in (X-1) or (X-2)" [21].

"The Five-year Impact Factor is similar in nature to the regular 'two-year' Impact Factor, but instead of counting citations in a given year to the previous two years and dividing by source items in these years, citations are counted in a given year to the previous five years and again divided by the source items published in the previous five years" [21].

"The Immediacy Index is a measure of the speed at which content in a particular journal is picked up and referred to. The Immediacy Index of journal J in the calendar year X is the number of citations received by J in X to any item published in J in X, divided by the number of source items published in J in X" [21].

"The Cited Half-Life is a measure of the 'archivability' of content in a particular journal, or of how long content is referred to after publication. The Cited Half-Life of journal J in year X is the number of years after which 50% of the lifetime citations of J's content published in X have been received" [21].

"The Eigenfactor of journal J in year X is defined as the percentage of weighted citations received by J in X to any item published in (X-1), (X-2), (X-3), (X-4), or (X-5), out of the total citations received by all journals in the dataset. Only citations received from a journal other than J are counted. Article Influence is calculated by dividing the Eigenfactor by the percentage of all articles recorded in the Journal Citation Reports that were published in J. Article Influence is therefore conceptually similar to the Impact Factor and SCImago Journal Rank" [21].

For this study, a restriction was defined to only include SCI-E and SSCI journals for the analysis. Therefore, all journals in these indexes (WoS and four categories in Scopus) were joined together (nearly 1000 journals obtained) and their intersection set was taken for journal selection. There were 222 journals in this intersection set. These journals' information were used for expert opinions.

Expert Opinion is one of the techniques that can be used to solve the problems in many fields. Using this technique, the identification of problem can be easier or/and it can be used to clarify issues related to a specific field, such as management information systems. Expert opinions were used in a lot of problems such as forecasting [22], risk assessment [23], climate policy [24], medical management [25], and so on.

Expert opinion were used in this study to solve the uncertainty of journal selection. Because, there is no subheading for MIS field in web of science. That is why expert opinions are important to determine which journal is related to MIS. If it was worked with the previous journal set (222 journals), as a result of the analyzes, the results could not be related to MIS or interpretation of the clusters could be very difficult and complicated.

Six experts in the field of MIS who are either an editor or reviewer in international journals evaluated these journals using 3 point Likert scale (Agree, Neither Agree Nor Disagree, Disagree). 24 journals, approved by all of the 6 experts, were chosen for MIS to better clarify the field. These journals were given in Table 1.

Table 1. *Journal list of MIS field after expert opinions*

No	ISSN	Journal Name
1	0165-5515	Journal of Information Science
2	0167-9236	Decision Support Systems
3	0169-023X	Data and Knowledge Engineering
4	0218-8430	International Journal of Cooperative Information Systems
5	0219-1377	Knowledge and Information Systems
6	0276-7783	MIS Quarterly: Management Information Systems
7	0306-4379	Information Systems
8	0306-4573	Information Processing and Management
9	0315-5986	INFOR: Information Systems and Operational Research
10	0362-5915	ACM Transactions on Database Systems
11	0378-7206	Information and Management
12	0742-1222	Journal of Management Information Systems
13	0887-4417	Journal of Computer Information Systems
14	0963-8687	Journal of Strategic Information Systems
15	1047-7047	Information Systems Research
16	1058-0530	Information Systems Management
17	1063-8016	Journal of Database Management
18	1091-9392	Journal of Organizational Computing and Electronic Commerce
19	1097-198X	Journal of Global Information Technology Management
20	1365-8816	International Journal of Geographical Information Science
21	1384-5810	Data Mining and Knowledge Discovery
22	1477-8238	Knowledge Management Research and Practice
23	1567-4223	Electronic Commerce Research and Applications
24	1617-9846	Information Systems and e-Business Management

For example, "Data Mining and Knowledge Discovery" journal was chosen by experts but other journals which were related to "data mining" was not. This could be explained as follows. It has been requested from the experts to review the journals' web pages and the detailed list which sent them. After these reviews, although some journals were related to data mining, they have reached the idea that these journals were not appropriate subheading or content to management information systems. It should also be taken into account that only those journals that all experts have found suitable for the MIS have been chosen.

2.2. Data Collection And Analysis

All articles in English under these journals were obtained from the WoS Core Collection during the period of 1980 (the year of first publication)-2015. Thus, a total of 20497 articles were identified.

All data merges and data cleaning processes were done for text mining by the help of BibExcel. Statistical analysis was used for showing the effective organizations, authors and countries using MS Office Excel 2016. Also, annual evolution of published papers was illustrated and trend analysis of these articles was interpreted.

The most related and significant terms in this field were obtained by co-occurrence analyses from abstracts and keywords separately. VosViewer was used for visualization which provides better understanding and ease of interpretation of items and its clusters. VosViewer was also used for constructions of density maps.

3. RESULTS AND DISCUSSIONS

3. 1. Statistical Analysis

3.1.1. Effective organizations

Figure 1 shows top 20 organizations which supported academic studies from high frequency to low frequency in MIS field. After text mining operations and determining threshold value as 157, the current figure was obtained. In this figure, effective 20 organizations were illustrated with their names and frequencies. City University Hong Kong supported 292 studies, followed by University Arizona (258), University Wisconsin (251), University Maryland (246) and National University of Singapore (242), respectively. At the end of the figure, University of Pittsburgh (160), University of Colorado (158) and University of Michigan (157) were seen. It is seen on the figure that City University Hong Kong supported academic studies nearly twice of University of Michigan did.

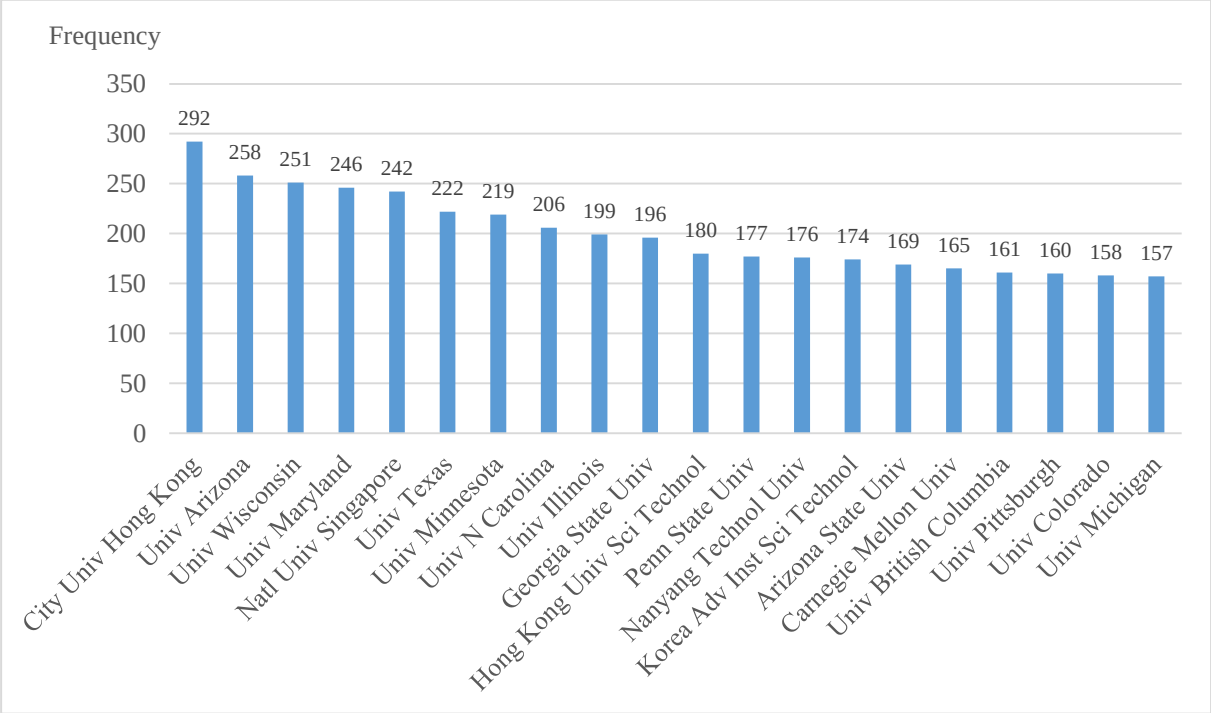

Figure 1. *Top 20 organizations in MIS*

3.1.2. Effective authors

Figure 2 shows top 10 authors and their contributions to the field in terms of number of publications. After data cleaning and data merging processes, it was hard to define the correct frequency, because author names were written in different formats. So, every author name was checked for verification to determine the actual frequency of their publications. Nevertheless, these frequencies might not reflect the real values.

To obtain this figure, threshold value was accepted as 43. At the end, 10 author names and their publications' frequencies were obtained and illustrated on Figure 2.

As understood from the Figure 2, Izak Benbasat had 66 articles which was related to MIS field. Andrew B. Whinston (64), Robert J. Kauffman (57), Hsinchun Chen (53), and Zhang J. (51) followed Izak Benbasat in this field. These authors' contributions to field cannot be ignored. It would not be wrong to say that these authors are leading and pioneers of the field.

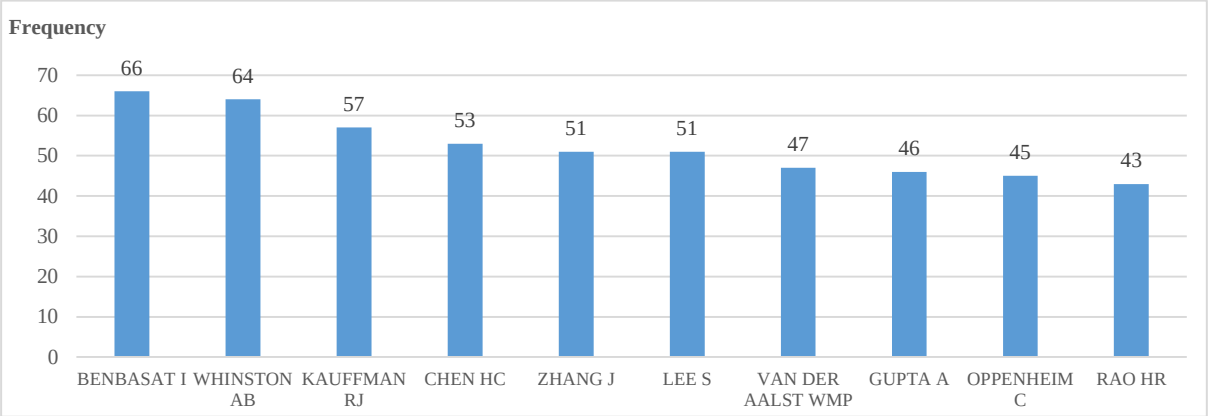

Figure 2. *Top 10 authors in terms of number of publications in MIS*

As it was seen from the figure that Izak Benbasat's publication count was nearly one and half times of Rao HR's publication count. However, it cannot be said that Izak Benbasat's contributions to the field was higher than Rao HR's. To say this, their articles should be examined by taking into account many dimensions and effects of the publications to the field.

Figure 3 illustrate the distributions of publications according to the number of authors. As it is seen from the figure, 4093 articles, 7156 articles (the highest frequency), 5578 articles and 2387 articles were studied by only one author, two authors, three authors and four authors, respectively. The total number of these (19214) formed the majority (93.7%) of the publications.

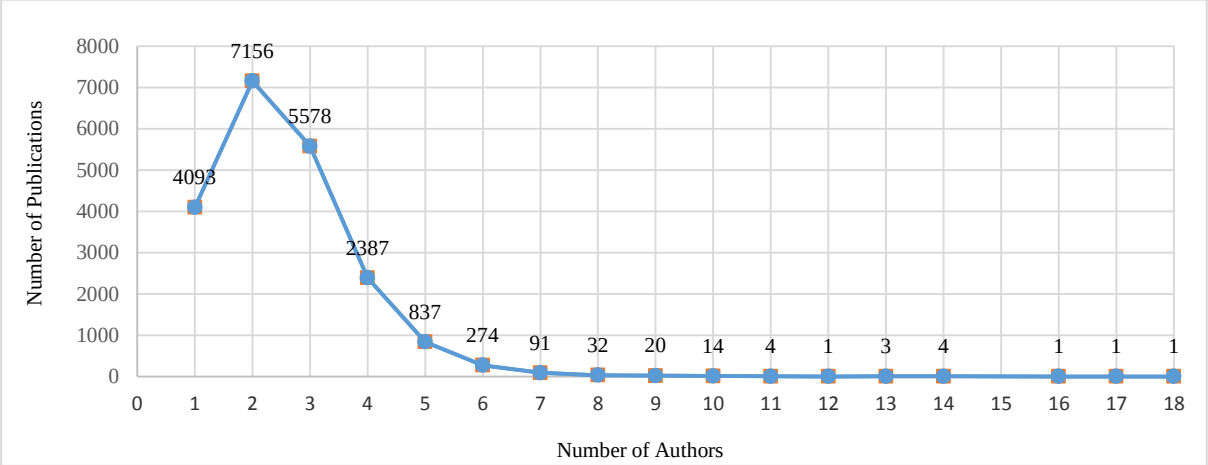

Figure 3. *Distribution of number of publications according to number of authors*

As it is understood from Figure 3, number of authors for an article changes from 1 to 18, which means that MIS field can be studied collaboratively. This assumption is supported by the number of articles with multiple authors (16404) being 80% of the total number of articles.

3.1.3. Effective countries

Figure 4 shows that 25 effective countries which contributed to the articles in MIS field. To obtain this figure, threshold value was chosen as 152. After analysis, it was seen that 119 countries contributed to MIS field. 52 of these countries contributed to MIS field with less than 10 publications. Some of 119 countries studied together in some articles. As a result, total number of these countries' publications were

obtained as 25448. If an article was studied by different countries, the frequencies of these countries were increased by one. On the other hand, if an article was studied by only one country, this country's frequency was increased by one. The number of authors was not taken into consideration in these processes. That is why it (25448) is higher than the real value (20497). This figure also shows that articles in MIS field can be studied by the participation of different countries. These interconnections can cause a faster growth in MIS field.

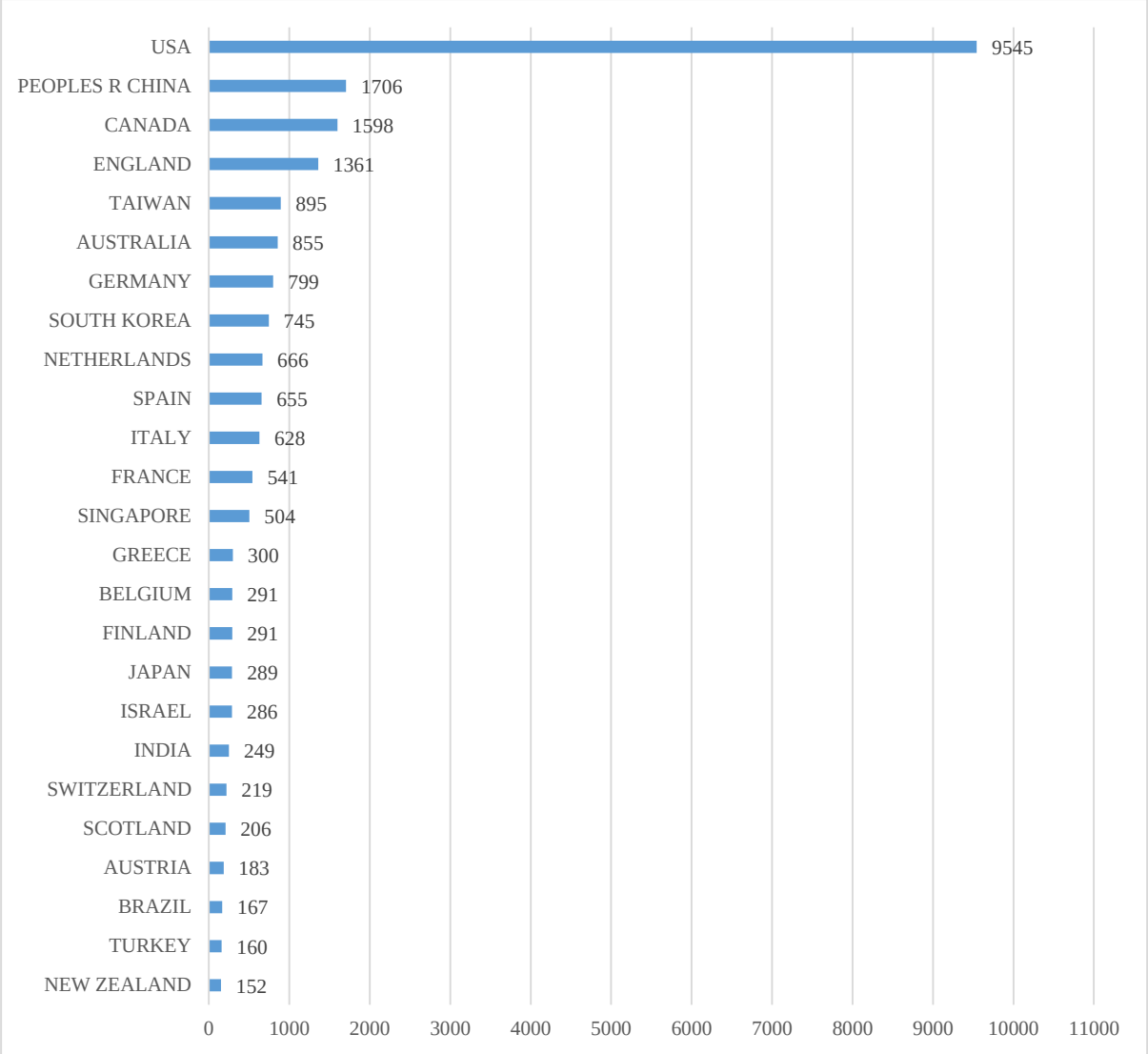

Figure 4. *Top 25 effective countries in MIS field*

The United States of America had a significant superiority in MIS field. It contributed to the 9545 (46.5%) of 20497 articles. Peoples Republic of China, Canada, England and Taiwan followed USA with 1706, 1598, 1361 and 895, respectively. Top ten countries' total frequency (18825) formed the majority (73.9%) of the contributions to the articles.

The United States of America is the first with 9545 and New Zealand is the last with 152 in this figure. From the figure, the last twelve countries' contributions to the field can be considered close. On the other hand, USA dominated the field and there is a huge gap between USA and other countries.

3.1.4. Change in the number of publications according to years

Figure 5 demonstrated change in the number of publications according to years from 1980 to 2015. First article in MIS field from the corpus (24 journals – 20497 articles) was published in 1980 and also 125

articles were added in this year. That was why the year 1980 was chosen for the beginning of our research chronology. In 2015, there were 1150 articles published and that was almost 10 times more than the number of articles published in 1980. This is a proof that interest in the field of MIS will increase in years.

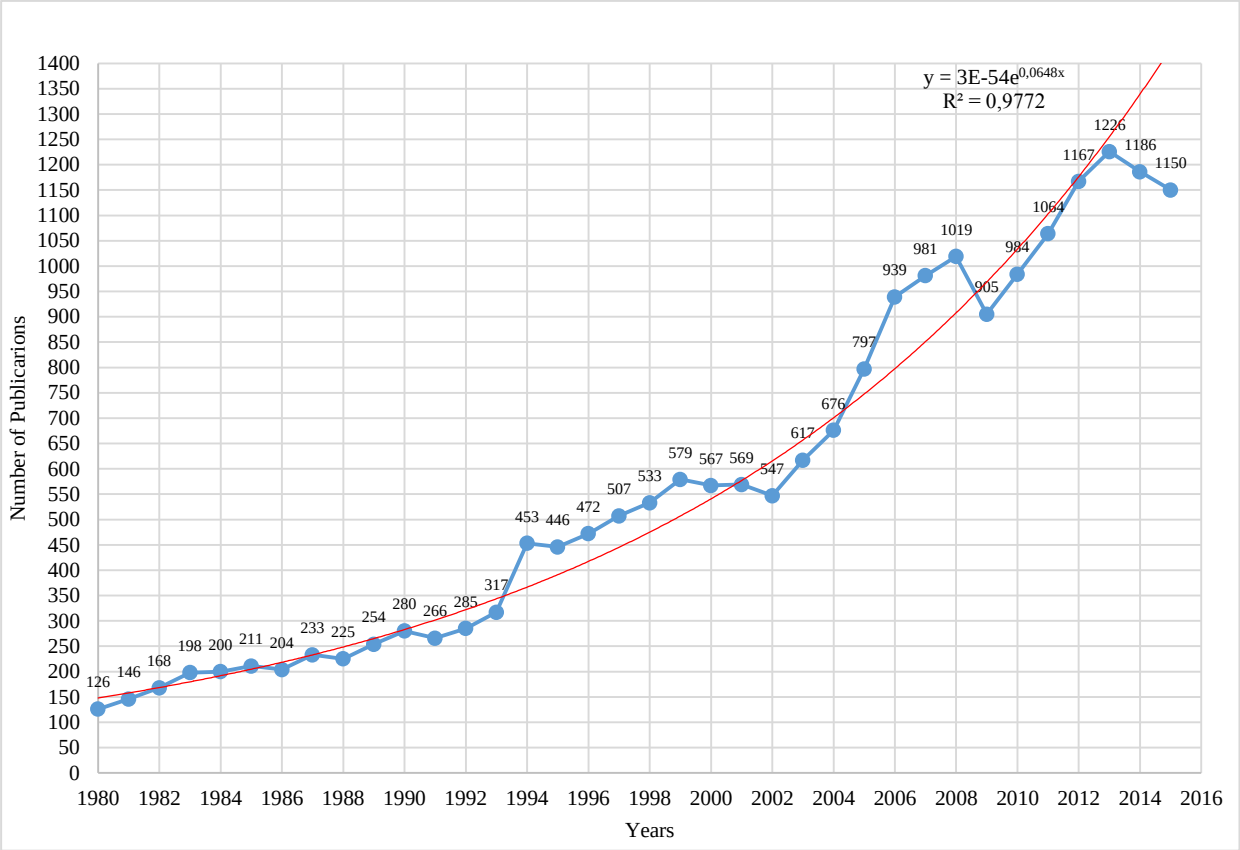

Figure 5. *Yearly distribution of number of publications and its trend analysis*

As it is seen on Figure 5, almost every year, there is an increase in the number of articles published. In some years (1986, 1988, 1991, 1995, 2000, 2002, 2009, 2014 and 2015), slight declines are observed. When the entire figure is considered, these declines do not affect the growth of MIS field much.

Red line in the figure demonstrates the trend of the number of publications in MIS field. As understood from the line, it promises a future for MIS field. It is estimated that the number of publications will increase in years.

3.1.5. Top cited articles in MIS field

Table 2 indicates 25 top cited articles in MIS field with the information of time-cited value, year and journal name. In this table, the journal MIS Quarterly draws attention. 13 out of 25 top cited articles were published by MIS Quarterly in different years.

"Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", published in 1989 in MIS Quarterly, was cited 5858 times, which recorded as the highest. Also, its replication – "Perceived Usefulness, Ease of Use, and Usage of Information Technology - A Replication" - published in 1992 in MIS Quarterly, was cited 714 times and ranked 18th in this table.

Information System Research follows MIS Quarterly in this table with publishing 4 articles. Most cited article of Information System Research is "Understanding Information Technology Usage - a Test of Competing Models". It was cited 1539 times and ranked 5th in this table.

This table which illustrates the important articles can be helpful for beginners in MIS field. It is useful to read these articles to understand the field better.

Table 2. *Most time-cited articles in MIS field*

No	Time-cited	Article Title	Year	Journal
1	5858	Perceived Usefulness, Perceived Ease Of Use, And User Acceptance Of Information Technology	1989	MIS Quarterly
2	4596	A Tutorial On Support Vector Machines For Pattern Recognition	1998	Data Mining And Knowledge Discovery
3	3342	User Acceptance Of Information Technology: Toward A Unified View	2003	MIS Quarterly
4	2061	Term-Weighting Approaches In Automatic Text Retrieval	1988	Information Processing & Management
5	1539	Understanding Information Technology Usage - A Test Of Competing Models	1995	Information Systems Research
6	1507	The Delone And Mclean Model Of Information Systems Success: A Ten-Year Update	2003	Journal Of Management Information Systems
7	1069	A Partial Least Squares Latent Variable Modeling Approach For Measuring Interaction Effects: Results From A Monte Carlo Simulation Study And An Electronic-Mail Emotion/Adoption Study	2003	Information Systems Research
8	1044	Computer Self-Efficacy - Development Of A Measure And Initial Test	1995	MIS Quarterly
9	919	Understanding Information Systems Continuance: An Expectation-Confirmation Model	2001	MIS Quarterly
10	913	A Set Of Principles For Conducting And Evaluating Interpretive Field Studies In Information Systems	1999	MIS Quarterly
11	867	Why Should I Share? Examining Social Capital And Knowledge Contribution In Electronic Networks Of Practice	2005	MIS Quarterly
12	862	Task-Technology Fit And Individual-Performance	1995	MIS Quarterly
13	779	Information Technology Adoption Across Time: A Cross-Sectional Comparison Of Pre-Adoption And Post-Adoption Beliefs	1999	MIS Quarterly
14	773	Time Flies When You're Having Fun: Cognitive Absorption And Beliefs About Information Technology Usage	2000	MIS Quarterly
15	767	The Case Research Strategy In Studies Of Information-Systems	1987	MIS Quarterly
16	734	A Survey Of Trust And Reputation Systems For Online Service Provision	2007	Decision Support Systems
17	731	Extending The Tam For A World-Wide-Web Context	2001	Information & Management
18	714	Perceived Usefulness, Ease Of Use, And Usage Of Information Technology - A Replication	1992	MIS Quarterly
19	661	The Garp Modelling System: Problems And Solutions To Automated Spatial Prediction	1999	International Journal Of Geographical Information Science
20	619	Applying The Technology Acceptance Model And Flow Theory To Online Consumer Behavior	2002	Information Systems Research
21	613	Usage Patterns Of Collaborative Tagging Systems	2006	Journal Of Information Science
22	591	The Measurement Of End-User Computing Satisfaction	1988	MIS Quarterly
23	590	Information Technology And Sustained Competitive Advantage: A Resource-Based Analysis	1995	MIS Quarterly
24	567	Research Commentary: Desperately Seeking The "It" In It Research - A Call To Theorizing The It Artifact	2001	Information Systems Research
25	562	Top 10 Algorithms In Data Mining	2008	Knowledge And Information Systems

3.2. Bibliometric Analysis

3.2.1. Term extraction from abstracts and mapping of terms

By the help of VosViewer, bibliometric analyses were done. First, counting method was chosen as full counting, which means that all occurrences of a term in a document are counted, and 200509 terms were obtained. Then, 4 experiments were conducted to determine threshold value. In the experiments, threshold value was chosen 25, 50, 75 and 100, respectively. There were no significant changes observed in the maps. Therefore, threshold value was determined as 50. 1363 out of 200509 terms were obtained after threshold. For each of these 1363 terms, relevance scores were calculated. Based on these scores, 818 terms were selected for mapping. Visualization weight was chosen as co-occurrence and clustering resolution was determined as 1.00 after several experiments. The density cluster map in Fig. 6 provides a descriptive overview of the terms which were obtained from the abstracts in MIS field.

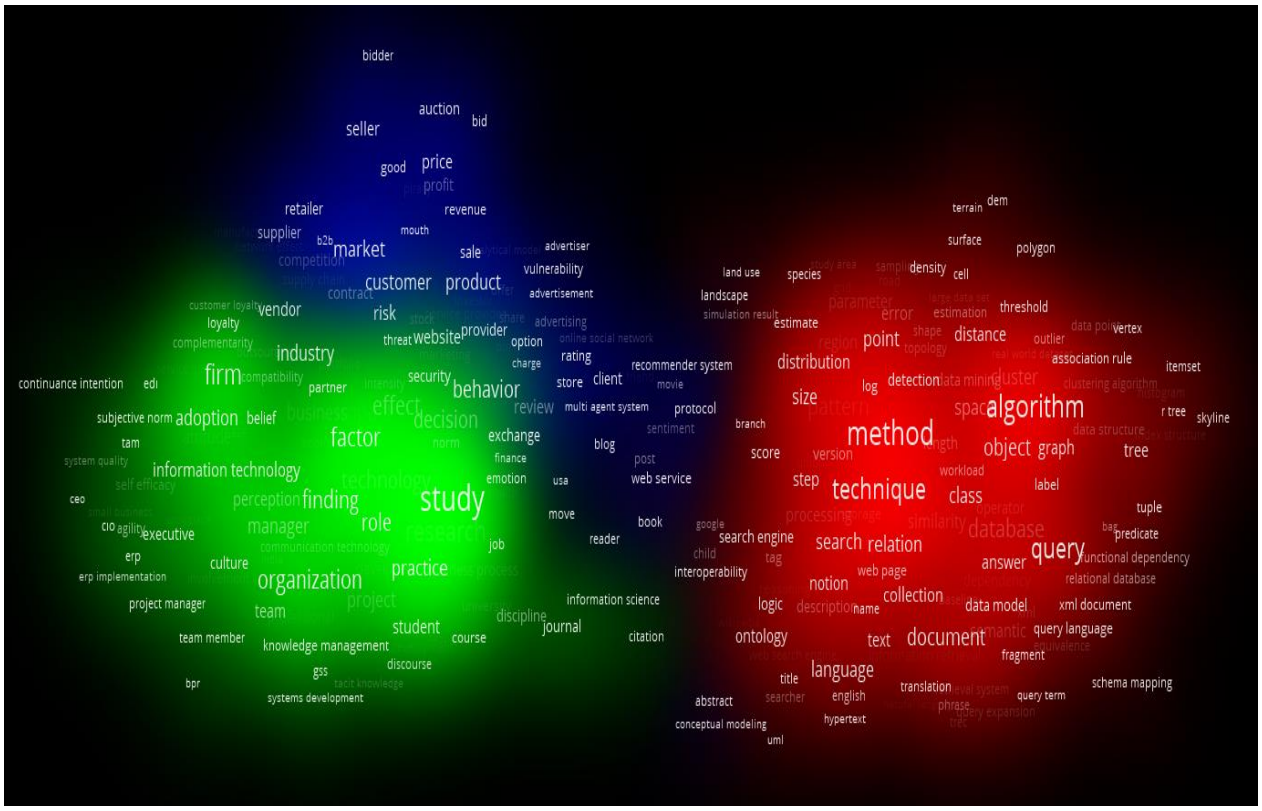

Figure 6. *Density cluster map of the terms from abstracts*

Considering the density cluster map, three major clusters draw the attention. Green (357 terms), blue (92 terms) and red (369 terms) clusters can be defined as the clusters coincide with industrial engineering, business / management and computer science, respectively. As it is known intrinsically, management information systems associate with various fields. However, it was observed that these three fields become prominent among fields which interconnect with MIS.

Table 3 shows the clusters' names, definitions and high most repeated terms of every clusters. As it was understood from Table 3 and Figure 6, many articles in MIS were also related to these fields. Computer science, industrial engineering and business / management have a great effect on MIS which has a potential to contribute to other fields.

Table 3. *Cluster's names, definitions and high frequency terms of clusters*

Cluster	Definition	5 terms with highest occurrences
Industrial engineering	Discipline of utilizing and coordinating humans, machines, and materials to attain a desired output rate with the optimum utilization of energy, knowledge, money, and time [26].	1. Study (8319) 2. Research (4342) 3. Organization (3415) 4. Theory (2946) 5. Firm (2871)
Business / Management	An organization or economic system where goods and services are exchanged for one another or for money [27]. The organization and coordination of the activities of a business in order to achieve defined objectives [28].	1. Product (1500) 2. Market (1455) 3. Customer (1181) 4. Consumer (921) 5. Internet (909)
Computer Science	The study of computing, programming, and computation in correspondence with computer systems. This field of study utilizes theories on how computers work to design, test, and analyze concepts. Computer science usually has a stronger mathematical foundation than a scientific one and on some occasions may not focus directly on computers and their systems [29].	1. Method (7662) 2. Algorithm (5673) 3. Technique (4179) 4. Query (3623) 5. Set (3181)

Most effective terms in MIS field were illustrated in Figure 7. Red, yellow and green fields of the map indicate most important terms, important terms and less important terms in the field, respectively. It also shows the interrelationships of the terms with the other terms.

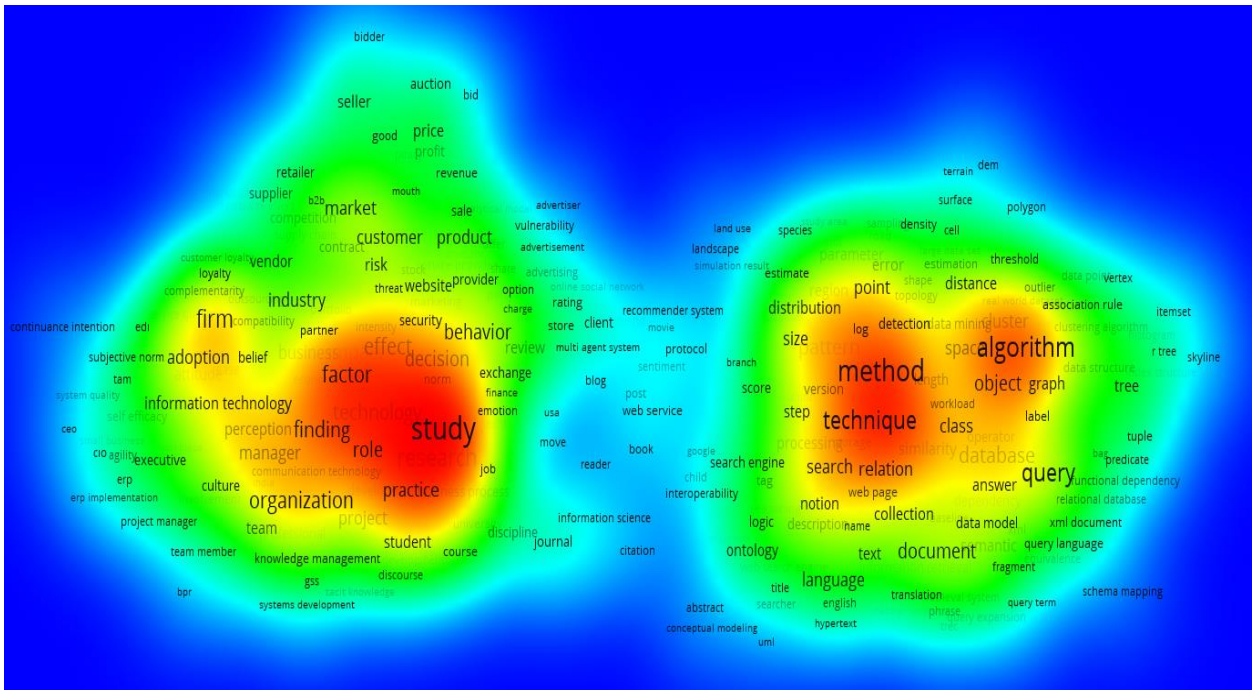

Figure 7. *Density map of terms in MIS field*

Considering the density map, as it is seen from the left side (namely the cluster of industrial engineering) the terms "study", "technology" and "research" can be seen at the center of the red field and can be accepted as the most important terms of the left side. On the right side of the map (namely the cluster of computer science), the terms "method", "technique" and "algorithm" stand out. It can be said that these terms are the most important terms in the field.

In the Table 4, the most repeated 50 terms and their relevance scores were given. As it is seen from the table, the terms "study" (8319), "method" (7662), "algorithm" (5673), "research" (4342) and "technique" (4179) were the most used terms in the MIS field. As it is understood from the table, computer science has a significant effect on the MIS field.

Table 4. *Most occurrences terms and their relevance scores*

Id	Term	Occurrences	Relevance Score	Id	Term	Occurrences	Relevance Score
1	study	8319	0.3213	26	project	1608	0.5308
2	method	7662	0.6588	27	information system	1554	0.46
3	algorithm	5673	13.971	28	benefit	1500	0.5156
4	research	4342	0.3484	29	product	1500	0.5924
5	technique	4179	0.6268	30	company	1487	0.7242
6	query	3623	16.218	31	representation	1485	0.9095
7	organization	3415	0.727	32	language	1466	0.7488
8	set	3181	0.6324	33	market	1455	11.351
9	theory	2946	0.3983	34	perspective	1409	0.4158
10	firm	2871	12.908	35	manager	1359	0.9271
11	factor	2846	0.6094	36	relation	1345	0.7011
12	effect	2613	0.5344	37	capability	1342	0.425
13	technology	2613	0.5797	38	constraint	1304	0.8106
14	database	2499	11.425	39	point	1236	0.6581
15	pattern	2424	0.5065	40	customer	1181	0.6533
16	finding	2297	0.7521	41	class	1174	0.9117
17	impact	2063	0.6294	42	space	1165	11.228
18	document	2045	11.679	43	search	1163	0.5041
19	decision	2033	0.394	44	size	1161	0.326
20	behavior	1950	0.3097	45	property	1152	0.7719
21	literature	1921	0.3757	46	accuracy	1143	0.7034
22	role	1792	0.5088	47	scheme	1139	0.7862
23	object	1765	12.402	48	trust	1123	14.011
24	practice	1752	0.4112	49	success	1111	0.8817
25	rule	1743	0.8046	50	business	1098	0.8354

3.2.2. Term extraction from keywords and mapping of terms

Counting method was chosen as full counting similar to term extraction from the abstracts and 10365 terms were obtained. Then, several experiments were conducted to determine threshold value. In the experiments, threshold value was chosen 10, 20, 25, 30, 40 and 50, respectively. There were no significant changes observed in the maps. Therefore, threshold value was determined as 25. 410 out of 10365 terms were obtained after threshold. For each of these 410 terms, relevance scores were calculated. Based on these scores, 246 terms were selected for mapping. Visualization weight was chosen as co-occurrence and clustering resolution was determined as 0.80 after several experiments. The density cluster map in the Figure 8 provides a descriptive overview of the terms which were obtained from the keywords in MIS field.

Four clusters (red, blue, yellow and red) were obtained after bibliometric analysis. Considering the density cluster map in Figure 8, it is very difficult to categorize the clusters in meaningful groups. The terms were distributed into the clusters so dispersedly that entitling them correctly was impossible. Only red cluster could be named as Computer Science.

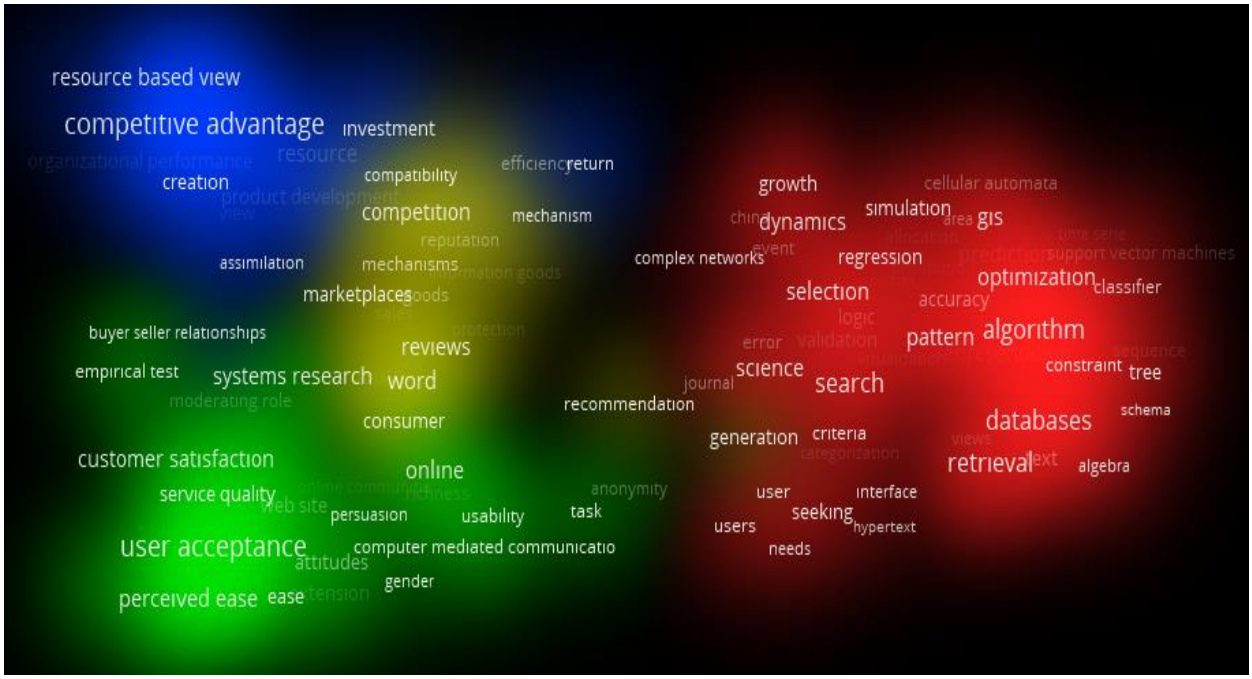

Figure 8. *Density cluster map of the terms from keywords*

As it can be seen on the upper left side of the density map the terms “resource based view” and “competitive advantage”; at the lower left side of the map the terms “user acceptance” and “perceived ease”; in the middle right side that the terms “optimization”, “algorithm” and “databases” drew attention.

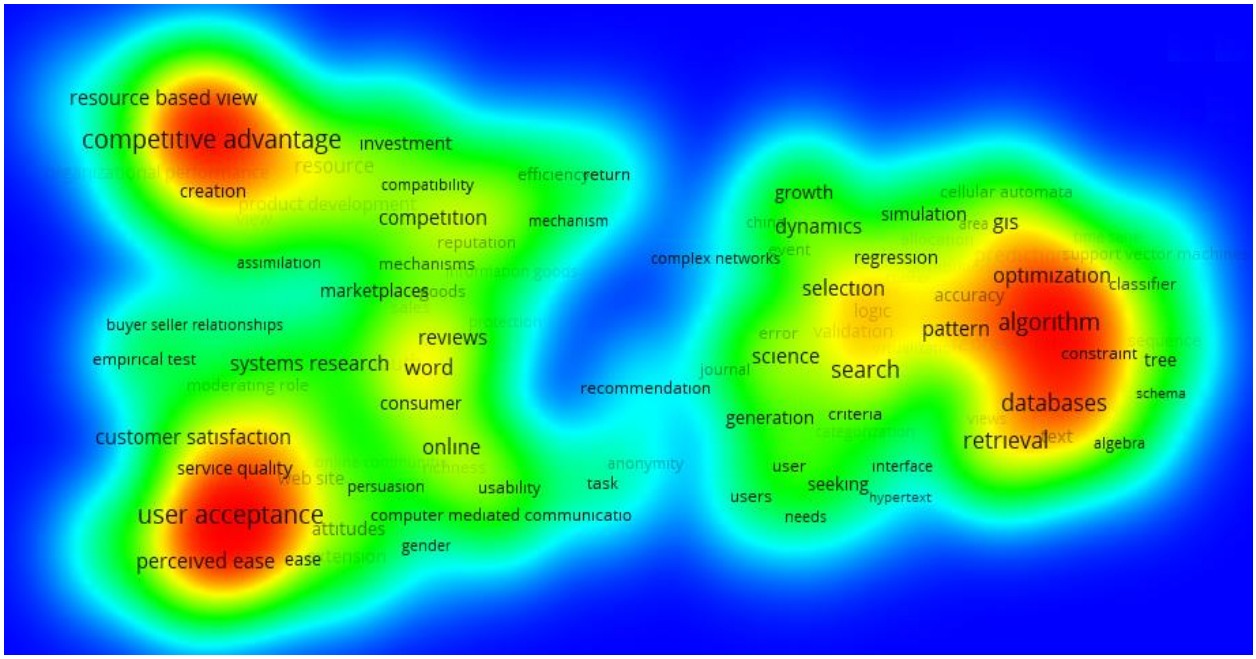

Figure 9. *Density map of terms in MIS field*

Terms which were obtained from keywords could not reflect the field clearly. The terms were spread the map chaotically. Therefore, their relations in clusters could not be resolved. There could be several reasons why exact results from the keywords could not be obtained. Some of the reasons could be given as follows;

- Authors could not use correct keywords for their articles,
- The data set could not be enough for term extraction to get obvious results,
- Proximities of terms to each other could be so closed or so far.

4. CONCLUSION

In this study, firstly 24 journals in MIS field were determined by the help of experts. Articles in English in these journals (20719) were collected from WoS database during the period of 1980-2015 for using in statistical and bibliometric analysis.

Effective organizations, authors and countries in MIS field were shown using figures after text mining operations. Also, distribution of numbers of publications according to numbers of authors and change in the numbers of publications according to years from 1980 to 2015 were illustrated by the help of figures. At the end of statistical analysis, the top cited articles in MIS field were given in a table. "MIS Quarterly: Management Information Systems" was the most noticeable journal among the journals, because 13 out of 25 top cited articles were published in this journal.

Term extraction from abstract and keywords were done for bibliometric analysis, respectively. In these analyses, we benefited from density cluster maps and density maps for showing the terms and understanding the field better. In these analyses, some terms come forward such as study, method, algorithm, research, technique, etc. Also, it was obvious that computer science has influenced the MIS field directly. Better results were obtained from the analyses from the abstracts than the ones from the keywords. The map which was generated by the help of terms from the keywords was too messy to define the clusters. On the other hand, the map which was obtained from the abstracts was clear enough to describe the cluster and MIS field. When considering the maps obtained from the abstracts, the MIS field was seen to be directly interconnected with business / management, computer science and industrial engineering fields.

As a result of this study, it has been seen that the MIS field actually consists of 3 basic parts (computer science, industrial engineering and business/management) and can not be considered separately from these parts. MIS specialist should be able to not only understands the management issues but also knows basic subjects of the field of computer and industrial engineering. The specialist should know that only one area is not enough for his personal development.

The selection of the journal in the study can be done in a different way and the results of the study can be controlled.

Next research is planned to focus on the change of the MIS field on yearly basis to understand the field better. This will also provide the opportunity to see the annual changes of the terms and the tendency of the field.

Then, a study on the position of Turkey in the MIS field is expected to be carried out. To determine Turkey's position, the abstracts of MSc and PhD theses from the year 2006 to 2015 will be searched. The map generated from the theses in Turkey and one obtained from the articles which were published in the journals utilized in this study between 2006-2015 will be compared and evaluated.

CONFLICTS OF INTEREST

No conflict of interest was declared by the authors.

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