Analysis of the Research in High Profile of the Selected Institutions

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ABSTRACT: *This study measuring the research productivity of centre with potential for Excellence in Particular Area (CPEPA), status in Karnataka state. The research publication data, indexed in SCOPUS database for the three Institutions for 10 years (2010 – 2019) are used for analysis. The parameters such as from-wise, year-wise, subject-wise classification of published papers, most productive authors, and the most preformed journals and citation impact and discipline –wise research strength of these three institutions. Measuring research productivity of the centre with potential for excellence in Particular Area (CPEPA) is measured and compared with three institutions such as Karnatak University, Dharwad, Bangalore University, Bangalore and University of Mysore, Mysore. Nowadays, the workflow of bibliometrics study has been automated because of the uses of software packages like (Bibliometrix R Package, Bib excel, VOSviewer, etc.) for automated bibliometrics workflow. In this article, we propose to utilize an open-source and exclusive tool, developed and produced in R language, for classic and logical bibliometrics study. For creating and visualizing a bibliometric network between author, sources, keywords, and publications we used VOSviewer software.*

1. Introduction

The idea of 'excellence' is entrenched in many areas of activity, and the term is used commonly to refer to extremely good or magnificent. In higher education, it implies various things in various contexts. Excellence might be connected with the status and standing of institutions, but much relies upon the view of student knowledge and the differing missions of institutions. It is easy to explain, it relates to academic quality and standards, where excellence identifies with the quality of teaching, the competencies of students, the scale of resource provision, and the level of student success.

All the first world countries understood the significance of the link between higher education, research, and development well as expected and made fundamental activities and strides for fortifying this sector. Across the Globe, universities are measured as places where education, research, and development happen. Hence, appropriate higher education and research set-up are now essential for the improvement and progress of a nation. In India as of October 2020, 958 universities are delivering to the higher education needs of the country. These include 54 Central universities (CUs), 416 State Universities, 124 Deemed to be universities, and 364 private universities. Of these 958 universities, 12 universities were selected under the scheme Centre with Potential for Excellence in Particular Area (CPEPA). The University Grants Commission (UGC) has been empowering well-performing colleges and universities in the nation to strive for excellence in their chosen areas of academic and research work.

The UGC (UGC CPEPA12, 2011) has conferred the status of Universities with Potential for Excellence to 12 Universities (as of 18th October 2011). UGC eligibility criteria laid down in the XI Plan Guidelines on CPEPA, 12 universities were selected, viz., Karnataka University, Dharwad, Karnataka; Bangalore University, Bangalore, Karnataka; Guru Nanak Dev University, Amritsar, Punjab; JaiNarayan Vyas University, Jodhpur, Rajesthan; University of Madras, Tamil Nadu ("Development of Drugs from Medicinal Plants for Human Welfare); Annamalai University, Annamalainagar, Tamil Nadu; University of Calcutta, Kolkata, West Bengal; Punjab University, Chandigarh (Cultural Fixation on "Honour": A Gender Audit of Punjab and Haryana); Osmania University, Hyderabad, Andhra Pradesh; University of Madras, Chennai, Tamil Nadu (Climate Change and its impact on man-grove ecosystem in the region); Punjab University, Chandigarh (Application of Nanomaterials, Nanoparticles and Nanocomposites) and University of Mysore, Mysore, Karnataka. The current study was confined to three CPEPA's of Karnataka and identified how the institutions are performing in various fields of research and development.

Karnataka University, Dharwad; Bangalore University, Bangalore and University of Mysore, Mysore are the highly reputed universities of Karnataka. These CPEPA's identified by National Institutional Ranking Framework (NIRF) 2020, MHRD, Gov-ernment of India's ranked 68th and 27th unfortunately, Karnataka University, Dharwad didn't get placed in top 100 and these universities appear with a good rank in world's ranking of various academic ranking agencies.

2. Literature Review

Over the year's various bibliometric studies/ scientometric studies has been accomplished to evaluate the research productivity of an organization, country, subject, author, sources, etc. Essential factors have been identified, the complexity of variance defined and remedies were recommended to overcome. These studies have proven a mirror to the researchers and policymakers in formulating the future road map.

(GN Gourikeremath et al., 2015; Gouri Gourikeremath & Hiremath, 2020) performed comparative assessments of scientific research output of science faculties of University of Mysore and the Karnatak University, and Scientific Productivity of Univer-sities with Potential for Excellence (UPE) status in India using different bibliometric indicators, by using Web of Science database during 2002-16 and 1999-2014 respectively. (Kappi et al., 2020; S. Kumar & Senthilkumar, 2019) examined the research performance of India's NIRF first ranked institute, Indian Institute of Science (IISc), Bangalore during 2014-2018 using WoS database and Research Productivity of NIRF 2020 Top Indian Law Institutions during 2009 – 2019 using SCOPUS database. (Kappi, 2019) evaluated the scientific research output of the Kuvempu University using different bibliometric indica-tors during 1990–2019 based on the Web of Science database. (A. Kumar et al., 2019) examined the growth of publication in the different subject categories, the impact of growth before and after NIRF. The sample data is considered for 20 universities from the top 25 top universities ranked last three years in NIRF using the Web of Science database for the period 2014 – 2016. (Utama et al., 2019) studied research productivity of Diponegoro University, Indonesia by using various bibliometric tools during 2014 – 2018 by using the SCOPUS database.

(Prathap & Gupta, 2009) studied the top 30 Indian engineering and technological institutions found on their research produc-tion during 1999–2008. (Prathap, 2014) assessed the research productivity of institutions associating to the higher educa-tion sector for the period 2003–2011. (Basu et al., 2016) evaluated the research productivity of the central institutions in India during 2010 – 2014. (Solanki et al., 2016) done a scientometric study of the research productivity of IISER for the period 2010-2014. (Rajan et al., 2018) examined the research output of Indian institutions for the period 2011–2016 based on data gained from the SciVal bibliometric tool. (Das, 2019; Prathap, 2013) assessed the research output of the IITs in India by using Web of Science (WoS) and SCOPUS databases. (Prathap & Sriram, 2017) (Prathap & Sriram, 2017) likened the research quality and socio-economic output of private institutions in India with IISc by using bibliometric and fiscal data

from NIRF 2017. (Marisha et al., 2017) studied the research output of the 39 central universities in India using Wos data-base. (Banshal et al., 2018) done bibliometric study of the research output of the NIT's in India for the period 2005–2016. (Sharma et al., 2019) during 2008-2017 studied the research output of Indian institutions in biotechnology research. (Sangam & Bagalkoti, 2015) assessed and measured the growth of publications of the National Assessment and Accreditation Council (NAAC) accredited universities in India during 2001-2010 using the SCOPUS database.

3. Objectives

The main objective of the study to find out and evaluate the research output of Centre with Potential for Excellence in Particular Area (CPEPA) status in India, restricted to Karnataka state universities viz. Karnatak University, Dharwad; Bengaluru Univer-sity, Bengaluru and University of Mysore, Mysore. The specific objectives are as follows:

• To analyse year-wise research output and CPEPA's research output.

• To identify different type of channels used for communicating

• To know the most preferred subject/research area.

• To identify the most productive authors.

• To know the most productive sources.

• To identify the most used keywords.

4. Methodology

The data was collected by searching the SCOPUS database from 2010 to 2019 and compare the research performance of Karnataka state CPEPA Universities. The advanced search option of SCOPUS database has been chosen ((AFFILCOUNTRY(India) AND AF-ID ("Karnatak University" 60029908) OR AF-ID("Bangalore University" 60009220) OR AFID(" University of Mysore" 60013290)) AND (LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010))). The mentioned affiliations ID has been considered and all the associated papers are extracted, retrieved, collected, and analysed with Excel, VOSviewer (van Eck & Waltman, 2010), and R (Aria & Cuccurullo, 2017) package. A total of 8,953 records were retrieved on 1st October 2020 for respective Karnataka state CPEPA Univer-sities. Further, the study uses VOS viewer software and the R Bibliometrix package for visualization network.

5. Bibliometrics Indicators

Some of the Research output indicators are used to analyse the collected data, based on the SCOPUS database.

Participative Index (PaI)
To evaluate the performance level of research of an institution, an index called 'Participative Index (PaI)' has been designed (García-García et al., 2005). PaI is the ratio of the number of papers generated in a country or institution and the total number of documents collected in this repertoire. This will be expressed as:

$$PaI = \frac{\text{Number of papers generated in an institution}}{\text{Total number of documents collected in this repertoire}} \times 100$$

6. Results and Discussions

6.1. Year-wise Distribution of Publications
Table 1 and Figure 1 highlights the year-wise distribution of publications, h-index, mean TCPA, and citations received for CPEPA of Karnataka State. A total of 8, 953 papers were published by these three CPEPA's and is found that the most productive year in terms of publication count is 2011 with 1005 publications and 1247 citations, followed by 952 publica-

tions with 3554 citations and ACPP 3.733 published in 2013, 917 papers were published in the year 2014, and 915 papers were published in the year 2019 and has got highest citations with 12393. The lowest number of articles i.e., 803 were published in the year 2017. The h-index, Mean TCPA, and the Mean TCPY are shown in Table 1.

Year	Publications	TC	ACPP	h-index	Mean TCPA	Mean TCPY
2010	875	218	0.249	45	12.749	1.275
2011	1005	1247	1.241	47	11.812	1.312
2012	906	2399	2.648	38	8.921	1.115
2013	952	3554	3.733	34	7.879	1.126
2014	917	4915	5.36	37	8.462	1.41
2015	827	5998	7.253	32	7.045	1.409
2016	855	7072	8.271	29	6.692	1.673
2017	803	8517	10.606	27	6.306	2.102
2018	898	10507	11.7	23	4.601	2.301
2019	915	12393	13.544	18	2.223	2.223

TC=Total Citations, ACPP= Average Citation per Publication, TCPA= Total Citations per Article, TCPY= Total Citations per Year

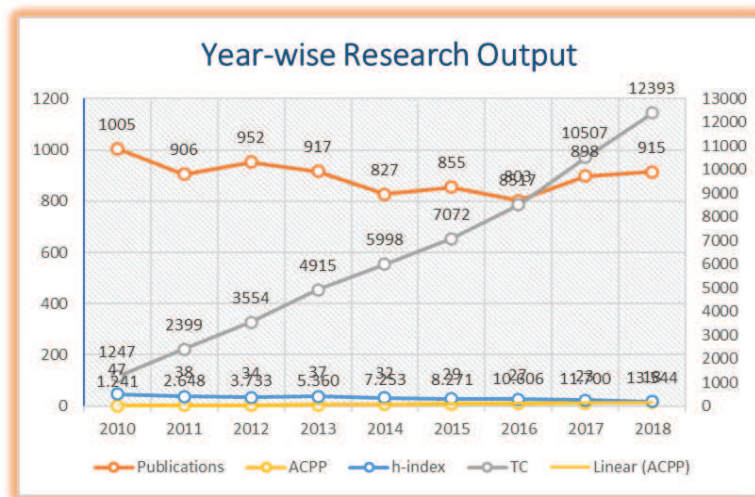Table 1. Year wise distribution of publications

Figure 1. Year wise distribution of publications

6.2. University wise Distribution of Publications

University of Mysore, Mysore has contributed 4330 publications with 47.183 of PaI and placed first, followed by Bangalore University, Bangalore contributed 2660 publications with 28.996 of PaI and Karnatak University, Dharwad contributed 2186 publications with 23.820 of PaI. During the study period, University of Mysore (UMM), Mysore published the highest publica-tions 4330 with 24066 citations of papers closely followed by Bangalore University (BUB), Bangalore 2661with

19306 citations of the papers. The lowest number of papers was published by Karnatak University (KUD), Dharwad 2186 with 15463 of the output. Data presented in Table 2 and Figure 2 indicates that the output of the three CPEPA institutions has grown continuously during the period of study.

Year	KUD				BUB				UMM			
	TP	TC	ACPP	PoI	TP	TC	ACPP	PoI	TP	TC	ACPP	PoI
2010	213	59	0.277	2.321	238	69	0.290	2.593	443	96	0.217	4.827
2011	214	337	1.575	2.332	317	384	1.211	3.454	496	540	1.089	5.405
2012	199	649	3.261	2.168	273	836	3.062	2.975	456	958	2.101	4.969
2013	182	938	5.154	1.983	293	1262	4.307	3.193	502	1401	2.791	5.470
2014	225	1284	5.707	2.452	251	1785	7.112	2.735	466	1953	4.191	5.078
2015	234	1533	6.551	2.550	208	2148	10.327	2.267	421	2542	6.038	4.588
2016	226	1839	8.137	2.463	242	2472	10.215	2.637	407	3058	7.514	4.435
2017	205	2327	11.351	2.234	224	2889	12.897	2.441	392	3573	9.115	4.272
2018	248	2963	11.948	2.702	290	3482	12.007	3.160	381	4532	11.895	4.152
2019	240	3534	14.725	2.615	325	3979	12.243	3.541	366	5413	14.79	3.988

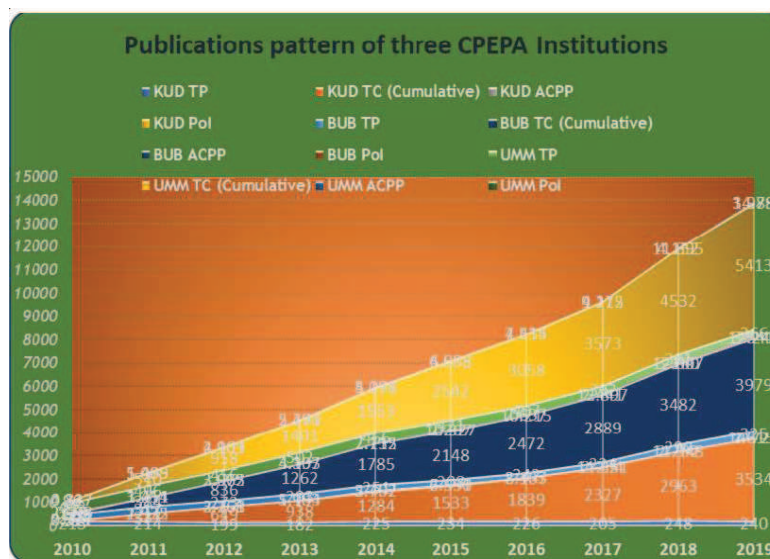Table 2. Publications pattern of three CPEPA Institutions

Figure 2. Publications pattern of three CPEPA Institutions

6.3. Channels Used for Communicating

The channels used for communicating three CPEPA institutions' research publications published include articles published in the journals, conference papers, book chapters, reviews, data papers, notes, erratum, editorial materials, and others. This study has observed a total of 8953 publications. It has been observed from table 3 & figure 3, there are many communicating channels are used by scientists to publish their research articles. The majority of publications are published in Journal articles i.e. 7211 (81%), followed by Conference Paper 1118 (1.24%) publications, 245 (0.27%) papers published as book Chapter, 173 are published as Review and less than 1% of publications are published in other communication channels.

Document Type	No of Pub
Article	7211
Conference Paper	1118
Book Chapter	245
Review	173
Data Paper	68
Note	33
Erratum	29
Editorial	27
Letter	19
Book	17
Short Survey	10
Undefined	3

Table 3. Channels Used for Communicating
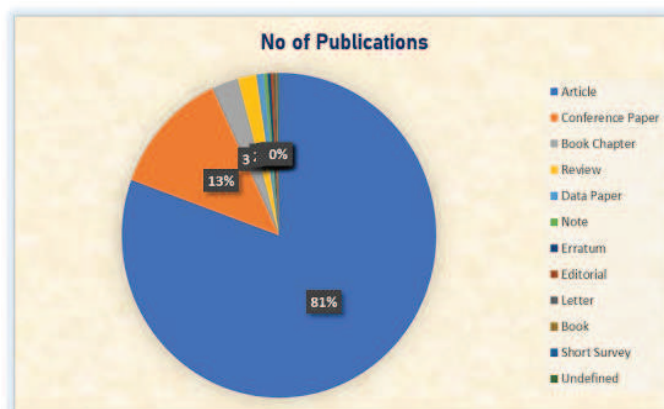
Figure 3. Channels Used for Communicating

Subject Area	Publications
Chemistry	2823
Physics and Astronomy	2049
Materials Science	1763
Biochemistry, Genetics and Molecular Biology	1458
Engineering	1249
Agricultural and Biological Sciences	1033

Pharmacology, Toxicology and Pharmaceutics	1006
Computer Science	832
Mathematics	726
Chemical Engineering	692
Medicine	692
Environmental Science	591
Social Sciences	310
Immunology and Microbiology	266
Energy	231
Earth and Planetary Sciences	199
Multidisciplinary	180
Psychology	117
Arts and Humanities	101
Business, Management and Accounting	73

Table 4. Most Preferred Subject/ Research Areas

6.4. Most Preferred Subject/ Research Areas

It is observed from table 4 & figure 4, Chemistry has been identified as the three high priority research area of were published in CPEPA institutions research with each contributing publication, followed by Physical and astronomy published 2043 publications, Materials Science published 1763 papers, Biochemistry, Genetics, and Molecular Biology published 1458 papers, Engineering subject published 1249 papers, Agricultural and Biological Sciences published 1033 papers, Pharmacology, Toxicology and Pharmaceutics published 1066 papers, Computer Science published 832 papers, Mathematics published726 papers, Medicine papers published 692 papers, etc.
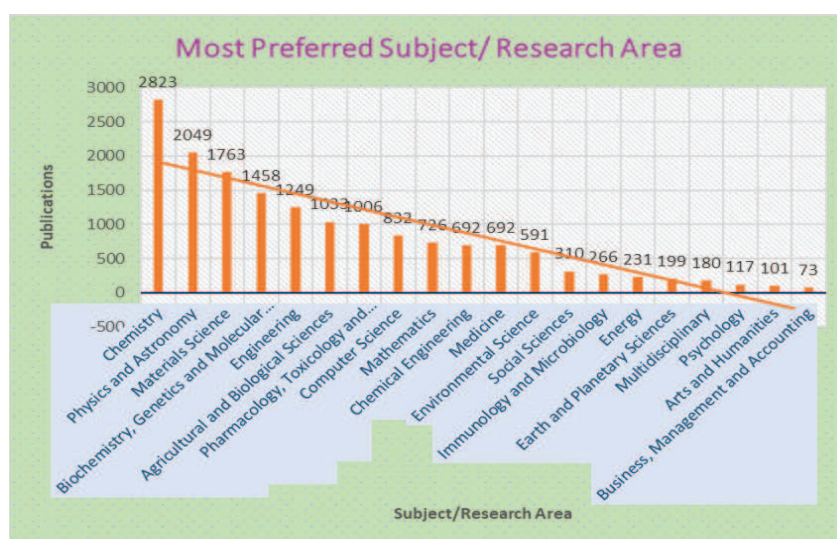

Figure 4. Most preferred subject/research areas

6.5. Most Productive Authors and Affiliations

The most productive authors of CPEPA institutions in Karnataka are listed in table 5 & figure 5. It is worth to note that the Yathirajan H S; UMM top of the list by contributing 355 papers, 1417 citations with 17 h-index, followed by Lokanath N K; UMM contributed 213 papers with 820 citations and having 12 h-index and Jasinski J P; Keene State College, USA 201 papers with 561 citations and having 8 h-index respectively. Rangappa K S; UMM stand first in g index 38, followed by Nandibewoor S T; KUD with g index 34 and Yathirajan H S with g index 24 ranked second and third respectively. The majority of most productive authors belong to UMM (10), followed by BUB with 3 authors; and 3 foreign authors got placed in top 20 list.

| Author	Institution	NP	TC	h_index	g_index	m_index
Yathirajan H S	UMM	355	1417	17	24	1.545
Lokanath N K	UMM	213	820	12	19	1.333
Jasinski J P	Keene State College, USA	201	561	8	13	0.727
Rangappa K S	UMM	191	2687	27	38	2.455
Narayana B	Mangalore University, Mangalore	182	892	14	21	1.273
Venugopal K R	BUB	172	572	9	19	0.818
Nandibewoor S T	KUD	152	1677	21	34	1.909
Basavaiah K	UMM	128	506	10	12	0.909
Byrappa K	UMM	112	1037	20	27	1.818
Sureshbabu V V	BUB	104	940	18	24	1.636
Naveen S	UMM	99	553	13	20	1.182
Patnaik L M	IISc, Bangalore	96	345	9	15	0.818
Guru D S	UMM	95	455	11	18	1.000
Murthy H N	KUD	92	1462	19	35	1.727
Shivakumara I S	BUB	90	905	16	23	1.455
Butcher R J	Howard University, USA	79	247	7	9	0.636
Girish K S	UMM	79	1518	23	34	2.091
Kaur M	Keene State College, USA	78	222	7	11	0.778
Somashekar R	UMM	78	366	9	16	0.818
Chandraju S	UMM	77	312	10	12	0.909

Table 5. Most productive authors
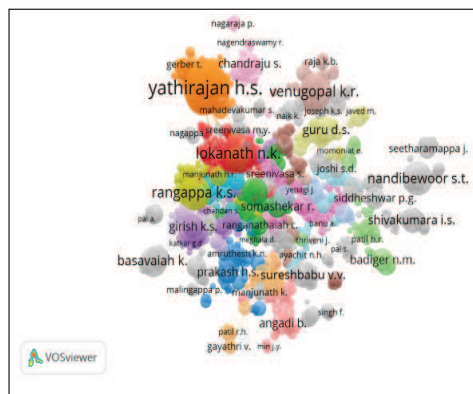
Figure 5. Co- author's network

6.6. Most Productive Sources

Table 6 & figure 6 presents a list of journals used by the faculties, researchers, and scientists of the CPEPA institutions in Karnataka. Among the various scientific communication journals, it is found that the *ACTA Crystallographica Section E: Structure Reports Online* (USA) the highest number of publications i.e. 482 and 1,285 citations, followed by *AIP Conference Proceedings* (USA) with 266 publications and 239 citations, *Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy* (Netherlands) with 95 publications and 1,740 citations, *ACTA Crystallographica Section E: Crystallographic Communications* (United Kingdom)**,** *Journal of Molecular Structure* (Netherlands**)** with 76 publications and 112 citations,

Source	TP	TC	h_index	g_index	m_index
ACTA Crystallographica Section E: Structure Reports Online	482	1285	11	18	1.000
AIP Conference Proceedings	266	239	5	7	0.455
Spectrochimica ACTA - Part A: Molecular and Biomolecular Spectroscopy	95	1740	27	37	2.455
ACTA Crystallographica Section E: Crystallographic Communications	76	112	5	6	0.833
Journal of Molecular Structure	76	751	15	21	1.364
International Journal of Pharma and Bio Sciences	73	156	7	8	0.636
International Journal of Pharmacy and Pharmaceutical Sciences	70	420	12	16	1.091
Chemical Data Collections	68	224	7	10	1.400
Synthetic Communications	59	442	12	17	1.091
RSC Advances	56	1003	20	27	2.500
Molecular Crystals and Liquid Crystals	53	200	8	11	0.727
Advanced Studies in Contemporary Mathematics (KYUNGSHANG)	52	32	4	4	0.364
Advances in Intelligent Systems and Computing	51	56	4	4	0.500
Communications in Computer and Information Science	51	86	5	8	0.455
European Journal of Medicinal Chemistry	50	1995	28	44	2.545
International Journal of Earth Sciences and Engineering	50	21	2	3	0.182
DER Pharma Chemica	49	193	8	12	0.800
Tetrahedron Letters	47	763	17	25	1.545
Nature Environment and Pollution Technology	46	43	4	5	0.364
Chemistryselect	43	188	7	8	1.400

Table 6. Most productive authors

International Journal of Pharma and Bio Sciences (India) with 73 publications and 156 citations. It is noted from the table that *European Journal of Medicinal Chemistry* (France), has received the highest number of citations 1995 with 28 h-index among the list; this retrieves the excellence of the journal and out of the 8953 papers, 1813 (20.25%) appears in the top 20 list.
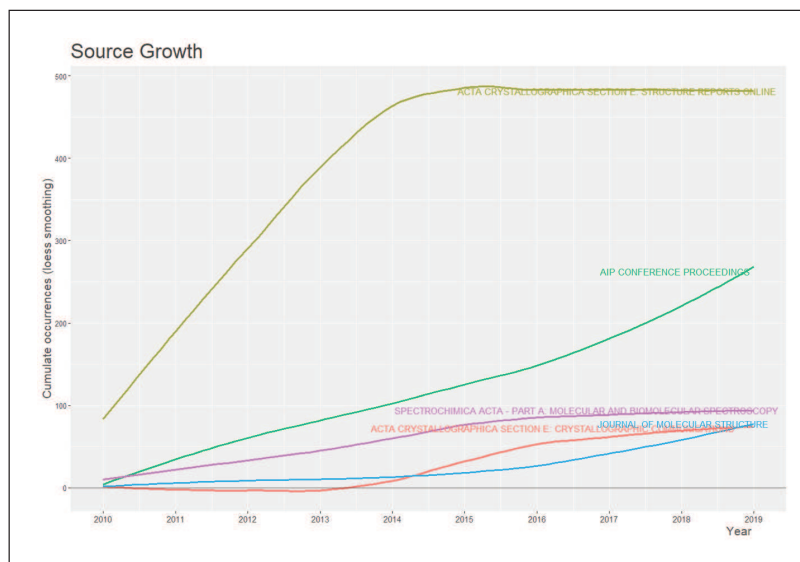

Figure 6. Source growth

6.7. Most cited papers

The most cited papers of CPEPA of Karnataka are listed in table 7 (Madhu & Kannappanavar, 2020). The paper *"Review on Modified TiO2 Photocatalysis under UV/Visible Light: Selected Results and Related Mechanisms on Interfacial Charge Carrier Transfer Dynamics by S. Girish Kumar and L. Gomathi Devi"* has cited 1277 times with 127.7 TCPY followed by *"Emissive ZnO–graphene quantum dots for white-light-emitting diodes by Dong Ick Son, Byoung Wook Kwon, Dong Hee Park, Won-Seon Seo, Yeonjin Yi, Basavaraj Angadi, Chang-Lyoul Lee & Won Kook Choi"* with 509 citations and 56.556 TCPY and *"A review on non metal ion doped titania for the photocatalytic degradation of organic pollutants under UV/solar light: Role of photogenerated charge carrier dynamics in enhancing the activity by L Gomathi Devi & R.Kavitha"* with 377 citations and 47.125 TCPY. 4 papers have 200 and more citations and 13 papers have more than 100 citations. Figure 7 shows the most cited documents network.

Paper	DOI	TC	TCPY
KUMAR S G, 2011, J PHYS CHEM A	10.1021/jp204364a	1277	127.700
SON DI, 2012, NAT NANOTECHNOL	10.1038/nnano.2012.71	509	56.556
DEVI LG, 2013, APPL CATAL B ENVIRON	10.1016/j.apcatb.2013.04.035	377	47.125
BHAT R, 2010, COMPR REV FOOD SCI FOOD SAF	10.1111/j.1541-4337.2009.00094.x	278	25.273
MURTHY HN, 2014, PLANT CELL TISSUE ORGAN CULT	10.1007/s11240-014-0467-7	241	34.429
KARIGAR CS, 2011, ENZYME RES	10.4061/2011/805187	215	21.500
ACHAR KCS, 2010, EUR J MED CHEM	10.1016/j.ejmech.2010.01.029	204	18.546
REDDY AJ, 2011, J ALLOYS COMPD	10.1016/j.jallcom.2011.02.043	189	18.900
BARH D, 2010, CURR ONCOL	10.3747/co.v17i1.356	185	16.818

| JAYANANDA M, 2013, PRECAMBRIAN RES	10.1016/j.precamres.2012.05.002	182	22.750
DEVI LG, 2016, APPL SURF SCI	10.1016/j.apsusc.2015.11.016	180	36.000
VAJRAVELU K, 2011, INT J THERM SCI	10.1016/j.ijthermalsci.2011.01.008	177	17.700
LAMBERT NM, 2013, PERS SOC PSYCHOL BULL	10.1177/0146167213499186	170	21.250
SHINGALAPUR RV, 2010, EUR J MED CHEM	10.1016/j.ejmech.2010.01.007	157	14.273
NAIK PN, 2010, J PHOTOCHEM PHOTOBIOL B BIOL	10.1016/j.jphotobiol.2010.05.014	153	13.909
NAGENDRAPPA G, 2011, APPL CLAY SCI	10.1016/j.clay.2010.09.016	149	14.900
DEVI LG, 2010, J MOL CATAL A CHEM	10.1016/j.molcata.2010.05.021	140	12.727
GAO W, 2018, INF SCI	10.1016/j.ins.2018.07.049	138	46.000
PARK A, 2010, TISSUE ENG PART A	10.1089/ten.tea.2009.0710	125	11.364
GOMATHI DEVI L, 2014, RSC ADV	10.1039/c4ra03291h	119	17.000

Table 7. Most cited papers
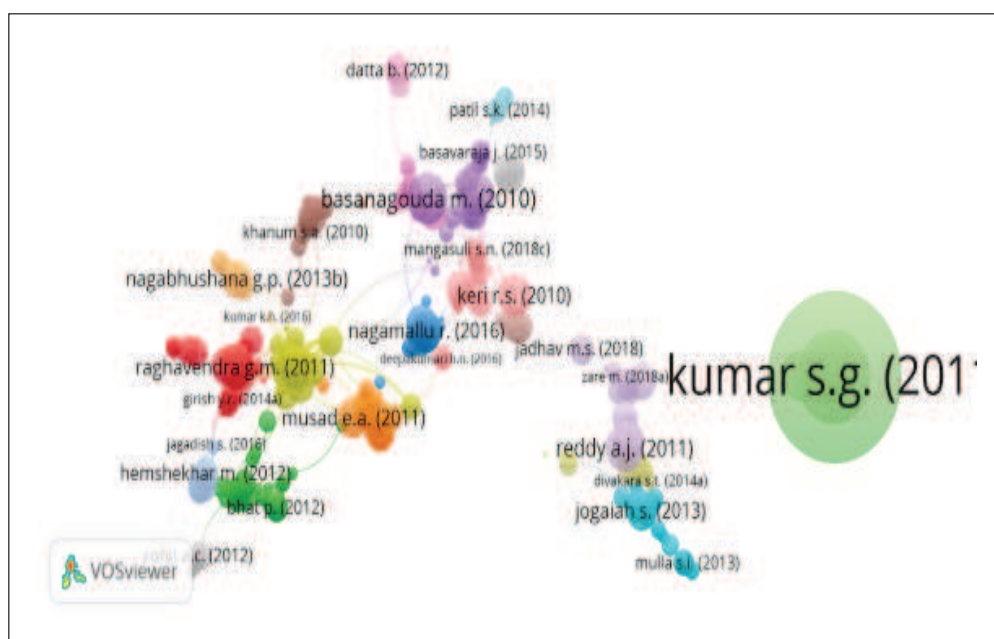
Figure 7. Documents citation network

6.8. Country Collaboration

Research collaboration and co-authorship is a growing phenomenon in research and development (Noruzi & Abdekhoda, 2013) (Noruzi & Abdekhoda, 2014). Table 8 shows the distribution of international collaboration; the three CPEPA's of Karnataka together have published 2114 international collaborative papers. The researchers of these CPEPA's of Karnataka together have collaborated with 19 countries of the world during 2010 – 2019. The highest research collaboration of these CPEPA's of Karnataka has been found with the USA (645 papers; 2136 TC) followed by the UK with 189 papers and Korea with 167 papers. Among these collaborative countries, only two countries have produced 4000 (52.45 %) total citations. Figure 8 & figure 9 shows the country collaboration map and Co-authorship-Countries network.

| Country	TP	TC	ACPA
USA	645	2136	08.18
United Kingdom	189	504	13.62
Korea	167	1864	19.02
China	149	264	11.00
Malaysia	120	524	19.41
Japan	119	325	17.11
Iran	114	411	09.56
Saudi Arabia	99	63	15.75
Germany	84	404	21.26
South Africa	81	166	03.32
Turkey	76	178	07.74
Australia	66	72	12.00
Singapore	60	79	09.88
Poland	48	139	03.76
Netherlands	30	179	29.83
Hong Kong	25	134	14.89
Brazil	22	70	23.33
Ireland	11	71	71.00
Qatar	9	43	21.50

Table 8. Collaboration with othaer countries
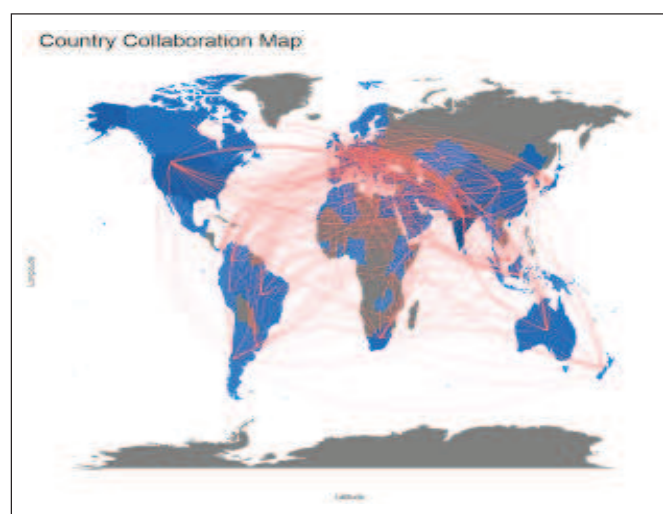
Figure 8. Country collaboration map

6.9. Most Used Keywords

The keywords co-occurrence network map, the top 20 keywords of these three CPEPA's of Karnataka publications, the keywords density visualization map, and the keywords timeline view will be shown (Figure 10). Keywords co-occurrence can effectively reflect the research hotspots in the discipline fields, providing secondary support for scientific research. In all
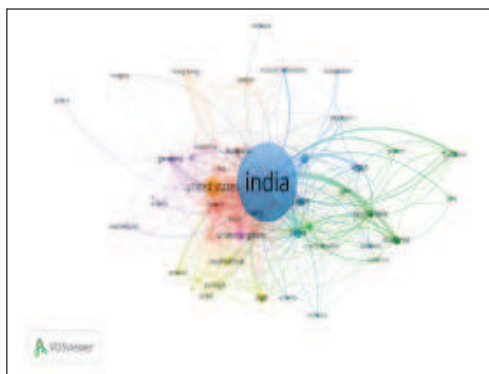

Figure 9. Co-authorship Countries network

Keyword	No of Times
Article	2093
Nonhuman	1146
Controlled Study	1129
Unclassified Drug	1020
Human	757
Animals	537
Priority Journal	525
Humans	500
Chemistry	487
India	487
X Ray Diffraction	444
Metabolism	438
Male	432
Drug Synthesis	414
Female	385
Animal	384
Crystal Structure	373
Animal Experiment	340
In Vitro Study	313
Scanning Electron Microscopy	294

Table 9. Keywords analysis

8953 publications, we got 38347 keywords. The keyword co-occurrence network of CPEPA's of Karnataka was constructed by the VOSviewer software. The nodes with the same colour belong to a cluster. VOSviewer divided the keywords of CPEPA's of Karnataka publications into 5 clusters. The keyword 'article' is used 2093 times followed by 'Nonhuman' 1146 times, 'Controlled Study' 1129 times, and 'Unclassified Drug' 1020 times. Four keywords 'Human', 'Animals', 'Priority Journal', 'Humans' are occurred between 500 to 757 times, and the remaining 12 keywords occurred between 294 to 487 times. The top 20 keywords with their frequencies are shown in Table 9.
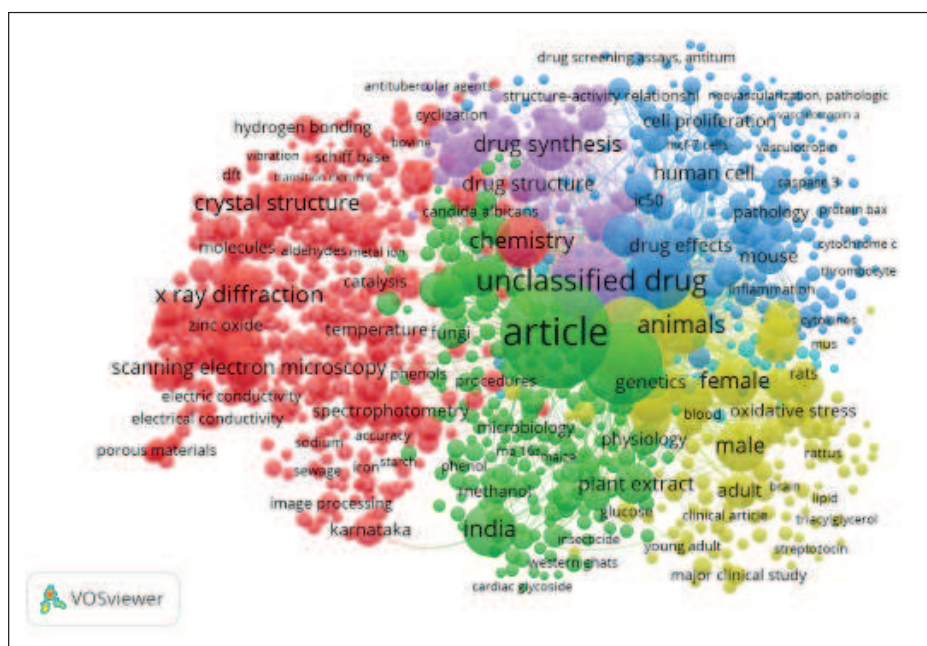

Figure 10. All keywords co-occurrence network

6. Discussion and Conclusion

This study measured research productivity and visualization on CPEPA's of Karnataka publications. The analysis focused on significant indicators of research productivity, distribution of publications, and most productive authors and keyword analysis. The Scientific productivity of institutions/ universities can be measured by the counting of research publications in the journals and proceedings, and the number of citations received in those publications. Although the leading faculty members of universities contribute much of their work in journals covered by Scopus, a significant number of publications of universities appear in national and other international journals, which are not covered by the Scopus.

The results presented that UMM performs top on most of the indicators among the CPEPA's of Karnataka and the other two also performed reasonably well in some indicators.

The authors think that the CPEPA's in Karnataka state should pay special attention to develop a suitable research policy. As the CPEPA's in Karnataka state receive funds from UGC (University Grants Commission), these institutions should utilize funds for improving research facilities and availing equipment for scientific productivity. To increase citations and visibility of publications from universities and to improve their research impact, universities should establish repositories at the regional or institutional level.

The Indian government contributes about one-fourth of total governmental expenditure on education in India, though it has a key share in research funding. The data points towards the fact that organized and planned efforts by the governments are essential in the higher education sector to progress the overall environment in which Indian higher education institutions are working at present. In the modern time of a globalized world and knowledge-based economies, it becomes more significant

that we initiate an efficient and honest effort to progress the Indian higher education system, particularly the multidisciplinary universities.

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