A trend study on the impact of social media in decision making

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CHRONICLE	ABSTRACT

Social media has grown steadily during the last decade and it is now considered as a new opportunity to use for different purposes such as decision making. The primary objective of this paper is to review articles related to social media and decision making using manual and bibliometrics analysis methods, and to identify top themes in these articles. We have reviewed the papers published between 2008 and the first month of 2019 in Scopus where 1,159 articles were published in this period. These articles come from 733 sources and 3,459 authors. According to our survey, United States is the most productive country. Moreover, most collaborations occurred between two countries of United States and United Kingdom as well as between United States and China. The bibliometrics analysis examines global research in this field from the different point of views.

1. Introduction

Social media (SM) includes divulgence websites that help relationship happening between users from different backgrounds, arising in a rich social structure. User-generated content persuades requirements and decision-making. According to the relevance of SM for different stakeholders, it has gained substantial attention from scholars of different areas such as information and decision sciences. To the best of authors' knowledge, there exists no comprehensive review that integrates and synthesizes the findings of the literature on social media (Kapoor et al., 2018). The subject matter of decision making is applied in a variety of fields, and the reviewed articles also show that the articles presented have a variety of backgrounds (Avudaiappan et al., 2018). A large amount of information on social media such as text, photos, and videos shared by users indicate there are two main categories on decision making.

- How social media manipulates users' decisions?

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- How institutions, organizations, and governments use social media to make decisions?

Prior to this, there were limited studies on the review of social media literature (Kapoor et al., 2018), and research was not focused on the decision-making using the social media. Many articles have been examined both in terms of the positive effect of this phenomenon (e.g. Gao et al., 2011; Munar and Jacobsen 2014b; Yates and Paquette 2011) and its negative impact (e.g. Dubé et al., 2014b; Kata 2012b; Reyna 2012). One of the major topics in these articles is the impact of social media on health and one of the most important articles is associated with the anti-vaccination problem. The use of social media by adherents of this theory and the lack of active participation by related organizations and specialists is causing the growth of this belief in public opinion. There are, of course, positive use cases such as checking the media to identify disasters or help the affected people in emergency situations (e.g. Widener et al., 2013). In the following, we will look at the literature search method and look for the selected articles in the Scopus database, most of the issues that have been addressed and explain the results of our findings.

2. Literature search method

To do our research, we acted in two ways:

- Manual method: review abstracts of most cited articles,
- software bibliometrics analysis: export articles information and import into analysis software.

2.1. Search based on keywords

First, in the Scopus database, the study searched all the articles that contained social media, and decision making in their abstracts, titles and keywords. But by reviewing the abstracts, we found that the number of irrelevant articles in this methodology is high. Also, there is a limitation on the Scopus database which is the maximum export size of BibTeX format (needs for bibliometrix) is 2,000 articles. So in both method, we searched articles using "social media" AND "decision making" in keywords. A total of 1,159 articles were found. After sorting them based on the most cited articles, we reviewed 150 first articles manually and exported all articles' information in BibTeX format in order to use in bibliometrix package.

2.2 Software analysis package

The bibliometrix R-package (http://www.bibliometrix.org) provides a set of tools for quantitative research in bibliometrics and scientometrics. It is written in the R language, which is an open-source environment and ecosystem. The existence of substantial, effective statistical algorithms, access to high-quality numerical routines, and integrated data visualization tools are perhaps the strongest qualities that distinguishes R from other languages for scientific computation (Aria & Cuccurullo, 2017). Data were retrieved from Scopus web site using BibTeX format which is recognizable by Bibliometrix. Data were analyzed by using R studio v.1.1.456, R v.3.5.1 (2018-07-02) and bibliometrix R-package (http://www.bibliometrix.org) (Aria & Cuccurullo, 2017). We have generated graphs and other information using biblioshiny.

3. Literature synthesis

In a short list of reviewed articles, various themes were identified based on their similarity. In Table 1 we have identified relevant themes of each article using the manual method. The first highest cited article reviews the effect of social media and collaboration in disasters and how it helps to collaborate and knowledge sharing. It is cited by 412 articles (Yates & Paquette, 2011). The second article is also related to disaster management. It describes the advantages and disadvantages of using social media for disaster relief coordination (Gao et al., 2011). Third place in rank belongs to the marketing field. It tries to tell us

how can we use social media and extract information to make marketing decisions. This study has been cited by 271 articles (He et al., 2013). In Table 1 we can go through all of 150 reviewed articles. Table 1 shows 53 articles in the health field. From this point of view healthcare is the most important theme which is well developed.

Table 1
Most cited articles and their relevant themes

#	Article	Total Citation	Crisis/disaster management	Marketing	Professional Health	Anti-Vaccination	Tourism	Information Technology	Policy & Government	Mental health & emotions	Organizations & Enterprises	Social media (itself)	Environment
1	(Yates & Paquette, 2011)	412	√										
2	(Gao et al., 2011)	324	√										
3	(He et al., 2013)	271		√									
4	(Lee Ventola, 2014)	244			√								
5	(Kata, 2012b)	224				√							
6	(Kamel Boulos et al., 2011)	209	√										
7	(Munar & Jacobsen, 2014b)	200					√						
8	(Youyou et al., 2015)	178						√					
9	(Imran et al., 2015)	177	√										
10	(MacEachren et al., 2011)	175	√										
11	(Betsch et al., 2012)	125				√							
12	(Zheng et al., 2014)	93							√				
13	(Hamm et al., 2013)	88			√								
14	(Dubé et al., 2014)	84				√							
15	(Naslund et al., 2016)	76								√			
16	(Diga & Kelleher, 2009)	69									√		
17	(Metaxas & Mustafaraj, 2012)	66							√				
18	(Leskovec et al., 2010)	65										√	
19	(Bilgihan et al., 2016)	57					√						
20	(Velasco et al., 2014)	57	√										
21	(Musiat et al., 2014)	56								√			
22	(Richards et al., 2015)	53			√								
23	(Reyna, 2012)	53				√							
24	(Witteman & Zikmund-Fisher, 2012)	50				√							
25	(Riemer & Richter, 2010)	50									√		
26	(Kapoor et al., 2018)	48										√	
27	(Munar, 2012)	48					√						
28	(San Martini et al., 2015)	47											√
29	(Madden et al., 2012)	46				√							
30	(Meske & Stieglitz, 2013)	45									√		
31	(Vayena & Tasioulas, 2013)	44			√								
32	(Shelby & Ernst, 2013)	42				√							
33	(Xu et al., 2015)	41	√										
34	(Bentley et al., 2014)	40						√					
35	(Silva et al., 2014)	39							√				
36	(Power & Phillips-Wren, 2011)	39										√	
37	(Tuarob & Tucker, 2013)	38		√									
38	(Stockwell & Fiks, 2013)	37				√							
39	(Charalabidis & Loukis, 2012)	37							√				
40	(Auer, 2011)	37							√				
41	(Binali et al., 2010)	37							√				
42	(Xie & Lee, 2015)	35		√									
43	(Denecke & Deng, 2015)	34			√								
44	(Portier et al., 2013)	34			√								
45	(Sonter et al., 2016)	33					√						
46	(Palen & Anderson, 2016)	33	√										
47	(Kogan, Palen, & Anderson, 2015)	33	√										
48	(Maddock et al., 2011)	33			√								
49	(Kumar & Havey, 2013)	32	√										
50	(Harrison et al., 2011)	32							√				
51	(Centola & van de Rijt, 2015)	31			√								
52	(Karimi et al., 2015)	31			√								
53	(Pullman et al., 2013)	31			√								
54	(Lau et al., 2012)	31			√								
55	(Beam & Kohane, 2018)	30			√								
56	(Munson et al., 2013)	30			√								
57	(Whitty, 2013)	30			√								

		Total Citation	Crisis/disaster management	Marketing	Professional Health	Anti-Vaccination	Tourism	Information Technology	Policy & Government	Mental health & emotions	Organizations & Enterprises	Social media (itself)	Environment
58	(Hiltz & Plotnick, 2013)	29	√										
59	(Zingg & Siegrist, 2012)	29				√							
60	(Diouf et al., 2016)	27			√								
61	(Hanks et al., 2016)	27			√								
62	(Jent et al., 2011)	27			√								
63	(Hess et al., 2014)	26			√								
64	(Rupert et al., 2014)	26			√								
65	(Abbasi et al., 2014)	26								√			
66	(Corroon J.M et al., 2017)	25			√								
67	(Greenwood et al., 2014)	24			√								
68	(Mathiesen et al., 2013)	24		√									
69	(Yin et al., 2013)	23								√			
70	(Fortinsky et al., 2012)	22			√								
71	(Del Giudice et al., 2016)	21		√									
72	(Aladwani, 2015)	21									√		
73	(Immonen et al., 2015)	21						√					
74	(Gu et al., 2014)	21										√	
75	(Widener et al., 2013)	21	√										
76	(Robichaud et al., 2012)	21				√							
77	(Goyal et al., 2016)	20			√								
78	(Gallinucci et al., 2015)	20		√									
79	(Sygna et al., 2015)	20			√								
80	(Liu et al., 2015)	20									√		
81	(Beykikhoshk et al., 2015)	20			√								
82	(Clerici et al., 2012)	20			√								
83	(Kucukaltan et al., 2016)	19									√		
84	(Schroeder & Pennington-Gray, 2015)	19					√						
85	(George et al., 2015)	19			√								
86	(Phillips-Wren & Hoskisson, 2015)	19						√					
87	(Tavares & Faisal, 2013)	19						√					
88	(Hildebrand et al., 2013)	19			√								
89	(Kauffman et al., 2013)	19			√								
90	(Li et al., 2018)	18	√										
91	(SteelFisher et al., 2015)	18			√								
92	(Bratt et al., 2015)	18			√								
93	(Huerta et al., 2014)	18			√								
94	(Ritter & Lancaster, 2013)	18			√								
95	(Pérez-Escamilla, 2012)	18			√								
96	(Jain et al., 2017)	17								√			
97	(Asghar et al., 2017)	17								√			
98	(Lee, 2017)	17			√								
99	(Yaqoob et al., 2016)	17						√					
100	(Luyten & Beutels, 2016)	17				√							
101	(Hasan & Ukkusuri, 2015)	17					√						
102	(Gupta et al., 2015)	17			√								
103	(Lapinski et al., 2015)	17			√								
104	(Zuiderwijk & Janssen, 2013)	17							√				
105	(Eveland Jr. & Cooper, 2013)	17								√			
106	(Lehavot et al., 2012)	17								√			
107	(Holtzblatt & Tierney, 2011)	17										√	
108	(Stephen & Perera, 2014)	16								√			
109	(Pulverer, 2013)	16						√					
110	(Clancy et al., 2013)	16			√								
111	(Cain et al., 2013)	16			√								
112	(Cheong & Lee, 2010)	16											√
113	(Mandl & Kohane, 2015)	15			√								
114	(G. Wang et al., 2015)	15			√								
115	(Ghirlanda et al., 2014)	15										√	
116	(Vázquez et al., 2014)	15		√									
117	(Ai et al., 2016)	14						√					
118	(Tarzia et al., 2016)	14								√			
119	(Kim et al., 2016)	14		√									
120	(Kuehne & Olden, 2015)	14										√	
121	(Zhang, 2015)	14		√									
122	(Merino, 2014)	14			√								
123	(Atzmanstorfer et al., 2014)	14							√				
124	(Cobb et al., 2013)	14			√								
125	(Pergament & Pergament, 2012)	14			√								

		Total Citation	Crisis/disaster management	Marketing	Professional Health	Anti-Vaccination	Tourism	Information Technology	Policy & Government	Mental health & emotions	Organizations & Enterprises	Social media (itself)	Environment
126	(Maddock et al., 2012)	14			√								
127	(Keegan & Gergle, 2010)	14										√	
128	(Sobo et al., 2016)	13				√							
129	(Jones & Kramer, 2016)	13								√			
130	(Y. Wang et al., 2016)	13	√										
131	(Gendron et al., 2016)	13			√								
132	(Sharif et al., 2015)	13							√				
133	(Altshuler et al., 2015)	13										√	
134	(Deloney et al., 2014)	13			√								
135	(Krätzig & Warren-Kretzschmar, 2014)	13							√				
136	(Chapman et al., 2014)	13			√								
137	(Venkataraman & Das, 2013)	13									√		
138	(Berg, 2012)	13			√								
139	(Marchand et al., 2017)	12	√										
140	(Tseng, 2017)	12									√		
141	(Gollust et al., 2016)	12				√							
142	(Elwyn et al., 2016)	12			√								
143	(Egawa-Takata et al., 2015)	12				√							
144	(Kesselheim et al., 2015)	12			√								
145	(Campagna et al., 2015)	12						√					
146	(Glanz et al., 2015)	12				√							
147	(Gilbert et al., 2014)	12			√								
148	(McCorkindale & DiStaso, 2013)	12									√		
149	(Lin et al., 2013)	12			√								
150	(Tayebi, 2013)	12							√				
Total			14	10	53	15	6	10	11	11	10	8	2

4. Bibliometrics analysis results

In our survey, 1,159 articles retrieved from Scopus shows an average of 2.98 authors per article with collaboration index of 3.5. Average citation per documents is 7.194. These articles come from 733 sources and 926 articles were published by multiple authors.

Table 2
Articles statistics

Description	Results
Documents	1159
Sources (Journals, Books, etc.)	733
Keywords Plus (ID)	6670
Author's Keywords (DE)	2451
Period	2008 – first month of 2019
Average citations per documents	7.194
Authors	3459
Author Appearances	3767
Authors of single-authored documents	219
Authors of multi-authored documents	3240
Single-authored documents	233
Documents per Author	0.335
Authors per Document	2.98
Co-Authors per Documents	3.25
Collaboration Index	3.5
Document types	
ARTICLE	522
ARTICLE IN PRESS	27
BOOK	3
BOOK CHAPTER	17
CONFERENCE PAPER	338
EDITORIAL	70
LETTER	26
NOTE	48
REVIEW	81
SHORT SURVEY	26

Fig. 1 shows that research and papers began in 2008 and have had an uptrend till 2018, reaching 241 articles in 2018, only declining slightly in 2017 and returning to the number of articles in 2015.
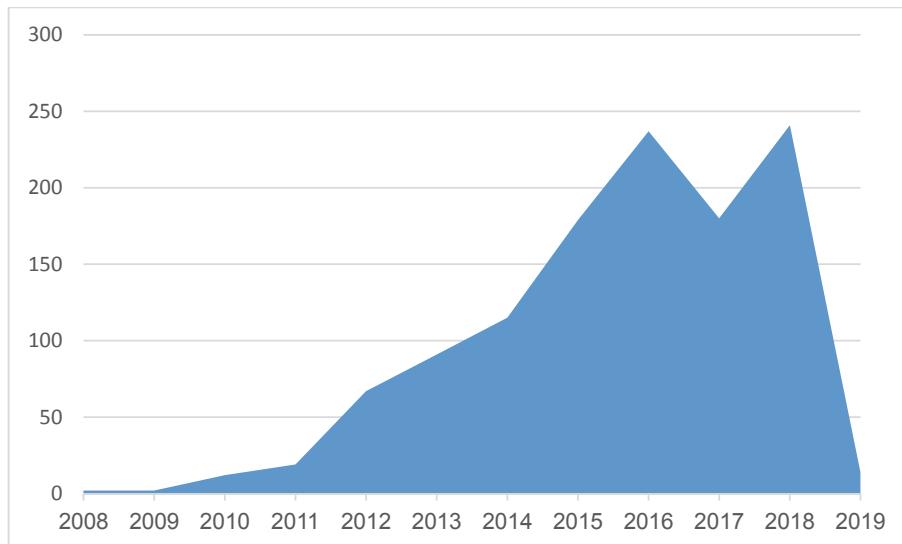
Fig. 1. Annual Scientific Production

Also, the journals that contained the most studied articles, containing "decision-making" and "social-media" keywords, were presented in Table 3, with the largest number of articles related to the LECTURE NOTES IN COMPUTER SCIENCE journal with 40 papers.

Table 3
Most productive sources

Sources	Articles
LECTURE NOTES IN COMPUTER SCIENCE (INCLUDING SUBSERIES LECTURE NOTES IN ARTIFICIAL INTELLIGENCE AND LECTURE NOTES IN BIOINFORMATICS)	40
PLOS ONE	22
ACM INTERNATIONAL CONFERENCE PROCEEDING SERIES	19
ADVANCES IN INTELLIGENT SYSTEMS AND COMPUTING	13
BMJ (ONLINE)	13
AMERICAN JOURNAL OF BIOETHICS	12
VACCINE	12
CEUR WORKSHOP PROCEEDINGS	11
COMPUTERS IN HUMAN BEHAVIOR	11
LECTURE NOTES IN BUSINESS INFORMATION PROCESSING	10
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	10
COMMUNICATIONS IN COMPUTER AND INFORMATION SCIENCE	9
JOURNAL OF DECISION SYSTEMS	9
HUMAN VACCINES AND IMMUNOTHERAPEUTICS	8
NATURE	8
PEDIATRICS	7
PROCEDIA COMPUTER SCIENCE	7
FRONTIERS IN ARTIFICIAL INTELLIGENCE AND APPLICATIONS	6
INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT	6
SCIENCE	6

On the other hand, Table 3 shows the core sources or focus of articles in journals, with only first 18 journals publishing nearly 20% of the total articles. According to Fig. 2, the maximum H-Index of the journals was 16, which is associated with the SCIENCE Journal, and 2 journals have H-Index 11, and other journals have H-Index 8 and lower.
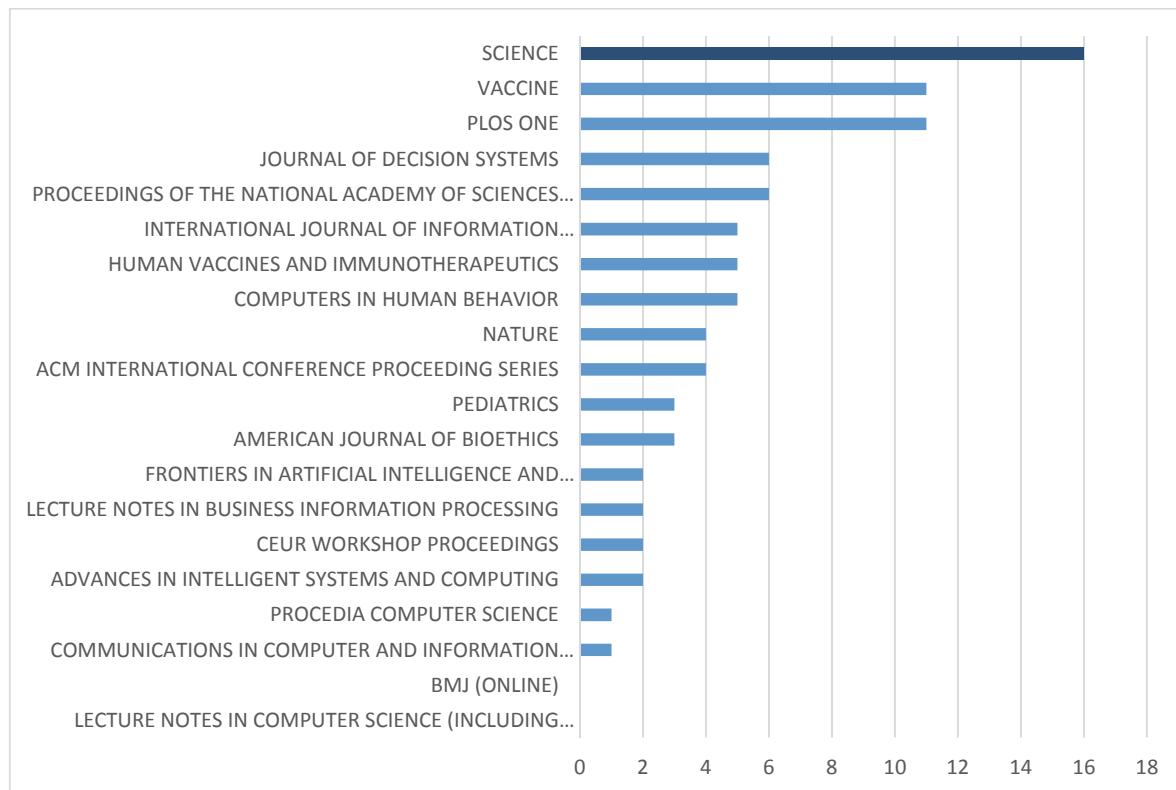
Fig. 2. Sources' impact

A review in the first five journals, with the highest number of "decision-making" and "social media" subjects' articles, suggests that the number of related articles has been steadily rising and has peaked in 2015, 2016, and 2017 years, and is declining thereafter.
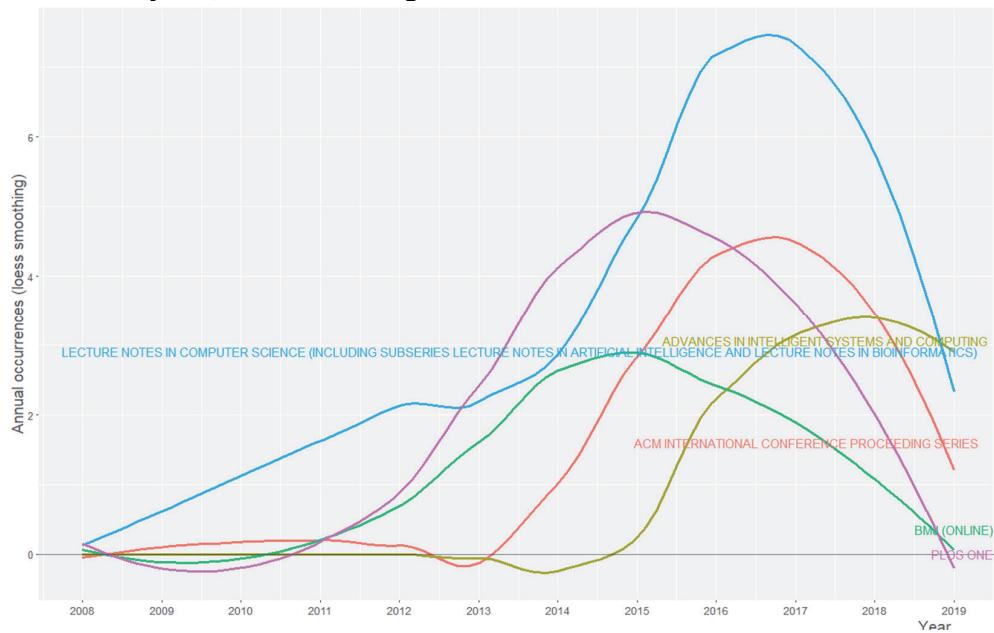
Fig. 3. Source Growth

Fig. 4 shows how many articles have written by the authors with the highest number of articles during the time, and how many citations each one received. The size of each circle indicates the number of articles and the amount of boldness of the circles shows the number of citations in that year.
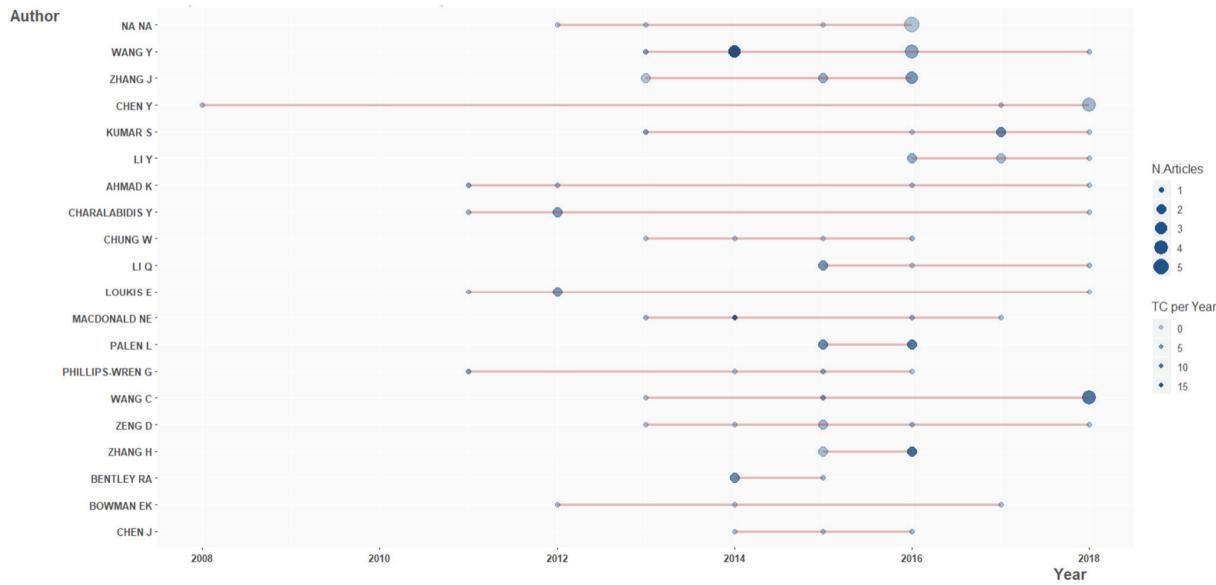
Fig. 4. Top-Authors' productivity over the time

Fig. 5 shows that 93.2% of the authors wrote just one related article and 5.5% of each author contributed to the presentation of two papers. Among other authors, 27 authors produced 3 articles, 11 authors produced 4 articles and 3 authors submitted 5 papers and 2 authors produced 7 papers. Finally only one author wrote 8 papers.
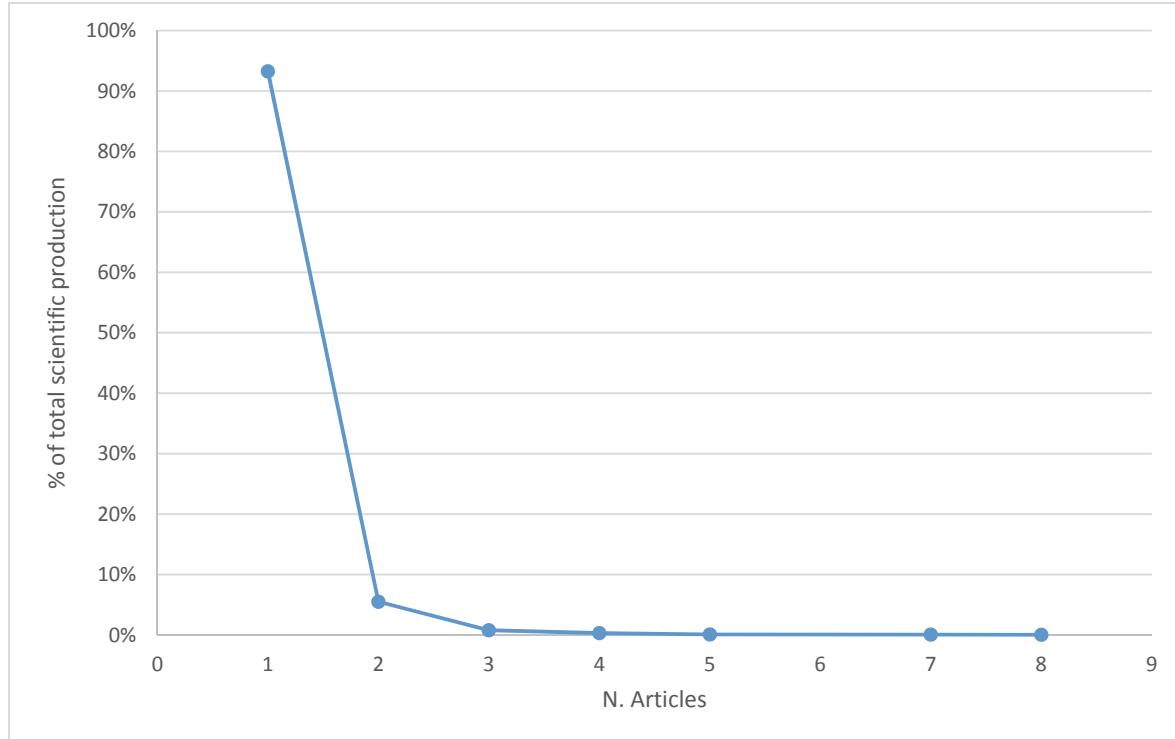
Fig. 5. Author scientific productivity

As shown in Fig. 6, the authors' H-index was maximum 4.
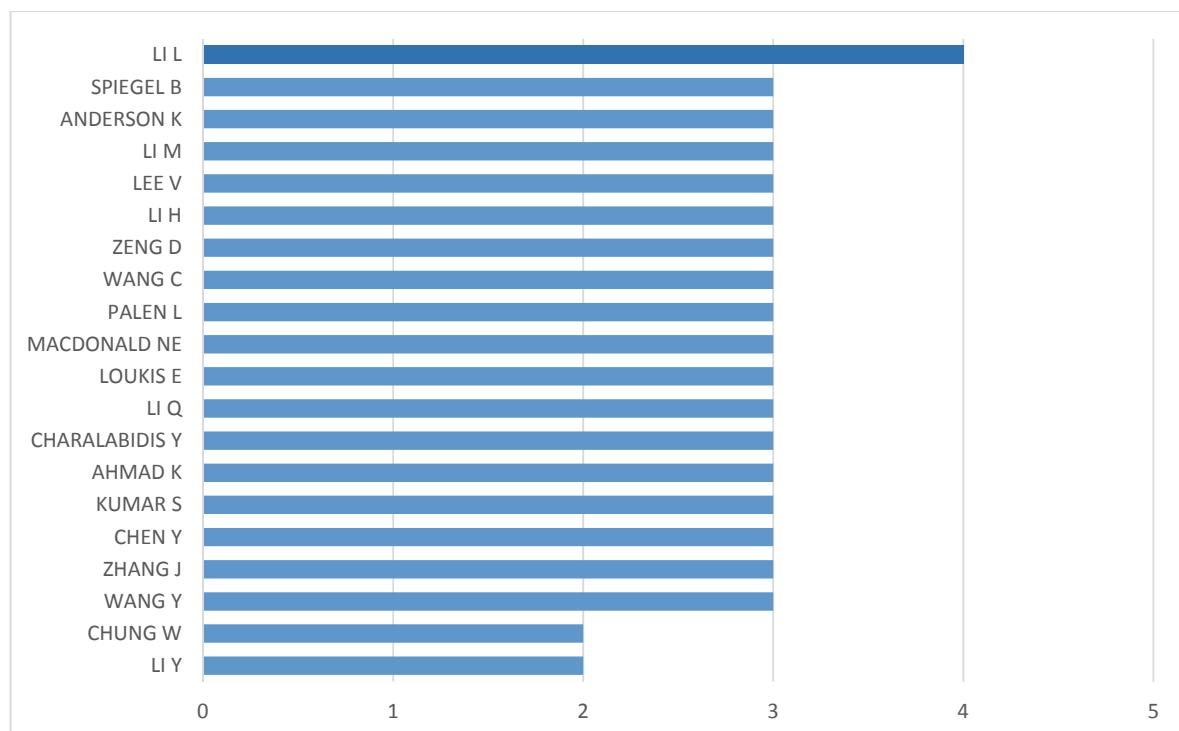
Fig. 6. Authors' impact

The authors of the studied articles are more affiliated with UNIVERSITY OF OTTAWA with 20 articles and then, respectively, in accordance with Table 4.

Table 4
Top affiliations

Affiliations	Articles
UNIVERSITY OF OTTAWA	20
UNIVERSITY OF TORONTO	19
UNIVERSITY OF CALIFORNIA	16
UNIVERSITY OF PENNSYLVANIA	14
UNIVERSITE LAVAL	13
UNIVERSITY OF WASHINGTON	13
UNIVERSITY OF ABERDEEN	12
UNIVERSITY OF MARYLAND	11
CORNELL UNIVERSITY	10
ARIZONA STATE UNIVERSITY	9
UNIVERSITY OF BRITISH COLUMBIA	9
UNIVERSITY OF MICHIGAN	9
HARVARD MEDICAL SCHOOL	8
QUEENSLAND UNIVERSITY OF TECHNOLOGY	8
UNIVERSITY OF ALABAMA AT BIRMINGHAM	8
UNIVERSITY OF SOUTHERN CALIFORNIA	8
DALHOUSIE UNIVERSITY	7
MAYO CLINIC	7
MCGILL UNIVERSITY	7
MONASH UNIVERSITY	7

Fig. 7 shows the number of articles produced by the authors of different countries and the rate of cooperation of each country's authors with other countries' authors. For instance, authors of the United States have produced 286 articles, but the rate of American authorship co-authorship with other countries is about 10%. Subsequently, the authors of the UK ranked second with 62 papers, and the authorship rate for contributing articles to other authors with other countries is 27.4%.
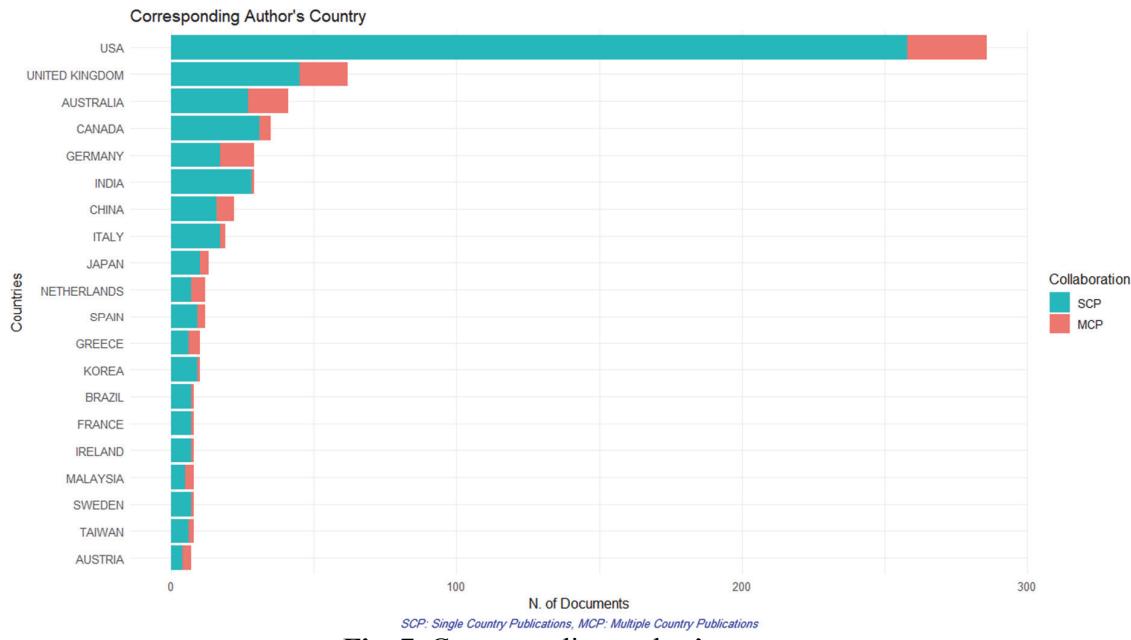
Fig. 7. Corresponding author's country

Table 5 shows the total number of citations referenced to articles and the average citation of articles produced by the authors of each country. For example, 286 articles produced by American writers totaled 2691 citations and received an average of 9.4 citations per article.

Table 5
Total number of citations referenced to articles

Country	Total Citations	Average Article Citations
USA	2691	9.409
UNITED KINGDOM	608	9.806
CANADA	500	14.286
GERMANY	344	11.862
AUSTRALIA	286	6.976
DENMARK	278	55.600
QATAR	176	88.000
SWITZERLAND	98	16.333
ITALY	93	4.895
INDIA	92	3.172
LEBANON	76	38.000
SPAIN	44	3.667
KOREA	39	3.900
SWEDEN	39	4.875
MALAYSIA	37	4.625
CHINA	35	1.591
JAPAN	34	2.615
NETHERLANDS	34	2.833
GREECE	31	3.100
AUSTRIA	22	3.143

From the series of articles studied, Yated et al. (2011) with 410 citations ranked first. This article has an average of 51.2 citations per year. In total, it can be said that 11 articles have had more than 100 total citations, and other articles have received fewer than 100 citations. The statistical status of some of the articles with the most citations is presented in Table 5.

Table 5
Most cited papers

Paper	Total Citations	TC per Year
YATES D, 2011, INT J INF MANAGE	410	51.250
GAO H, 2011, IEEE INTELL SYST	322	40.250
HE W, 2013, INT J INF MANAGE	269	44.833
LEE VENTOLA C, 2014, P T	239	47.800
KATA A, 2012, VACCINE	223	31.857
KAMEL BOULOS MN, 2011, INT J HEALTH GEOGR	209	26.125
MUNAR AM, 2014, TOUR MANAGE	200	40.000
IMRAN M, 2015, ACM COMPUT SURV	176	44.000
YOUYOU W, 2015, PROC NATL ACAD SCI U S A	176	44.000
MACEACHREN AM, 2011, VAST - IEEE CONF VIS ANALY SCI TECHNOL , PROC	175	21.875
BETSCH C, 2012, VACCINE	125	17.857
ZHENG Y, 2014, UBICOMP - PROC ACM INT JT CONF PERVASIVE UBIQUITOUS COMPUT	91	18.200
HAMM MP, 2013, BMJ OPEN	88	14.667
DUBE E, 2014, EXPERT REV VACCINES	84	16.800
NASLUND JA, 2016, EPIDEMIOL PSYCHIATR SCI	76	25.333
DIGA M, 2009, PUBLIC RELAT REV	69	6.900
METAXAS PT, 2012, SCIENCE	65	9.286
LESKOVEC J, 2010, ICWSM - PROC INT AAAI CONF WEBLOGS SOC MEDIA	65	7.222
BILGIHAN A, 2016, TOUR MANAGE	57	19.000
VELASCO E, 2014, MILBANK Q	57	11.400

As shown in Fig. 8, the total number of citations to articles related to the subject gradually increased over time from the 1960s, and since 2000 the slope of the growth has been markedly increased and could reach its peak in 2011-2013, but after it has fallen quickly.

Number of Cited References (black line) - Deviation from the 5-Year Median (red line)
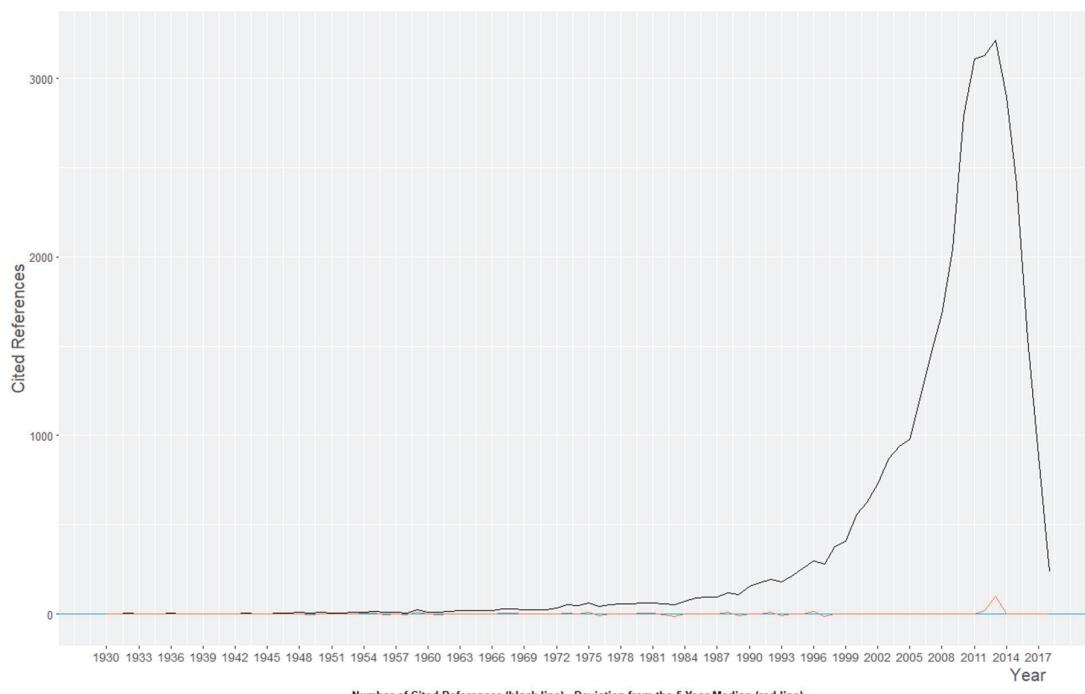
Fig. 8. Reference publication year spectroscopy

Fig. 9 shows the highest number of repetitive words in the articles studied after "social media" and "decision making" with the sequence of words "human", "humans", "social networking (online)", "gender", "internet", etc.
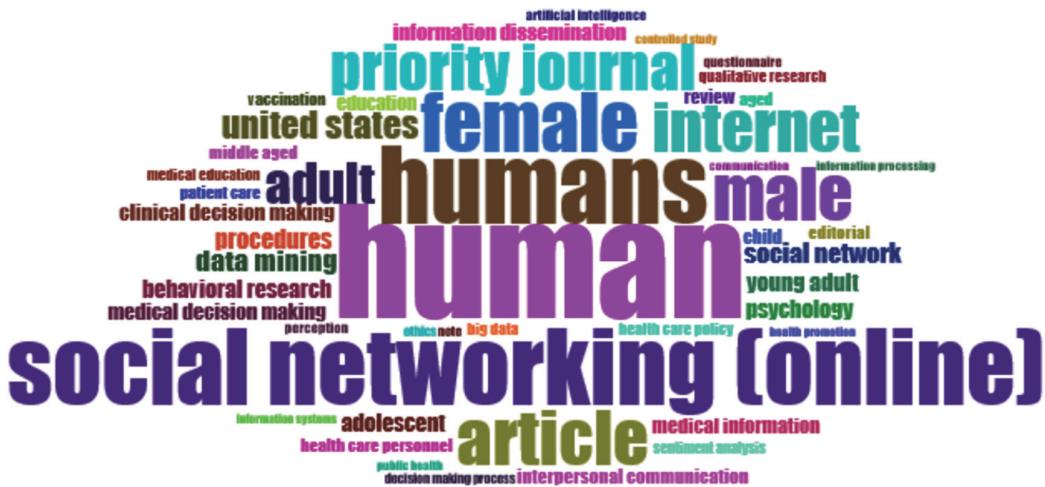
Fig. 9. Highest number of repetitive words in articles

The repetition trend of each these words over time suggests that almost all of these repetitive words will be maximized in 2016, after which they will be downtrend, according to Fig. 10.
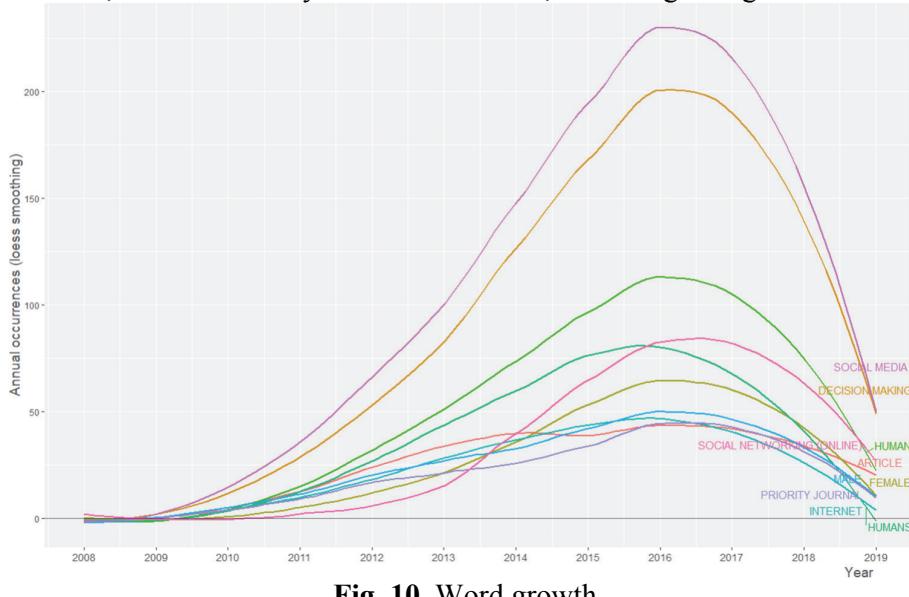
Fig. 10. Word growth

Conceptual Structure, Factorial Analysis

Based on the results of factor analysis, 3 major clusters have been identified, each containing close and related keywords used in our studies. Fig. 11 shows the results of this analysis.
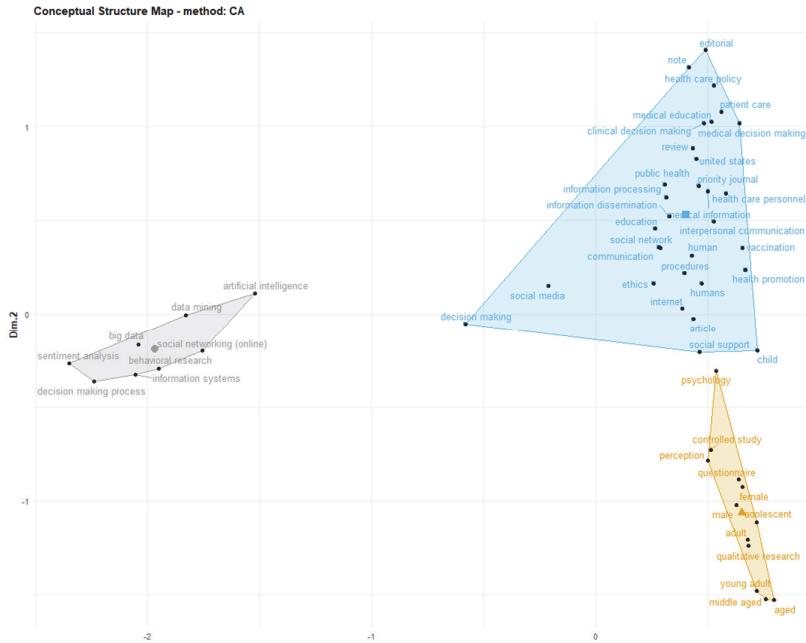
Fig. 11. Conceptual structure map with CA method

Thematic Map

Fig. 12, which is a strategic diagram based on density and centrality, shows that the clusters of "human", "priority journal", "interpersonal communication" have maintained a high density and centrality, in other words, are well developed and are very important in mapping the conceptual map of the area under study. On the other hand, the clusters of "social media", "ethics", "tends" have preserved a low density and centrality, in other words, they are emerging or neglected.
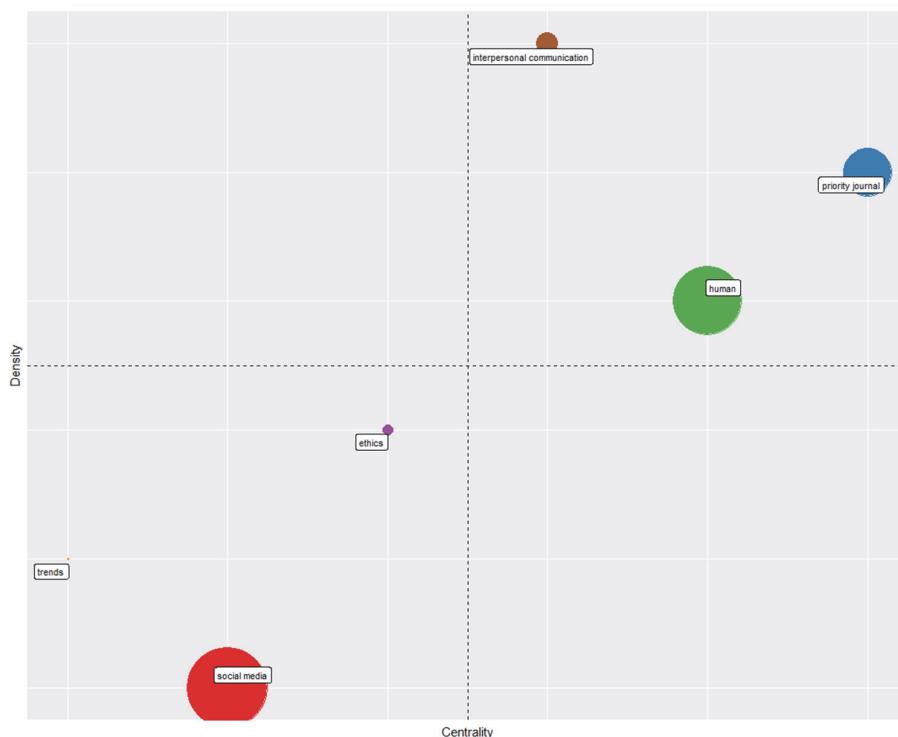
Fig. 12. Thematic map

Intellectual Structure

A citation network survey shows that the article Asur (2010) has received the most centrality and citation relationship with other documents followed by Golder (2011). Table 6 shows the number of co-citation between the documents and the articles studied.

Table 6
Intellectual Structure

Node	Cluster	Btw Centrality
asur s. 2010-1	1	40.979
golder s.a. 2011-1	1	17.103
kahneman d. 2011	1	14.618
gigerenzer g. 2011-1	1	13.956
choi h. 2012	1	10.107
surowiecki j. 2004	2	9.311
granovetter m.s. 1973-2	1	7.249
kahneman d. 1979	1	7.138
kaplan a.m. 2010-1	1	3.955
kietzmann j.h. 2011-1	1	0.779
pang b. 2008-1	1	0.511
kata a. 2010-2	1	0.293
surowiecki j. 2005	1	0
bikhchandani s. 1992-1	1	0
cha m. 2010-1	1	0

Social Structure

Fig. 13 shows that most collaborations have been co-authored by authors from the United States to four countries in the United Kingdom, China, Canada, and Australia.

Fig. 13. Country collaboration map

Conclusion

This study has tried to provide a comprehensive view of scientific papers between 2008 and the first month of 2019 in social media and decision-making fields. This research has shown the United States, United Kingdom, and Australia have been the most productive countries in this area. The thematic map has identified that clusters of "human", "priority journal", "interpersonal communication" have been well developed. On the other hand, the clusters of "social media", "ethics", "tends" have been emerged or neglected. The result of this research has shown "Health" and "Disaster/Crisis Management" are popular among scientists. We hope the present study may help scholars identify gaps in their researches.

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