BIBLIOMETRIC ANALYSIS OF DEMATEL METHOD

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Original scientific paper

Abstract: *In this study, a bibliometric analysis of the studies evaluated with DEMATEL (Decision Making Experiment and Evaluation Laboratory Method), one of the MCDM methods in Web of Science, was performed according to various performance indicators. The total number of DEMATEL publications examined is 1963 documents. When DEMATEL studies are evaluated in terms of countries, it is seen that China is the leader (553 documents; 28.17%). The most cooperative country is China. The country with the highest h-index is Taiwan (62). Journal of Cleaner Production is the most efficient journal (96; 4.88%). National Chiao Tung University (102, 5.19%) is ranked as the most efficient institution in DEMATEL research. Among the most used words are "Model", "DEMATEL", "Selection", "Management", "fuzzy DEMATEL".*

Key words: *Multi-Criteria Decision Making, Bibliometric, Web of Science, DEMATEL.*

1. Introduction

Decision making can be defined as individuals and organizations choosing the best alternative under current conditions to achieve their goals. Decision making is an interdisciplinary field of research that attracts researchers and academics in almost every field. While intelligence, intuition and experience are important in decision making, it is equally important to use scientific methods.

MCDM methods (Multi-criteria decision-making methods) have been developed for the correct evaluation of multiple different criteria in solving complex problems. MCDM methods refer to the process of evaluating many criteria in a problem at the same time and assigning numerical evaluation to alternatives. MCDM allows decision-makers to make evaluations and make decisions in multiple dimensions by bringing together multiple disciplines such as mathematics, management, social sciences, and economics (Yıldırım & Önder, 2018). Each method has solution logic in itself (Çelikbilek & Özdemir, 2018). The MCDM process consists of two stages. In the first of these stages, all the objectives and provisions given according to the alternatives are

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brought together, in the second stage; the most appropriate decision is made by evaluating the alternatives among the combined provisions. (Aytaç & Gürsakal, 2015).

DEMATEL (The Decision Making Trial and Evaluation Laboratory), one of the MCDM methods, was developed in 1972 by the Battelle Memorial Institute of Geneva Research Center. The method is used in solving complex problem groups (Shgeh et al., 2010). The advantage of the DEMATEL method is that it separates the distributor and receiver groups in the problem and determines the relationships between the criteria based on Graph Theory (Impact-Directional Diagram) (Lin & Tzeng, 2009). The DEMATEL method, which assumes that all criteria determined for the decision-making problem are in interaction with each other, evaluates the effect levels among the criteria. In the method, factors that are higher than the other criteria are called distributive, and criteria whose exposure level is higher than the effect on the system are called buyers (Karaoğlan, 2016).

The increasing interest in MCDM methods has caused the publication of DEMATEL method to increase continuously. In this study, bibliometric analysis was performed on the studies related to the method to interpret and summarize the information confusion caused by the continuous increase of the publications made with the DEMATEL method. The reason why the DEMATEL method is examined in this study is that it covers a very different literature that contributes from different disciplines. Apart from this, it is to show how the method is examined in different disciplines by revealing causality and by revealing the importance of its differentiation from other MCDM methods. Bibliometric analysis is an analysis method that examines scientific studies with the help of numerical analysis and statistics and shows the activities and current status of scientific studies in the field (Çetinkaya Bozkurt & Çetin, 2016). Accordingly, bibliometric analysis reveals the productivity of countries, institutions and authors, citation analysis of countries, institutions and authors, which type of documents are used more, and how much the documents are distributed, and cooperation maps.

For the research, the 1963 document searched from the Web of Science database with the subject "DEMATEL" on 12.12.2020 was found in the bibliometrix library of the R Studio program and analyzed with biblioshiny. All studies on the DEMATEL method between 1999 and 2020 in the Web of Science database were included in the analysis. Along with the analysis, annual studies and total citation rates, the productivity of countries, the number of citations and the cooperation map between countries, the most used journals and the number of citations in the studies conducted on the subject, the most efficient universities, the fields of science in which the DEMATEL method is used and In which journals the studies were published the most, the most productive authors and citation rates, the most cited articles and the most used words in the articles written on the subject and the conceptual structure of the field were shown.

2. Literature Overview

The study conducted by Cole and Eales (1917) in the literature is known as the first bibliometric study. In this study; Analyzes of studies published in the field of anatomy between 1550-1860 were made. After this study, an analysis was made in the field of historical science by E.Wyndham Hulme, a librarian at the British Patent Office in 1923. Later, in 1927, P.L.K. Gross and E.M. A citation analysis study was conducted by Gross to evaluate the bibliography of the articles published in the Journal of the American Chemical Society. The first two studies were based on bibliographic

features, not citations, and in Gross & Gross's study, citation analysis was performed (Lawani, 1981; Hotamışlı & Erem, 2014). On the subject of MCDM, there are many studies conducted in the related literature. Popular tools such as VOSviewer, R-Bibliometric Package were used in some of these studies. Bibliometric studies made using popular tools in the field of MCDM are summarized in Table 1 below.

Table 1. Bibliometric Studies Using Popular Tools in the MCDM Field

Authors	Keyword Used	Time Span	Number of Publications Reviewed
Bragge et al. (2010)	Multi objective, Multi criteria	1970-2007	15198
Guerrero-Baena et al. (2014)	MCDM	1980-2012	347
Zavadskas et al. (2014)	MCDM review papers	1990-2013	71
Tramarico et al. (2015)	Analytic Hierarchy Process and Supply Chain	1990-2014	116
Blanco-Mesa et al. (2017)	Fuzzy decision-making	1970-2014	8135
Liu and Liao (2017)	Fuzzy Decision	1970-2015	13901
Zyoud and Funchs-Hanusch (2017)	AHP ve TOPSIS	1976-2016	10188 AHP 2412 TOPSIS
Peng and Dai (2018)	Neutrosophic set	1998-2017	137
Yu et al. (2018)	Multiple criteria decision-making	1977-2016	4464
Liao et al. (2019)	Hesitant fuzzy sets	2009-2018	484
Morkūnaitė et al. (2019)	Cultural heritage buildings with MCDM	1994–2018	1039

There are literature reviews in the field of MCDM without using popular bibliometric tools. Abu-Taha (2011) reviewed more than 90 publications on MCDM in the field of renewable energy. He summarized both the application areas and the methodologies used in these publications. As a result of the literature review, it is revealed that AHP is the most used method among all MCDM methodologies. Kahraman et al. (2015) examined the MCDD literature by dividing it into two parts as multi-specific and multi-purpose. In particular, they focused on multi-purpose decision making. They provided tables and graphs for each method (Fuzzy AHP, Fuzzy VIKOR, Fuzzy TOPSIS, Fuzzy ELECTRE, etc.). Mardani et al. (2015) examined a total of 393 articles published in more than 120 peer-reviewed journals between 2000 and 2014. Especially in the fields of energy, environment, and sustainability, they found that MCDM methods are frequently used. Gul et al. (2016) conducted a literature review on VIKOR and Fuzzy VIKOR applications and reviewed 343 publications in total. This comprehensive literature review they have done provides insight into VIKOR applications for researchers and practitioners. In their study, Renganath and Suresh (2016) analyzed the literature of MCDM methods used in supplier selection. After all, they said that the most popular method was fuzzy TOPSIS. Stojčić et al. (2019)

reviewed the literature on the application of MCDM methods in the field of sustainable engineering. They analyzed 108 articles scanned in the Web of Science (WoS) database between 2008-2018. As a result, they found that sustainable engineering is a very suitable field for the use of MCDM. Liu et al. (2019) conducted a comprehensive review of FMEA (Error Type and Effects Analysis) studies using MCDM approaches to evaluate and prioritize error types. They reviewed 169 articles published between 1998-2018. This research sup0ports and provides insight into academics and practitioners in effectively adopting MCDM methods to overcome the shortcomings of traditional FMEA. Chowdhury and Paul (2020) conducted a literature analysis of MCDM methods used in corporate sustainability between 2007 and 2019. As a result of this analysis, in which they examined 52 publications, they determined that the most used methods were AHP and TOPSIS.

3. Method

Bibliometric analysis is to make the scope of research in a particular area of interest both quantitatively and qualitatively (Ellegaard & Wallin, 2015). Bibliometry developed for library and information sciences is used to classify research according to publications, times, and journals (Merigó & Yang, 2017). In other words, bibliometry strengthens the scientific literature by understanding the research literature better (Osareh, 1996). Stevens (1953) divided bibliometric studies into two main areas as seen below. Descriptive studies contribute to authors, journals, years, and discipline by categorizing publications by country, while evaluators show where and how many publications are cited.

    1. Descriptive studies
- Country or geographic location
- Timespan

Discipline or subject area
    2. Evaluative studies
- Source
- Citation

The analysis made allows identifying early trends in studies conducted in any field (Ellegaard & Wallin, 2015). In general terms, it describes scientific collaboration through collaborations between researchers, institutions, and countries. Some new tools have been introduced to generate more broadcast data and provide a wide variety of indicators as listed in Table 2. In this study, R-Biblioshiny was used.

Table 2. Popular Tools for Bibliometric Analysis

Tools	Practitioners
BibExcel	Olle Persson
Authors	Authors ' frequency tables
Pajek	Vladimir Batagelj and Andrej Mrvar
CiteSpace	ChaomeiChen
VOSviewer	Nees Jan Van Eck and LudoWaltman
R-Bibliometric Package	Massimo Aria and Carrado Cuccurullo

4. Results

1963 DEMATEL publications in 800 sources (Journals, Books, etc) between 1999 and 2020 in the WOS database were examined. DEMATEL publications mostly consist of articles, book chapters, early access, proceedings papers and, review publications. Average citations per document are 15,39 and Average citations per year per doc is 3.274.

Figure 1 shows the annual number of citations of the studies conducted with the DEMATEL method. The most citations to DEMATEL's work took place in 2015 and 2018. It is seen that DEMATEL studies get quite high citations. This shows that the method has a very dynamic structure. The distribution of the examined publications by years is given in Figure 2. As can be understood from Figure 2, the studies made with the DEMATEL method have increased over the years. Especially after 2015, the number of studies conducted with the method has increased. It is seen that most work on the method is in 2020.
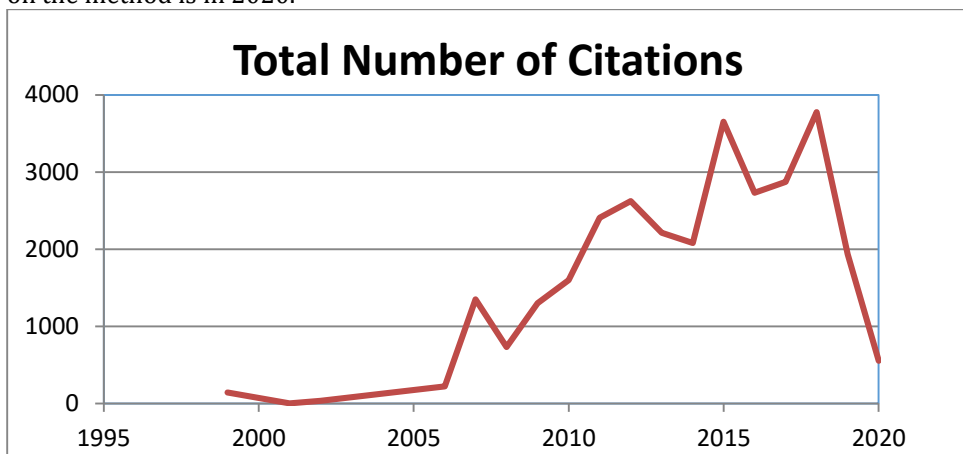

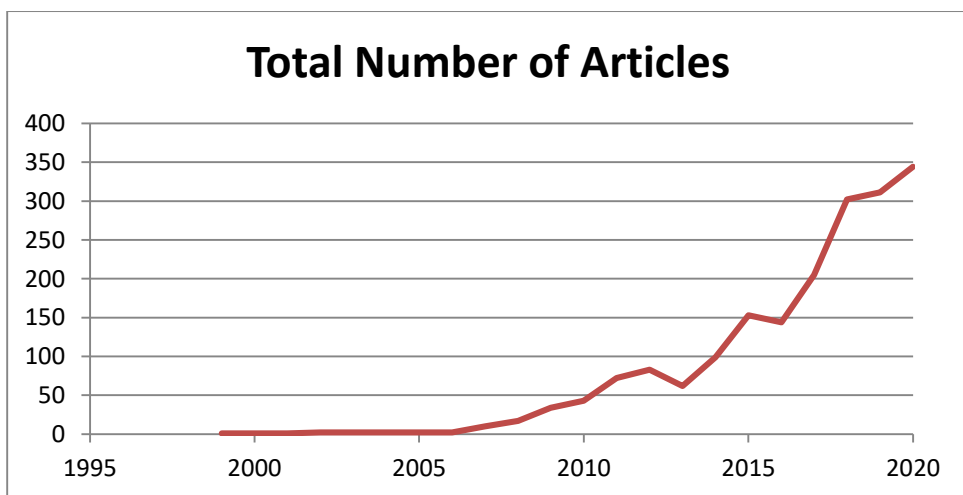**Figure 1.** Number of citations by years

Figure 2. Number of articles by years

Table 3 shows the 20 most productive countries in the DEMATEL method. According to the table, it is seen that the most productive country is China (553; 28.171%). After China, respectively, Taiwan (519; 26.439%), Iran (251; 12.787%), India (241; 12.277%) and Turkey (184; 9.373%) are ranked. With the highest h-index of 62, and it was recorded by Taiwan China (41), India (29), Iran (27), Turkey (24), and the United States (24) respectively. Considering the citation rates of the countries, it is seen that the most cited country is Taiwan (12884). After Taiwan, respectively, China (6228), India (2892), Iran (2878), and Turkey (2499) are ranked. According to the number of studies of the countries, it is seen that the country with the highest citation average is Denmark with 50.87%.

Table 3. Ranking of top twenty most productive countries

Country	No. of documents	%	h-index	No. Of citations	Average citations
CHINA	553	28,171	41	6228	11,26
TAIWAN	519	26,439	62	12884	24,82
IRAN	251	12,787	27	2878	11,42
INDIA	241	12,277	29	2892	12,00
TURKEY	184	9,373	24	2499	13,58
USA	74	3,770	24	1710	23,11
ENGLAND	63	3,209	17	839	13,32
MALAYSIA	57	2,904	16	679	11,91
AUSTRALIA	41	2,089	11	492	12,00
SPAIN	34	1,732	11	460	13,53
SERBIA	32	1,630	16	1039	32,47
DENMARK	31	1,579	23	1577	50,87
POLAND	31	1,579	7	217	7,00
LITHUANIA	30	1,528	13	796	26,53
CANADA	29	1,477	8	354	12,21
ITALY	27	1,375	11	467	17,30
PHILIPPINES	24	1,223	9	476	19,83
SOUTH KOREA	24	1,223	7	284	11,83
JAPAN	23	1,172	8	524	22,78
INDONESIA	21	1,070	3	128	6,10

The world density map is shown in Figure 3 below. The countries where DEMATEL studies are carried out the most are listed from dark to light. Countries with gray color do not have studies on the method.

Country Scientific Production
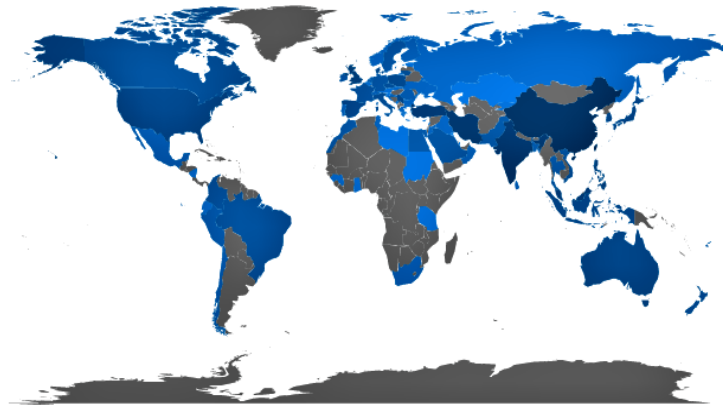
CHINA	553
TAIWAN	519
IRAN	251
INDIA	241
TURKEY	184
USA	74
ENGLAND	63
MALAYSIA	57
AUSTRALIA	41
SPAIN	34
SERBIA	32
DENMARK	31
POLAND	31
LITHUANIA	30
CANADA	29
ITALY	27
PHILIPPINES	24
SOUTH KOREA	24
JAPAN	23

Figure 3. The world density map

The most cooperating twenty countries according to the number of documents are shown in Table 4. According to the table, among the countries with the highest cooperation, Taiwan-China is the first with 74 documents, the USA-China is the second with 31 documents, and the UK-China is the third with 22 documents.

Table 4. The twenty most cooperative countries according to the number of documents

From	To	Frequency
Taiwan	China	74
USA	China	31
United Kingdom	China	22
India	United Kingdom	20
Turkey	China	20
China	Australia	17
Iran	Lithuania	16
Iran	Malaysia	14
India	Denmark	11
Iran	USA	11
Malaysia	Saudi Arabia	11
China	Denmark	10
China	Canada	9
India	China	9
India	USA	9
Iran	Australia	9
Taiwan	USA	9
India	Lithuania	8
India	Spain	8
Taiwan	Philippines	8

World cooperation map is given in Figure 4. The countries where the lines are concentrated are determined as the countries that cooperate most with other countries. Accordingly, China the country with the highest cooperation with other countries, India, Iran, Taiwan, Turkey, the UK and the US appear to be.
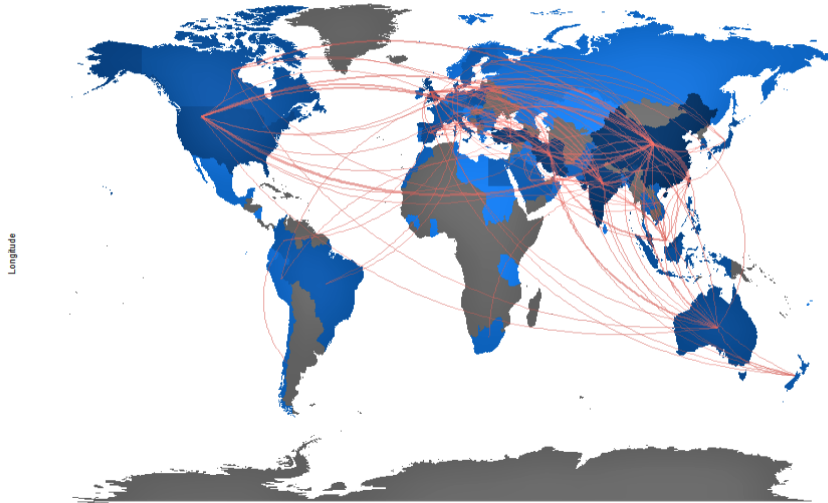

Figure 4. World cooperation map

Table 5 shows the sources of DEMATEL publications. As shown in Table 5 in this study, Journal of Cleaner Production (96; 4,888%) has been the most comprehensive source of DEMATEL research. Then, Sustainability (90; 4,582%) and Expert System Applications (77; 3,921%) journals follow. The most cited journal was determined to be the Expert System Applications journal with 7074 citations. Besides, Expert System Applications journal has the highest h-index (48) and the highest average citation rate (91.87). Then, it was seen that Journal of Cleaner Production ranked second with 2895 citations. The journals with the highest h-indexes after the Expert System Application journal are Journal of Cleaner Production (28), Sustainability (16), Computers & Industrial Engineering (16), Applied Soft Computing (16), respectively.

Table 5. Sources of DEMATEL publications

Sources	Articles	%	h-index	Total citations	Average citations
Journal of Cleaner Production	96	4,888	28	2895	30,16
Sustainability	90	4,582	16	741	8,23
Expert Systems with Applications	77	3,921	48	7074	91,87
Computers & Industrial Engineering	32	1,629	16	844	26,38
Applied Soft Computing	26	1,324	16	917	35,27
Benchmarking-An International Journal	21	1,120	8	167	7,59
International Journal of Fuzzy Systems	20	1,018	10	387	19,35
Mathematical Problems in Engineering	20	1,018	7	216	10,80
International Journal of Environmental Research and Public Health	19	0,967	5	91	4,79
Symmetry-Basel	19	0,967	5	154	8,11
Resources Conservation and Recycling	18	0,916	12	573	31,83
Ieee Access	17	0,866	4	40	2,35
International Journal Of Production Research	17	0,866	11	483	28,41
Journal of Intelligent & Fuzzy Systems	17	0,866	4	71	4,18
International Journal of Information Technology & Decision Making	16	0,815	8	192	12,00
Soft Computing	16	0,815	6	288	18,00
International Journal of Production Economics	15	0,764	13	1004	66,93
Safety Science	15	0,764	9	500	33,33
Energies	14	0,713	5	68	4,86
Technological And Economic Development of Economy	14	0,713	8	331	23,64

Table 6 shows the 20 most active universities in DEMATEL research. Accordingly, it is seen that the most productive university in DEMATEL studies is National Chiao Tung University in Taiwan with 102 documents (5,196). Islamic Azad University in Iran ranks second with 90 documents (4,585) and Nan Kai University Technology in China is third with 86 documents (4,381). The most cited university is National Chiao Tung University with 4344 citations and an average citation rate of 42.59%. Also, National Chiao Tung University has the highest h-index (37).

Table 7 shows the ranking of the twenty most common areas in DEMATEL studies. Most of the published studies are in the field of Computer Science Artificial Intelligence (332; 16,904) and it was seen that the most used journal in this field was Expert System With Applications (77; 23,193%). Following this area, the most common areas

are Environmental Sciences (288; 14.664%), Operations Research Management Science (285; 14.511%), Management (272; 13.849%), Green Sustainable Science Technology (235; 11.965%).

Table 8 shows the most productive twenty authors on DEMATEL research. According to the table, with 121 documents (6.161%), Tzeng G.H. seems to be. Also, Tzeng G.H is the author with the highest h-index (34) and the highest number of citations (4117). Tzeng G.H. It is seen that the most prolific authors are Tseng M.L. (38), Dincer H. (36), and Liou J.J.H (36). Also, Tseng M.L. is the second most cited author (1605).

Table 6. The 20 most active universities in DEMATEL research

Name of the institution	No. Of documents	%	h-index	Total citations	Average citations	Country
National Chiao Tung University	102	5,196	37	4344	42,59	Taiwan
Islamic Azad University	90	4,585	17	971	10,67	Iran
Nan Kai University Technology	86	4,381	33	3631	42,22	China
National Taipei University	66	3,362	19	1238	18,76	Taiwan
National Taipei University Of Technology	58	2,955	19	1285	22,16	Taiwan
University Of Tehran	54	2,751	16	648	12,00	Iran
Indian Institute Of Technology System Iit System	53	2,700	16	663	12,51	India
Dalian University Of Technology	51	2,598	18	1114	21,84	China
National Taiwan Normal University	40	2,038	12	509	12,73	Taiwan
Istanbul Medipol University	36	1,834	8	166	4,61	Turkey
Asia University Taiwan	35	1,783	10	591	16,89	Taiwan
University Of Electronic Science Technology Of China	34	1,732	20	940	27,65	China
Chung Hua University	29	1,477	10	335	11,55	Taiwan
University Of Southern Denmark	28	1,426	22	1464	52,29	Denmark
Vilnius Gediminas Technical University	28	1,426	13	788	28,14	Lithuania
Chinese Culture University	27	1,375	9	252	9,33	China
Tamkang University	27	1,375	16	759	28,11	Taiwan
National Central University	25	1,274	15	1134	45,36	Taiwan
National Taiwan University Of Science Technology	24	1,223	9	810	33,75	Taiwan
Shanghai Jiao Tong University	24	1,223	11	360	15,00	China

Table 7: The twenty most common areas in DEMATEL studies

Subject Area	No. Of documents	%	Most used journal	No. Of documents	%
Computer Science Artificial Intelligence	332	16,904	Expert Systems With Applications	77	23,193
Environmental Sciences	288	14,664	Journal Of Cleaner Production	96	33,333
Operations Research Management Science	285	14,511	Expert Systems With Applications	77	27,018
Management	272	13,849	Benchmarking An International Journal	22	8,088
Green Sustainable Science Technology	235	11,965	Journal Of Cleaner Production	96	40,851
Engineering Electrical Electronic	187	9,521	Expert Systems With Applications	77	41,176
Engineering Industrial	187	9,521	Computers Industrial Engineering	32	17,112
Computer Science Interdisciplinary Applications	161	8,198	Computers Industrial Engineering	32	19,876
Environmental Studies	144	7,332	Sustainability	90	62,500
Engineering Environmental	131	6,670	Journal Of Cleaner Production	96	73,282
Business	124	6,314	African Journal Of Business Management	9	7,258
Computer Science Information Systems	114	5,804	Ieee Access	17	14,912
Engineering Multidisciplinary	111	5,652	Mathematical Problems In Engineering	20	18,018
Economics	105	5,346	Echnological And Economic Development Of Economy	14	13,333
Engineering Manufacturing	88	4,481	International Journal Of Production Research	17	19,318
Computer Science Theory Methods	79	4,022	Journal Of Multiple Valued Logic And Soft Computing	5	6,329
Energy Fuels	70	3,564	Energies	14	20,000
Automation Control Systems	61	3,106	International Journal Of Fuzzy Systems	20	32,787
Engineering Civil	58	2,953	Engineering Construction And Architectural Management	7	12,069
Multidisciplinary Sciences	54	2,749	Symmetry Basel	19	35,185

Table 8. The most productive twenty authors on DEMATEL research

Authors	Articles	%	h-index	Total citations	Average citations
Tzeng GH	121	6,161	34	4117	34,02
Tseng ML	38	1,935	19	1605	42,24
Dincer H	36	1,833	8	165	4,58
Liou JJH	36	1,833	17	1115	30,97
Huang CY	35	1,782	7	394	11,26
Yuksel S	32	1,629	8	161	5,03
Kumar A	26	1,324	9	230	8,85
Pamucar D	23	1,171	13	826	35,91
Govindan K	22	1,120	16	1202	54,64
Liu HC	21	1,069	16	1054	50,19
Mangla SK	21	1,069	11	440	20,95
Tsai SB	21	1,069	14	464	22,10
Chuang YC	20	1,018	8	315	15,75
Luthra S	20	1,018	12	478	23,90
Lee YC	17	0,866	8	279	16,41
Zavadskas EK	17	0,866	13	741	43,59
Sarkis J	16	0,815	12	686	42,88
Wu KJ	16	0,815	9	429	26,81
Wu HH	15	0,764	8	484	32,27
Hsu Cc	14	0,713	11	390	27,86

In Table 9, the most cited ten articles about the DEMATEL method are given. The most cited article in DEMATEL with 570 citations is Tzeng G.H., et al "Evaluating intertwined effects in e-learning programs: A novel hybrid MCDM model based on factor analysis and DEMATEL" (Tzeng et al., 2007). In this article, the factors of the e-learning program are analyzed. The second most cited article with 500 citations, Wu, W.W. & Lee, Y.T. "Developing global managers' competencies using the fuzzy DEMATEL method" (Wu & Lee, 2007). The article by Büyüközkan and Çifçi (2012) titled "A novel hybrid MCDM approach based on fuzzy DEMATEL, fuzzy ANP, and fuzzy TOPSIS to evaluate green suppliers" is ranked third with 444 citations.

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Table 9: The most cited twenty articles about the DEMATEL method

Authors	Title	Publication Year	Source Title	Total Citations	Average per Year
Tzeng et al. (2007)	Evaluating intertwined effects in e-learning programs: A novel hybrid MCDM model based on factor analysis and DEMATEL	2007	Expert Systems With Applications	570	40,71
Wu and Lee (2007)	Developing global managers' competencies using the fuzzy DEMATEL method	2007	Expert Systems With Applications	500	35,71
Büyüközkan and Çifçi (2012)	A novel hybrid MCDM approach based on fuzzy DEMATEL, fuzzy ANP and fuzzy TOPSIS to evaluate green suppliers	2012	Expert Systems With Applications	444	49,33
Wu (2008)	Choosing knowledge management strategies by using a combined ANP and DEMATEL approach	2008	Expert Systems With Applications	286	22
Lin (2013)	Using fuzzy DEMATEL to evaluate the green supply chain management practices	2013	Journal Of Cleaner Production	266	33,25
Lin and Wu (2008)	A causal analytical method for group decision-making under fuzzy environment	2008	Expert Systems With Applications	260	20
Hsu et al. (2013)	Using DEMATEL to develop a carbon management model of supplier selection in green supply chain management	2013	Journal Of Cleaner Production	252	31,5
Chang et al. (2011)	Fuzzy DEMATEL method for developing supplier selection criteria	2011	Expert Systems With Applications	249	24,9
Shieh et al. (2010)	A DEMATEL method in identifying key success factors of hospital service quality	2010	Knowledge-Based Systems	247	22,45
Tseng (2009)	A causal and effect decision making model of service quality expectation using grey-fuzzy DEMATEL approach	2009	Expert Systems With Applications	222	18,5

The most commonly used keywords in DEMATEL method are shown in Figure 5. Keyword analysis shows common keywords used by authors. Accordingly, the most used keyword in DEMATEL is seen as "model". In addition, the words "dematel", "selection", "management", "performance", "anp", "decision making" are the most common keywords.
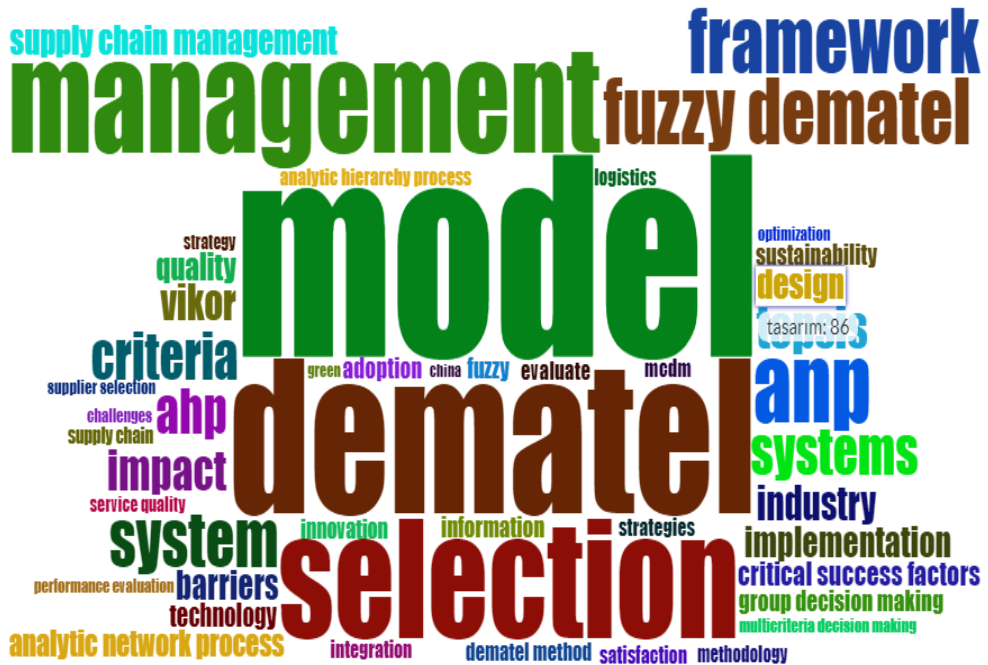

Figure 5. The most commonly used keywords in DEMATEL method

5. Conclusion

The focus of this study was to conduct a bibliometric analysis of global studies on the DEMATEL method, one of the MCDM methods. 1963 documents obtained from the WOS database between 1999-2020 were analyzed with the R Studio program. In the study, the annual research outputs of the researches published on the DEMATEL method, document types, countries, important journals and authors contributing to the field, the most efficient universities, and which fields of science the method is used in are shown.

In the DEMATEL method, China (553), Taiwan (519), Iran (251), India (241), Turkey (184) are among the top five countries. The most cited country in his studies was observed as Taiwan (12884). With the cooperation of Taiwan and China 74, it is in the main position of international cooperation. In the analysis, it was seen that he was actively participating in researches related to the DEMATEL method in other countries.

The most prolific authors in the field are Tzeng G.H. was seen as. Next comes Tseng M.L. (38), Dincer H. (36), Liou J.J.H. (36), Huang C.Y. (35).

When we look at the Web of Science categories, it is seen that studies are concentrated in fields such as computer science and artificial intelligence, environmental science, operations research and management science, management, green sustainable technologies, electrical electronics engineering, and industrial engineering.

In the studies related to the field, the journal "Journal Of Cleaner Production" ranks at the top with 96 studies. Then, the magazine "Sustainability" takes second place with 90 studies, and the magazine "Expert Systems With Applications" takes third place with 77 studies. The most cited journal is "Expert Systems With Applications" with 7074 citations.

The most productive university is National Chiao Tung University (Taiwan) with 102 studies. Next is Islamic Azad University (Iran) with 90 studies, followed by Nan Kai University Technology (China) in three with 86 studies.

When we look at the conceptual structure of the studies, it is seen that they concentrate on words such as model, dematel, selection, management, performance, anp, decision making, fuzzy dematel.

The findings of the study show the development of the studies in the DEMATEL method, which is the MCDM method. As a result of the evaluations, it was seen that the studies on the DEMATEL method were quite dynamic. It is possible to say that the studies on this method will increase in the following years. The methodology used can be applied to other methods and other topics.

Overall, the findings of this analysis provide a general picture of the evolution of the DEMATEL method. This can assist practitioners and academics in identifying and evaluating efforts to advance research in these areas. This will help develop new lines of research for the future and advance the use of these methods in more applications. The methodology used can be applied to other MCDM methods or other topics. Using the relative advantages of different bibliometric tools, the use of variables can be expanded.

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