

Global Research Output in the Patent Publication: A Scientometric Study

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Abstract: *The present study analyzed research output for a period of ten years between 2011 to and 2020. Web of science database a service from clarivate analytics has been used to download citation and source data. Histcite application software have been used to present the datasets. The study focuses on author productivity pattern, types of documents, individual author's research productivity and their TLCS (Total Local Citation Score), TGCS (Total Global Citation Score) TLCR (Total Local Citation References) in addition to this scientographical mapping of data is presented through graphs using VOS viewer software mapping technique.*

Keywords: Scientometric analysis, VOS viewer, Patent, TLCS (Total Local Citation Score).

Introduction

A patent is a type of intellectual property that gives its owner the legal right to exclude others from making, using, or selling an invention for a limited period of years in exchange for publishing an enabling disclosure of the invention. In most countries, patent rights fall under private law and the patent holder must sue someone infringing the patent in order to enforce their rights [1]. In some industries patents are an essential form of competitive advantage; in others they are irrelevant.

Under the World Trade Organization's (WTO) TRIPS agreement, patents should be available in WTO member states for any invention, in all fields of technology, provided they are new, involve an inventive step, and are capable of industrial application [2]. The procedure for granting patents, requirements placed on the patentee, and the extent of the exclusive rights vary widely between countries according to national laws and international agreements. Typically, however, a patent application must include one or more claims that define the scope of protection that is being sought. A patent may include many claims, each of which defines a specific property right.

The paper analyses research output of organic farming discipline of 'J-gate plus' databases during 1980-2018. The analysis indicates that highest number of journals and international collaboration, subject wise, top authorship pattern, year wise relative growth rate and doubling time of records in year wise and top most productive journals [3]. The major research is focused organic farming, agriculture plants. A total number of 6886 records for 38 years between 1980 to

2018 were retrieved from 'J-gate plus' databases. The study explores the quantitative analysis of research performance of the Organic Farming research output in world level. The study aims to ascertain the growth of literature, top authors, relative growth rate, source wise publications identification of prolific authors, country wise and core journals of organic farming.

Santosh D, Vaishali KS, Sagar AP. Mapping of world publications: Sydenham chorea disease. The paper focuses on mapping of world publications: Sydenham chorea disease. Which has given on PubMed database for during the year 2000 to 2018? There are total 9799 documents on Sydenham chorea disease. It discusses on ascertain the Sydenham chorea research of documents, ranking of most prolific authors, institution wise distribution of publications. The main objective of the study is to analyze to ascertain the Sydenham chorea research output in world during 2000 to 2018. The present study analyzed research output for a period of 5 years between 2015 to and 2019 [4]. Web of Science database a service from clarivate analytics has been used to download citation and source data. Histcite application software have been used to present the datasets. Analysis part focuses on the parameters like citation impact at local and global level, influential authors and their total output, ranking of contributing institutions and countries.

Materials and Methods

Objectives of the study

- To identify year wise distribution of publications.
- To identify document wise contribution of publication.
- To analyse the authorship pattern and examine the extent of research collaboration.
- To identify journal wise distribution of publications.
- To find out the most common key word used while publication.
- To identify language wise distribution of publications.
- To assess the institution wise research concentration and global citation score of the Publications.
- To identify country wise distribution of publications.
- To identify Institution with subdivision wise of contribution.

The research publications were retrieved from the web of science core collections database on the topic patent publication which is scattered over the period from 2011 to 2020 [5]. The search was carried out using the keyword "patent publication" in the topic field. A total of 1030 publications were downloaded and the same was analysed using the software Histcite, VOS viewer and Microsoft Excel as per the objectives of the study.

Results and Discussion

Data analysis and interpretation

The Table 1 and Figure 1 reveals that the numbers of research documents published from 2011 to 2020 are gradually increased. According to the publication output from the Table 1. The year wise distribution of research documents, 2020 has the highest number of research documents 247 (23.98%) with 2 of total local citation score and 637 total global citation score. The year 2019 has 112 (10.87%) research documents and it stood in second position with 7of total local citation score and 1092 total global citation score. It is noticed that the increase in publications may not create impact on citation score yet the quality matters on total local citation scores and on total global citation scores.

Table 1: Annual distribution of publications and citations

Sr. No.	Publication year	Records	Percent	TLCS	TGCS
1	2011	85	8.25	6	4306
2	2012	58	5.63	8	2504
3	2013	68	6.6	17	3767
4	2014	71	6.89	15	2126
5	2015	79	7.67	10	2205
6	2016	81	7.86	24	1482
7	2017	98	9.51	18	3174
8	2018	131	12.72	12	1434
9	2019	112	10.87	7	1092
10	2020	247	23.98	2	637
/	Total	1030	100	/	/

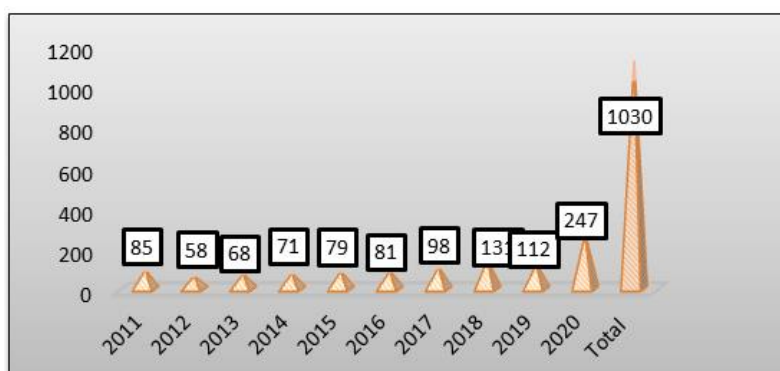


Figure-1: Year wise distribution of publications

Document type indicates the type of publication in which the researchers published their research outputs. Most of them published in a form of articles. Table 2 and Figure 2 reveal the distribution of the research output according to document type [7]. It is an accepted fact that most of the scholarly communication of scientific research is published in journals as articles and sometimes presented in book chapter and proceedings papers. Article 974 (94.8%) with TLCS (Total Local Citation Score) is 264 and TGCS (Total Global Citation Score) is 41624. Proceeding paper 30 (2.9%) with TLCS is 3 and TGCS is 1393 respectively.

Table 2: Document wise contribution of publication

Sr.No.	Document type	Records	Percent	TLCS	TGCS
1	Article	974	94.8	264	41624
2	Proceedings paper	30	2.9	3	1393
3	Editorial material	18	1.8	0	4
4	Book chapter	4	0.4	2	60
5	Review	1	0.1	0	1

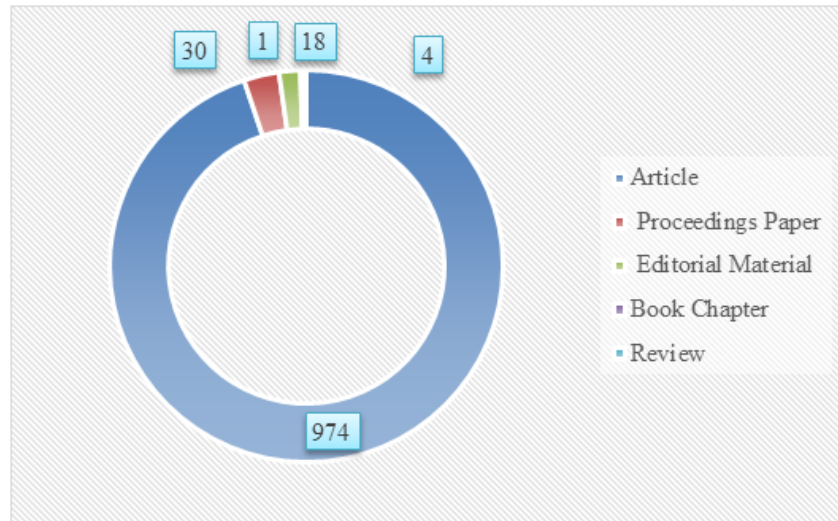


Figure-2: Document wise distribution of publication

Analysis of the top 30 most productive author

Table 3 and Figure 3 Showed the ranking of authors of research articles in the rank analysis the authors who have published more than 5 articles or more are considered into account to avoid a long list. It was observed that there is total of 1030 author’s records and it shows the top 30 most productive authors during 2011-2020 [8]. It shows the author’s TLCS (Total Local Citation Score, which is the number of times cited by other papers in the local collection) TLCS/t (average value of TLCS in a year) TGCS (Total Global Citation Score, which is the citation frequency based on the full Web of Sciences count at the time the data was downloaded) TGCS/t (Average value of TGCS in a year) TLCR (Total Local Citation References).

Zhou Y is topmost author with published research records of 8 (0.8%), with 7 in TLCS, 228 in TGCS, 14 in TLCR and TLCS/t 2.25 with 98 TGCS/t contributions to all-over research contribution. Following research Authors are Grimpe C, Hussinger K and Link A.N .respectively. The data set clearly depicts that no matter how many publications that an author brings out yet the quality publications alone shows impact in the form of total local citations score and total global citations score.

Table 3: Publication output of top 30 authors and citation score

Sr. No.	Author	Records	Percent	TLCS	TLCS/t	TLCSx	TGCS	TGCS/t	TLCR
1	Zhou Y	8	0.8	7	2.25	1	228	98	14
2	Grimpe C	6	0.6	3	0.33	1	223	22.71	8
3	Hussinger K	5	0.5	3	0.33	1	137	16.12	6
4	Link AN	5	0.5	1	0.07	1	102	9	0
5	Wu Y	5	0.5	4	0.36	0	199	23.97	4
6	Colombelli A	4	0.4	2	0.22	1	110	17.9	9
7	Corradini C	4	0.4	4	0.64	0	34	6.86	13
8	de Faria P	4	0.4	3	0.54	2	33	6.99	5
9	Gronseth GS	4	0.4	0	0	0	404	36.41	0
10	Hu YY	4	0.4	4	0.36	0	153	16.31	4
11	Li Y	4	0.4	0	0	0	43	8.49	2
12	Liu J	4	0.4	1	0.14	0	64	9.98	0
13	Luo SL	4	0.4	4	0.36	0	153	16.31	4
14	McIntosh JM	4	0.4	4	0.36	0	153	16.31	4
15	Quatraro F	4	0.4	2	0.22	1	110	17.9	9

16	Zhangsun DT	4	0.4	4	0.36	0	153	16.31	4
17	Zhu XP	4	0.4	4	0.36	0	153	16.31	4
18	Aldieri L	3	0.3	1	0.25	0	64	16	3
19	Beyeler N	3	0.3	1	0.14	0	58	8.4	1
20	Bolton EE	3	0.3	0	0	0	96	91.51	1
21	Chen YJ	3	0.3	0	0	0	97	7.71	0
22	Chen Z	3	0.3	0	0	0	12	3.21	2
23	Christensen S	3	0.3	4	0.36	0	113	11.31	2
24	Craik DJ	3	0.3	4	0.36	0	125	13.19	3
25	Czarnitzki D	3	0.3	4	0.58	3	114	12.63	1
26	Demirel P	3	0.3	3	0.5	0	93	10.63	3
27	Drivas K	3	0.3	0	0	0	19	3.5	2
28	Duysters G	3	0.3	8	0.67	7	272	20.58	3
29	Greisen G	3	0.3	1	0.2	0	567	140.47	1
30	Hagedoorn J	3	0.3	0	0	0	122	8	5

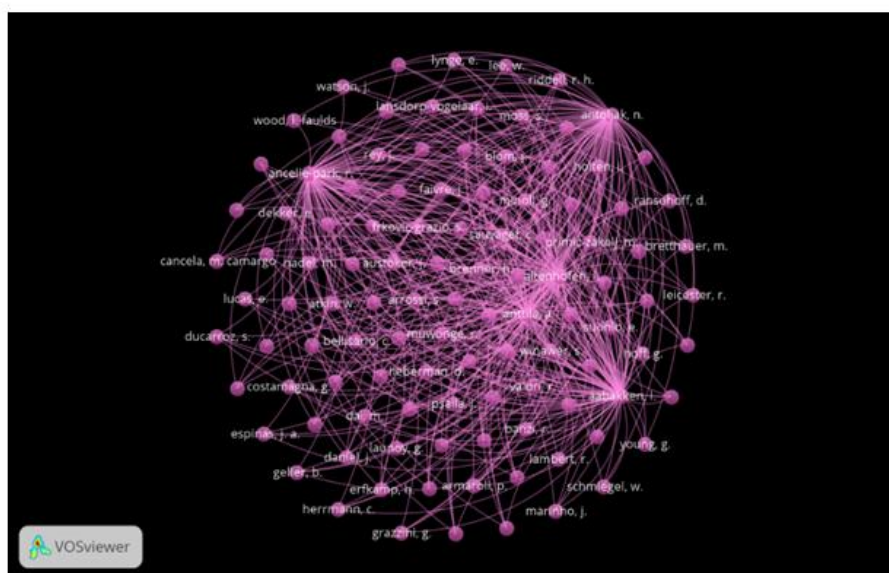


Figure-3: Author wise distribution of publications (five cluster)

Analysis of the top 30 journal wise distribution of publications

The study found that the total research output of the patent publication for the study period (2011–2020) published in 1030 journals. Table 4 shows the journal “research policy” topped with 31 (3%) publications with the total local citation score of 34 and total global citation score 3005. Second position “Plos One” with 24 (.3%) publications with the no total local citation score and total global citation score 471 [9]. Third position by “sustainability” with 19 (1.9%) publications with the total global citation score of 133 respectively.

Table 4: Journal wise distribution of the publication output of top 30

Sr. N.	Journal	Records	%	TLCS	TLCS/t	TGCS	TGCS/t	TLCR
1	Research policy	31	3	34	3.81	3005	265.3	25
2	Plos one	24	2.3	0	0	471	61.99	8
3	Sustainability	19	1.9	0	0	133	43.13	11
4	Technological	18	1.8	9	1.82	375	76.18	16

	forecasting and social change							
5	Journal of vascular surgery	16	1.6	1	0.04	691	43.06	1
6	Journal of technology transfer	15	1.5	7	0.82	357	40.27	4
7	Scientometrics	14	1.4	7	1.26	343	46.7	8
8	Clinical orthopaedics and related research	13	1.3	0	0	719	72.66	0
9	Journal of cheminformatics	13	1.3	0	0	300	36.52	2
10	Nucleic acids research	13	1.3	12	1.8	2121	385.13	6
11	Neurology	10	1	3	0.28	995	91.92	1
12	Small business economics	9	0.9	2	0.5	337	36.35	15
13	Industrial and corporate change	8	0.8	2	0.33	190	24.55	8
14	IEEE access	7	0.7	0	0	19	11.33	0
15	Management science	7	0.7	6	0.72	464	42.38	8
16	Strategic management journal	7	0.7	9	0.61	1813	85.26	6
17	Annals of regional science	6	0.6	0	0	366	28.82	3
18	BMC health services research	6	0.6	0	0	71	10.33	1
19	Energy policy	6	0.6	2	0.29	346	55.59	3
20	Human reproduction	6	0.6	1	0.05	129	16.32	1
21	Industry and innovation	6	0.6	0	0	163	22.63	11
22	Organization science	6	0.6	5	0.53	155	18.42	3
23	Applied economics	5	0.5	1	0.08	46	4.75	4
24	Economics of innovation and new technology	5	0.5	8	1.37	89	14.87	1
25	Engineering economics	5	0.5	0	0	26	4.23	2
26	Journal of biological chemistry	5	0.5	4	0.36	198	18.13	1
27	Medicine	5	0.5	0	0	4	1.08	0
28	Neurosurgical focus	5	0.5	0	0	116	12.7	1
29	Regional studies	5	0.5	2	0.11	808	53.68	3
30	Stroke	5	0.5	1	0.09	1323	121.91	1

Analysis of the top 30 most productive keywords

Table 5 and Figure 4 present the top 30 keywords used by the researchers in their publications. It is clearly seen from the table that the word “patent” has been used 118 (11.5%) times by the researchers with total local citation score 105 and total local citation score is 5243. Followed

by” innovation” has been used 101 (9.8%) times by the researchers with total local citation score 22 and total local citation score is 2639 [10]. “Analysis” with used 99 (9.6%) times by the researchers with total local citation score 18 and total local citation score is 3045 respectively.

Table 5: Keyword wise contribution of publication

Sr.No.	Keyword	Records	Percent	TLCS	TGCS
1	Patent	118	11.5	105	5243
2	Innovation	101	9.8	22	2639
3	Analysis	99	9.6	18	3045
4	Technology	60	5.8	29	2247
5	Evidence	54	5.3	11	1888
6	Case	53	5.2	11	827
7	Knowledge	53	5.2	23	3351
8	Patents	52	5.1	21	960
9	Research	51	5	7	2382
10	Based	47	4.6	7	1660
11	Development	41	4	3	1135
12	Review	41	4	4	2064
13	Technological	41	4	22	1196
14	Treatment	40	3.9	0	1226
15	Literature	35	3.4	7	554
16	Report	33	3.2	4	1189
17	Using	33	3.2	10	718
18	Disease	31	3	0	1205
19	New	31	3	6	870
20	Performance	30	2.9	6	724
21	Industry	29	2.8	11	1021
22	Firms	28	2.7	13	833
23	Clinical	27	2.6	0	974
24	Meta	27	2.6	3	1010
25	Network	27	2.6	6	698
26	China	26	2.5	5	208
27	Effects	26	2.5	2	458
28	Model	26	2.5	19	3511
29	Patients	24	2.3	0	636
30	Effect	23	2.2	1	369

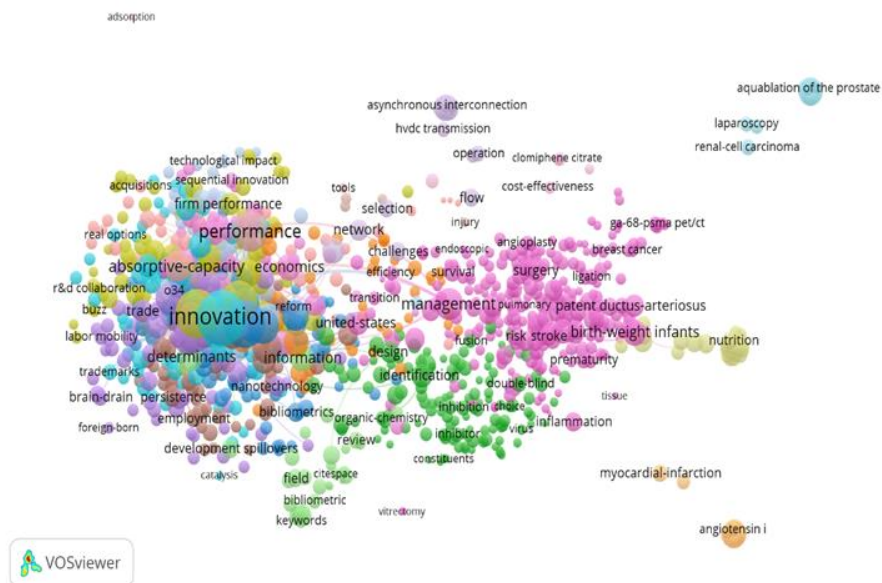


Figure-4: Keywords density visualization

Analysis of the publication output of top 20 countries

Table 6 and Figure 5 displays the publication output of the language of papers and english 1004 (97.4%) with 269 total local citation score and total global citation score is 43030. Portuguese 7 (0.7%) with no total local citation score and total global citation score is 23 respectively.

Table 6: Language wise distribution of contribution

Sr. No.	Language	Records	Percent	TLCS	TGCS
1	English	1004	97.8	269	43030
2	Portuguese	7	0.7	0	23
3	Spanish	7	0.7	0	10
4	German	2	0.2	0	4
5	French	1	0.1	0	2
6	Hungarian	1	0.1	0	1
7	Japanese	1	0.1	0	5
8	Korean	1	0.1	0	4
9	Russian	1	0.1	0	0
10	Serbo-Croatian	1	0.1	0	3
11	Slovenian	1	0.1	0	0

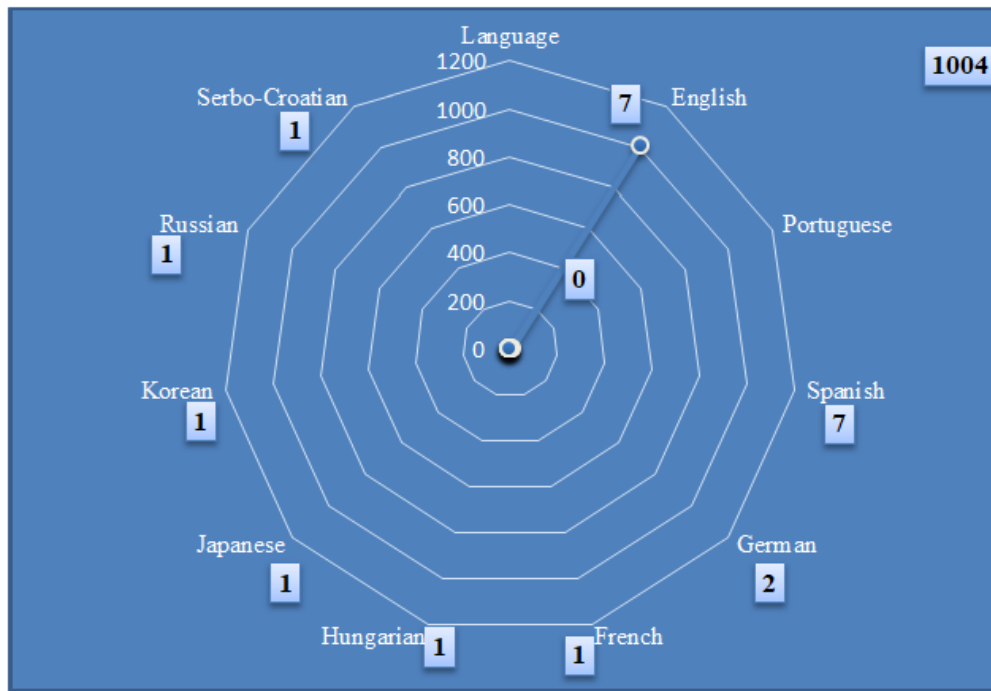


Figure-5: Language wise distribution of contribution

Analysis of the publication output of top 30 institutions

The individualities of 30 most productive institutions were analyzed in this part, institutions which published more than 25 and above publications have considered as highly productive institutions [11]. Table 7 summarizes articles, the total local citation score, and local global citation score and average author per paper of the publications of these institutions. The institution “Katholieke Univ Leuven” holds the first rank and the Institution published 22 (2.1%) research papers with 12 local and 1133 global citation Scores, the second rank holds by “Harvard Univ” the institution published 20 (1.9%) research papers with 1 local and 865 global citation scores. The “Stanford Univ” holds the 3rd rank, the institution published 17 (1.7%) research papers with 11 local and 1256 global citation scores [12]. The “Univ Manchester” holds the 4th rank; the institution published 17 (1.7%) research papers with no local and 272 global citation scores. The “Duke Univ” holds the 5th rank; the institution published 15 (1.5%) research papers with 1 local and 1249 global citation scores. It is clear from the analysis that following institutions Maastricht Univ, Univ Toronto Univ Utrecht, identified the most productive Institutions based on the number of research papers published.

Table 7: Institution wise distribution of contribution

Sr.No.	Institution	Records	Percent	TLCS	TGCS
1	Katholieke Univ Leuven	22	2.1	12	1133
2	Harvard Univ	20	1.9	1	865
3	Stanford Univ	17	1.7	11	1256
4	Univ Manchester	17	1.7	0	272
5	Duke Univ	15	1.5	1	1249
6	Maastricht Univ	14	1.4	14	490
7	Univ Toronto	14	1.4	12	2571
8	Univ Utrecht	14	1.4	2	668
9	Univ Oxford	13	1.3	5	851
10	Leiden Univ	12	1.2	1	514

11	Mayo Clin	12	1.2	0	842
12	MIT	12	1.2	6	462
13	NYU	12	1.2	5	604
14	Univ Groningen	12	1.2	8	316
15	Natl Bur Econ Res	11	1.1	10	691
16	Univ Calif Los Angeles	11	1.1	5	1511
17	Univ Calif San Francisco	11	1.1	2	462
18	Univ Michigan	11	1.1	11	2252
19	Emory Univ	10	1	0	373
20	Univ Calif Berkeley	10	1	4	173
21	Univ Chicago	10	1	1	811
22	Univ Washington	10	1	0	395
23	Harvard Med Sch	9	0.9	0	296
24	Huazhong Univ Sci and Technol	9	0.9	0	83
25	Tsinghua Univ	9	0.9	7	228
26	Univ Cambridge	9	0.9	5	1354
27	Univ Edinburgh	9	0.9	0	1383
28	Univ Milan	9	0.9	3	466
29	Univ N Carolina	9	0.9	1	554
30	Univ Penn	9	0.9	3	713

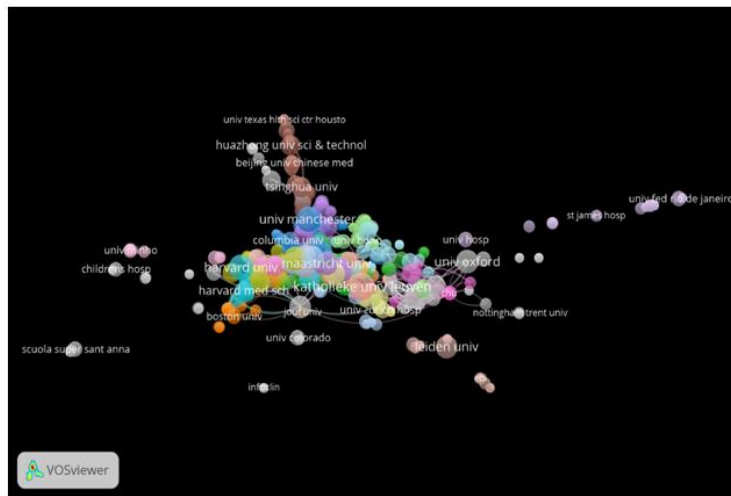


Figure-6: Collaboration of institutions and their clusters

Analysis of the publication output of top 30 countries

Table 8 and Figure 7 displays the publication output of the top twenty countries by number of papers and USA 365 (35.2%) acquired 1st rank among the top twenty countries under consideration with its total global citation score 20667. In all 114 countries participated in research during 2011-2020. The countries that rank between 2nd and 25th position are UK, Peoples R China, Italy, Germany, Netherlands, Spain, Canada, and France. We have found by using this country mapping analysis that there are nodes with clarity of linking between each node, which indicates that there are countries linking and associated with other associated countries. It could be identified that the country wise analysis the following countries USA, UK, peoples R China, and Italy identified the most productive country based on the number of research papers published [13].

Table 8: Distribution of the publication output of top 30 countries

Sr. No.	Country	Records	Percent	TLCS	TGCS
1	USA	362	35.2	140	20667
2	UK	194	18.9	60	9861
3	Peoples R China	105	10.2	12	2027
4	Italy	102	9.9	16	4712
5	Germany	93	9.1	18	4095
6	Netherlands	89	8.7	29	3890
7	Spain	61	5.9	13	3006
8	Canada	57	5.6	31	9369
9	France	54	5.3	9	2265
10	Belgium	44	4.3	25	2353
11	Switzerland	42	4.1	4	3176
12	Australia	40	3.9	11	1626
13	Brazil	32	3.1	0	519
14	Sweden	31	3	3	2428
15	Japan	27	2.6	3	871
16	Denmark	22	2.1	8	1276
17	India	20	1.9	0	962
18	Unknown	18	1.8	2	1770
19	Austria	17	1.7	2	964
20	Finland	17	1.7	1	1375
21	Turkey	16	1.6	1	724
22	South Korea	15	1.5	2	1259
23	Norway	13	1.3	3	1399
24	Taiwan	12	1.2	0	472
25	Hungary	11	1.1	2	935
26	Singapore	11	1.1	4	430
27	Ireland	10	1	1	677
28	Portugal	10	1	0	463
29	New Zealand	9	0.9	5	1342
30	Greece	8	0.8	0	433

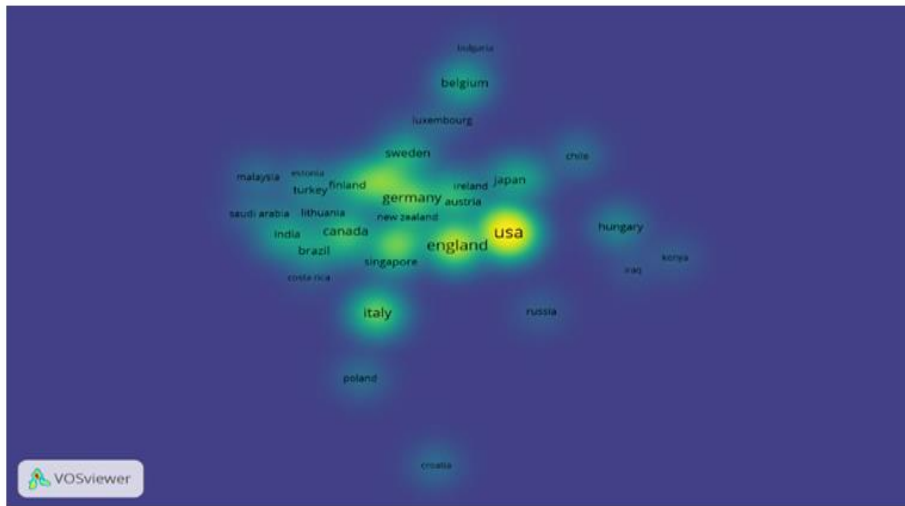


Figure-7: Showing Ranking of Country wise Distribution

Analysis of Top 30 institutions with subdivision wise of contribution

Table 9 shows including subdivisions published research papers during 2011-2020. The topmost twenty prolific institutions involved in this research have published 30 and more research articles. The institution “Natl Bur Econ Res” holds the first rank and the institution published 11 (1.1%) research papers with 10 local and 691 global citation scores, the second rank holds by “Harvard Univ, Sch Med” the institution published 10 (1%) research papers with 402 global citation scores. The “Emory Univ, Sch Med” holds the 3rd rank, the institution published 7 (0.7%) research papers with 3 local and 614 global citation scores respectively.

Table 9: Institution with subdivision wise of contribution

Sr.No.	Institution with subdivision	Records	Percent	TLCS	TGCS
1	Natl Bur Econ Res	11	1.1	10	691
2	Harvard Univ, Sch Med	10	1	0	402
3	Emory Univ, Sch Med	7	0.7	0	221
4	Katholieke Univ Leuven	7	0.7	3	614
5	Tsinghua Univ,	7	0.7	6	69
6	CEPR	6	0.6	8	432
7	Duke Univ, Med Ctr	6	0.6	0	752
8	Katholieke Univ Leuven,	6	0.6	4	170
9	NBER	6	0.6	11	551
10	Johns Hopkins Univ, Sch Med	5	0.5	0	501
11	Stanford Univ, Sch Med	5	0.5	0	563
12	Univ Copenhagen	5	0.5	1	813
13	Univ Groningen, Fac Econ & Business	5	0.5	7	98
14	Maastricht Univ	4	0.4	14	310
15	NIMH, Expt Therapeut & Pathophysiol Branch	4	0.4	0	54
16	Oregon Hlth & Sci Univ	4	0.4	0	384
17	Stanford Univ	4	0.4	0	84
18	Univ bath, sch management	4	0.4	0	53
19	Univ calif los angeles	4	0.4	0	919

20	Univ cambridge,	4	0.4	0	438
21	Univ manchester,	4	0.4	0	31
22	Univ so calif,	4	0.4	0	44
23	Univ utah,	4	0.4	4	153
24	Univ utah, dept psychiat	4	0.4	4	153
25	Univ washington, sch med	4	0.4	0	173
26	Yale univ, sch med	4	0.4	0	81
27	Aston univ, aston business sch	3	0.3	3	28
28	Boston univ, sch med	3	0.3	0	294
29	Cleveland clin	3	0.3	0	225
30	Copenhagen business sch	3	0.3	0	77

Conclusion

The number of papers published in “patent publication” has gradually increased during 2011-2020 and the study has shown that 1030 research documents have been published in patent publication during the period. 2020 has the highest number of research documents 247 (23.98%) with 2 of total local citation score and 637 total global citation score. Zhou Y is topmost author with published research records of 8 (0.8%) research papers contributed. It could be identified that the institutions wise analysis the following institutions Maastricht Univ, Univ Toronto Univ Utrecht, were acknowledged the most prolific institutions based on the number of research papers output they published.

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