

Twenty-Five Years of Group Decision and Negotiation: A Bibliometric Overview

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Abstract Twenty-five years ago, in 1992, a journal named Group Decision and Negotiation was established in association with the Institute for Operations Research and the Management Sciences with the vision of promoting theoretical and empirical research, real-world applications and case studies on group decision and negotiation processes. To celebrate its 25 years of continuous and outstanding contributions, this study aims to develop a bibliometric analysis of the publications of the journal between 1992 and 2016. The Web of Science Core Collection database is used to identify the leading trends of the journal in terms of impacts, topics, authors, universities and countries. Moreover, it utilizes the visualization of similarities viewer software to analyze the bibliographic couplings, co-citations, citations, co-authorships and co-occurrences of keywords.

Keywords Bibliometrics · Journal · Web of Science · VOS viewer

1 Introduction

The journal *Group Decision and Negotiation* (GDN) started its journey in 1992 and is now celebrating its 25th anniversary for its outstanding contributions in group decision and negotiation processes. The journal was established mainly to uphold and meet complex and self-organizing processes involving multiplayer, multicriteria, ill-structured, evolving, dynamic problems. It publishes research works mainly based on

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computer group decision and negotiation support systems, artificial intelligence and management science, applied game theory, experimental and social choice, and cognitive/behavioral sciences in group decisions and negotiations (Kersten 2016, 2017). It focuses on research studies combining two or more of these fields. Its areas of application include intraorganizational coordination, computer-supported collaborative work, labor-management negotiations, interorganizational negotiations, international negotiations, and environmental negotiations. In the foundational year, GDN started its journey by publishing three issues. In the next two years, i.e., in 1993 and 1994, it published four issues per year. The journal grew again in 1995, and since then, it has been publishing 6 issues per year. According to the 2017 Journal Citation Reports of Thomson and Reuters, the GDN has an impact factor of 1.688 and an eigenfactor score of 0.001620, with a total of 1060 citations.

This study aims to celebrate the Silver jubilee of the GDN through a general bibliometric analysis. Data are collected using the Web of Science Core Collection database to explore the importance, specialty, productivity and influence of the journal and to demonstrate its leading topics, authors, institutions and countries. The bibliometric study originated in the field of library and information science and is defined as the science of the quantitative study of bibliographic materials (Broadus 1987). Topic-based bibliometric studies are common in the literature. This type of study is also used to analyze various issues, such as different topics and the performances of journals, universities and countries. Glänzel and Schoepflin (1995) used the bibliometric study to analyze the time behavior of citations of articles from seven journals representing different scientific fields, such as sociology, psychology, chemistry, general and internal medicine, statistics and probability theory. In the literature, bibliometric studies are used to analyze various issues, such as topics (Blanco-Mesa et al. 2017; Emrouznejad and Marra 2014; Yu 2015), journals (Thongpapanl 2012), universities (Linton 2004), and countries (Bonilla et al. 2015). There are many examples of bibliometric studies in the literature based on different topics, such as finance (Alexander and Mabry 1994), management (Podsakoff et al. 2008), operations management (Hsieh and Chang 2009), entrepreneurship (Landström et al. 2012), automotive industry supply chains (González-Benito et al. 2013), fuzzy research (Merigó et al. 2015a), innovation (Merigó et al. 2016), operations research and management science (Merigó and Yang 2017), group aggregation techniques for analytic hierarchy process and analytic network process (Ossadnik et al. 2016), and leather science (Basak and Bandyopadhyay 2017). Bibliometric studies are also used to celebrate and reflect on journals' performances during their significant anniversaries. Table 1 provides some information on the bibliometric studies that analyzed the performance of journals during their significant anniversaries.

GDN, as an academic journal, plays a prominent role in the development of the field of group decision and negotiation processes by representing the topical preferences of the scientific community and publishing their essential research findings. This study also explores the background of the success of GDN during its first 25 years. This study targets the following queries. First, what was the yearly performance and citation structure of the GDN over the last 25 years? Second, among the 25 years of publication, which papers are recognized as having the high research values and the most citations? Third, which are the mostly cited documents among all GDN publications? Fourth,

Table 1 Bibliometric studies celebrated journals' anniversary

Reference	Journals	Interval
Heck & Bremser (1986)	The Accounting Review	1926–1985
Schwert (1993)	Journal of Financial Economics	1974–1991
Hoffman & Holbrook (1993)	Journal of Consumer Research	1974–1988
Borokhovich et al. (1995)	Financial Management	1972–1994
Ramos-Rodríguez & Ruíz-Navarro (2004)	Strategic Management Journal	1980–2000
García-Merino et al. (2006)	Technovation	1981–2004
Biemans et al. (2007)	Journal of Product Innovation Management	1984–2003
Casillas & Acedo (2007)	Family Business Review	1988–2005
Weiss & Qiu (2008)	The Journal of Risk and Insurance	1932–2006
Dereli et al. (2011)	Total Quality Management & Business Excellence	1995–2008
Merigó et al. (2015b)	Journal of Business Research	1973–2014
Cobo et al. (2015)	Knowledge-Based Systems	1991–2014
Merigó et al. (2017)	International Journal of Intelligent Systems	1986–2015
Valenzuela et al. (2017)	Journal of Business & Industrial Marketing	1986–2015
Laengle et al. (2017)	European Journal of Operational Research	1977–2016
Cancino et al. (2017)	Computers & Industrial Engineering	1976–2015
Tur-Porcar et al. (2018)	The Journal of Psychology	1936–2015
Yu et al. (2018)	IEEE Transactions on Fuzzy Systems	1994–2015
Merigó et al. (2018)	Information Sciences	1968–2016
Wang et al. (2018)	International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems	1993–2016
Martínez-López et al. (2018)	European Journal of Marketing	1967–2016

which authors, institutions and countries contributed highly during the first 25 years of the GDN? Fifth, which authors, institutions and countries are mostly cited in the GDN? Sixth, is there any collaboration among the authors, institutions and countries? If there is any collaboration, then how are they connected?

This study measures the performance of the GDN using both quantity and quality indicators. It explores the leading topics and the top contributing authors, institutions and countries and their collaborations during the first 25 years of the GDN. The network visualization of collaborations, such as the bibliographic couplings (Kessler 1963), co-citations (Small 1973), co-authorships and co-occurrences of keywords, are

prepared with the help of the visualization of similarities (VOS) viewer software (Van Eck and Waltman 2010). This study has several benefits to readers, the editorial board of the journal and researchers. For instance, with respect to readers, this study can clarify the direction that the journal has taken since the first publication and the type of studies that have been accepted until now. As to the benefit for the editorial board, they can either make new policies for the journal or modify the current policies by examining the type of studies that have more impact. Furthermore, researchers who aim to submit their future research into the GDN can truly have a comprehensive template on the type of studies that have been accepted and the research gaps that still remain to be filled in the journal.

The rest of the paper is organized as follows. The methodology of the bibliometric study is discussed in Sect. 2. Section 3 addresses the results, including the publication and citation structure and the top contributing authors and institutions. Section 4 presents a graphical visualization of the collaborations of bibliographic data with the help of the VOS viewer software. Section 5 summarizes the main findings and concludes the paper.

2 Methods

The Web of Science (WoS) Core Collection database is used to collect the information for the bibliometric analysis of the 25 year performance of GDN. The Web of Science (WoS) is a well-known and mostly reliable database of scientific publications (Yang et al. 2013). The Institute for Scientific Information (ISI) formed this database. Later, Thomson and Reuters took ownership of this database as their intellectual property and used it for scientific business. Currently, Clarivate Analytics is maintaining it, and it includes more than 15,000 journals and 50,000,000 papers classified into approximately 251 subject categories and 151 subject areas. The present bibliometric study collects the publication data of GDN from the WoS for the 25 year time period from 1992 to 2016. Then, quantitative methods are used to classify the collected data and construct the representative summaries.

The present study uses different bibliometric indicators such as the total number of papers, the total number of citations, the citations per paper and the h -index (Hirsch 2005) to measure both the productivity and the influence. The main reason behind the choice of different indicators is that some people prefer to focus on certain bibliometric productivity indicators, whereas other people might prefer quality indicators. However, it is clear that the comparison between productivity and influence can be measured with the numbers of publications and citations, respectively. An alternative to obtain a unified method could be using an indicator in which everyone agrees on the importance of each variable. The h -index is an indicator that combines publications with citations. If a variable has an h -index of N , then there are N papers inside the set of considered papers that have received at least N citations or more. Moreover, to measure the quantity of the publications' quality, several citation thresholds, such as more than 500, 100, 50, 10 and one citation, are considered in this study.

To obtain a more general view of the results, graphical visualizations of bibliographic couplings, co-authorships, co-citations and co-occurrences of keywords are

prepared through the VOS viewer software (Van Eck and Waltman 2010). The VOS viewer software has the ability to construct the networks connections of scientific publications, scientific journals, researchers, research organizations, countries, keywords, or terms based on co-authorship, co-occurrence, citation, bibliographic coupling, or co-citation links. The VOS viewer can present a map in three ways: the network visualization, the overlay visualization, and the density visualization. This work presents the network visualization of bibliographic couplings (Kessler 1963), co-citations (Small 1973), co-authorships and co-occurrences of keywords. Note that two documents are said to be bibliographically coupled (Kessler 1963) if both documents cite one or more documents in common. Bibliographic coupling helps researchers to find related research done in the past. Conversely, if two documents are given a citation from a third document, then both documents get a co-citation (Small 1973) index. Co-authorship measures the degree of connectivity of coauthors from different productive sources. Common and frequent keywords are visualized through the co-occurrence of author keywords. Two standardized weights, the number of links and the total strength of the links are the basics behind the graphical network visualization. The size of a circle and the network connections in graphical representations respectively denote its relevance and link strength.

Some limitations can occur due to the particular issues that affect different types of research. For example, the WoS does not consider different weights for a publication based on number of coauthors, the number of pages and other related issues that could condition the analysis. The WoS always provides one unit to any coauthor of a paper and one unit to each participating institution and country. This procedure provides an advantage to papers written by many authors rather than a single-author paper. Another important limitation when conducting country/institution analysis in academic research is that many people who work in one country may have a different nationality. However, this difficulty should be taken into account because this issue may have different inferences depending on the future growth of the research infrastructures of the world.

3 Results

The search engine of the WoS Core Collection database reveals that a total of 863 documents were published in the journal up to 31 December 2016. If only considering the articles, reviews, letters and notes, the number is 787. According to the WoS Core Collection database, the 787 publications have received a total of 9720 citations up to December 2017.

GDN published its first issue, volume 1, in April 1992. “Competitive intelligence and strategic group decisions: A new diagnostic tool.” authored by Benjamin Gilad, George Gordon and Ephraim Sudit was the very first article published in this journal, and it discussed issues such as competitive intelligence, strategic group decisions, intelligence availability, intelligence demand and diagnostic indices. The journal completed its first 25-year journey in 2016 by publishing the 6th issue of the 25th volume (Kersten 2016). It was a Special Issue titled “Negotiation and Collaborative Technologies in Organisations and Supply Chains,” and it ends with the memoriam of Akira

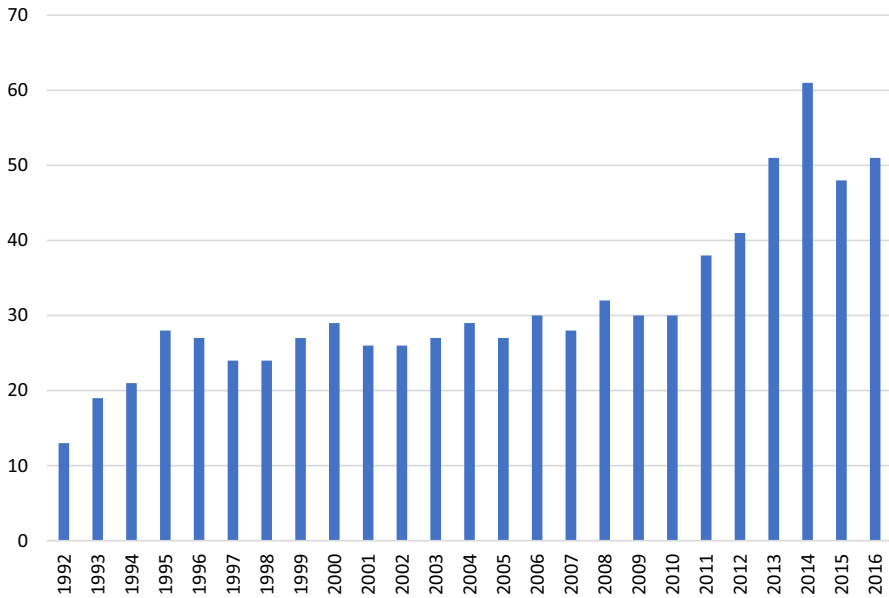


Fig. 1 Annual number of papers published in GDN

Ishikawa, who contributed significantly as an associate editor of GDN since the very beginning of the journal (Kersten 2017). The next subsection analyzes the year wise publication and citation structure of GDN.

3.1 Publication and Citation Structure of GDN

In its inaugural year, GDN published thirteen articles in three issues. In the next two years, i.e., in 1993 and 1994, the journal released 19 and 21 papers, respectively. The journal grew again in 1995 and published 28 papers. Figure 1 presents the annual number of publications in the GDN from 1995 to 2016.

From 2009 to 2014, the number of publications increased in comparison to the previous year. In 2014, the GDN published 61 papers. In 2015 and 2016, the journal released 48 and 51 papers, respectively. Now, for the quantitative and the qualitative measures of the publications of GDN, Table 2 presents the information about the total number of publications (TP) and the total number of citations (TC), which are categorized as more than 1, 10, 50, 100 and 500 citations received by these papers up to 31 December 2016. Additionally, the table also presents the impact factor of GDN since 1997 and the rankings that GDN obtained in the Journal Citation Reports in the research categories of “Management” and “Social Sciences, Interdisciplinary”, where it is currently indexed. Note that for obtaining the ranking, the work uses the average journal impact factor (JIF) percentile of the Web of Science—Journal Citation Reports (Clarivate Analytics 2018; Yu and Yu 2016). Observe that GDN requires an average percentile because it appears in two research categories. The formula is Aver-

age JIF percentile = (JIF percentile (Management) + JIF Percentile (Social Sciences, Interdisciplinary))/2. For each category, the JIF percentile is calculated by using JIF percentile = $(N - R + 0.5)/N$, where N is the number of journals in the category and R is the descending ranking of the journals in the category according to their respective impact factor. In order to obtain a better overview of the results, the last rows of Table 2 compares the results of GDN with the results of some representative journals in Web of Science Core Collection. The journals are ranked according to the total number of citations.

From 2003 to 2010, the journal provided a consistent performance. During that interval, 10 publications in each year received 10 citations or more. Note that it will be unscientific if we compare the citation structure of recent publications with the old publications using the indicator TC. However, the trends of the table indicate that recent publications will also receive much attention from the scientific community in the future. Table 2 also depicts that 6 papers received huge attention from researchers by having more than one hundred citations. Of the total papers, 5.08% have more than fifty citations and approximately one-third have more than ten citations. The documents published in 2001 received the most citations, followed by 2003. The impact factor of GDN reveals that the journal is well established in the scientific community and is growing in its relative position in the journal ranking of the Journal Citation Reports thanks in part to the increase in the number of journals indexed in the Web of Science. It is worth noting that GDN performs better in the research category of “Social Sciences, Interdisciplinary” than in “Management”.

3.2 Influential Papers in GDN

This section demonstrates the top 50 influential papers of GDN over two and a half decades. The influential papers are determined based on the total citations. That is, a paper will be more influential if it receives more citations. Table 3 presents a list of the fifty most cited papers of all-time in the journal.

The most cited paper was published in 2001 and was written by Jennings et al. (2001). It has more than four hundred citations with an average of 27.67 citations per year. Jennings et al. (2001) discussed the space of the negotiation opportunities for autonomous agents. The article titled “Some hesitant fuzzy aggregation operators with their application in group decision making” has the most average citations per year and is the second most cited paper of this list. ‘A linguistic decision process in group decision making’ is the oldest paper of the list and was published in 1996. These two articles address group decision making. The citations of two recent papers published in 2015 are improving quickly and are in the top 50. Approximately one-fourth of the top 50 influential papers received more than ten citations per year, and two of them have received more than forty citations per year. Interestingly, the first six papers of the list that have more than 100 citations were published after 2000. Note that GDN has a score of 46 in the H-classics concept (Martínez et al. 2014). That is, 46 documents in the journal have 46 citations or more, but there are not 47 documents with at least 47 citations.

Next, Table 4 depicts the Top 40 documents cited in GDN publications.

Table 2 Annual citation structure of GDN and comparison with some selected journals

Year	TP	TC	>500	>100	>50	≥10	≥1	IF	IF-P	IF-M	IF-S
1992	13	234	0	0	0	10	12	-	-	-	-
1993	19	366	0	0	2	10	17	-	-	-	-
1994	21	130	0	0	1	2	10	-	-	-	-
1995	28	272	0	0	0	10	25	-	-	-	-
1996	27	415	0	0	2	14	23	-	-	-	-
1997	24	172	0	0	0	6	23	0.164	19.16	17.79	20.53
1998	24	302	0	0	0	8	19	0.118	13.27	7.37	19.16
1999	27	346	0	0	2	11	27	0.208	15.19	12.29	18.10
2000	29	369	0	0	2	10	26	0.294	27.99	24.16	31.81
2001	26	985	0	1	4	16	25	0.304	29.88	18.85	40.90
2002	26	236	0	0	1	8	21	0.655	62.17	48.46	75.89
2003	27	829	0	1	7	18	26	1.038	75.38	58.95	91.81
2004	29	662	0	1	5	13	27	0.509	46.70	33.58	59.82
2005	27	551	0	0	2	18	25	0.696	51.28	37.32	65.25
2006	30	615	0	0	3	16	28	0.429	25.52	20.88	30.17
2007	28	317	0	0	2	11	25	0.526	34.30	20.37	48.24
2008	32	569	0	1	2	18	26	0.586	30.42	17.41	43.44
2009	30	371	0	0	1	10	25	0.783	47.70	34.37	61.02
2010	30	341	0	1	1	10	27	1.048	58.30	43.40	73.21
2011	38	308	0	0	1	9	30	1.017	56.16	44.34	67.97
2012	41	346	0	0	1	8	38	0.897	54.13	37.06	71.19
2013	51	514	0	1	1	10	42	1.253	67.57	52.89	82.25

Table 2 continued

Year	TP	TC	>500	>100	>50	≥10	≥1	IF	IF-P	IF-M	IF-S
2014	61	250	0	0	0	7	37	2.120	85.10	78.10	92.10
2015	48	167	0	0	0	2	22	1.312	64.33	51.30	77.36
2016	51	53	0	0	0	1	11	1.688	66.54	49.22	83.85
Total	787	9720	0	6	40	256	617	-	-	-	-
%	100%	-	0%	0.76%	5.08%	32.53%	78.40%	-	-	-	-
EJOR	16,535	391,161	24	664	1968	8372	14,173	3.297	-	-	-
MS	7038	381,180	92	895	1830	4734	6672	2.822	-	-	-
OBHDP	2621	161,673	25	364	793	2053	2592	2.454	-	-	-
JORS	6493	95,077	3	106	388	2355	5529	1.077	-	-	-
DSS	2607	64,330	5	100	307	1571	2542	3.222	-	-	-
Omega	2916	60,987	3	110	300	1278	2454	4.029	-	-	-
DS	1332	45,512	8	96	235	770	1259	1.595	-	-	-
TD	1535	12,980	2	10	33	342	1243	0.606	-	-	-
IJITDM	601	5530	0	7	11	169	522	1.664	-	-	-
NJ	362	1815	0	0	1	67	272	0.288	-	-	-

TP and TC total papers and citations, >500, >100, >50, ≥10, ≥1 = number of papers with more than 500, 100 and 50, and equal to or more than 10 and 1 citations; IF impact factor, IF-P average JIF percentile; and IF-M and IF-S their respective JIF percentiles in "Management" and "Social Science, Interdisciplinary", EJOR European J. Operational Research, MS Management Science, OBHDP Organizational Behavior and Human Decision Processes, JORS J. Operational Research Society, DSS Decision Support Systems, Omega Omega—Int. J. Management Science, DS Decision Sciences, TD Theory and Decision, IJITDM Int. J. Information Technology and Decision Making, NJ negotiation

Table 3 The 50 most cited documents in GDN

R	TC	Title	Author/s	Year	Citations per year
1	415	Automated negotiation: Prospects, methods and challenges	Jennings, NR; Faratin, P; Lomuscio, AR; et al.	2001	27.67
2	166	Some hesitant fuzzy aggregation operators with their application in group decision making	Xia, MM; Xu, ZS; Chen, N	2013	55.33
3	149	Cracks in diversity research: The effects of diversity faultlines on conflict and performance	Thatcher, SMB; Jehn, KA; Zanutto, E	2003	11.46
4	115	Automating linguistics-based cues for detecting deception in text-based asynchronous computer-mediated communication	Zhou, L; Burgoon, JK; Numamaker, JF; et al.	2004	9.58
5	106	A deviation-based approach to intuitionistic fuzzy multiple attribute group decision making	Xu, ZS	2010	17.67
6	102	The effects of conflict types, dimensions, and emergent states on group outcomes	Jehn, KA; Greer, L; Levine, S; et al.	2008	12.75
7	100	A linguistic decision process in group decision making	Herrera, F; Herrera-Viedma, E; Verdegay, JL	1996	5.00
8	93	A note on linguistic hybrid arithmetic averaging operator in multiple attribute group decision making with linguistic information	Xu, ZS	2006	9.30
9	93	Towards a structured design of electronic negotiations	Bichler, M; Kersten, G; Strecker, S	2003	7.15
10	82	Coalition analysis in group decision support	Kilgour, DM; Hipel, KW; Peng, XY; et al.	2001	5.47
11	81	Diversity in demographic characteristics, abilities and personality traits: Do faultlines affect team functioning?	Molleman, E	2005	7.36
12	81	Non-numeric multi-criteria multi-person decision making	Yager, RR	1993	3.52

Table 3 continued

R	TC	Title	Author/s	Year	Citations per year
13	80	A classification scheme for negotiation in electronic commerce	Lomuscio, AR; Wooldridge, M; Jennings, NR	2003	6.15
14	76	An interactive approach to multiple attribute group decision making with multigranular uncertain linguistic information	Xu, ZS	2009	10.86
15	71	Aggregation of individual preference structures in AHP-group decision making	Teresa Escobar, M; Moreno-Jimenez, JM	2007	7.89
16	70	An integrated group decision-making method dealing with fuzzy preferences for alternatives and individual judgments for selection criteria	Zhang, GQ; Lu, J	2003	5.38
17	66	Group decision support using fuzzy cognitive maps for causal reasoning	Khan, MS; Quaddus, M	2004	5.50
18	66	Participants' perceptions on the role of facilitators using Group Decision Support Systems	Ackermann, F	1996	3.30
19	64	Deception in computer-mediated communication	Carlson, JR; George, JF; Burgoon, JK; et al.	2004	5.33
20	63	Groups formation and operations in the Web 2.0 environment and social networks	Lai, Linda S. L.; Turban, Efrain	2008	7.88
21	63	Negotiating complex contracts	Klein, M; Faratin, P; Sayama, H; et al.	2003	4.85
22	63	ELECTRE TRI for groups with imprecise information on parameter values	Dias, L; Climaco, J	2000	3.94
23	62	The Montreal Taxonomy for electronic negotiations	Strobel, M; Weinhardt, C	2003	4.77
24	62	Stakeholder values and scientific modeling in the neuse river watershed	Borsuk, M; Clemen, R; Maguire, L; et al.	2001	4.13
25	61	Introduction	Button, K; Reggiani, A	2011	12.20

Table 3 continued

R	TC	Title	Author/s	Year	Citations per year
26	61	User acceptance of e-collaboration technology: An extension of the technology acceptance model	Dasgupta, S; Granger, M; McGarry, N	2002	4.36
27	61	The effects of media and task on user performance: A test of the task-media fit hypothesis	Mennecke, BE; Valacich, JS; Wheeler, BC	2000	3.81
28	60	The effects of cultural diversity in virtual teams versus face-to-face teams	Staples, DS; Zhao, L	2006	6.00
29	60	The graph model for conflict resolution: Past, present, and future	Kilgour, DM; Hipel, KW	2005	5.45
30	59	Emergent leadership in self-managed virtual teams—A longitudinal study of concentrated and shared leadership behaviors	Carte, TA; Chidambaram, L; Becker, A	2006	5.90
31	58	Asynchronous computer-mediated communication versus face-to-face collaboration: Results on student learning, quality and satisfaction	Ocker, R.J; Yaverbaum, GJ	1999	3.41
32	57	Strength of preference in the graph model for conflict resolution	Hamouda, L; Kilgour, DM; Hipel, KW	2004	4.75
33	57	Do friends perform better than acquaintances? the interaction of friendship, conflict, and task	Shah, PP; Jehn, KA	1993	2.48
34	56	Nash equilibrium and decentralized negotiation in auctioning divisible resources	Maheswaran, RT; Basar, T	2003	4.31
35	56	Evaluating a framework for multi-stakeholder decision support in water resources management	Hamalainen, R; Kettunen, E; Marttunen, M; et al.	2001	3.73
36	56	Impacts of asynchronous learning networks on individual and group problem solving: A field experiment	Benbunan-Fich, R; Hiltz, SR	1999	3.29
37	55	A distance-based collective preorder integrating the relative importance of the group's members	Jabeur, K; Martel, JM; Ben Khelifia, S	2004	4.58

Table 3 continued

R	TC	Title	Author/s	Year	Citations per year
38	54	Induced and linguistic generalized aggregation operators and their application in linguistic group decision making	Merigo, JM.; Gil-Lafuente, AM.; Zhou, LG; et al.	2012	13.50
39	53	Drama theory and its relation to game theory. Part I: Dramatic resolution vs. Rational solution	Howard, N	1994	2.41
40	52	Negotiation support and e-negotiation systems: An overview	Kersten, GE.; Lai, H	2007	5.78
41	50	Fallback bargaining	Brams, SJ; Kilgour, DM	2001	3.33
42	50	Negotiator relationships: Construct measurement, and demonstration of their impact on the process and outcomes of negotiation	Greenhalgh, L; Chapman, DI	1998	2.78
43	49	Introduction	Doemeland, D; Braga, CA. Primo	2009	7.00
44	48	Group decision and negotiation in strategy making	Eden, C; Ackermann, F	2001	3.20
45	48	A framework for thinking about Group Decision Support Systems (GDSS)	Eden, C	1992	2.00
46	47	Consensus-based group decision making under multi-granular unbalanced 2-tuple linguistic preference relations	Dong, YC; Li, CC; Xu, YF; et al.	2015	47.00
47	46	Some intuitionistic fuzzy weighted distance measures and their application to group decision making	Zeng, SZ	2013	15.33
48	45	Perceived relative power and its influence on negotiations	Wolfe, RJ; McGinn, KL	2005	4.09
49	44	A fuzzy stochastic multi-attribute group decision-making approach for selection problems	Mousavi, SM; Jolai, F; Tavakkoli-Moghaddam, R	2013	14.67
50	44	Power imbalance and the pattern of exchange in dyadic negotiation	Mannix, EA; Neale, MA	1993	1.91

R rank

Table 4 Top 40 most cited documents in GDN publications

R	Year	Reference (only first author)	Type	TC	Co-citations
1	1982	Raiffa H, <i>The Art and Science of Negotiation</i>	B	75	72
2	1987	Desanctis G, <i>Manage Sci</i> , V33, P589	A	41	40
3	1991	Nunamaker JF, <i>Commun ACM</i> , V34, P40	A	37	36
4	1986	Daft RL, <i>Manage Sci</i> , V32, P554	A	35	34
5	1980	Saaty TL, <i>Analytic Hierarchy Process</i>	B	34	29
6	1999	Kersten GE, <i>Decis Support Syst</i> , V25, P135	A	32	31
7	1984	McGrath JE, <i>Groups: Interaction and Performance</i>	B	31	29
8	1950	Nash JF, <i>Econometrica</i> , V18, P155	A	29	25
9	1996	Nunamaker JR Jr, <i>J Manage Inform Syst</i> , V13, P163	A	28	24
10	1981	Pruitt DG, <i>Negotiation Behavior</i>	B	26	25
11	1975	Rubin J, <i>Social Psychology of Bargaining and Negotiation</i>	B	23	21
12	1988	Dennis AR, <i>MIS Quart</i> , V12, P591	A	22	22
13	1989	Jelassi MT, <i>Decision Support Systems</i> , V5, P167	A	22	21
14	1976	Keeney R, <i>Decisions with Multiple Objectives</i>	B	22	22
15	1988	Shakun MF, <i>Evolutionary Systems</i>	B	22	19
16	1990	Thompson L, <i>Psychol Bull</i> , V108, P515	A	21	20
17	2003	Briggs RO, <i>J Manage Inform Syst</i> , V19, P31	A	20	17
18	1988	Yager RR, <i>IEEE T Syst Man Cyb</i> , V18, P183	A	20	13
19	1990	Connolly T, <i>Manage Sci</i> , V36, P689	A	19	19
20	1965	Walton RE, <i>A Behavioral Theory of Labor Negotiations</i>	B	19	18
21	1987	Daft RL, <i>MIS Quart</i> , V11, P355	A	18	18
22	1993	Fang L, <i>Interactive Decision Making</i>	B	18	15
23	1987	Jarke M, <i>Eur J Oper Res</i> , V31, P314	A	18	17
24	1982	Rubinstein A, <i>Econometrica</i> , V50, P97	A	18	15

Table 4 continued

R	Year	Reference (only first author)	Type	TC	Co-citations
25	1976	Short J, Social Psychology of Telecommunications	B	18	17
26	1981	Fisher R, Getting to Yes: How to Negotiate	B	17	15
27	1999	Fjermestad J, J Manage Inform Syst, V15, P7	A	17	17
28	1991	Mumpower JL, Manage Sci, V37, P1304	A	17	17
29	1988	Watson RT, MIS Quart, V12, P463	A	17	17
30	1994	Desanctis G, Organ Sci, V5, P121	A	16	15
31	2002	Raiffa H, Negotiation Analysis	B	16	15
32	1992	Sebenius JK, Manage Sci, V38, P18	A	16	15
33	1986	Siegel J, Organ Behav Hum Dec, V37, P157	A	16	16
34	1990	Thompson L, Organ Behav Hum Dec, V47, P98	A	16	16
35	1992	Bazerman MH, Negotiating Rationally	B	15	15
36	1996	Buller DB, CommunTheor, V6, P203	A	15	15
37	1986	Carnevale PJD, Organ Behav Hum Dec, V37, P1	A	15	15
38	1998	Eden C, Making Strategy	B	15	12
39	1986	Lax DA, Manager as Negotiator	B	15	15
40	1991	Nunamaker JF, Manage Sci, V37, P1325	A	15	15

The abbreviations are available in previous tables except for: B book, A article

'Raiffa H, The art and science of negotiation' leads Table 4 with a large margin from the second paper. The oldest paper in the list is 'Nash JF, *Econometrica*, V18, P155'. 'Briggs RO, *J Manage Inform Syst*, V19, P31' is the newest paper on the list. The Top 40 has only five documents with more than a thirty co-citation index. Interestingly, the Top 40 contain no document from GDN and all are from different journals. The result shows the diversity in the citation pattern. The importance and majority of management science in Table 4 are noticeable. The Top 40 most cited documents in GDN publications have six documents from management science and it is the most influential journal of GDN. The next subsection analyzes the highest contributing authors, institutions and countries of GDN.

3.3 Leading Authors, Institutions and Countries

First, let us examine the leading authors of GDN. Table 5 provides the information of the 40 most contributing authors of GDN based on number of publications. The list also provides information about the institutions, countries and citation structures of the Top 40 authors.

D. Marc Kilgour of Wilfrid Laurier University leads the list in the total publications and h-index categories. Zeshui Xu from the Sichuan University leads the list in two categories: the total number of citations (441) and the citations per paper (49.00). Note that five authors have at least ten publications. Eight authors of the top 40 have more than twenty cites per paper. Twenty-two publications of the top 40 authors have more than 50 citations. Recall that 37 total papers of the GDN have more than 50 citations. Nine authors in the list have h-indexes of more than or equal to seven. José A. Pino of Chile is the only author in Top 40 representing South America while no African authors are in Top 40. Notice that fourteen authors of the list are from the USA. The PR China has seven authors in the list and Canada has five. Canada leads in the top 5 positions of the table. The University of Arizona in the USA has three authors in the Top 40. Educational institutions, especially universities around the world, are playing important roles in developing research, innovation and knowledge creation. To identify the leading institutions of GDN, Table 6 presents its top 40 productive and influential institutions.

The Delft University of Technology in the Netherlands is the most productive university of GDN and is closely followed by the University of Arizona in the USA. The University of Arizona, Wilfrid Laurier University and the University of Waterloo are in top three positions in the TH category. Five publications of the University of Liverpool have 528 total citations and, as a result, it leads in the TC/TP category. Thirteen universities in the USA appear in the Top 40. It is worth noting that eight Canadian and three Dutch universities are in the world's Top 40 productive and influential universities of GDN. Europe has nine universities in the Top 40 ranking, while Asia has only seven such universities. China is showing absolute dominancy among Asian countries as six out of the top seven Asian universities are from China. The outcomes in Table 6 clearly show that the GDN has a universal profile in publishing papers from universities from different countries around the World. To achieve a more general perspective of the

Table 5 Top 40 leading authors in GDN

R	Full name	University	Country	TP	TC	H	TC/TP	>50	>20	>10
1	Xu ZS	Sichuan Univ	China	9	441	8	49.00	3	5	7
2	Kilgour DM	Wilfrid Laurier Univ	Canada	24	427	11	17.79	3	8	11
3	Hipel KW	Univ Waterloo	Canada	19	367	9	19.32	3	7	9
4	Ackermann F	Curtin Univ	Australia	9	254	7	28.22	1	5	7
5	Nunamaker JF	Univ Arizona	USA	9	254	7	28.22	1	4	6
6	Kersten GE	Concordia Univ	Canada	14	248	7	17.71	1	3	6
7	Burgoon JK	Univ Arizona	USA	5	208	4	41.60	2	2	3
8	Eden C	Strathclyde Business Sch	UK	8	205	6	25.63	0	4	6
9	George JF	Iowa State Univ	USA	5	157	4	31.40	1	3	4
10	Moreno-Jimenez JM	Univ Zaragoza	Spain	5	139	4	27.80	1	3	4
11	Shakun MF	New York Univ	USA	18	137	9	7.61	0	0	7
12	Fang LP	Ryerson Univ	Canada	7	134	5	19.14	1	2	3
13	Zhou LG	Anhui Univ	China	7	130	7	18.57	1	2	4
14	Chen HY	Anhui Univ	China	7	129	7	18.43	1	2	4
15	Chidambaram L	Univ Oklahoma	USA	7	113	4	16.14	1	2	3
16	Druckman D	George Mason Univ	USA	6	106	5	17.67	0	2	5
17	Ehtamo H	Helsinki Univ Tech	Finland	5	96	4	19.20	1	2	4
18	Qureshi S	Univ Nebraska	USA	6	96	5	16.00	0	2	3
19	Hiltz SR	New Jersey Inst Tech	USA	4	92	4	23.00	1	1	3
20	Vogel D	City Univ Hong Kong	China	6	88	4	14.67	0	2	3
21	Briggs RO	San Diego State Univ	USA	8	77	4	9.63	0	0	4
22	Tjosvold D	Lingnan Univ	China	6	75	3	12.50	0	2	2
23	Cai XQ	Chinese Univ Hong Kong	China	5	68	5	13.60	0	1	3
24	Rapoport A	Univ Arizona	USA	5	64	4	12.80	0	2	3

Table 5 continued

R	Full name	University	Country	TP	TC	H	TC/TP	>50	>20	>10
25	Hamalainen RP	Helsinki Univ Technol	Finland	4	62	4	15.50	0	1	4
26	Pino JA	Univ Chile	Chile	5	61	4	12.20	0	1	2
27	De Vreede GJ	Delft Univ Technol	Netherlands	6	59	5	9.83	0	0	3
28	Koeszegi ST	Vienna Univ Technol	Austria	7	52	4	7.43	0	1	1
29	Yuan YF	McMaster Univ	Canada	4	51	3	12.75	0	1	2
30	Turel O	Calif State Univ Fullerton	USA	5	48	5	9.60	0	0	2
31	Liu JP	Anhui Univ	China	4	46	4	11.50	0	0	2
32	Kolfschoten GL	Delft Univ Technol	Netherlands	7	44	4	6.29	0	0	2
33	Lai HC	Natl Sun Yat Sen Univ	Taiwan	4	42	4	10.50	0	0	2
34	Sheikhmohammady M	Tarbiat Modares Univ	Iran	3	42	3	14.00	0	1	2
35	Schoop M	Univ Hohenheim	Germany	5	39	3	7.80	0	1	1
36	Palmon D	Rutgers Business Sch	USA	7	37	2	5.29	0	0	2
37	Antunes P	Victoria Univ Wellington	New Zealand	4	36	4	9.00	0	0	1
38	Kleinman G	Montclair State Univ	USA	6	36	2	6.00	0	0	2
39	Vetschera R	Univ Vienna	Austria	10	36	3	3.60	0	0	1
40	Bui T	Univ Hawaii	USA	4	35	3	8.75	0	1	1

Abbreviations are available in previous tables except for: *H* h-index, *TC/TP* cites per paper

Table 6 The most productive and influential institutions in GDN

R	University	Country	TP	TC	H	TC/TP	>50	>20	>10	ARWU	QS
1	U Arizona	USA	23	541	11	23.52	3	7	12	99	230
2	U Liverpool	UK	5	528	4	105.60	2	3	3	101–150	173
3	Wilfrid Laurier U	Canada	21	409	10	19.48	4	8	10	–	–
4	U Waterloo	Canada	21	390	10	18.57	3	7	9	201–300	152
5	U Strathclyde	UK	10	259	7	25.90	1	6	7	501–600	277
6	Southeast U China	China	5	215	4	43.00	1	2	4	201–300	501–550
7	City U Hong Kong	China	13	200	8	15.38	0	4	7	201–300	49
8	Delft U Technology	Netherlands	24	188	9	7.83	0	1	7	151–200	54
9	Karlsruhe Inst Tech	Germany	7	187	5	26.71	2	2	3	201–300	107
10	New York U	USA	21	183	8	8.71	1	1	7	29	52
11	U Pennsylvania	USA	5	174	3	34.80	1	2	2	17	19
12	U Ottawa	Canada	11	163	6	14.82	1	1	3	151–200	289
13	Aalto U	Finland	11	149	7	13.55	1	2	5	401–500	137
14	Concordia U Canada	Canada	10	142	6	14.20	1	2	4	401–500	431–440
15	National Sun Yat Sen U	Taiwan	6	138	6	23.00	1	2	4	701–800	388
16	New Jersey Inst Tech	USA	9	133	7	14.78	1	1	4	501–600	801–1000
17	Chinese U Hong Kong	China	10	132	7	13.20	0	2	5	151–200	46
18	Anhui U	China	7	131	7	18.71	1	3	4	–	–
19	Ryerson U	Canada	6	128	4	21.33	1	2	3	–	801–1000
20	Duke U	USA	7	126	4	18.00	1	3	3	26	21
21	Indiana U Bloomington	USA	4	113	3	28.25	1	3	3	101–150	304
22	Curtin U	Australia	8	109	5	13.63	1	1	2	151–200	262

Table 6 continued

R	University	Country	TP	TC	H	TC/TP	>50	>20	>10	ARWU	QS
23	Washington State U	USA	5	107	4	21.40	1	2	2	401–500	401–410
24	U Nebraska Omaha	USA	10	105	5	10.50	0	2	4	–	–
25	Laval U	Canada	6	99	5	16.50	1	2	2	301–400	378
26	George Mason U	USA	6	91	4	15.17	0	2	4	201–300	801–1000
27	U Vienna	Austria	17	86	5	5.06	0	1	3	151–200	154
28	Penn State U	USA	6	86	4	14.33	1	1	2	85	93
29	U Oklahoma Norman	USA	5	79	3	15.80	1	1	2	401–500	501–550
30	U Chile	Chile	7	74	5	10.57	0	1	2	301–400	201
31	Lingnan U	China	5	73	3	14.60	0	2	2	–	551–600
32	Hong Kong U Sci Tech	China	5	71	4	14.20	0	1	3	201–300	30
33	Tilburg U	Netherlands	9	66	3	7.33	0	1	3	601–700	357
34	U Lisbon	Portugal	7	65	5	9.29	0	0	3	151–200	305
35	McMaster U	Canada	6	65	5	10.83	0	1	2	66	140
36	Federal U Pernambuco	Brazil	5	57	3	11.40	0	1	3	701–800	801–1000
37	U Georgia	USA	5	57	4	11.40	0	0	3	201–300	421–430
38	Erasmus U Rotterdam	Netherlands	4	54	4	13.50	0	1	1	73	147
39	Rutgers State U Newark	USA	10	51	4	5.10	0	0	2	–	651–700
40	U Windsor	Canada	6	49	3	8.17	0	1	2	–	651–700

The abbreviations are available in previous tables except for: ARWU Academic Ranking of World Universities, QS Quacquarelli-Symonds University Ranking

results, let us examine the publications at the country level. Table 7 presents the thirty most productive countries of GDN ranked according to the number of citations.

In all categories except 'TC/TP', the USA has occupied the top position and is well ahead of its challengers. In terms of total publications, Canada and China, respectively, occupy the second and third places. Sixteen European countries are in the Top 30. Although there are no African representatives in the previous tables of contributing authors and universities, South Africa appears in the table of the top 30 most productive countries of GDN. Brazil leads the Latin American countries, with 11 publications, although Chile has more citations. Nine countries have contributed more than thirty publications to the GDN, and four among them have more than fifty publications. The results of Tables 5 and 6 clearly depict that there are several authors and institutions from the USA that have contributed significantly in the GDN. The USA, China, Canada and the UK have more than one thousand citations. Finally, let us examine the citing articles of all GDN publications. For doing so, Table 8 presents the authors, institutions, countries and journals that have the most cited articles of the GDN.

The self-citations of GDN are the most relevant ones and are followed by the citations of the European Journal of Operational Research. The Journal of Intelligent and Fuzzy Systems cited publications of GDN in 100 articles. Six other journals have cited GDN in more than fifty documents available in the WoS. At the country level, the top countries of Table 7 also lead this table but with a different order. China is the second highest contributing nation by citing GDN in 1080 articles. The UK and Canada are, respectively, in third and fourth place by citing GDN in 512 and 452 articles. Interestingly, the University of Waterloo is in the 4th position in Table 6, but it leads this table by citing GDN publications in 131 papers. The 2nd most contributing author, Keith W. Hipel, leads this table by citing GDN publications in its 114 publications. Ten institutions were cited in more than 50 articles in the GDN. Fifteen European and eight Asian countries are in the Top 30 list. To obtain a wide-ranging view of the results, the next section presents graphical visualizations of the bibliographic couplings, co-authorships, co-citations and co-occurrences of keywords.

4 Mapping GDN with VOS Viewer Software

This section discusses a graphical mapping of the bibliographic material of GDN by using the VOS viewer software (Van Eck and Waltman 2010). Note that other software that could be used is discussed by Cobo et al. (2011, 2012). First, let us visualize the co-citation of journals with the GDN. Note that the co-citation of journals occurs when two documents of two different journals receive a citation from the same third document of another journal. Figure 2 presents the results of the co-citations of GDN with a minimum threshold of twenty citations.

Figure 2 depicts that GDN has a high co-citation link with EJOR and Management Science. Table 9 provides detailed statistics about the co-citations and link strength of the top 40 journals with the GDN. Ten journals have a greater than 200 link strength with the GDN. To extend the analysis based on time, Figs. 3 and 4 respectively depict the network visualization of co-citations of journals in GDN for the decades of 1997–2006 and 2007–2016. Management Science leads the decade of

Table 7 The most productive and influential countries in GDN

R	Country	TP	TC	H	TC/TP	>50	>20	>10	Population	TP/Pop	TC/Pop
1	USA	278	3398	27	12.22	13	49	97	326.385	0.85	10.41
2	China	73	1391	21	19.05	6	22	36	1.386.877	0.05	1.00
3	Canada	93	1252	20	13.46	8	19	32	36.591	2.54	34.22
4	UK	44	1020	15	23.18	3	12	17	65.648	0.67	15.54
5	Spain	46	880	10	19.13	4	8	10	46.529	0.99	18.91
6	Netherlands	56	677	15	12.09	2	9	20	17.163	3.26	39.45
7	Australia	31	310	8	10.00	2	3	8	24.742	1.25	12.53
8	Germany	32	303	7	9.47	2	3	5	82.800	0.39	3.66
9	France	42	202	8	4.81	0	2	6	65.017	0.65	3.11
10	Finland	18	201	8	11.17	1	3	6	5510	3.27	36.48
11	Taiwan	18	199	8	11.06	1	2	5	23.557	0.76	8.45
12	Singapore	4	145	4	36.25	1	2	2	5607	0.71	25.86
13	Portugal	12	136	7	11.33	1	1	4	10.310	1.16	13.19
14	Iran	10	124	6	12.40	0	2	5	79.926	0.13	1.55
15	Austria	26	115	5	4.42	0	1	4	8794	2.96	13.08
16	Italy	15	92	6	6.13	0	2	2	60.508	0.25	1.52
17	Chile	8	74	5	9.25	0	1	2	17.374	0.46	4.26
18	Brazil	11	71	4	6.45	0	1	3	208.397	0.05	0.34
19	New Zealand	8	68	5	8.50	0	0	2	4835	1.65	14.06
20	Poland	11	56	4	5.09	0	1	1	38.427	0.29	1.46
21	South Africa	4	51	3	12.75	0	1	2	56.522	0.07	0.90
22	Sweden	8	49	4	6.13	0	0	2	10.081	0.79	4.86
23	Belgium	7	44	3	6.29	0	1	1	11.371	0.62	3.87

Table 7 continued

R	Country	TP	TC	H	TC/TP	>50	>20	>10	Population	TP/Pop	TC/Pop
24	Denmark	4	40	3	10.00	0	0	2	5779	0.69	6.92
25	Turkey	8	37	4	4.63	0	0	1	79,815	0.10	0.46
26	Japan	15	31	4	2.07	0	0	0	126,670	0.12	0.24
27	Switzerland	4	28	4	7.00	0	0	1	8418	0.48	3.33
28	Israel	10	23	3	2.30	0	0	1	8751	1.14	2.63
29	Malaysia	4	19	2	4.75	0	0	1	32,210	0.12	0.59
30	India	8	17	3	2.13	0	0	0	1,210,855	0.01	0.01

Note that the population is in thousands. The abbreviations are available in previous tables except for: TP/Pop and TC/Pop = Number of papers per million inhabitants

Table 8 Citing articles of GDN: authors, universities, countries and journals

R	Author	TP	University	TP	Country	TP	Journal	TP
1	Hipel KW	114	U Waterloo	131	USA	1533	Group Decision Negotiation	352
2	Kilgour DM	83	Wilfrid Laurier U	88	China	1080	European J Operational Res	126
3	Xu ZS	62	Central South U	73	UK	512	J Intelligent Fuzzy Systems	100
4	Chen XH	44	City U Hong Kong	69	Canada	452	Expert Systems Applic	73
5	Merigó JM	43	Delft U Technology	66	Spain	437	Decision Support Systems	68
6	Wang JQ	40	U Arizona	63	Netherlands	348	Information Sciences	58
7	Zhou LG	36	Southeast U China	62	Germany	312	Computers in Human Behavior	58
8	Chen HY	36	Sichuan U	61	Australia	295	Knowledge Based Systems	57
9	Liu PD	33	U Chile	58	France	211	Applied Soft Computing	51
10	Herrera-Viedma E	31	U Fed Pernambuco	53	Italy	178	Int J Conflict Management	49
11	Zeng SZ	30	Concordia U Canada	45	Taiwan	161	Small Group Research	46
12	Wei GW	29	U Amsterdam	44	Brazil	153	J Operational Research Society	41
13	Kersten GE	26	U Granada	44	Portugal	139	J Management Inform Syst	37
14	De Vreede GJ	25	Aalto U	43	Iran	136	J Applied Psychology	34
15	Antunes P	25	U Lisboa	43	Turkey	135	Computers Industrial Engin	34
16	Wang J	18	Islamic Azad U	42	Japan	110	Int J Fuzzy Syst	30
17	Ackermann F	24	U North Carolina	42	Poland	93	Int J Uncertainty Fuzziness Knowledge Based Syst	28
18	Xu HY	23	CNRS	41	Finland	89	IEEE T Professional Comm	28
19	Mousavi SM	23	U Politec Valencia	40	South Korea	80	Int J Intelligent Systems	27
20	Zhang HY	22	Anhui U	38	Switzerland	77	J Environmental Management	26

Table 8 continued

R	Author	TP	University	TP	Country	TP	Journal	TP
21	Pino JA	22	U Barcelona	38	Austria	76	Negotiation Journal	24
22	Ochoa SF	22	New York U	37	Sweden	75	Negotiat Conflict Manag Res	24
23	Madani K	22	Northwestern U	37	Israel	75	Computers Education	24
24	Jennings NR	21	Eindhoven U Tech	36	Chile	75	Organizational Behavior Human Decision Processes	24
25	Morais DC	20	Rutgers State U	36	India	74	Mathematical Problems Engin	24
26	Martinez L	20	U Manchester	36	Belgium	73	Int J Inform Tech Decis Mak	24
27	De Almeida AT	20	Zhejiang U Fin Econ	36	Greece	70	Tech Econ Develop Economy	23
28	Xu YJ	20	U Illinois	35	Singapore	66	Soft Computing	22
29	Burgoon JK	20	U Southampton	34	Malaysia	59	Int J Comput Intelligence Syst	22
30	Briggs RO	19	U Strathclyde	34	New Zealand	57		

The abbreviations are available in previous tables

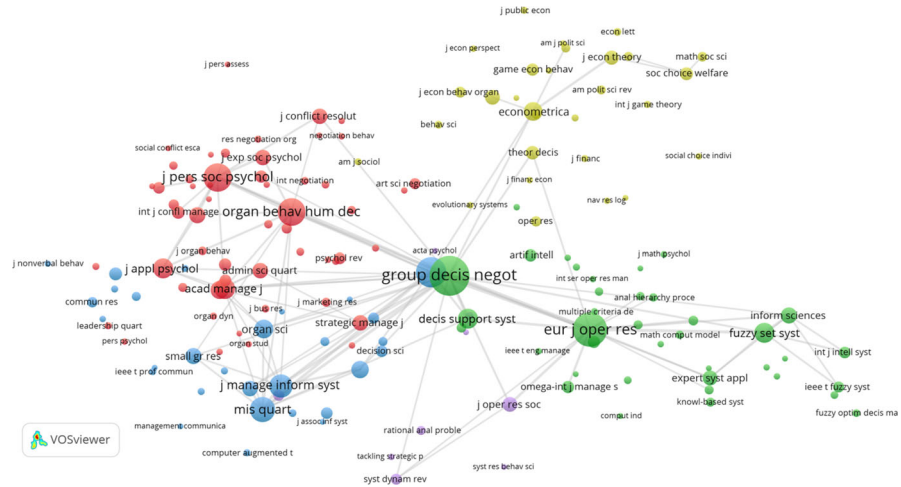


Fig. 2 Co-citations of journals in GDN

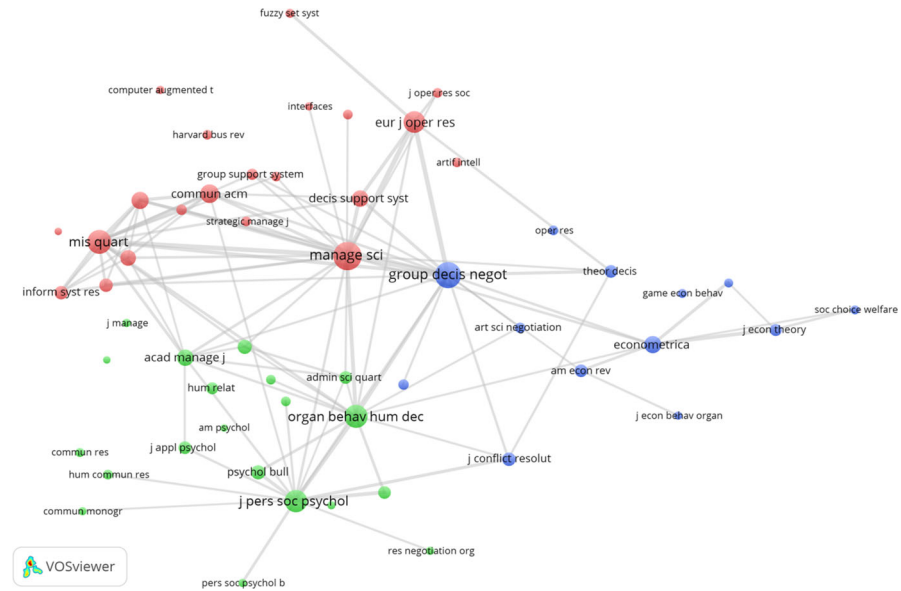


Fig. 3 Co-citations of journals in GDN: 1997–2006

1997–2006 while GDN itself leads the decade of 2007–2016 followed by EJOR. Note that eight journals have a greater than 100 link strength with the GDN from 1997 to 2006, while it increased to 16 journals in the current decade. That is, the relevance of GDN is increasing rapidly. Different colors represent different clusters. The VOS viewer software automatically generates these clusters based on links.

Figure 5 presents the graphical visualization of the co-citations of authors in GDN generated with Scopus and a threshold of thirty citations. Top leading authors of GDN

Table 9 Co-citations of journals in GDN: global and temporal analysis

R	1997–2006				2007–2016				
	Journal	Cit	CLS	Journal	Cit	CLS	Journal	Cit	CLS
1	Group Decis Negot	939	795.27	Manage Sci	249	215.30	Group Decis Negot	690	571.30
2	Eur J Oper Res	681	544.43	Group Decis Negot	221	169.64	Eur J Oper Res	497	383.10
3	Manage Sci	557	505.19	MIS Quart	178	152.23	J Pers Soc Psychol	300	251.70
4	J Pers Soc Psychol	481	412.67	Organ Behav Hum Dec	166	137.06	Organ Behav Hum Dec	278	241.80
5	Organ Behav Hum Dec	457	401.09	J Pers Soc Psychol	164	130.92	Manage Sci	250	226.70
6	MIS Quart	383	334.10	Eur J Oper Res	152	114.97	Fuzzy Set Syst	221	180.85
7	J Manage Inform Syst	327	286.97	J Manage Inform Syst	140	130.38	J Appl Psychol	179	161.74
8	Acad Manage J	258	241.83	Commun ACM	107	91.49	Acad Manage J	165	153.39
9	Fuzzy Set Syst	246	202.14	Econometrica	94	72.97	MIS Quart	160	141.53
10	J Appl Psychol	242	222.85	Acad Manage J	90	83.19	Inform Sciences	145	128.23
11	Decis Support Syst	233	213.68	Decis Support Syst	87	80.39	Decis Support Syst	138	123.47
12	Econometrica	216	185.25	Organ Sci	76	68.50	Organ Sci	129	122.16
13	Organ Sci	208	195.10	Acad Manage Rev	68	62.28	Expert Syst Appl	126	111.61
14	Acad Manage Rev	197	184.18	Psychol Bull	63	61.17	J Manage Inform Syst	184	165.43
15	Commun ACM	189	170.75	J Conflict Resolut	61	44.26	Acad Manage Rev	122	111.89
16	Psychol Bull	157	152.66	Inform Syst Res	59	55.27	Strategic Manage J	100	81.25
17	Inform Sciences	155	137.68	Small Gr Res	57	55.11	Econometrica	99	87.87
18	Small Gr Res	152	140.53	Admin Sci Quart	55	51.06	J Oper Res Soc	99	90.49
19	J Conflict Resolut	143	123.47	Theor Decis	55	49.42	Small Gr Res	88	77.28

Table 9 continued

R	1997–2006				2007–2016				
	Journal	Cit	CLS	Journal	Cit	CLS	Journal	Cit	CLS
20	J Exp Soc Psychol	142	134.87	J Appl Psychol	54	50.76	Psychol Bull	87	83.92
21	Inform Syst Res	141	134.40	J Exp Soc Psychol	52	46.23	J Exp Soc Psychol	85	81.77
22	Admin Sci Quart	140	132.39	Am Econ Rev	50	40.44	Int J Conf Manage	81	76.30
23	Strategic Manage J	140	118.38	J Econ Theory	45	37.92	Admin Sci Quart	78	72.97
24	J Oper Res Soc	139	127.01	Hum Relat	44	40.66	Inform Syst Res	77	73.46
25	Am Econ Rev	133	118.94	Decision Sci	36	35.14	J Conflict Resolut	76	70.15
26	Expert Syst Appl	129	114.63	Negotiation J	36	31.94	Omega-Int J Manage S	74	72.15
27	J Econ Theory	121	105.83	Hum Commun Res	33	30.32	IEEE T Fuzzy Syst	72	65.35
28	Theor Decis	113	104.44	Inform Manage	33	31.31	J Manage	71	67.46
29	Int J Conf Manage	100	95.28	IEEE T Syst Man Cyb	32	27.67	Int J Intell Syst	70	64.91
30	Soc Choice Welfare	99	76.78	Harvard Bus Rev	31	25.57	Am Econ Rev	69	60.99
31	Hum Commun Res	98	90.83	J Oper Res Soc	31	25.67	Commun ACM	69	63.92
32	J Manage	95	91.41	Artif Intell	30	16.90	Syst Dynam Rev	63	46.69
33	Omega-Int J Manage S	93	90.98	Psychol Rev	30	28.87	Game Econ Behav	62	52.40
34	Game Econ Behav	91	76.53	Strategic Manage J	30	28.59	J Econ Theory	61	51.93
35	Artif Intell	90	63.95	Oper Res	29	26.84	Soc Choice Welfare	61	46.07
36	Negotiation J	90	84.58	Game Econ Behav	28	22.03	Artif Intell	59	39.01
37	IEEE T Syst Man Cyb	89	83.39	Rev Econ Stud	28	24.50	Hum Commun Res	59	53.03
38	Hum Relat	84	80.50	Soc Choice Welfare	28	16.57	Pers Soc Psychol B	58	56.00
39	Pers Soc Psychol B	82	79.27	Commun Res	26	24.85	J Econ Behav Organ	53	47.93
40	Int J Intell Syst	81	74.50	Fuzzy Set Syst	25	15.10	J Manage Stud	51	48.25

R rank, Cit citations, CLS citation link strength

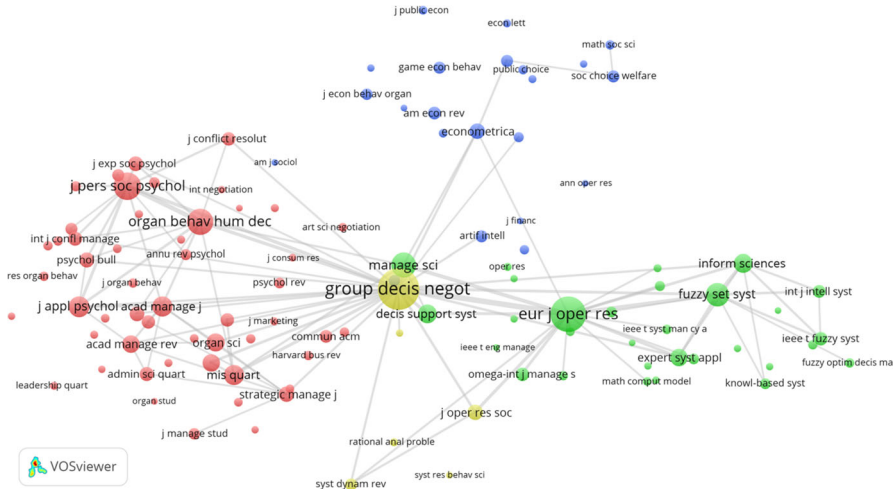


Fig. 4 Co-citations of journals in GDN: 2007–2016

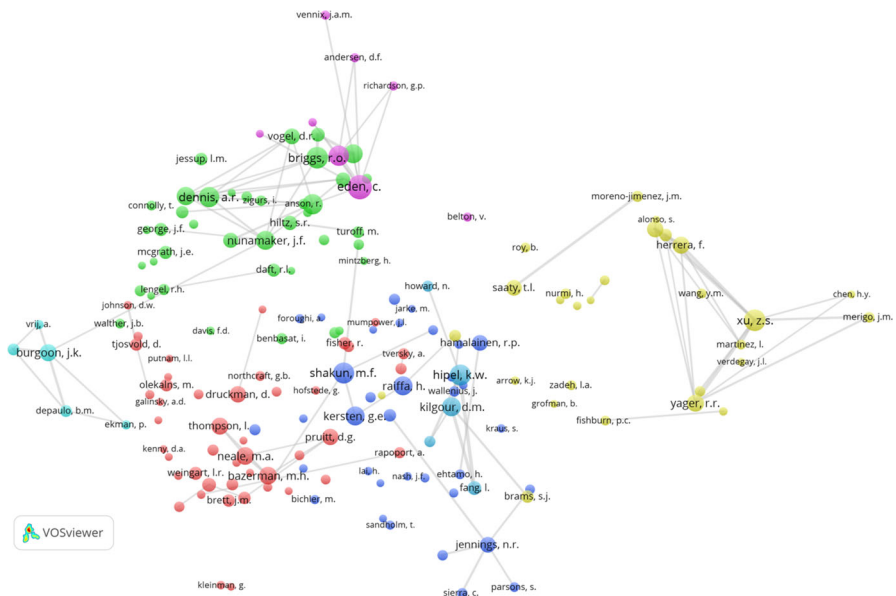


Fig. 5 Co-citations of authors in GDN

(Table 5) are also highlighted in this figure. The main advantage of Fig. 5 is the visualization of the authors in order to see those with closer profiles.

Another interesting issue is to see how the most productive institutions of GDN are connected between each other. Recall that bibliographic coupling (Kessler 1963) occurs when two documents from different institutions cite the same third document from another institution. Figure 6 presents the couplings of institutions publishing in GDN with a minimum threshold of three documents.

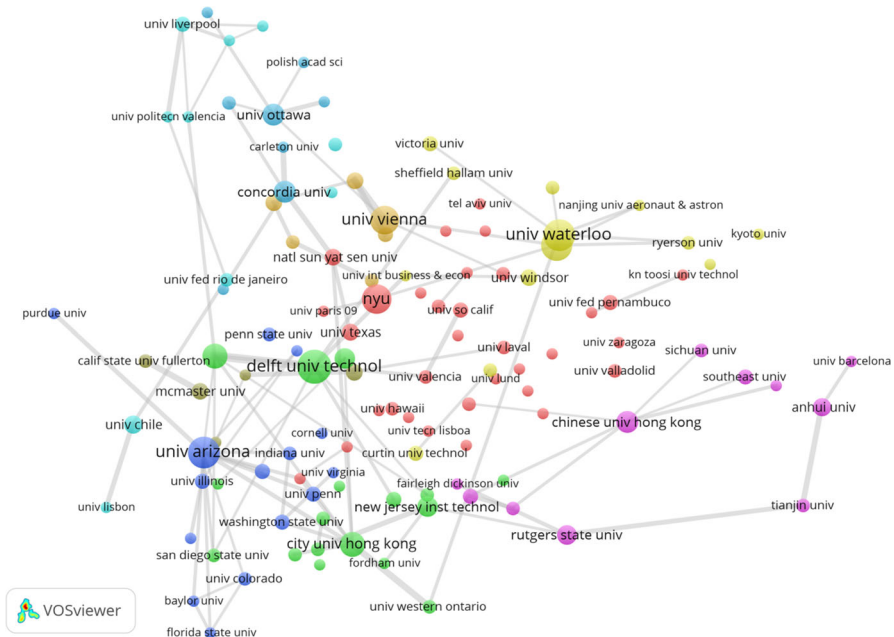


Fig. 6 Bibliographic couplings of institutions publishing in GDN

The results are in accordance with the results of the most productive and influential institutions in GDN in which Delft University of Technology in the Netherlands is the most productive institution and is followed by the University of Arizona. Delft University of Technology, the University of Arizona, Wilfrid Laurier University and the University of Waterloo are highlighting their presence in Fig. 6. Delft University of Technology and the University of Arizona have better connectivity than the others. Thus, from a general point of view, we can conclude that more productive institutions have more connectivity. Figure 7 presents the bibliographic couplings of countries that publish regularly in GDN.

The presence of the USA, the most productive country of GDN, is particularly noticeable. Other leading countries listed in Table 7 are also involved in collaborative works. The main advantage of Fig. 7 is the visualization of the countries in order to see those with closer profiles. For example, the USA and Canada are linked closely. That is, these countries have more collaborative research works in GDN.

Finally, the characteristics of publications of GDN are analyzed based on author keywords. Author keywords refer to those keywords that usually appear below the abstract and that are used to identify the topic of the paper. To do so, Fig. 8 presents the network visualization of the co-occurrence of author keywords in GDN with a minimum threshold of three occurrences. This analysis helps to depict those keywords that appear more frequently in the GDN.

According to Fig. 8, ‘negotiation’, ‘group decision making’ and ‘group support systems’ are three primary keywords that have been used most frequently in GDN publications. Figure 8 and Table 10 further indicate which keywords have been mostly

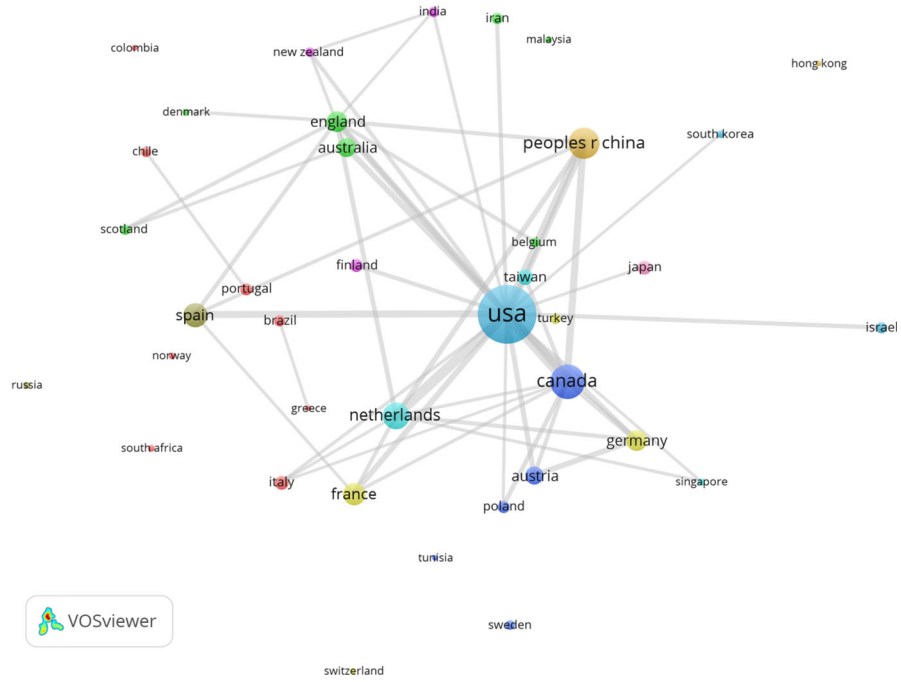


Fig. 7 Bibliographic couplings of countries publishing in GDN

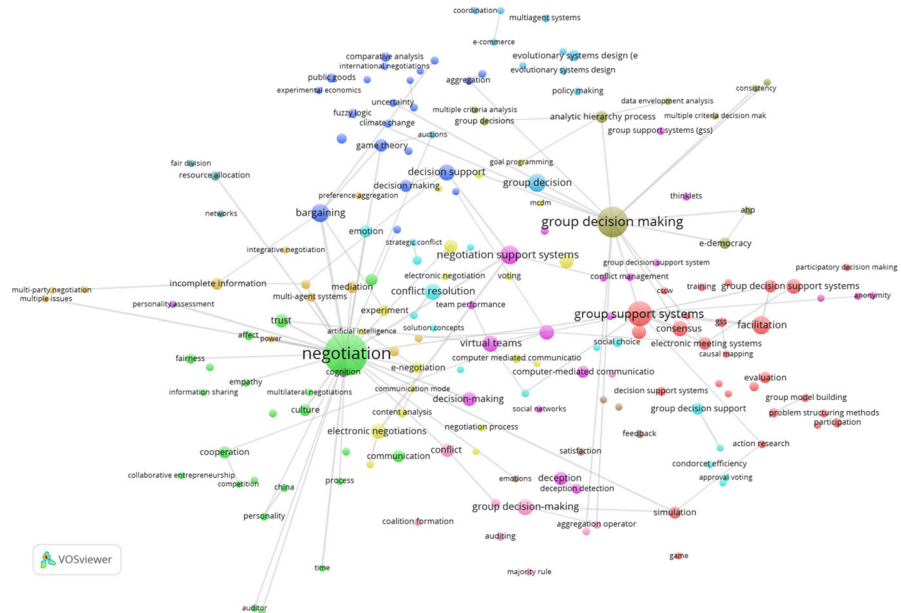


Fig. 8 Co-occurrences of author keywords in GDN

Table 10 Co-occurrences of author keywords in GDN: global and temporal analysis

R	Global				1997–2006				2007–2016			
	Keyword	Oc	Co	Co	Keyword	Oc	Co	Co	Keyword	Oc	Co	Co
1	Negotiation	103	65	20	Negotiation	35	20	20	Negotiation	60	45	45
2	Group Decision Making	51	22	15	Group Support Systems	18	15	15	Group Decision Making	33	22	22
3	Group Support Systems	34	26	7	Group Decision Making	14	7	7	Group Decision	11	4	4
4	Negotiation Support Systems	20	13	8	Groupware	9	8	8	Conflict Resolution	10	7	7
5	Bargaining	18	15	5	Virtual Teams	8	5	5	Facilitation	10	9	9
6	Facilitation	18	17	6	Bargaining	7	6	6	Negotiation Support Systems	10	6	6
7	Group Decision	18	7	6	Electronic Meeting Systems	7	6	6	Collaboration	9	6	6
8	Decision Support	15	13	5	Evolutionary Systems Design	6	5	5	Collaboration Engineering	9	7	7
9	Group Decision-Making	15	8	4	GDSS	6	4	4	Consensus	9	4	4
10	Conflict Resolution	14	10	3	Group Decision-Making	6	3	3	Electronic Negotiations	9	7	7
11	Virtual Teams	14	9	4	Negotiation Support Systems	6	4	4	Group Decision-Making	9	8	8
12	Consensus	13	9	2	Computer-Mediated Commun	5	2	2	Bargaining	8	8	8
13	Electronic Negotiations	13	7	3	Conflict	5	3	3	Deception	8	4	4
14	Collaboration	12	7	3	Group Decision	5	3	3	Decision Support	8	7	7
15	Group Decision Support Syst	12	7	3	Group Decision Support Syst	5	3	3	Decision-Making	8	5	5
16	Decision-Making	11	7	4	Negotiation Support	5	4	4	Emotion	8	6	6
17	GDSS	11	5	1	Analytic Hierarchy Process	4	1	1	Group Support Systems	8	7	7
18	Groupware	11	8	0	Asynchronous Learning Networks	4	0	0	Trust	8	7	7
19	Conflict	10	9	0	Comparative Analysis	4	0	0	E-Democracy	7	5	5

Table 10 continued

R	Global	1997–2006			2007–2016		
		Keyword	Oc	Co	Keyword	Oc	Co
20	Deception	Decision Support	10	7	Cooperation	4	4
21	Negotiation Support	Electronic Negotiations	10	7	Culture	4	2
22	Trust	Experiment	10	8	Virtual Teams	4	3
23	Collaboration Engineering	Facilitation	9	7	Argumentation	4	4
24	Electronic Meeting Systems	Group Decision Support	9	9	Communication	4	2
25	Emotion	Simulation	9	8	Conflict	4	3
26	Game Theory	Voting	9	5	Content Analysis	4	2
27	Analytic Hierarchy Process	Action Research	8	2	Group Decision Support Syst	3	3
28	Communication	Adaptation	8	8	Incomplete Information	3	2
29	Computer-Mediated Commun	Case Study	8	3	Mediation	3	3
30	Cooperation	Collaboration	8	3	Negotiations	3	2
31	Culture	Collaborative Learning	8	7	Participation	3	2
32	Decision Making	Communication	8	6	System Dynamics	3	3
33	Group Decision Support	Computer Mediated Commun	8	3	Affect	3	3
34	Incomplete Information	Consciousness	8	6	Aggregation Operator	3	3
35	Mediation	Consensus	8	4	Analytic Hierarchy Process	3	3
36	Negotiations	CSCW	8	4	Auditing	3	3
37	Simulation	Decision Making	8	5	Coalition Formation	3	2
38	E-Democracy	Decision Support System	7	5	Deception Detection	3	1
39	E-Negotiation	Decision-Making	7	5	E-Negotiation	3	2
40	Evaluation	E-Negotiation	7	6	Evaluation	3	2

R rank, Oc occurrences, Co co-occurrence link strength

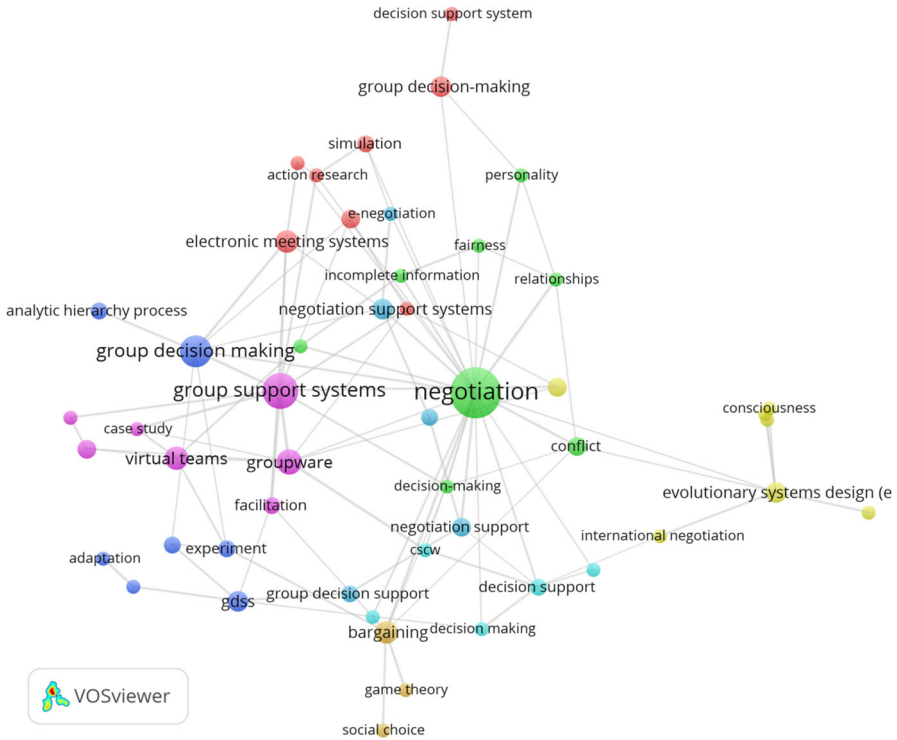


Fig. 9 Co-occurrences of author keywords in GDN: 1997–2006

used in these journals. For example, Negotiation Support Systems, Bargaining, Facilitation and Group Decision are used frequently. To analyze this more deeply, the graphical visualizations of the co-occurrence of keywords of GDN for the decades of 1997–2006 and 2007–2016 are presented in the following figures (Figs. 9, 10).

From the beginning of the journal and throughout its journey, ‘Negotiation’ is the most frequent keyword of GDN. Recent publications are showing interest in its topics, such as Conflict Resolution, Facilitation, Negotiation Support Systems, Collaboration, Consensus and Electronic Negotiations.

5 Conclusions

In 2017, Group Decision and Negotiation celebrated its Silver jubilee for its noteworthy journey of publishing marvelous research works. During the past 25 years, it has published several notable research works. Those research findings help to develop the field of group decision and negotiation processes significantly. To celebrate its success, this study presents a bibliometric study of the publications of the GDN during the time period from 1992 to 2016. The WoS Core Collection database is used to depict the foremost trends of this journal in terms of impacts, topics, authors, universities and countries.

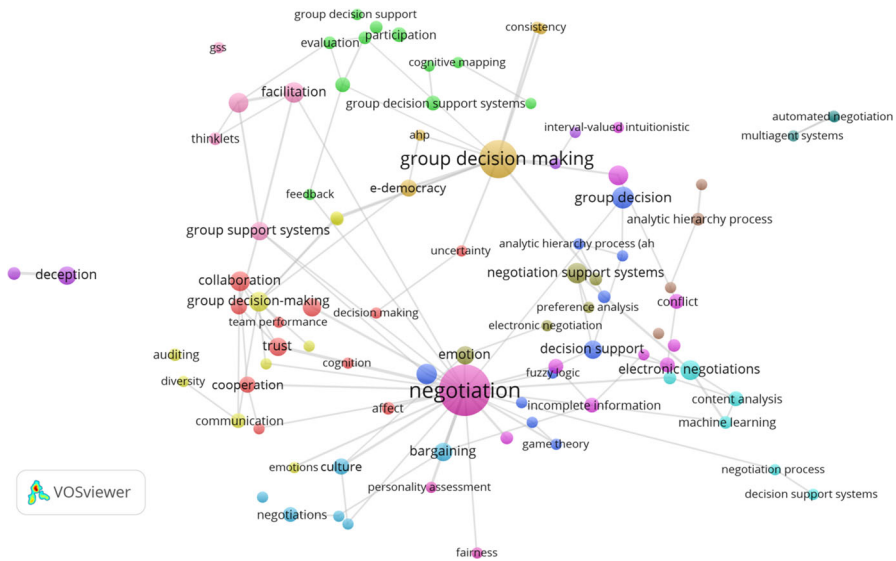


Fig. 10 Co-occurrences of author keywords in GDN: 2007–2016

The present study depicts the following insights. First, the journal shows steady and consistent performance from 2003 to 2013. According to the WoS database, 6 GDN papers have more than one hundred citations. Approximately 32% of the total documents have more than ten citations. Documents published in 2001 received the most citations and were followed by 2003. The trends in the citation structure confirm the future growth of GDN. Second, it depicts the 50 most influential documents of GDN. The article entitled “Automated negotiation: Prospects, methods and challenges” has received more than 400 citations and is the most cited paper of GDN. The article titled “Some hesitant fuzzy aggregation operators with their application in group decision making” has the most average citations per year and it is the second most cited paper of this list. Eleven of the top 50 influential papers received more than ten citations per year and three among them have received more than forty citations per year. Third, Table 4 demonstrates the 40 most cited documents in GDN publications. The leader of the Table 4, ‘Raiffa H, The Art and Science of Negotiation’, has been cited 75 times in GDN publications. The oldest and newest papers in the list are ‘Nash JF, *Econometrica*, V18, P155’ and ‘Briggs RO, *J Manage Inform Syst*, V19, respectively. *Management Science* is the most influential journal of GDN.

The analysis of the most contributing authors depicts that D. Marc Kilgour of Wilfrid Laurier University leads the list in the total publication and h-index categories. Zeshui Xu from Sichuan University leads the list in two categories: the total number of citations (441) and citations per paper (49.00). The USA, the PR China and Canada respectively have fourteen, seven and five authors in the list of Top 40 authors. The Delft University of Technology in the Netherlands is the most productive university of GDN. The University of Arizona and the University of Liverpool respectively lead in the TH and TC/TP categories. Thirteen universities in the USA and eight Canadian

universities are in the world's Top 40 most productive and influential universities of GDN. Europe has nine universities in the Top 40 ranking, while Asia has only seven universities in the Top 40 ranking. Consequently, in the country analysis, the USA has occupied the top position well ahead of its challengers. Sixteen European countries are in the Top 30. South Africa is the lone African representative nation in the table of the top 30 most productive countries of GDN. The USA, China, Canada and the UK have more than one thousand citations. Twenty-seven of those 37 papers having more than 50 citations are from the top three countries of the USA, China and Canada.

The self-citations of GDN are the most relevant ones and are followed by the citations of the *European Journal of Operational Research*. At the institution and country levels, the top institutions and countries of Tables 6 and 7 are also contributing to GDN in their articles. Finally, the graphical visualizations of the bibliographic couplings, co-authorships, co-citations and co-occurrences of keywords demonstrate the collaboration among the authors, institutions and countries. 'Negotiation' and 'group decision making' are two primary keywords that have been used most frequently in GDN publications. Beside the primary keywords, publications during the last 10 years frequently use the topics Conflict Resolution, Facilitation, Negotiation Support Systems, Collaboration, Consensus and Electronic Negotiations.

This work presents a broad outline of the publication and citation structures of GDN with the help of several indicators, including the total number of papers and citations, the *h*-index, and the citations per paper. This bibliometric study might be useful for the researchers who intend to submit their research to GDN. They might use the results of the keyword analysis to assess the general direction of the journal, the various subjects that have been published, and the gaps that can be addressed by new studies. This paper may also be used as a source for the editors of the journal to evaluate the records of GDN in publishing the studies of the field, which can be used as a guideline to plan future directions.

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