

# Research Performance of Sri Sivasubramaniya Nadar College of Engineering, Chennai, Tamil Nadu, India

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**Abstract.** The research performance of Sri Siva Subramaniya Nadar College of Engineering, a major technical college in Chennai, Tamil Nadu, India, was investigated in this report. The study's goals are to assess Sri Siva Subramaniya Nadar College of Engineering's numerous scientific research factors in order to plan for the future. Using SCOPUS data from 2003, this study examines and visualises scholarly articles from Sri Siva Subramaniya Nadar College of Engineering. Measurement of research performance can be done in a variety of ways, both qualitative and quantitative. Several Publications were used in this study, which were categorised by author, institution, nation, and year, as well as document type, subject area, and number of citations. VOS Viewer and R Tool were used to examine the relative growth rate, doubling time, and coauthor activity index. In the recent year, Sri Siva Subramaniya Nadar College of Engineering has outperformed other engineering colleges in Tamil Nadu in terms of research production. It also cooperated with Chennai's Anna University. For their research projects, the United States is the most common collaborator. Furthermore, the Department of Science and Technology has mostly funded this institution's research operations. According to the findings of this study, publishing in top-ranked journals increases the chances of receiving more citations. Only papers that are indexed in SCOPUS were examined for the investigation. As per SCOPUS editorial policy, it only covered a small number of sources. Journals and conference proceedings make up the majority of the sources covered. The majority of the academic departments at Sri Siva Subramaniya Nadar College of Engineering are in the Engineering and Technology disciplines, making it a technology-based college.

**Keywords:** Scientometrics, Research impact, Relative Growth Rate, VOS Viewer, Research performance, SSN College of Engineering, Chennai

## 1 Introduction

The Sri Siva Subramaniya Nadar College of Engineering in Chennai is one of Tamil Nadu's most prestigious technical colleges. Research output and citations are also important elements in various agencies' rankings of institutions. As a result, a study analysing various aspects of Sri Sivasubramaniya Nadar College of Engineering research works and comparing them to peer universities across the country is critical in assisting the institution in developing research planning and funding strategies. Using SCOPUS, an Elsevier citation database, this study did scientometric analysis and visualization of the scholarly publications of Sri Siva Subramaniya Nadar College of Engineering, Chennai. VOS Viewer was used to analyse and visualise citation networks in the study. The findings of this study are likely to aid Sri Siva Subramaniya Nadar College of Engineering in gaining a better knowledge of the research impact of its publications

and in developing research policies and strategies for boosting the institution's visibility and citation impact.

Vasistha (2011) examined the scientific publishing production of the PEC University of Technology, Chandigarh, and discovered a 131.85% rise in output from 1996 to 2009. Savanur and Konnur (2012) examined Bangalore University's research output from 1970 to 2010 and discovered that the growth rate of publications was highest between 1996 and 2000, with a slow decline after 2001. Maharana and Sethi examined Sambalpur University's publishing output from 2007 to 2011 and investigated the institution's numerous scientific characteristics. Arumugam et al. (2019) examined the Scholarly Research Output of Indian Institutes of Management (IIMs) and discovered that the faculty of IIM Ahmedabad contributed significantly, with 85.3 percent of publications.

## **2 Aim and Objectives of the Study**

The primary goal of this research was to examine Sri Sivasubramaniya Nadar College of Engineering's research production trends and identify areas of growth in order to assist the school in developing research plans to meet future needs.

The following are the objectives of the study

- To find out the chronological growth of research publication output
- To explore the various types of publication.
- To identify the most productive authors and authorship patterns.
- To find out major research areas of the university in terms of published works.
- To find out the impact of international collaborations and source of publications on received citations.

### 3 Methodology

The Scopus database was used to gather information on the publication output of SSN College of Engineering from 2003 to 2020. As an Elsevier-produced product, it provides abstracts and bibliographic data on peer-reviewed literature in science, technology, medicine, social sciences and the arts and humanities from over 5,000 publishers. Bibliographic data, references, and citation counts for each published document are all included in the bibliographical data for each author. An author's and an institution's h-index can be calculated using this software. Visualisation graphs were created using SCOPUS data by using VOS Viewer, a tool for domain visualisation. As a result, the VOS Viewer is capable of displaying various bibliometric and citation analysis matrices in various ways.

### 4 Limitations Of The Study

Only papers that are indexed in SCOPUS were examined for the investigation. As per SCOPUS editorial policy, it only covered a small number of sources. Journals and conference proceedings make up the majority of the sources covered. The Citation Index data coverage of books is rather poor, and the bulk of academic departments are in the engineering and technology sectors.

#### Analysis

##### Type of Resources

The graph below clearly illustrates that there are more articles published in subscribed resources than open access platforms, indicating that there is a lack of awareness regarding open access publishing among teachers in technical universities.

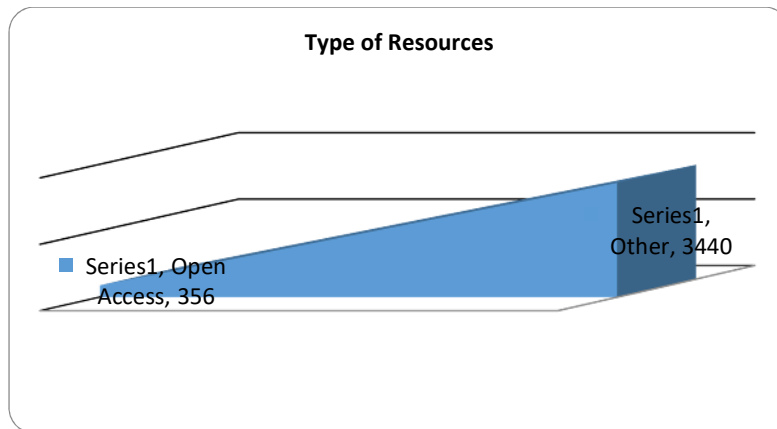


Figure 1. Type of Publishing Resources

### Chronological Growth of Publications

Table 1 demonstrates a considerable growth in publication beginning in 2003 with 6 publications and ending in 2019 with 595 (15.67%) publications, followed by 2018 and 2017 with 524 (13.8%) and 421 (11.09%) publications, respectively. The output in the last ten years, from 2011 to 2020, comprises 3394 (89.40 percent) of the total of 3796 publications in 18 years (2003 to 2020).

Year Range	Year		Total Publication
	No of Publication	Percentage	
2003-2010	402	10.59009	3796
2011-2020	3394	89.40991	

**Table 1. Year-wise Output of Publications**

### Relative Growth Rate [R(a)]

The rise in the quantity of publications in one year, is known as the relative growth rate. The following equation proposed by Mahapatra can be used to calculate the mean relative growth rate  $R(1-2)$  over a specific period of the interval:

$R(1-2)$  = Mean relative growth rate over a specific period of the interval;

$W1$  = Log  $W1$  (Natural log of the initial sum of publications at the beginning);

$W2$  = Log  $W2$  (Natural log of the initial sum of publications at the end);

$T2 - T1$  = Unit difference between the beginning and end time.

Table 2 shows the  $R(a)$  &  $D(t)$  of SSN College of Engineering's publishing output, and the findings demonstrate that there were not a lot of publications until 2008, compared to the previous ten years. The rate of relative growth varies between 1.79 and 0.88. The average rate of relative growth is 0.46.

### Doubling Time (DT)

The following formula, proposed by Mahapatra, can be used to calculate the doubling time for publishing. As a result, the doubling time for SSN College of Engineering's publishing output increased from 2007(1.07) to 20.87 in 2020. At the aggregate level, the doubling time for publications has been calculated to be 1.2 years. The number of publications of SSN College of Engineering's research output has been steadily increasing, however its Doubling Time is showing an increasing trend because the pace of rise is significant.

Year	No. of Records	Cumulative	log W1	log W2	RGR	Doubling Time
2003	6	6	0.00	1.79	1.79	0.39
2004	4	10	1.79	2.30	0.51	1.36
2005	10	20	2.30	3.00	0.69	1.00
2006	28	48	3.00	3.87	0.88	0.79
2007	44	92	3.87	4.52	0.65	1.07
2008	70	162	4.52	5.09	0.57	1.22
2009	108	270	5.09	5.60	0.51	1.36
2010	132	402	5.60	6.00	0.40	1.74
2011	203	605	6.00	6.41	0.41	1.70
2012	220	825	6.41	6.72	0.31	2.23
2013	246	1071	6.72	6.98	0.26	2.66
2014	311	1382	6.98	7.23	0.25	2.72
2015	396	1778	7.23	7.48	0.25	2.75
2016	354	2132	7.48	7.66	0.18	3.82
2017	421	2553	7.66	7.85	0.18	3.85
2018	524	3077	7.85	8.03	0.19	3.71
2019	595	3672	8.03	8.21	0.18	3.92
2020	124	3796	8.21	8.24	0.03	20.87

**Table 2 Relative Growth Rate and Doubling Time**

**Annual Growth Rate (AGR)**

This is one of the indicators of Annual Growth Rate (AGR) for each year. The formula for AGR is: **AGR** = (Ending Value Beginning Value) / Beginning value

The formula for AAGR is: **AAGR** = (Growth Rate in Period A + Growth Rate in Period B + Growth Rate in Period C + ...Growth Rate in Period X) / Number of Periods

S.No	Year	No of Publications	ARoG	AGR
1.	2003	6		
2.	2004	4	0.667	-0.333
3.	2005	10	2.500	1.500
4.	2006	28	2.800	1.800
5.	2007	44	1.571	0.571
6.	2008	70	1.591	0.591
7.	2009	108	1.543	0.543
8.	2010	132	1.222	0.222
9.	2011	203	1.538	0.538
10.	2012	220	1.084	0.084
11.	2013	246	1.118	0.118
12.	2014	311	1.264	0.264
13.	2015	396	1.273	0.273
14.	2016	354	0.894	-0.106
15.	2017	421	1.189	0.189
16.	2018	524	1.245	0.245
17.	2019	595	1.135	0.135
18.	2020	124	0.208	-0.792

**Table 3 Annual Ratio of Growth and Annual Growth Rate**

2006 (1.800) has the greatest AGR, followed by 2005 (1.500) and 2008. (0.591). In 2012, the AGR was at its lowest (0.084). In terms of negative growth rates, the year 2016 had an AGR of -0.106, which was followed by -0.333 in 2004. During the study period, the AGR of SSN College of Engineering research output fluctuated.

## 5 Document Type Distribution

Table 4 reveals that the faculty of SSN College of Engineering preferred to publish their research findings in the form of journal papers (2192, or 57.74 percent). They've also presented their works in 1437 conferences (37.85%). In addition, they have published 39 (1.03 percent) review papers. Other sorts of publishing are book chapter 97 (2.55%), books (4 of 0.104 percent), and others. Short survey, editorial, and other forms are still available.

S.No	Document Type	No of Publications	Percentage (%)
1	Article	2192	57.74
2	Conference Paper	1437	37.85
3	Book Chapter	97	2.55
4	Review	39	1.02
5	Editorial	8	0.21
6	Erratum	6	0.15
7	Book	4	0.10
8	Letter	3	0.07
9	Data Paper	2	0.05
10	Note	2	0.05
11	Short Survey	1	0.02
12	Undefined	5	0.13

**Table 4. Type of Documents**

**Predominant Authors of the Institution**

Table 5 shows that Ramasamy, P. is the most prolific author, with 417 (10.98%) publications, followed by Radha, S., with 134 (3.53%) publications. The table below shows the top 20 writers ranked by number of publications.

S.No	Author	No of Publications	Percentage (%)
1	Ramasamy, P.	417	10.98
2	Radha, S.	134	3.53
3	Senthil Kumar, P.	101	2.66
4	Amutha, R.	75	1.97
5	Ramaprabha, R.	74	1.94
6	Rajini, V.	70	1.84
7	Srinivasan, R.	65	1.71
8	Sreeja, B.S.	62	1.63
9	Kumar, P.S.	60	1.58
10	Vishvakshenan, K.S.	59	1.55
11	Kamaraj, V.	55	1.44
12	Rajesh, N.P.	53	1.39
13	Pandian, M.S.	52	1.36
14	Vijayalakshmi, P.	52	1.36
15	Muthu, R.	50	1.31
16	Nagarajan, T.	50	1.31
17	Rajesh, P.	50	1.31
18	Senthil Pandian, M.	49	1.29
19	Seyezhai, R.	48	1.26
20	Kanagasabai, M.	46	1.21

**Table 5: Ranking of Authors**

### Authorship Pattern

Table 6 reveals that 3678 papers were written in collaboration. Articles by two authors (1260 with CAI 239.12) are followed by collaborative papers by more than two authors (2418 with CAI 85.03). Single authors contributed 118 articles (CAI 27.75).

Co-Authorship Index							
Year	Single Author	CAI	Two Authors	CAI	More than Two Authors	CAI	Total
2003	0	0.00	3	360.20	3	66.74	6
2004	1	223.15	0	0.00	3	100.11	4
2005	1	89.26	2	144.08	7	93.44	10
2006	0	0.00	6	154.37	22	104.88	28
2007	3	60.86	9	147.35	32	97.08	44
2008	4	51.01	26	267.57	40	76.28	70
2009	5	41.32	42	280.15	61	75.39	108
2010	9	60.86	51	278.33	72	72.81	132
2011	5	21.99	89	315.84	109	71.67	203
2012	11	44.63	85	278.33	124	75.24	220
2013	5	18.14	99	289.91	142	77.05	246
2014	12	34.44	110	254.80	189	81.12	311
2015	12	27.05	154	280.15	230	77.53	396
2016	17	42.87	117	238.10	220	82.96	354
2017	11	23.32	130	222.45	280	88.78	421
2018	9	15.33	139	191.10	376	95.78	524
2019	12	18.00	162	196.14	421	94.45	595
2020	1	7.20	36	209.15	87	93.65	124
<b>Total</b>	118	27.75	1260	239.12	2418	85.03	3796

**Table 6. Authorship Pattern**

### Degree of Collaboration

It is the measure in extent of collaboration and lies amongst 0 & 1.

$$C = Nm/Nm+Ns.$$

C: Degree of Collaboration

Nm: Number of multi-authored publications

Ns: Number of single-authored publications

Hence  $C = 0.95$  Hence, it is found that the degree of collaboration of publications of SSN College of Engineering faculty is 0.95.

### Pattern of Co-Authorship

To assess CAI, it is represented through Garg and Padhi as.

$$N_{ij}/N_{io} \text{ CAI} = \text{-----} N_{oj}/N_{\infty}$$

Where,  $N_{ij}$  = Number of papers having authors in block  $i$

$N_{io}$  = Total output of block  $i$

$N_{oj}$  = Number of papers having  $j$  authors for all blocks

$N_{\infty}$  = Total number of papers for all authors and all blocks

Hence CAI= 27.75 for a single author, 239.12 for two authors, 85.03 for multiple authors

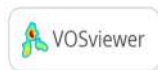
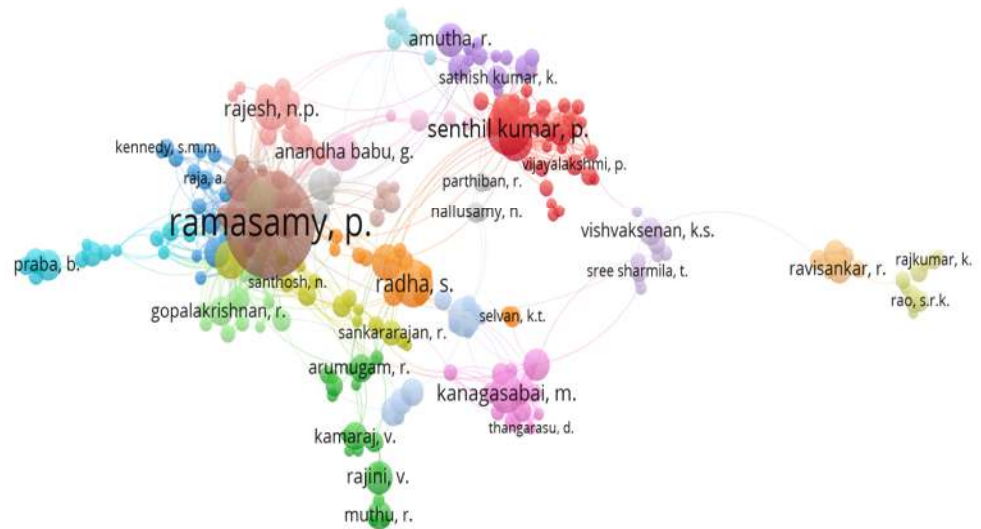


Figure 2. Pattern of Co-Authorship

### Source wise Distribution

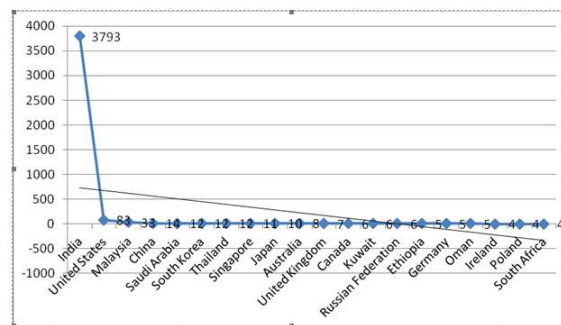
Table 7 demonstrates that the distribution of journals based on the number of publications on which the papers appeared shows a high degree of scattering in terms of journal numbers. Less than 20% of all publications were produced by the top 20 journals.

S.No	Name of the Source	No of Publications	Percentage (%)
1	AIP Conference Proceedings	125	3.29
2	Journal Of Crystal Growth	93	2.44
3	International Journal Of Applied Engineering Research	88	2.31
4	Advances In Intelligent Systems And Computing	62	1.63
5	IEEE Region 10 Annual International Conference Proceedings TENCON	42	1.10
6	Desalination And Water Treatment	40	1.05
7	European Journal Of Scientific Research	36	0.94
8	Lecture Notes In Mechanical Engineering	35	0.92
9	Spectrochimica Acta Part A Molecular And Biomolecular Spectroscopy	35	0.92
10	Materials Today Proceedings	32	0.84
11	Arpn Journal Of Engineering And Applied Sciences	31	0.81
12	Advanced Materials Research	30	0.79
13	Communications In Computer And Information Science	30	0.79
14	International Conference On Communication And Signal Processing Iccsp 2014 Proceedings	29	0.76
15	Multimedia Tools And Applications	27	0.71
16	Materials Letters	26	0.68
17	Optik	26	0.68
18	Cluster Computing	24	0.63
19	International Journal Of Recent Technology And Engineering	23	0.60
20	Journal Of Materials Science Materials In Electronics	23	0.60

**Table 7. Ranking of Journals based on Publications**

**Collaborative Country**

Figure 3 shows that the faculty of SSN College of Engineering collaborated most with researchers of India (3793) followed by United States 83 publications.



**Figure 3. Collaborative Countries**

### Collaborative Institutions

Table 8 shows that researchers from 20 institutions collaborated with the faculty of SSN College Of Engineering for more than 20 publications. Among them, Anna University stands first with 537 publications.

S.No	Collaborative Institutions	No of Publication	Percentage (%)
1	Anna University	537	14.14
2	Vellore Institute of Technology, Chennai	100	2.63
3	Sathyabama Institute of Science and Technology	71	1.87
4	Vellore Institute of Technology, Vellore	70	1.84
5	College of Engineering, Guindy	69	1.81
6	Rajalakshmi Engineering College	68	1.79
7	Indian Institute of Technology Madras	65	1.71
8	National Physical Laboratory India	56	1.47
9	Indira Gandhi Centre for Atomic Research	50	1.31
10	Sri Venkateswara College of Engineering, Sripurumbudur	44	1.15
11	St. Joseph's College of Engineering	41	1.08
12	SRM Institute of Science and Technology, Ramapuram Campus	36	0.94
13	Sri Sai Ram Engineering College, Chennai	34	0.89
14	SRM Institute of Science and Technology	31	0.81
15	KCG College of Technology	24	0.63
16	SASTRA Deemed University	23	0.60
17	Alagappa College of Technology	22	0.57
18	Anand Institute of Higher Technology	21	0.55
19	Madras Institute of Technology	20	0.52
20	Tagore Engineering College	20	0.52

**Table 8. Ranking of Collaborative Institutions**

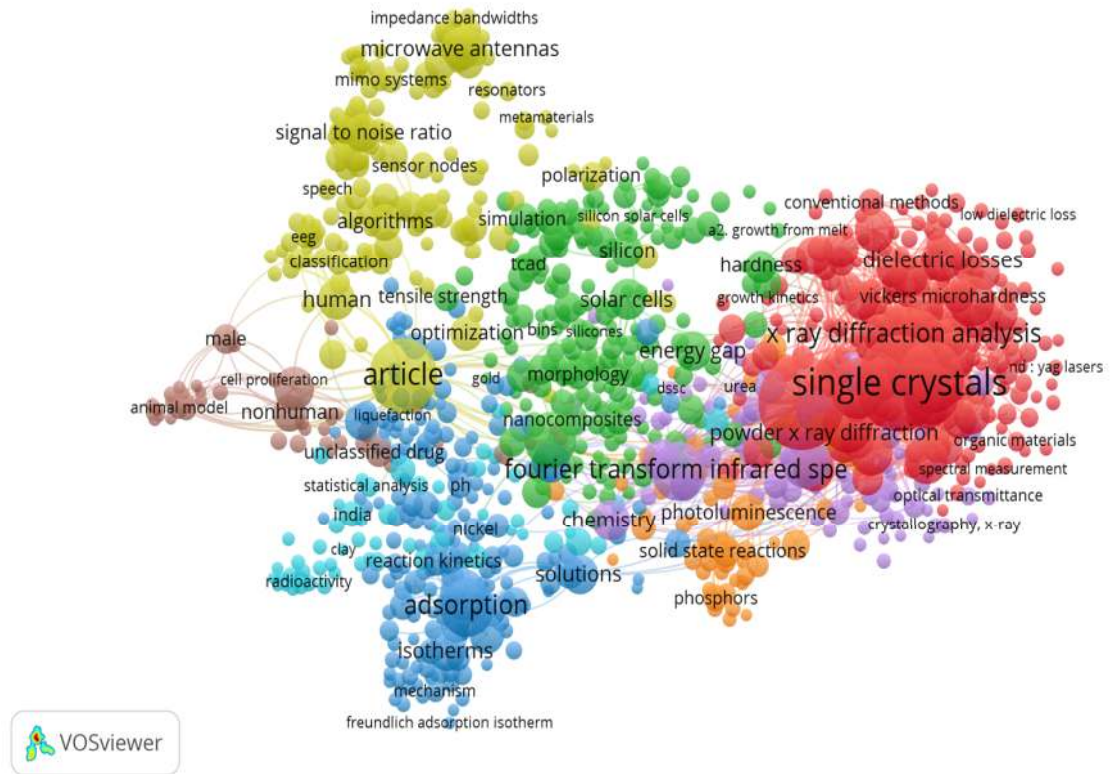
### Subject wise Distribution

Table 9 shows that 1930 papers were published in the broad area of 'Engineering' followed by Computer Science (1478) and Physics and Astronomy (834).

<b>S.No</b>	<b>Subject Category</b>	<b>No. of Publications</b>	<b>Percentage (%)</b>
1	Engineering	1930	50.84
2	Computer Science	1478	38.93
3	Physics and Astronomy	834	21.97
4	Materials Science	782	20.60
5	Mathematics	396	10.43
6	Chemistry	395	10.40
7	Chemical Engineering	261	6.87
8	Energy	261	6.87
9	Environmental Science	218	5.74
10	Biochemistry, Genetics and Molecular Biology	125	3.29
11	Medicine	117	3.08
12	Earth and Planetary Sciences	80	2.10
13	Business, Management and Accounting	72	1.89
14	Agricultural and Biological Sciences	70	1.84
15	Pharmacology, Toxicology and Pharmaceutics	63	1.65
16	Multidisciplinary	58	1.52
17	Decision Sciences	54	1.42
18	Social Sciences	48	1.26
19	Immunology and Microbiology	19	0.50
20	Neuroscience	14	0.36
21	Health Professions	12	0.31
22	Arts and Humanities	10	0.26
23	Psychology	5	0.13
24	Economics, Econometrics and Finance	4	0.10
25	Dentistry	1	0.02
26	Nursing	1	0.02

**Table 9. Broad Areas of Publication**

## Keyword Distribution



**Figure 4: Distribution of Keywords**

Figure 4 shows the most predominant keyword used by the faculty of the institution. It also identifies proximity of the relevance keywords used in the publications.

## Top Cited Papers

Table 10 shows that top 20 cited papers based on the citations received from the overall period of the study. It is evident that 2338 papers have received below 100 citations and 18 papers have received more than 100 citations. 1440 papers have not received single citations.

S.No	Authors	Title	Year	Source Title	Citation
1	Senthil Kumar P., Senthamarai C., Ramalingam S., Niranjanaa M., Vijayalakshmi P., Sivanesan S.	Studies on equilibrium isotherm, kinetics, and thermodynamics of interactions with cashew nut shell adsorption of dye from aqueous solution	2010	Desalination	460
2	Carolin C.F., Joshiba G.J., Kumar P.S., Saravanan A., Naushad M.	A review of effective methods for removing toxic heavy metals from aquatic environments.	2017	Journal of Environmental Chemical Engineering	270
3	Miriyala S., Panchatcharam M., Gayathri V.S., Suguna L.	Curcumin modulates collagen and reduces reactive oxygen species to promote wound healing.	2006	Molecular and Cellular Biochemistry	210
4	Ravikumar K., Krishnan S., Ramalingam S., Balu K.	Response surface methodology can be used to optimise process variables for dye removal using a novel adsorbent.	2007	Dyes and Pigments	180
5	Kumar P.S., Kirupha S.D., Murugesan A., Ramalingam S., Vidhyadevi T., Sivanesan S.	Nickel(II) adsorption onto cashew nut shell: equilibrium, thermodynamics, kinetics, mechanism, and process design.	2011	Chemical Engineering Journal	174
6	Pandiarajan N., Muthu R.	Simulink can be used to model photovoltaic modules.	2011	2011 1st International Conference on Electrical Energy Systems, ICEES 2011	164
7	Poornachandra S.	Subband dependent thresholds for wavelet-based denoising of ECG signals	2008	Digital Signal Processing: A Review Journal	164
8	Selvaraj V., Alagar M., Kumar K.S.	PPY-CNT composite decorated with metal nanoparticles and electrocatalytic oxidation of formic acid and formaldehyde for fuel cell applications: synthesis and characterization	2007	Applied Catalysis B: Environmental	144
9	Ramalingam S., Ravilumar K., Krishnan S., Balu K.	Reactive Red and Acid Brown dye removal with a new adsorbent can be improved using response surface methodology to optimise process variables.	2006	Dyes and Pigments	144
10	Rengaraj R., Subbaraj P., Salivahanan S.	Self-adaptive real-coded genetic algorithm for improved economic dispatch of combined heat and power	2009	Applied Energy	132

**Table 10. Top Cited Papers**

### Funding Sponsors

SSN College of Engineering's top 20 funding sources are shown in the table below. A look at Table 11 shows that the Department of Science and Technology, Government of Kerala sponsored (86) publications, followed by the Department of Science and Technology, Ministry of Science and Technology, India (45), Science and Engineering Research Board (41), and so on,

S.No	Funding Sponsor	No of Publications
1	Department of Science and Technology, Government of Kerala	86
2	Department of Science and Technology, Ministry of Science and Technology, India	45
3	Science and Engineering Research Board	41
4	SSN Educational and Charitable Trust	31
5	SSN College of Engineering	28
6	Ministry of New and Renewable Energy India	17
7	All India Council for Technical Education	15
8	Bangladesh Council of Scientific and Industrial Research	14
9	Defence Research and Development Organisation	12
10	Board of Research in Nuclear Sciences	10
11	University Grants Commission	10
12	Department of Atomic Energy, Government of India	9
13	Singapore Eye Research Institute	5
14	VIT University	5
15	Department of Science and Technology, Ministry of Science and Technology	4
16	National Natural Science Foundation of China	4
17	Universiti Malaya	4
18	University Grants Committee	4
19	Council of Scientific and Industrial Research, India	3
20	Department of Science and Technology, Government of West Bengal	3

**Table 11 Predominant Funding Sponsors**

## 6 Findings

- ❖ 3796 papers were published by the faculty of SSN College of Engineering in the span of 24 years from 2003 to 2020.
- ❖ Conference proceedings are the best procedure to choose journals.
- ❖ The relative growth rate ranges between 1.79 to 0.88.
- ❖ □ Senthil Kumar P., Ramalingam S., Senthamarai C., Niranjanaa M., Vijayalakshmi P., Sivanesan S.'s 'Adsorption of dye from aqueous solution by cashew nut shell: Studies on equilibrium isotherm, kinetics, and thermodynamics of interactions' in

'Journal of Desalination' in 2010 is SSN College of Engineering's most cited paper, with more than 400 citations as of now.;

- ❖ More than 100 citations: 18 papers
- ❖ 01 to 99 citations: 2338 papers.
- ❖ 0 citations: 1440 papers.

## 7 Conclusion

Every institution's reputation nowadays is built on its research output and innovation. This qualitative research is necessary for the technical institution to identify areas of research that need to be improved, as well as the existing state of technical advancement and the competitive institutions' future course of action. This high-quality work highlights the institution's scientific productivity across a variety of factors and promotes the institution's weaker areas. This study only looked at data from the Scopus database, however additional citation databases for scientific productivity can be looked into for other quality measures. Furthermore, it is the responsibility of the Library Science community to investigate scientometric research for each institution and to keep abreast of new study areas

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