

Research Productivity of Sri Venkateswara University, Andhra Pradesh: A Scientometric Study

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Sri Venkateswara University is the second oldest in Andhra Pradesh and has produced several academicians, philosophers, scientists, philanthropists, etc. In terms of academic performance, research, and outreach, it has a unique place among Indian universities. The current study demonstrated Sri Venkateswara University's research productivity based on information gathered from research papers indexed in SCOPUS during 2012 to 2021. During the given time, 3,144 indexed publications were downloaded. The objective of the research is to examine publication growth, citations, authorship patterns, country participation, and affiliation. The key results imply that research output decreases after 2014 into negative side; C.K. Jayasankar Department of Physics with 160 publications occupied as prolific author, Journal of Luminescence with 54 publications occupied as productive publication; most of the prolific authors do not appear in the highly cited publications list; India is the leading contributor with 2268 publications, followed by South Korea with 156 publications; 'Article' and 'Non human' are two currently popular terms being used during the period.

Keywords: *Research productivity, Sri Venkateswara University, Scientometrics, Publication growth rate, Productive Authors, Scopus.*

1 INTRODUCTION

The scholarly quality of the research publications that are published in peer-reviewed journals is considered one of the most important performance indicators for evaluating the institution's research productivity. In the modern

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world, the university is one of the most important places for research and development, knowledge production, and communication channels. Faculty members at universities are encouraged to publish their contributions in reputed national and international journals and to put together research teams to publish. Universities publish their implicit research information in the form of journal articles, research reports, reviews, course materials, books chapters etc. In this saturation, the present study was undertaken to assess the research productivity of SVU

Sri Venkateswara University (SVU) was formed in 1954 in the holy temple town of Tirupati on a magnificent campus of 1,000 acres of land donated by Tirumala Tirupati Devasthanams (TTD) with a delightful hill view. At its inception, six departments, namely Physics, Mathematics, Botany, Philosophy, Zoology, Economics and Chemistry comprised the university. There are now 54 departments, within these departments, 72 different post-graduate courses, several doctoral degrees, and a number of diploma and certificate courses are taught. The University Library is a capacious structure with the collection of 2,950,000 books and almost 35000 bound volumes and almost 3500 theses and dissertations. The University has achieved an 'A+' grade from the NAAC with a score of 3.52 out of 4. Its growth over the previous 60 years has been remarkable, it has been placed between 801-1000 on the global institutions by the Times higher Education World Ranking rang between 201-250 by the Asia University Rankings in 2020, and the National Institutional Ranking Framework (MHRD, Govt. of India) assigned in the 68th position to university. Sri Venkateswara University has produced the chief ministers, administrators, businessmen, renowned authors, doctors, distinguished scientists, and academicians. The present research endeavours to assess the Scopus-indexed research articles of the university.

2 LITERATURE SURVEY

The following lines provide an overview of a few studies on the research output of Indian institutions. Santhakumar(2020)¹ studied the Madras University's research output for ten year from 2009 to 2018. There were a total of 3,283 downloads from the web of science. The study analysed a changing relationship between publication growth and productivity. The researchers are preferred to publish their contributions in journal. With 165 articles, "ACTA Crystallographica: Section E Structure Reports" topped in the list. The researchers worked worldwide with 69 nations, and 30.32 % of Madras University research articles were published in chemistry-related journals.

Sunil Kumar Yadav. (2020)² studied the Indian Citation Index to examine the research output of Mizoram University for fourteen years, from 2004 to 2017. The key result suggested that the annual research production average is

18.93 articles. UK Sahoo, Department of Forestry, was the most prominent author with 25 articles. Current Science topped the list with 16 publications. The Biological Sciences published 54 publications, and the Mizoram University researchers preferred to publish research articles. The average collaborative index, modified collaboration coefficient and collaboration coefficient, Degree of Collaboration are 2.78, 0.51, 0.79 respectively.

Monda et al. (2019)³ evaluated the research contribution of the Indian Association for the Cultivation of Science researcher during 2008-2017 by using the web of science. The investigation uncovered the global collaboration in 22.58 percent of the 4304 publications retrieved. Most of the researchers like to publish in journal articles, while international collaboration pieces were the ones that get the most citations. The United States, Japan, Germany, and England were the most preferred countries for collaboration. For the study, the 80/20 rule was used to figure out how scholarly publications and papers were spread out.

Siwach and Parmar((2018)⁴ investigated the publication trends of CCS Haryana Agricultural University, Hisar, over a fifteen-year period from 2001 to 2015, divided into three five-year time slots, a total of 2649 papers were retrieved and 15282 citations were obtained. With 2038 articles, Agricultural and Biological Sciences was the topic with the most prominence during the study period. The College of Veterinary Science is a leading collaborating institution with 141 publications. The annals of biology, with 325 articles, was the prolific publication and N Khetarpaul, Department of Food and Nutrition was the most prominent author throughout the research period with 63 publications. During the time of the study, the cooperation coefficient was found to be 0.668%, which shows that there is a lot of cooperation between researchers.

Bhakta and Bhui(2018)⁵ analyzed the research productivity of University of Petroleum and Energy, Dehradun for ten years during 2008-2017. A total of 892 articles were retrieved, 54.82 percent of which were academic journals and conference proceedings. The study found that the International Journal of Applied Engineering Research (IJAER) was the most popular publication and Kumar, A was the prolific author, with far more publications. UPES is active in all areas of research, including their efforts to work together, in publications, and in citations, among other research activities.

Gautam and Mishra(2015)⁶ analysed the research output of Banaras Hindu University(BHU) during 2004-2013 by using Indian Citations Index (ISI). A total of 1041 publications were retrieved, during the above period. It was determined that the publishing growth rate was rising at an average rate of 104.1 and that joint authors contributed to publications. A. K. Singh of the Department of Physics, with 18 publications, was the most prolific author. Journal articles (60) have collaborated with 18 nations throughout the globe,

with the United States was the most collaborative, and the Indian Agricultural Research Institution was the most collaborative Institution. Current Science was the published most of articles with 25, and the trend of having more than one author was seen throughout the research period.

3 OBJECTIVES

The objectives of the study are as follows:

- (i) To analyse the publication output of Sri Venkateswara University research literature indexed in 'SCOPUS' from 2012 to 2021.
- (ii) To examine the forms of research publications of the SVU
- (iii) To find out the most prominent authors and prominent journal publications from SVU
- (iv) To identify the highly cited papers of the SVU
- (v) To examine the contributing countries that collaborate with the SVU
- (vi) To identify the key word distribution of the publications.

4 METHODOLOGY

The main aim of the research is to examine the research publications of Sri Venkateswara University that are indexed in the Scopus database in Bibtex format between 2012 and 2021. The search string used to extract data is:

(AFFILORG (sri AND venkateswara AND university) AND AFFILCITY (Tirupati)

AND AFFILCOUNTRY (India)) AND PUBYEAR > 2012 AND PUBYEAR < 2021

The search was restricted to ten years of publications affiliation under the Sri Venkateswara University (accessed on April 15, 2021). 3144 publications were downloaded in total. R Platform Bibliometrix package was used to analyse to retrieve data, while an Excel spreadsheet is utilised to tabulate the findings. The 'VOSviewer' software was utilised for visualisation purposes. The data was examined in accordance with the study goals. To calculate the yearly growth rate of publications using the following formula:

$$AGR = \frac{\text{EndValue} - \text{FirstValue}}{\text{FirstValue}} \times 100$$

The research extracted metrics directly from the downloaded data, i.e., Total Papers, Highly Cited Papers, Total Citations, Citations per Paper, Average Citations Papers, H-Index and G-Index. Calculating the average number of citations per paper involves dividing the total numbers of citations received by the total of publications. For country-wise productivity, the full counting method was utilised, i.e., if a research publication has two authors, one publications count is attributed to each of the contributing countries.

5 DATA ANALYSIS AND INTERPRETATION

Year-Wise Research Publications Growth

The distribution of research output, annual growth rate, and citations received are given in Table 1

Table 1: Research Publication Growth of SVU

Year	Publications	%	Annual Growth Rate	Citations	CPP
2012	358	11.39	0	3062	8.55
2013	377	11.99	0.05	3351	8.89
2014	382	12.15	0.01	2494	6.53
2015	350	11.13	-0.08	2009	5.74
2016	343	10.91	-0.02	2487	7.25
2017	310	9.86	-0.10	1735	5.60
2018	291	9.26	-0.06	1293	4.44
2019	282	8.97	-0.03	852	3.02
2020	247	7.86	-0.12	720	2.91
2021	204	6.49	-0.17	113	0.55
	3144	100.00		18116	5.76

CPP = Citation per Paper

It is seen from table 1 that top CPP has been recorded in 2013 with 3351(8.89%), 2021 least citations received with 113(0.55%), an average of 5.76% during the study period. During 2013, the maximum Annual Growth rate of research production was 0.05%, after 2014 gradually decline the growth rate into the negative side. The topmost publication recorded in the year 2014 and the least research publication recorded in 2021. It evident that publication growth of first five years is increasing trend, but in 2016 publications has declined to negative side recorded.

5.1 TYPE OF DOCUMENTS

The distribution of various types of research publications and citations received are shown in Table 2

Table 2. Types of Research Publications

Document Type	Publications	%	Citations	ACPP
Articles	2684	85.37	14311	5.33
Book	1	0.03	0	0.00
Book Chapter	57	1.81	148	2.60
Conference Paper	291	9.26	905	3.11
Data Paper	2	0.06	26	13.00
Editorial	2	0.06	7	3.50
Erratum	9	0.29	10	1.11
Letter	11	0.35	125	11.36
note	11	0.35	152	13.82
Retracted	2	0.06	100	50.00
Review	67	2.13	2207	32.94
Short Survey	7	0.22	125	17.86
Total	3144	100	18116	

ACPP: Average Citation per Paper

It is evident from Table 2 that the highest publication are the articles 2684 (85.37 %), followed by Conference Papers with 291 (9.26%) records, Reviews with 67 (2.13%) records, Book Chapters with 57 (1.81 %) records, letters with 11(0.37), notes with 11 (0.35%) records. Articles are received lion share citations with 14311 followed by review with 2207 and conference papers with 905 among all document types. However, retracted publications received more citations 50.00 among all other types of publications, followed by a review with 32.94, short Survey with 17.86. The study found that Journal articles are preferred publications by researchers, most of the citations received by articles, reviews and conference papers,

52 AUTHOR-WISE RESEARCH DISTRIBUTION

The research distribution of publications of prominent authors and citations received, H-Index, Average citations per papers, and international collaborations are shown in Table 3

Table 3: Top Prominent Authors from the university publications

Author	Department	Publication	Citations	H-index	ACPP	International Collaboration Papers
Jayasankar, C.K.	Department of Physics	158	146	34	23.1	66
Sugunamma, V.	Department of Mathematics,	67	41	25	33.85	3
Sandeep, N.	Department of Mathematics,	66	40	25	34.4	4
Ratnakaram, Y.C.	Department of Physics	64	60	21	18.15	18
Deva Prasad Raju, B.	Department of Physics	58	31	20	31.47	11
Rao, J.L.	Department of Physics	55	53	19	15.56	51
Madhavi, G.	Department of Chemistry	54	43	18	18.75	12
Rajagopal Reddy, V.	Department of Physics	51	66	18	13.45	32
Rama Moorthy, L.	Department of Physics	50	26	17	29.96	5
Linganna, K.	School of Electrical Engineering and Computer Science, South Korea	49	25	17	26.23	49
Venkatramu, V.	Department of Physics	48	35	17	21.54	15
Vijayalakshmi, R.P.	Department of Physics	42	48	17	19	20
Murali, G.	Department of Physics	41	28	16	22.64	15
Choi, C.-J.	Chonbuk National University, South Korea	39	50	16	13.61	39
Hussain, O.M.	Department of Physics	36	25	16	12.12	21
Dillip, G.R.	Yeungnam University, Gyeongsan, South Korea	33	52	16	26.59	33
Sreenadh, S.	Department of Mathematics	30	32	16	9.39	15
Reddy, V.R.	Department of Physics	27	53	15	12.76	30
Reddy, P.S.	Department of Zoology	25	43	15	19.18	6
Basavapoornima, C.	Department of Physics	24	48	15	21.54	13

ACPP: Average Citation per Paper

Table 3 shows the most prolific author's research output, a total of 6307 authors participated in university research publications, including overseas authors. 1.51 is the average number of authors per article. It is clear that Dr. Jayasankar CK, Department of Physics, occupied the first rank with 158 publications followed by Sugunamma V, from the Department of Mathematics, who holds the second rank with 67 publications, Dr. Sandeep N, also from the Department of Mathematics, who holds the third position with 66 publications, Dr. Ratnakaram Y.C, from the Department of Physics, who holds the fourth position with 64 publications. The Physics and Mathematics departments at the university's Science Campus have contributed considerably to the overall

research publications. It is clear that the top 17 authors are from the university science departments. On the other hand, the type of cooperation among the department of Physics and Mathematics most prolific authors demonstrates that local collaboration is greater than worldwide collaboration. However, the university's collaboration index is 1.52, and the physics department faculty are among the top thirteen writers, quite strong contribution. The h-index ranged from 15 to 34 for the 20 prolific authors at University, with an H-Index average of 18.65. Dr. Jayasankar CK from the Department of Physics has the highest H-Index with 34, followed by Dr. Sugunamma V and Sandeep N from the Department of Mathematics with 25 and Dr. Ranthakaram YC from the Department of Physics with 21. Table 3 shows that among the top twenty authors, three international authors, who have contributed under university affiliations, Linganna K was tenth with 49 publications, Choi, C-J was fourteenth with 39 publications, and Dellip G.R was sixteenth with 33 publications.

53 PREFERENCE OF JOURNALS FOR PUBLICATIONS

The distribution of research publications and citations received, G-Index, and impact factor are shown in Table 4

Table 4: Top Ten Ranked Publications

Name of the Journal	Publications	H_Index	G_Index	Citations	Country	Citescore 2020
Journal of Luminescence	54	26	37	1593	Netherland	6.1
Spectrochimica Acta-Part A: Molecular and Bimolecular Spectroscopy	43	23	36	1809	Netherland	5.8
Optical Materials	38	22	34	1243	Netherland	4.8
Journal of Alloys and Compounds	36	21	34	1223	Switzerland	8.9
Ceramics International	33	19	27	795	England	6.9
Journal of Molecular Structure	30	16	26	700	Netherland	4.6
Physica B: Condensed Matter	26	15	22	592	Netherland	4
European Journal of Medicinal Chemistry	26	14	17	740	France	9.8
Journal of Molecular Liquids	24	14	22	528	Netherland	4.6
Journal of Non-Crystalline Solids	22	12	19	534	Netherland	5.6
Materials Research Bulletin	22	12	14	327	United Kingdom	8.4
3 Biotech	19	11	18	360	Switzerland	3.5
Applied Nanoscience	19	11	13	435	Switzerland	3.7
Applied Physics A: Materials Science and Processing	18	11	13	198	USA	3.5
Medicinal Chemistry Research	17	11	14	273	USA	3.5
Arabian Journal of Chemistry	16	10	15	349	Saudi Arabia	9.4
RSC Advances	16	10	16	334	United Kingdom	5.9
Superlattices and Microstructures	15	10	15	239	USA	5
Journal of Electronic Materials	14	9	14	222	USA	3.3
Journal OF Materials Science: Materials in Electronics	13	9	13	226	USA	4

Table 4 reveals that the Journal of Luminescence ranked top with 54 contributions from the university. The second place was occupied by Spectrochimica Acta-Part A: Molecular and Bimolecular Spectroscopy with 43 articles and third position was occupied by Optical Materials with 38 publications. The top 20 publications are also published in journals with impact factors ranging from 9.8 to 3.3. It indicates that researchers are preferred to publish in journals with a high impact factor. In addition, the distribution of the top 20 journals by countries reveals that the Netherlands has published 237 articles in seven journals that have garnered 6,999 citations. The United States has published 77 articles in five journals that have earned 1158 citations, followed by Switzerland with 74 articles in three journals that have received 2018 citations and England with 71 articles in three journals that have received 1456 citations. It is evident that scholars prefer publishing their research publications in foreign journals.

**54 MEASURES OF THE COLLABORATION OF RESEARCH PRODUCTIVITY
(BY PUBLICATION COUNT)**

The distribution of research collaborations, citations received, country participation, and Average Article Citations are shown in table 5

Table 5: Country-wise Distribution of University

Country	Publications	%	Citations	%	Average Article Citations
South Korea	156	4.96	2752	15.19	5.67
USA	30	0.95	434	2.40	6.91
China	29	0.92	525	2.90	5.52
Malaysia	26	0.83	538	2.97	4.83
South Africa	20	0.64	200	1.10	10.00
Portugal	11	0.35	131	0.72	8.40
United Kingdom	11	0.35	190	1.05	5.79
Italy	8	0.25	115	0.63	6.96
Mexico	8	0.25	176	0.97	4.55
Thailand	8	0.25	55	0.30	14.55
Spain	6	0.19	142	0.78	4.23
France	5	0.16	57	0.31	8.77
Saudi Arabia	5	0.16	156	0.86	3.21
Brazil	4	0.13	60	0.33	6.67
Greece	4	0.13	93	0.51	4.30
Australia	3	0.10	60	0.33	5.00
Canada	2	0.06	3	0.02	66.67
Poland	2	0.06	29	0.16	6.90
Turkey	2	0.06	17	0.09	11.76
Belarus	1	0.03	1	0.01	100.00

International Collaboration

Table 5 shows that researchers have collaborated on publications with 109 countries citations wise, with South Korea and the United States leading the list of the top 20 countries with their dominant publication shares (4.96 percent and 0.95 percent, respectively), followed by China (0.92 percent), Malaysia (0.83 percent), and sixteen other countries (from 0.64 percent to 0.06 percent, respectively) between 2012 and 2021. Therefore, in terms of citations, South Korea and Malaysia have an international partnership with appealing citations. While observing, Belarus (100%) was followed by Canada (66.67%) and Thailand (14.55%) in obtaining AAC more citations with fewer articles than other nations. India, on the other hand, had 2268 publications and a 12.59 percent average article citation score. During the time period, 10.84 percent of publications and 31.65 percent of citations came from the top 20 countries. There were a total of 28 countries contributions. But showed uneven distribution: 15 countries contributed 1-4 papers, 09 countries 5-20 papers, 4 countries 26-156 got highest publication papers. The 20 most productive countries produced 1 to 156 papers during 2012-2021.citations wise contributions, 59 countries contributed 1-4 papers, 32 countries contributed 5-20, 18 countries contributed 27-501 and highest citations contributed by India 6560 citations.

55 HIGHLY CITED PAPERS

The distribution of highly-cited papers, citations received are shown in table 6

Table 6: Highly Cited Publications from the SVU

S.No	Title	Citations
1	Fungal laccases and their applications in bioremediation	230
2	Biobased green method to synthesis palladium and iron nanoparticles using Terminalia chebula aqueous extract	228
3	The use of an agricultural waste material Jujuba seeds for the removal of anionic dye(Congo Red) form aqueous medium	223
4	Trends in dairy and non-dairy probiotic products - a review	200
5	A fast DBSCAN clustering algorithm by accelerating neighbor searchin using Group Method	174
6	Optimization of Cd(II),Cu(II) and Ni(II) biosorption by chemically modified Moringa oleifera leaves power	170
7	Green Synthesis and characterization of Silver Nanoparticles using Lantana Camera leaf extract	155
8	Synthesis of Silve Nanoparticles (Ag NPs) for anticancer activities (MCF 7 breast and A549 lung cell lines) of the crude extract of Syzgium aromaticum	144
9	Heat and Mass Transfer in Magneto hydrodynamic Casson fluid over an exponentially permeable stretching surface	140
10	Structural & Luminiscence properties of Dy ³⁺ ion in strontium lithium bismuth borate glasses	140

10 out of 3144 global papers on SVU research registered comparatively higher citations: 230 to 140 citations (Table 6). These 10 papers together contributed 1804 citations. 3 papers depict sole institution participation (zero collaboration), 1 papers are an international collaboration with Korea Advance Institute, South Korea 6 involving national collaboration with Vellore Institute, CSIR-CFTR, Vels university, Nehru memorial college, Gulbraga University, University of Hyderabad among 10 highly-cited papers. Amongst ten highly cited publications published in research journals: Enzyme research, Spectrochimica Acta-Part A:Molecular and Bimolecular Spectroscopy, Journal of Hazardous Materials, Pattern recognition, Carbohydrate Polymers, Material Science Engineering, Journal of Food Science & Technology Journal of Photochem Photobiol, International Journals of Engineering Science and Technology, Journal of Luminescence (1 paper each).

**56 TOP TEN COLLABORATIONS IN COLLABORATIVE RESEARCH
ACTIVITIES OF THE UNIVERSITY**

Table 7: Top Ten Collaborations of SVU

S.no	Name of the institution	Publications	%
1	Sri venkateswara veterinary university	227	7.22
2	Yogi vemaana university	104	3.31
3	Sri venkateswara university college of engineering	92	2.93
4	Yeungnam university	89	2.83
5	Vit university	77	2.45
6	Chonbuk national university	69	2.19
7	National atmospheric research laboratory	62	1.97
8	Ural federal university	57	1.81
9	College of veterinary science	47	1.49
10	Sri krishnadevaraya university	42	1.34
Total		866	27.54

Table 7 demonstrates the university's collaboration tendencies. Out of 3144 records, 227 are authored in collaboration with Sri Venkateswara Veterinary University, followed by Yogi Vemana University with 104 publications, Sri Venkateswara College of Engineering with 92 publications, VIT University with 77 articles, and Yeungnam University (South Korea) with 69 articles. The remaining partnerships are with other notable institutions of national prominence.

- 994 sources took part in SVU research during 2012-21, but showed uneven distribution: 562 contributed 1 paper each, 313 sources published 02-05 papers, 58 sources 06-10 papers, 71 sources 11-82 papers. The 10 most productive journals produced 30 to 82 papers during 2012-2021.

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Fig 1 shows that the Sri Venkateswara University top ten subject keywords during 2012-2021. Out of 18325 keywords, "Article" keyword is secured top rank with 757 (4.65 %), followed by "Nonhuman" with 468 (2.69 %) occupied the second position, "Controlled Study" with 447 (2.61 %) secured the third rank, "Unclassified Drug" got the fourth rank with 407 (2.22 %) keywords and least rank term is "Tons" with 194 (1.0 %) among top ten keywords.

6 MAJOR FINDINGS

The following are the study's key findings:

- (i) A significant publication growth is found in 2014 with 382(12.15%) after gradually decline the growth rate on the negative side.
- (ii) The majority of the university's research contributions (85.37 percent) are published as journal articles.
- (iii) Journal of Luminescence occupied the first position with 54 publications; authors are preferred to publish their content at an international level with a good impact factor.
- (iv) Dr. Jayasankar CK is a prolific author with 158 published articles, an amazing h-index of 34, and an exceptional international cooperation of 66 contributions. Physics departments published quite well on an international scale.
- (v) The university has collaborated with 109 countries South Korea occupied the second position after India with respective research publications.

7 SUMMARY AND CONCLUSION

The current study aimed to investigate Sri Venkateswara University's publishing patterns by analysing its SCOPUS-indexed research papers. The present analysis indicates that publication growth has advanced in terms of academic literature, after 2014 growth rate decline into negative territory. Science departments have a significant role in terms of university research production. In terms of publications and citations, the university's output has seen a significant increase throughout the years. Faculty members enjoy having their work published in national and international publications. Global scientific cooperation with leading organisations is visible. Sri Venkateswara University values Journal of Luminescence, Spectrochimica Acta-Part A: Molecular and Bimolecular Spectroscopy and optical materials among others, as its most favoured journals.

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