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Scientometric analysis based on dimension of research productivity of faculty in VIT University from Web of Science

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Abstract

This study to be providing a quantitative evaluation of science output in VIT University. Investigations have analyzed the research productivity and global citation score of the scientist. The data are collected from Web of Science one line Database. In the scientometric, the main criterion is ranking of the scientific centers and particularly the university. It is the rate of scientific production an innovative and in all participations in the global scientific development. The study merely focuses on year wise research output, citation impact at Local and Global level, prominent authors and their total output. Top journals of publications, Collaborating countries and most collaborative institutions of VIT University. The study period publication data of the university indicate that a total of 3874 papers have been published from 2015 to2019. In additional to this sciento graphical mapping of data is presented through graphs using VOS Viewer Software mapping technique.

Keywords : VIT University, Research Performance, Most Productive Authors, Scientometric Analysis, Histcite, VoS Viewer.

Introduction

Scientometrics are used to find the growth of academic literature. It comes under the major discipline and using statistical tools for the analysis. Scientometric is an important field in information science as it represents a unique set of techniques and tools for the monitoring and analysis of information resources and for the management of knowledge in social and organizational contexts.

Aminpour (2007)[1] has examined A University research performance is counting the related scientific production and development. The major role of research is sustainable development of countries all around the world. Research policy must be implemented and designed to valid and updated information. The past and present research performance can be evaluated in a region, a country and a university by means of scientometric tools and techniques.

Ball and Duke (2015)[2] evaluated the Research performance of an academic institution has become a key impact factor in ranking, Student recruitment and funding both within the academic community and beyond. Funding has emphasized more on monitoring the potential and actual impact of the research projects .

Centra (1977)[3] Universities can evaluate their performance using standard evaluation tools. This way to can improve on their weak points and obtain higher rankings.

Ghojazadeh.M (2014)[4] carried out a Scientometrics has become an important field of study to follow up the scientific products of a research group about the university. Scientometrics studies are very useful method for financial, human resources and it has been used many times in medical sciences during the recent years.

Kademani,et.al (2006)[5] worked out the Scientometric evaluation is a very key component of any research and development activity. One well known productivity indicator is the number of publications produced by the scientists, institutions and countries. Studies like this will provide some insight into the complex dynamic of research activity and enable researchers, scientists, policy makers and science administrators provide adequate facilities and proper guidance in which direction the research has to be conducted.

Muneer Ahmad (2019)[6] observed that Research Productivity in the Bharathiar University among the faculty is significantly higher, though the study started in recent decade, but there is really an optimistic growth in the research Productivity.

Rajeswari (2019)[7] worked on a Bibliometric analysis of digital literacy research output in J-gate analyzed the pattern of growth of the research output published in the pattern of authorship, author productivity and subjects covered in the papers over the period 2009-2018. It found that 1601 papers were published during the period of study 2009-2018. The Maximum number of publication is from United Kingdom 452 (28.23%). The Doubling Time has shown an increasing trend and RGR has been decreased from 0.23 to 0.20.

Rajeswari (2020)[8] analyzed that Thin Film for Solar cell Fabrication is analyzed patterns of authorship, author productivity, documents as well as language analysis covered in the paper over the period 1991-2019. It found that 5365 Papers were published during the study period of the study. The maximum numbers of articles were collaborative in nature. The highest contributed in the year 2017. It was an analysis Degree of Collaboration 0.98.

Subhodip Bid (2020)[9] has examined the research output of University of Burdwan and University of Kalyani for the period 2000-2019. The data was collected from WoS database and found that authors preferred to publish their papers both the universities most highly productive subject area were chemistry, physics, engineering, materials science and mathematics.

C. Baskaran (2020)[10] evaluated the research output of Citations h-Index of the Publications accomplished by the faculty members in Alagappa Univeristy, India. The data had been retrieved from Web of Science (WoS) and Google Scholar Metrics (GSM) for the period 1989 to 2018(WoS) and 2008-2018(GSM). The publications grows the proportion of citations and h-index were increased, Google is significantly use by the Researchers only free, whereas Web of Science (WoS) promote based on subscription through consortium or institution viable. Web of Science record more rely and double blind peer reviewed journal only incorporated in the Database. Whereas Google scholar may not be covered non peer-reviewed journals, therefore researchers easy to find the relevant material use citations for those areas. The conclusion of nearly all of these studies is that Google Scholar provides broader coverage for most disciplines and that the Web of Science and Scopus provide fairly similar results.

About University

VIT University is a private university in Vellore, Tamilnadu. It was established in 1984 as a self financing institution called the Vellore engineering college. The union ministry of Human Resource Development conferred University status on Vellore Engineering college in 2001. Its founder and chancellor, Dr.G.Viswanathan, a former parliamentarian and minister in the Tamilnadu Government. The Campus is spread over 360acre with over 50.83lakh sqft, built up space in Vellore. The University has 1400 Faculties and 1413 staff and about 3000 students with nearly 1/3rd of them women. The University has offered 51 Under Gratuate, 33 Post Gratuate, 11 Integrated, 2 Research Program and 2 M.Tech industrial programs. In addition, full-

time Ph.D in science and Language and Integrated Ph.D Program in engineering disciplines are offered.

Objectives

- To determine research productivity of academic and research community working in VIT University.
- To make an analysis of publications produced by VIT University.
- To identify the year wise contributions of research publications.
- To study the authorship pattern of research publications.
- To find out the ranking of leading contributions.

Materials & Methods

The source items that are recorded of publications by the faculty members of VIT University. They were all the documents published by Web of Science database for the year 2015 to 2019. The Advanced search resulted in a total of 3874 Records of VIT University. The data have been downloaded from Web of Science. Furthermore, The downloaded data's were analyzed by using Histcite and mapping the graphs using VoS Viewer Software. The following statistical tools were used in the present study.

- Relative Growth Rate and Doubling Time.
- Degree of Collaboration.
- Scattering Bradford's Law.
- Keyword Occurance of Zipf's Law.

Limitations

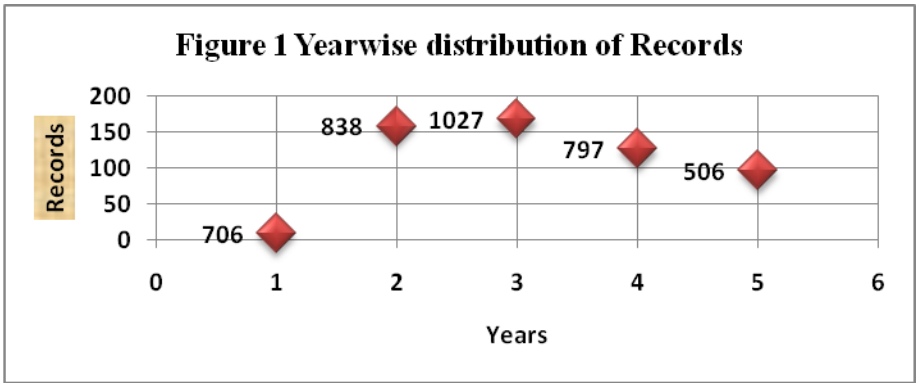
This paper examines exclusively 3874 Records of VIT University that have been indexed in Web of Science database ranging from the year 2015 to 2019. This study has been taken only Web of Science databases. Other databases have not been taken for the study.

Results and Discussion

Table 1 Year wise distribution records from VIT University

Year	Records	Percentage	TLCS	TGCS
2015	706	18.20	833	8655
2016	838	21.60	**1017**	10861
2017	**1027**	26.50	716	**10080**
2018	797	20.60	311	5171
2019	506	13.10	42	1192
	3874	100	2919	35959

TLCS = Total Local Citation Score TGCS = Total Global Citation Score



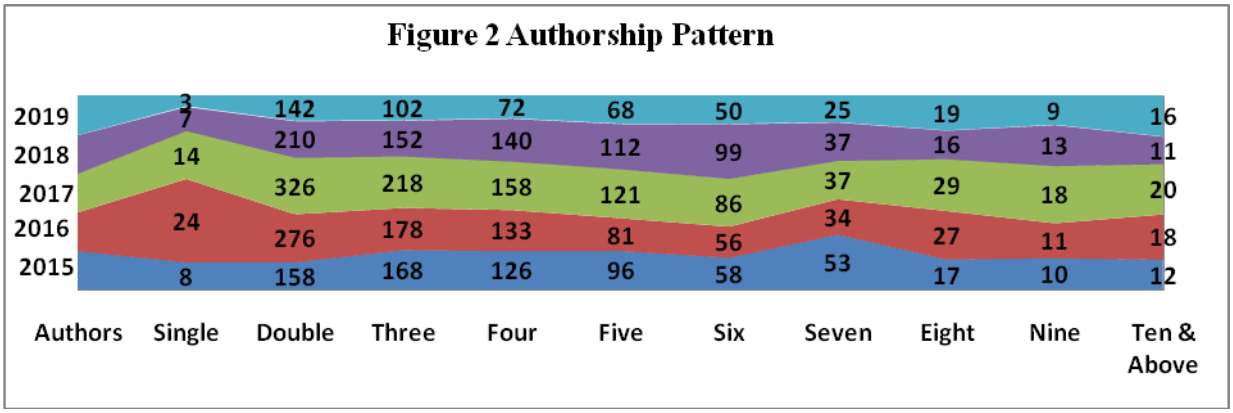
Evaluate the Annual output of Publications of VIT University

Table 1 and Figure 1 reveal that the number of research documents published from 2015 to 2019. According to the publication output from the table 1 the year wise distribution of research documents 2017 has the highest number of research documents 1027 (26.50%) with 716 of Total Local Citation Score and 10080 of Total Global Citation score values and being prominent among the five years output. It is noticed that the year wise contributions are increased as well as decreased trends.

Table 2 Authorship Pattern of VIT University research outputs

Authors	2015	2016	2017	2018	2019	Records	Percentage
Single	8	24	14	7	3	56	1.55
Double	158	**276**	**326**	**210**	**142**	**1112**	28.70
Three	**168**	178	218	152	102	818	21.12
Four	126	133	158	140	72	629	16.24
Five	96	81	121	112	68	478	12.24

Six	58	56	86	99	50	349	9.00
Seven	53	34	37	37	25	186	4.80
Eight	17	27	29	16	19	108	2.79
Nine	10	11	18	13	9	61	1.57
Ten & Above	12	18	20	11	16	77	1.99
Total	706	838	1027	797	506	3874	100
Percentage	18.20	21.60	26.50	20.60	13.10	100	

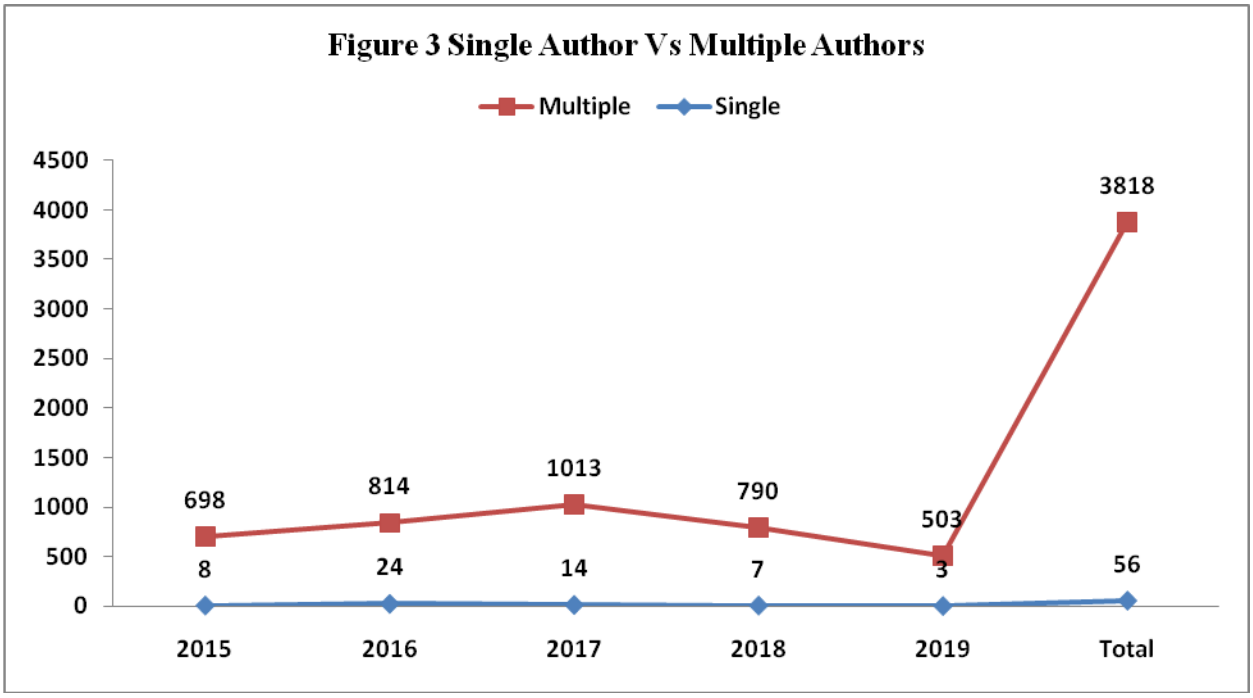


Analysis of the Authorship Pattern

Table 2 and Figure 2 it is observed the authorship pattern in VIT University. Most of the articles published are the multiple authors. Out of 3874 articles, 3818 (98.55%) articles Published in co-authors whereas only 56 (1.55%) articles have been published by Single author. Highest 1112 (28.70%) articles have been published by two authors. The lowest article has been published in single author.

Table 3 Calculation Degree of Collaboration of VIT University Research Output

Years	Single Author		Multiple Authors		Total	Percentage	DC
	Records	Percentage	Records	Percentage			
2015	8	14.28	698	18.28	706	18.20	0.99
2016	**24**	42.86	814	21.32	838	21.60	0.97
2017	14	25.00	**1013**	26.53	1027	26.50	0.99
2018	7	12.50	790	20.69	797	20.60	0.99
2019	3	5.36	503	13.18	506	13.10	0.99
Total	56	100	3818	100	3874	100	0.99



Calulate the Degree of Collaboration

Table 3 In order to determine the strength of Collaboration(DC), The following formula suggested by (Subramanyam, 1993)[11] has been employed.

DC = Nm/Nm+Ns

Where, DC = Degree of Collabration,

Nm = Number of Multiple Authored Papers,

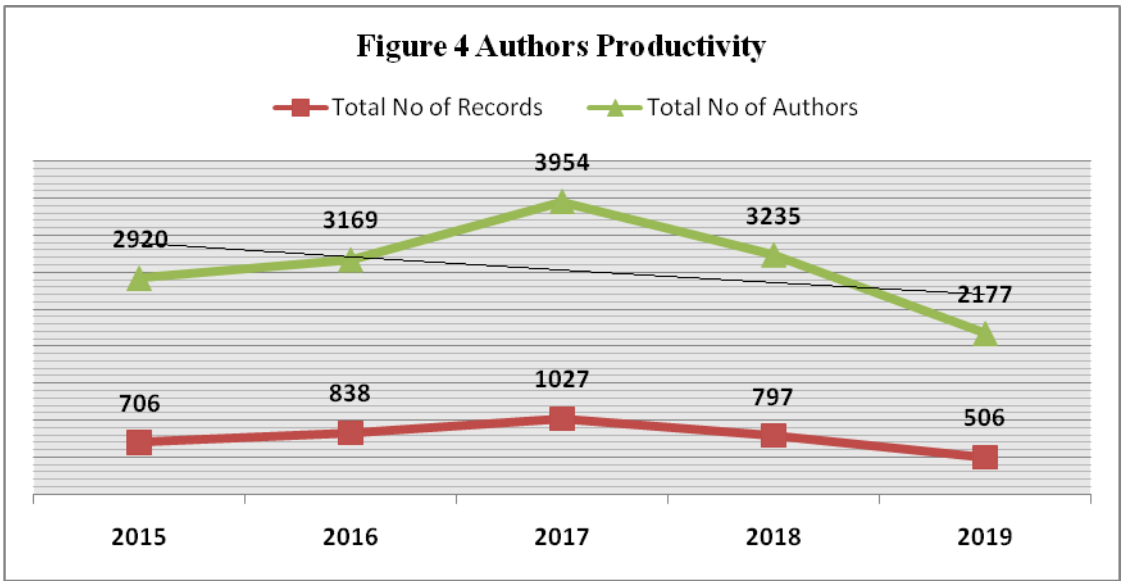
Ns = Number of Single Authored Paper.

The Degree of Collaboration of authors by yearwise is presented in the Table 3. The average degree of collaboration is 0.99 during the period 2015-2019 and It brings out clearly that there exists a high level of Collaboration.

Table 4 Productivity of per author of VIT University research output

Year	Total No of Records	Total No of Authors	AAPP	Productivity of per Authors
2015	706	2920	4.13	0.24
2016	838	3169	3.78	0.26
2017	**1027**	**3954**	3.85	0.26

2018	797	3235	4.06	0.25
2019	506	2177	4.30	0.23
	3874	15455	3.99	0.25



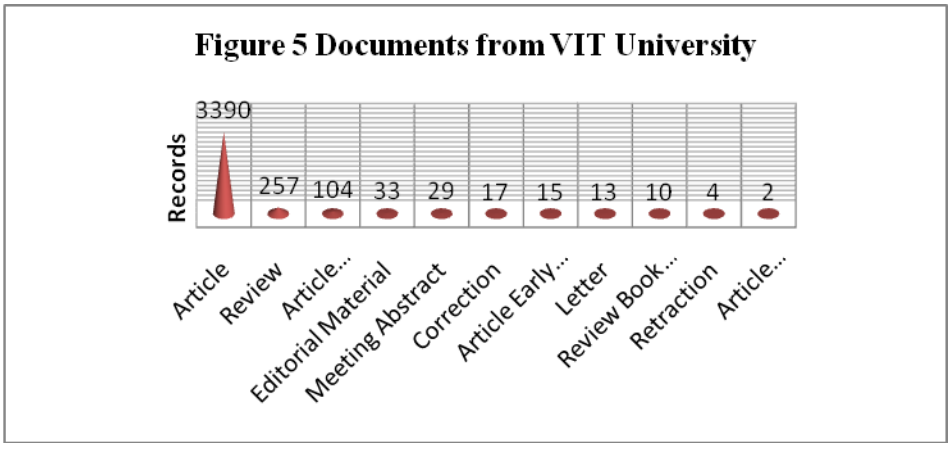
Analysis of the productivity of per Author

Table 4 and Figure 4 shows the data related to author's productivity during the period of study. The total number of articles increased from 706, 838 and 1027 in the year 2015, 2016 and 2017. It gradually decreased in the next two years 2018 and 2019. On the other hand the number of authors increased on par with the number of articles. Even though the number of articles calculated 1027 in 2017. The average author per paper is highly shown 4.30 in this year 2019. The total average number of authors per paper observed is 3.99 and the average productivity per author calculated is 0.25. The highest number of author's productivity found in the study was 3954 (0.26) in the year 2017. The minimum number of author's productivity noted was 2177 (0.23) in the year 2019.

Table 5 Document types for communication channels from VIT University

Document Type	2015	2016	2017	2018	2019	Records	%	TLCS	TGCs
Article	627	737	894	696	436	3390	87.5	2627	29250
Review	29	59	80	60	29	257	6.60	187	6069
Article proceedings	32	20	17	24	11	104	2.70	42	409

paper									
Editorial Material	6	5	8	5	9	33	0.90	1	32
Meeting Abstract	8	9	9	3	-	29	0.70	20	32
Correction	3	3	4	4	3	17	0.40	-	9
Article Early Access	-	-	-	-	15	15	0.40	-	1
Letter	1	1	6	3	2	13	0.30	8	39
Review Book Chapter	-	4	3	3	-	10	0.30	32	86
Retraction	-	-	3	-	1	4	0.10	-	5
Article Retracted Publication	-	-	2	-	-	2	0.10	2	27
Total	706	838	1026	798	506	3874	100	2919	35959



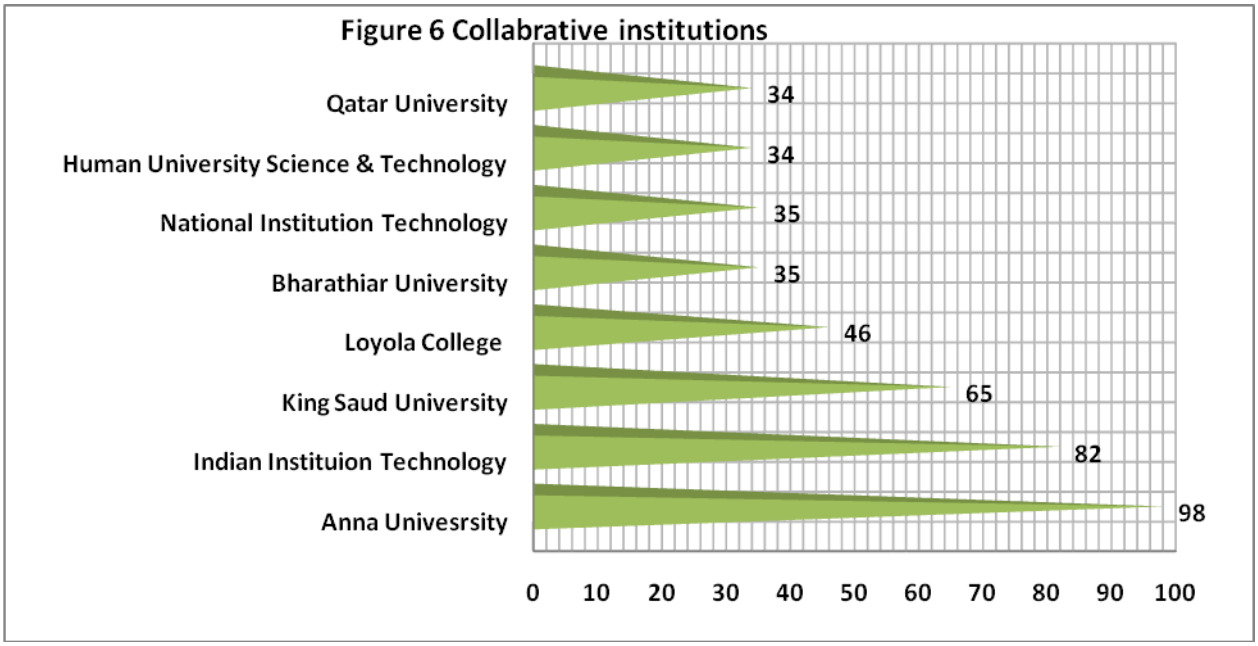
Different types of documents from VIT University

Table 5 and Figure 5 Types of documents are published by VIT University. They are Article, Review, Article proceeding papers, Editorial Material, Meeting Abstracts, Correction, Article Early Access, Letter, Review Book Chapter, Retraction and Article Retracted Publication. Out of all document forms, articles took a major chunk of over 87.5% of the articles (3990), with 6.60% appearing as Reviews (257), 2.70% appearing as Article proceeding papers (104). The other document types such as editorial materials are observed 33 in number and Meeting abstract 29. It is noted that out of 3874 records retrieved from the web of science

database, The other form the web of science database, the other forms of documents recorded have shown less than one percentage during the study period.

Table 6 Collaborative Institutions with VIT University (1771 Observed Institutions)

Institution	Records	Percentage	TLCS	TGCS
Anna Univesrsity	98	2.50	48	897
Indian Instituion Technology	82	2.10	30	686
King Saud University	65	1.70	87	1018
Loyola College	46	1.20	42	718
Bharathiar University	35	0.90	19	339
National Institution Technology	35	0.90	2	223
Human University Science & Technology	34	0.90	35	687
Qatar University	34	0.90	104	639



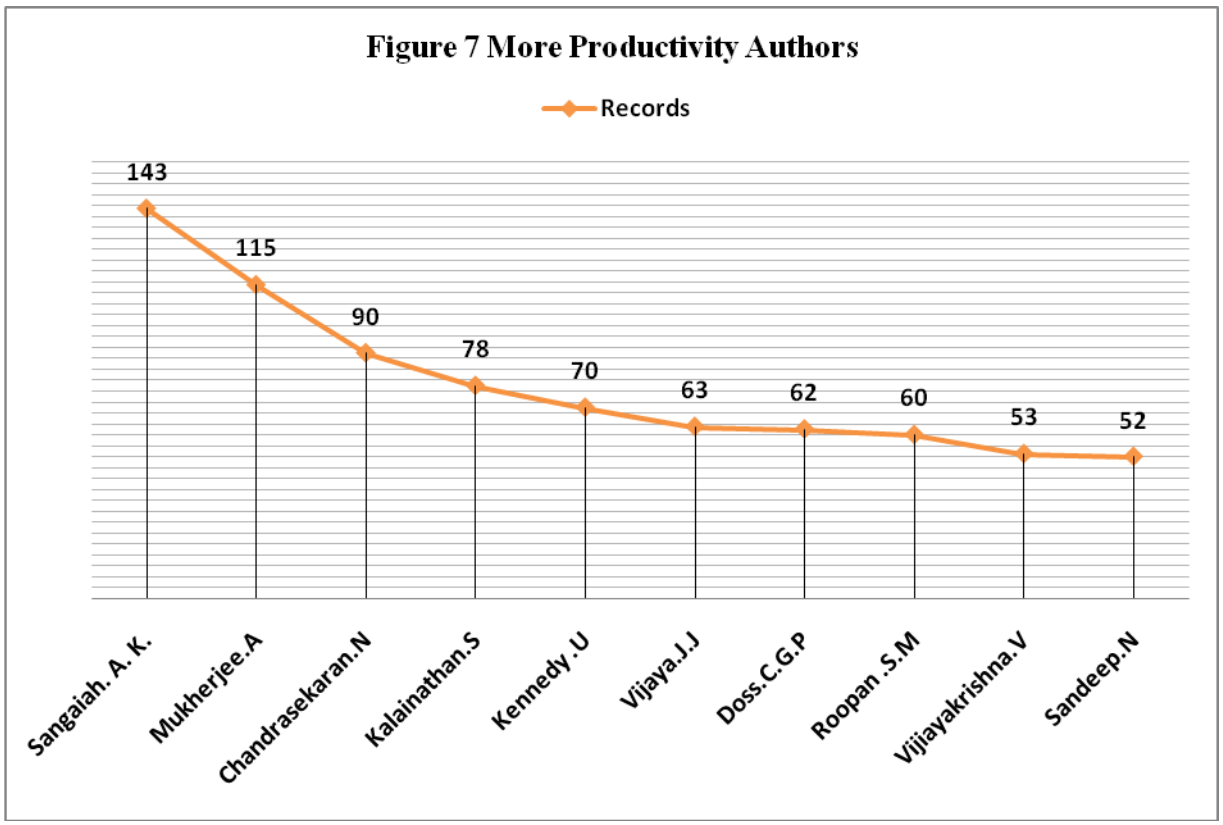
Ranking of collaborative Institutions

Table 6 and Figure 6 The productivity of the author publications based on the collaborative institutions is depicted in the following table 6. It is found that in total 1771 Institutions published 3874 research articles during 2015 to 2019 and these institutions have collaborated with faculty of VIT University for research and Publications. The topmost

institutions involved in this research have published 34 and more research articles. The mean average is 2.18 research articles per institution. Based on the number of published research records the institutions are ranked.

Table 7 Most Productivity authors from VIT University (6625 Observed authors)

Authors	Records	Percentage	TLCS	TGCS
Sangaiah. A. K.	143	3.70	79	1589
Mukherjee.A	115	3.00	90	1228
Chandrasekaran.N	90	2.30	118	946
Kalainathan.S	78	2.00	101	702
Kennedy .U	70	1.80	121	1386
Vijaya.J.J	63	1.60	86	1330
Doss.C.G.P	62	1.60	91	816
Roopan .S.M	60	1.50	237	1094
Vijiayakrishna.V	53	1.40	34	311
Sandeep.N	52	1.30	151	1430



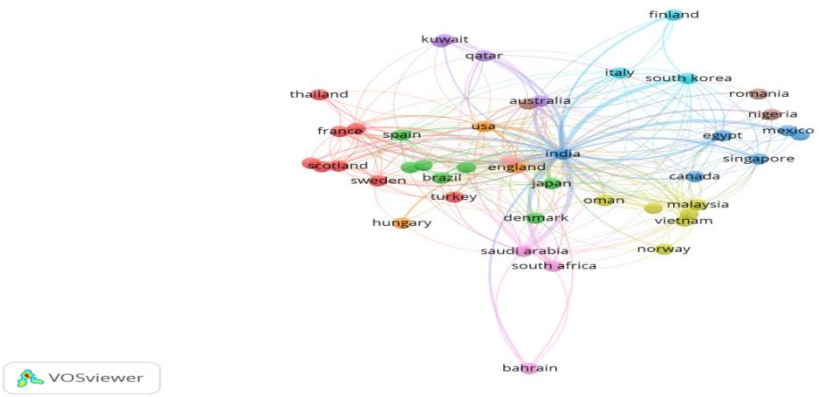
Analysis of Publication output of top Authors of VIT University

Table 7 and Figure 7 displays the ranking of authors of research articles. In the rank analysis the authors who have published 52 articles and more are considered into account to avoid long list. It was observed that there is a total of 6625 authors of 3874 records and it shows the top 10 most productive authors during 2015 to 2019. Sangaiah A K published 143 (3.70%) articles with 1589 TGCS articles, followed by Mukherjee A 155 (3.00%) with 1228 TGCS articles, Chandrasekaran V 90 (2.30%) with 946 TGCS articles and Kalainathan S 78 (2.00%) with 702 TGCS articles, other authors have contributed less than 2% during the period of study. 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 Citation Score. The data set puts forth that the authors Sangaiah A K with 1589 Citations, Sandeep N with 1430 Citations, Kennedy U with 1386 Citations, Vijaya JJ with 1330 Citations, Mukerjee A with 1228 Citations and Roopan S M with 1094 Citations.

Table 8 Country wise Collaborations

Country	Records	Percentage	TLCS	TGCS
People R China	167	4.30	75	1937
South Korea	126	3.30	78	2002
USA	115	3.00	71	1220
Saudi Arabia	100	2.60	99	1327
UK	71	1.80	48	908
Malaysia	62	1.60	10	676
South Africa	52	1.30	55	1030
Australia	51	1.30	15	623
Japan	48	1.20	58	387
Qatar	34	0.90	104	639

Figure 8 Ranking of Country wise Collaboration



Analysis of the Country wish collaboration

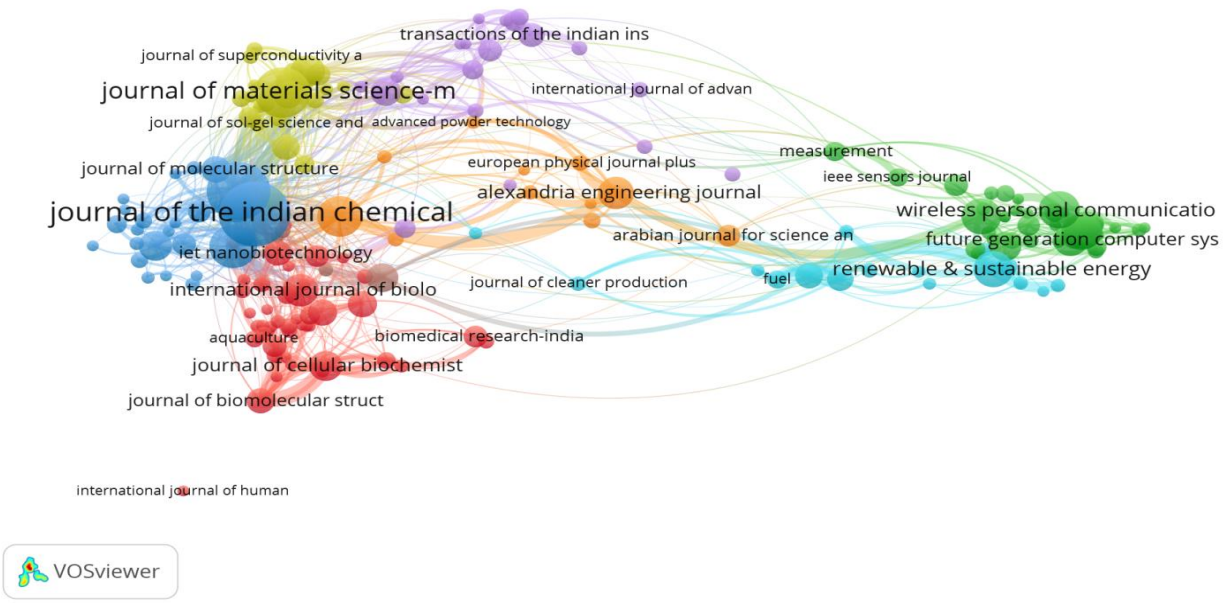
Table 8 and Figure 8 displays the Faculty of VIT University has collaborated with Peoples R China 167 (4.30%) publications followed by South Korea with 126 (3.30%) Publications, USA with 115 (3.00%) publications, SaudiArabia with 100 (2.60%) publications and UK with 71 (1.80%) publications. It also shows that VIT University has collaborated and contributed a good number of Articles with Malasiya, South Africa, Australia, Japan and Qatar.

Table 9 (a) Ranking of journal according to Bradford's Law

No of Journals	No of Publication	Cumulative No of Pub	Rank	Core
Journal of the Indian Chemical Society	95	95	1	I
RSC Advances	79	174	2	I
Journal of Materials science in Electronic	62	236	3	I
Journal of photo chemistry and photo chemistry and photobiology B-Biology	49	285	4	I
Journal of Molecular Liquids	44	329	5	I
Wireless personal Communications	38	367	6	I
3 journals with 36 Publication	108	475	9	I
1 journals with 34 Publication	34	509	10	I
1 journals with 31 Publication	31	540	11	I
1 journals with 30 Publication	30	570	12	I
2 journals with 29 Publication	58	628	14	I
1 journals with 27Publication	27	655	15	I
2 journals with 26 Publication	52	707	17	I

2 journals with 24 Publication	48	755	19	I
1 journals with 23 Publication	23	778	20	I
2 journals with 22 Publication	44	822	22	I
4 journals with 21 Publication	84	906	26	I
4 journals with 20 Publication	80	986	30	I
2 journals with 19 Publication	38	1024	32	I
4 journals with 16 Publication	64	1088	36	I
5 journals with 15 Publication	75	1163	41	I
4 journals with 14 Publication	56	1219	45	I
3 journals with 13 Publication	39	1258	48	I
6 journals with 12 Publication	72	1330	54	I
8 journals with 11 Publication	88	1418	62	II
7 journals with 10 Publication	70	1488	69	II
11 journals with 9 Publication	99	1587	80	II
22 journals with 8 Publication	176	1763	102	II
21 journals with 7 Publication	147	1910	123	II
29 journals with 6 Publication	174	2084	152	II
38 journals with 5 Publication	190	2274	190	II
58 journals with 4 Publication	232	2506	248	II
107 journals with 3 Publication	321	2827	355	III
220 journals with 2 Publication	440	3267	575	III
607 journals with 1 Publication	607	3874	1182	III

Figure 9 (a) Bradford's law of scattering of journals in VIT University



Ranking of journal according to Bradford's Law

Bradford's Law[12] describes a quantitative relationship between journals and the papers they publish. It explains that, only a small number of core journal will supply the nucleus of papers on a given topic, which accounts for a substantial percentage (1/3) of the articles to be followed by a second, larger group of Journals that accounts for another third, while a much larger group of journals picked up the last third. Bradford's did not give a mathematical model for his law. The models were suggested later by Brookers[13] and Leimkuhler[14] several authors while explaining the scattering of articles in journals have formulated many different models of Bradford's Law. Leimkuhler developed a model based on Bradford's verbal formulation as :
R (r) = a log (1+br) Gupta[15] has given the theoretical aspect of Bradford's Law and studied its applicability using the above method. According of Brookes to test the conformity of Bradford's Law. One should meet the following three implicit conditions:

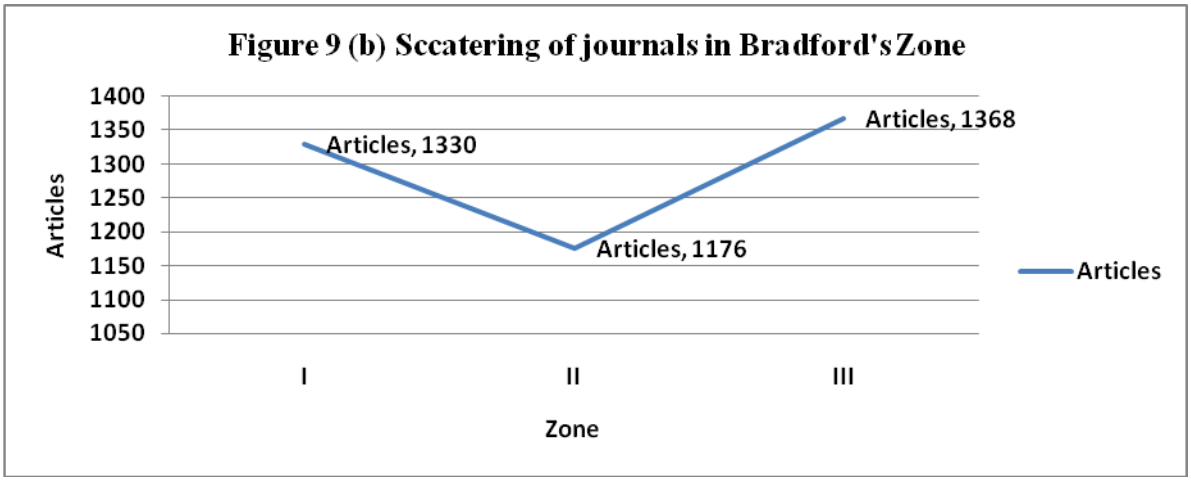
(i) In dividing the journals into zones, the number of articles in each zone must remain constant.
(ii)The Bradford multiplier k must be > 1.
(iii)The Bradford multiplier must remain approximately constant.

Core journals ranking studies are usually made to help in the selection of journals and assessing the importance of one or more journals in a particular subject field. The journals are arranged in their respective descending order of frequency. The journal contributing the largest number of articles is ranked as number one, next is ranked two and so on. Rank list of journals was prepared in Table 9 (a) total 35 ranks were awarded. Among these 'Journal of the Indian

Chemical Society' has first rank with 95 publications and followed by 'RSC Advances' with 79 publications, 'Journal of Material Science in Electronic' with 62 publications, 'Journal of photo chemistry and Photobiology B-Biology' with 49 publications, 'Journal of molecular liquids' with 44 publications and 'wireless personal communications' with 38 publications and so on.

9(b) Scattering of Journal in Bradford's Zone

Zone	Journals	Articles
I	54	1330
II	194	1176
III	934	1368



Scattering of Journal in Bradford's Zone

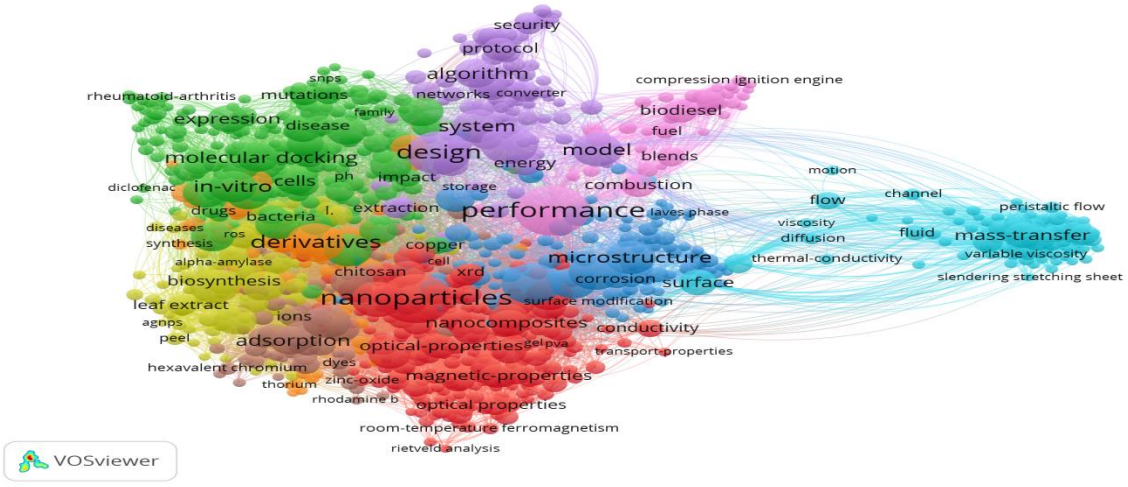
Table 9 (b) and Figure(b) There are 54 Journals listed in the zone I is observed as the core journals covering 1/3 of the articles i.e. 1330. The zone II covers 194 journals somewhat expanded zone covering next 1/3 of the articles i.e. 1176. The last and vast zone includes 934 journals which scatter about 1368 articles.

Table 10 Scattering of Keywords in Zipf's Law

S.No	Keywords	Frequency	Log of Frequency	Rank	Log of Rank	Log(c)
1	Using	503	6.22	1	0.00	6.52
2	Based	479	6.17	2	0.69	5.48
3	Synthesis	368	5.91	3	1.10	4.81
4	Properties	288	5.66	4	1.39	4.27

5	Nano Particles	254	5.54	5	1.61	3.93
6	Analysis	221	5.40	6	1.79	3.61
7	Effect	201	5.30	7	1.95	3.35
8	Applications	191	5.25	8	2.08	3.17
9	Optical	178	5.18	9	2.20	2.98
10	Characterization	172	5.15	10	2.30	2.85
11	System	169	5.13	11	2.40	2.73
12	Approach	166	5.11	12	2.48	2.63
13	Novel	164	5.10	13	2.56	2.54
14	Structural	147	4.99	14	2.63	2.36
15	Activity	146	4.98	15	2.71	2.27
16	Crystal	115	4.74	16	2.77	1.97
17	Performance	115	4.74	16	2.77	1.97
18	Review	115	4.74	16	2.77	1.97
19	Single	113	4.73	17	2.83	1.60
20	Efficient	112	4.72	18	2.89	1.83
21	Flow	107	4.67	19	2.94	1.73
22	Investigation	105	4.65	20	3.00	1.65
23	Energy	104	4.64	21	3.04	1.60
24	Molecular	104	4.64	21	3.04	1.60
25	Detection	101	4.61	22	3.09	1.52

Figure 10 Scattering of keywors and Zipf's law



Scattering of keywors and Zipf's law

Table 10 and Figure 10 Shows frequently used keywords in the research articles from VIT University. Top most words are shown in the table. Those words are listed in 25. The words are Ranked based on the Zipf's law that is 22 Ranks. Which are the first Rankin 'Using'. Second Rank is ' Based' followed by Synthesis (368), Properties (288), Nanopaticles (254), Analysis (221) and Effect (201) etc. Balance keywords are under 200 words. The 22 rank word is Detection (101). The table shows only above 100 Words.

Conclusion

Reputation and prestige of any institution greatly depend upon the research productivity and its impact. Scientometric analysis technique has emerged in the last few years and its fundamentally deals with the study of quantifying and analyzing science and technology and overall research performance of an Institution. The findings of the study are based on the data obtained from web of science. This article focuses on publishing trend authorship Pattern, Document wise Collaboration, Institutional wise Collaboration, Countries wise Collaborative, Collaboration of authors. The study has clearly brought out the increasing trends towards collaborative research. Hence this study will be useful for the VIT University to know the our research performance.

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