Mapping the Research Output of Jawaharlal Nehru Technological University, Hyderabad: A Bibliometric Study

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Abstract

The present study analysed the different bibliometric parameters to highlight the productivity analysis of Jawaharlal Nehru Technological University, Hyderabad (JNTUH). The data generated from Web of Science database has identified a total of 3879 publications during the study period of 2007 to 2021. The study analysis is carried out by different bibliometric parameters, i.e. Annual growth rate, relative growth rate and doubling time, most preferred national/International journals, most productive research areas, prolific authors, Impact factor of journals, and highly cited articles and citation analysis during the period. The study observes that the research community of JNTUH have to increase the productive output year by year and select the journals which are having the high impact factor for publication and disseminating the results.

Keywords
Jawaharlal Nehru Technological University, Hyderabad (JNTUH); Bibliometrics; Web of Science; Impact Factors; Research Productivity; Citation analysis.

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1. INTRODUCTION

Jawaharlal Nehru Technological University, Hyderabad, was established on 2nd October 1972 by the Legislature of the State of Andhra Pradesh as the first Technological University in the country. It has been in the forefront for the past 49 years in providing quality technological education of relevance in the State and going to celebrate its Golden Jubilee year in 2022. The JNT University, Hyderabad restructured into 4 different Universities namely JNT University Hyderabad, JNT University Anantapur, JNT University Kakinada and JNAFAU, Hyderabad by the Government of Andhra Pradesh in 2008. On 2nd June 2014, the new state of Telangana was formed by reorganizing the Unified state of Andhra Pradesh. Since then the JNTUH has been working as the State Affiliating University of Telangana State, with the Act. no.30 of 2008 of erstwhile State of Andhra Pradesh.

JNTUH is situated in a sprawling 89 acre campus at Kukatpally, Hyderabad. It has now 4 Constituent Engineering Colleges and 15 other constituent units on Hyderabad campus. The University Engineering/Pharmacy Colleges and Academic Units of JNTUH are offering B.Tech. in 11 branches, B.Pharmacy, M.Tech. in 28 specializations, M.Pharmacy in 4 specializations, M.Sc. in 8 specializations, MBA and MCA, and Five-year Integrated Dual Degree Masters Program in 5 specializations with M.Tech. Additionally, MS and Ph.D. programs in various disciplines of Engineering, Technology, Science, Management and Humanities & Social Sciences are offered. The University has Memoranda of Understanding (MoU) with many International and National Organizations/Universities/Institutions. JNTUH is re-accredited with 'A' Grade by the National Assessment and Accreditation Council (NAAC) in the year 2017. The University is ranked 62 in the Engineering Stream of NIRF Rankings 2021.

2. REVIEW OF LITERATURE

In Library and information Science 'Bibliometrics' is having an emergent attention among the research community worldwide. The study of bibliometrics, measures the performance and observes the trends of publications on different academic and R &D institutes. The present study also observes some of the relevant bibliometric studies on academic and technical institutes and findings.

Bid, Subhodip (2016) analysed the publications of Indian Institute of Technology Kharagpur (IIT Kharagpur) during 2000 to 2015, according to the data generated from SCOPUS database. A total of 18927 have been downloaded and analysed according to objectives. The study reveals that the growth of literature follows the exponential growth pattern and journal articles are the most published form of literature (74.37%); The highly productive subject areas are engineering and materials science, computer science, physics and astronomy. US, Germany and UK are the most favored countries for collaborations and authorship pattern analysis shows that degree of collaboration (0.95) is significantly high and suggests that periodically this type of data be reflected along with institutional repositories of the respective institutions. Marzi, G. et.al. (2018)have done a comprehensive overview of IEEE Transactions on Engineering Management (IEEE TEM) from 1985 to 2017. The study employs the challenges for the future of IEEE TEM, along with a bibliometric analysis of the journal by using Web of Science Core Collection data. This paper offers an example application of a mixed method bibliometric analysis, seeking to extend the quantitative findings by including other sources of data. Baskaran, C. (2013) analysed the author productivity discipline wise and institution-wise collaboration and ranking of authors in research contribution of Alagappa University during 1999-2011. Degree of collaboration and its mean value is found to be 0.963. The top three institutions with Alagappa University are Central Electro Chemical Research Institute, National Cheng King University andAnna University. Kademani, B.S.et.al.(2017)conducted a bibliometric study on Research and citation impact of publication of the Nuclear Physics Division at Bhabha Atomic Research Centre. They found 257 publications during 2003-2008 period by using the Web of Science database. The highest number of citations received was 1155 in 2007. High Energy Physics and Quark Gluon Plasma domain received the highest percentage (75.5%) of citations. Jeyshankar and Babu (2013) analysed the various bibliometric patterns such as authorship pattern, various forms of publications, collaboration of publications and most preferred output journal etc. The study found out of a total of 2120 publications in which 1524 publications were journal articles. The highest publications were made from multiple authors (79.67%). Rosaline Mary, A. and Dorairajan, M. (2016) attempts to analyse the excellence and performance of the University of Madras. The study focuses on the publications of the research scholars and faculty members carried out with the indexed records in web of science during the period of 1989 to 2014. The study aimed to evaluate the publication productivity of the University of Madras through its individual faculty members, no matter which department these faculty members are affiliated with. Sudhier and I S (2011)analyzed the research productivity of social scientists at the Centre for Development Studies (CDS), Thiruvananthapuram during 1998-2008.About 599 research articles were published by the CDS researchers, including38.23% of journal articles, 23.54% of chapters in books and 15.03% of working papers. The highest number of publications was in the year 2008. More than 66% of journal articles published are in Indian journals and 33.19% are published in foreign journals.

3. OBJECTIVES OF THE STUDY

The specific objectives of the study are:

1. to find out the yearwise distribution of productivity.
2. to measure the different growth rates and doubling time of publications of JNTUH.
3. to identify the high productive source of titles, top prolific countries and high productivity subject areas of publications;
4. to study the Impact factor of top productive journals and highly cited articles.
5. to overview the citations analysis during the study period of 2007-2021.

4. METHODOLOGY AND DATA SOURCE

The present study deals with the Research output and citation impact of Jawaharlal Nehru Technological University, Hyderabad (JNTUH) during the period of 2007-2021. The study is based on bibliometricanalysis and the data for this study was collected fromthe most trusted publisher-independent global citation database "Web of Science"a multidisciplinary platformdeveloped by Institute for Scientific Information (ISI) which is now maintained by Clarivate Analytics Group. WoS provides a comprehensive citation search which navigates the full citation network. The database supports 256 disciplines covering Science, Social science, Arts, Humanities.

The present study is limited to the research output of JNTUH for the years 2007-2021. The following search string was used for collecting the data (Basic search as **"Jawaharlal Nehru Technological University - Hyderabad"**andthe search field as **AFFILIATION) And** Selected**Year Published**to

custom rangeand Limited to Publication Year 2007-2021. A total of 3879 various publications were found, which includes Articles, Proceeding papers, editorial materials, meeting abstracts, reviews etc. There are 632 open access publications and remaining are other types of publications. The data was collected and analysed as per the objectives of the study. Each publication is recorded with complete bibliographical details such as Title, Year,type of document , geographical distributions, etc from the WoS database & the data was tabulated in MS Excel format for simple frequency calculation.

5. DATA ANALYSIS AND INTERPRETATION

The following selected parameterswere analysed for the present study i.e. distribution of literature, year wisepublications, Annual growth rate, Relative growth rate and Doubling time of publications, Country-wise distribution of articles, most preferred national and international source titles, most productive research areas, impact factors of journals, identifying the highest author profiles and, citations pattern. The following tables and figures briefly describe the results.

5.1 Distribution of Literature

The data presented in Table 5.1 describes the different forms of research documents published by JNTUH during the study period of 2007-2021. It is identified that overall 9 types of document formsand a sum of 3879 various publications were published during the time period. The majority of the researchers were preferred "articles" (2340,60.32%) followed by Proceeding papers (1379, 35.55 %) etc.

Table 5.1: Source wise distribution of Literature

Sl.No	DOCUMENT TYPES	Total	%
1	article	2340	60.32
2	article; proceedings paper	1379	35.55
3	review	83	2.14
4	meeting abstract	40	1.03
5	editorial material	15	0.39
6	correction	11	0.28
7	letter	8	0.21
8	news item	2	0.05
9	biographical-item	1	0.03
	Total	**3879**	100.00

5.2 Year-wise growth of Publications

The table 5.2 shows the year-wise distribution of publications of JNTUH during the study period of 2007-2021. The total publications output recorded was 3879 and the highest publications of 396 were recorded in the year 2016 with 6.45% , followed by 377 in the year 2017 with 10.21% whereas the lowest publications 148 was recorded in the year 2007 followed by 155 publications in the year 2010. The table also reveals the growth rate and annual growth rate (AGR)of JNTUH publications. It is observed that there areconstant fluctuations in the growth of publications as well as in the Annual Growth Rate. From 2009-2016 it observed a fair growth rate in publications and from 2017 onwards the publications growth rate is dropping.There has been an existent decrease in publications. The total year-wise distribution of publication details are shown in table 5.2.

Table 5.2: Year-wise growth of publications

Sl	Year	Articles	Percentage	Growth rate	AGR %
1	2007	148	3.82	0	0.00
2	2008	172	4.43	24	16.22
3	2009	159	4.10	-13	-7.56
4	2010	155	4.00	-4	-2.52
5	2011	209	5.39	54	34.84
6	2012	279	7.19	70	33.49
7	2013	316	8.15	37	13.26
8	2014	357	9.20	41	12.97
9	2015	372	9.59	15	4.20
10	2016	396	10.21	24	6.45
11	2017	377	9.72	-19	-4.80
12	2018	280	7.22	-97	-25.73
13	2019	219	5.65	-61	-21.79
14	2020	219	5.65	0	0.00
15	2021	221	5.70	2	0.91
	Total	**3879**	100.00	73	59.96
			avg	**4.86**	**4.00**

AGR=Annual Growth Rate

The table 5.2 also shows that the Annual Growth Rate of the total publications calculated year wise during the period 2007-2021. The AGR has decreased from 6.45 in 2016 to -4.80 in 2017 and followed up to -21.79 in 2019, it is also found that zero growth rate in the year 2020. Since there is afluctuations in number of publications year by year, as shown in figure 1, the reason for the variation is that there is no constant growth of publications every year, the total AGR data, as shown in table 5.2 and

figure 1 is calculated on the formula given by Kumar and Kaliyaperumal (2015) as follows.

$$AGR = \frac{End\ Value - First\ Value}{First\ Value} \times 100$$

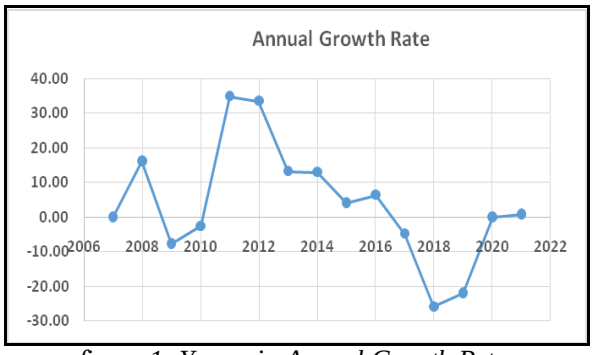


figure 1: Year-wiseAnnual Growth Rate

5.3 Relative Growth Rate (RGR) and Doubling time (Dt)of Publications of JNTUH

The RGR defines an increase in the number of documents/articles per unit of time. The mean Relative Growth Rate (RGR) over the specific period of an interval can be calculated from the following equationderivated by Mahapatra(1985).

$$\text{Relative Growth Rate (RGR)} = \frac{\text{Log } e\ W2 - \text{Log } e\ W1}{T2 - T1}$$

Where R=Mean relative growth rate over the specific period of interval

Loge W1 - log of the primary number of publications
Loge W2 - log of the ending number of publications
(The Log e W1 & W2 values are taken from the online logarithm calculator **https://www.rapidtables.com/calc/math/Log_Calculator.html**
T2-T1- the Unit difference between the initial and final time (The year can be taken here as the unit of time)
Dt- Doubling time

Table 5.3: Relative Growth Rate (RGR) and Doubling Time (Dt) of publications

Sl	Year	Articles	CU	Log1	Log2	R(P) (log2-log1)	Dt (0.693/R(P))
1	2007	148	148		4.99		
2	2008	172	320	4.99	5.76	0.77	0.90
3	2009	159	479	5.76	6.17	0.41	1.69
4	2010	155	634	6.17	6.45	0.28	2.48
5	2011	209	843	6.45	6.73	0.28	2.48
6	2012	279	1122	6.73	7.02	0.29	2.39
7	2013	316	1438	7.02	7.27	0.25	2.77
8	2014	357	1795	7.27	7.49	0.22	3.15
9	2015	372	2167	7.49	7.68	0.19	3.65
10	2016	396	2563	7.68	7.84	0.16	4.33
11	2017	377	2940	7.84	7.98	0.14	4.95
12	2018	280	3220	7.98	8.07	0.09	7.70
13	2019	219	3439	8.07	8.14	0.07	9.90
14	2020	219	3658	8.14	8.2	0.06	11.55
15	2021	221	**3879**	8.2	8.26	0.06	11.55
	Total	**3879**			**sum**	**3.27**	**69.48**
					avg	**0.218**	**4.63**

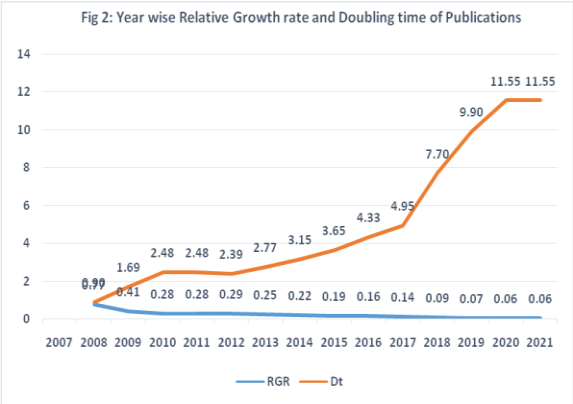
The table 5.3 shows the year-wise analysis of RGR, the values are found between 0.77 to 0.06. It shows that there are up and downs in the values of Relative Growth Rate. The highest value of RGR corresponds to 2007 (0.77), whereas the lowestvalue of RGR (0.06) in the years 2020 and 2021. The Mean Relative Growth Rate (R) observed was 0.218 over the specific period of 15 years. The trend shows that the Relative growth rate was decreasing during the study period.

Doubling time (Dt) : The data reveals that there is a direct equivalence existing between the Relative growth and the doubling time. If the contribution numbers of a subject doubles, during the study period, then the variation between the logarithm of the numbers at the beginning and at the end of the

period must be the logarithms of the number 2. If a natural logarithm is used for this, the difference is a value of 0.693(Beaie and Acol, 2009). The Doubling time for each specific period of interval and for articles/pages can be measured by the following formula.

$$\text{Doubling time (Dt)} = \frac{0.693}{\text{RGR}}$$

The table 5.3 shows the Doubling time (Dt) values are inopposed trend to RGR and the Dt ranges from 0.90 to 11.55, which is in increasing trend during the period of the study.



5.4 International Collaboration of Publications

As a Technological University of the state JNTUH is more focused in advancement of learning and knowledge in Engineering & Technology, Physical and Social Sciences by teaching, research and experimentation. The University is deemed to collaborative work with similar academic and research institutions of foreign countries. The research output, with collaboration at the International level, is gradually increased during the study period. The JNTUH has International Collaboration of Publications with total of 65 foreign countries during the study period 2007-2021. The table 5.4 depicts the top ten country-wise distribution of publications and Sum of Citations and Average Citations from the marked period. The maximum of 118 publications were contributed by the United States of America with sum of citation as 2108 at average citation of 17.86 per article, followed by Malaysia with 75 publications and sum of citation as 2244 at average of 29.92 per article and 56 publication contributed by South Korea with sum of citations as 1251 at average of 22.34 respectively.

Table 5.4: Country-wise distribution of articles (an International collaboration of articles)

Sl	Countries/ Regions	Records	Total times Cited	Avg. citations	h-index
	INDIA	3879	34272	8.84	**64**
1	USA	118	2108	17.86	27
2	MALAYSIA	75	2244	29.92	25
3	SOUTH KOREA	56	1251	22.34	16
4	IRAN	44	981	22.318	18
5	SAUDI ARABIA	41	293	7.15	9
6	AUSTRALIA	25	273	10.92	9
7	JAPAN	22	350	15.91	11
8	GERMANY	19	224	11.79	9
9	PORTUGAL	19	1207	63.53	16
10	QATAR	18	358	19.89	12

5.5 Preferred Sources

The table 5.5 reveals the top ten source of journals preferred to be published by JNTUH researchers during the period 2007-2021. A total of 3879 JNTUH publications are identified in 1490 national and international source of journals during the study. The highest publications at the International level were published in *Materials Today Proceedings* with a total of 186 publications, journal average citation is 3.89 per article followed by *International Journal of Systematic and Evolutionary Microbiology* (106 publications) with average citations 13.41 per articles. In National Journals *Asian Journal of Chemistry* has the highest publications of 67 with 0.71 average citations followed by *Indian Journal of Heterocyclic Chemistry* having 60 publications with 0.98 average citations. The significant observations from the top ten sources, majority of journals belongs to Chemistry and allied areas. The table also reveals the Journal Impact Factors, Journal citation Report (JCR)-2021 released by Clarivate Analytics group.

Table 5.5: Most Preferred National and International Sources

Sl	Publication Titles	No. of Articles	% of articles	Total Times Cited	Avg. Citations per item	Impact Factor (JCR 2021)
1	MATERIALS TODAY PROCEEDINGS	186	4.795	723	3.89	31.041
2	INTERNATIONAL JOURNAL OF SYSTEMATIC AND EVOLUTIONARY MICROBIOLOGY	106	2.733	1421	13.41	2.747
3	ADVANCES IN INTELLIGENT SYSTEMS AND COMPUTING	104	2.681	74	0.71	Book series
4	ASIAN JOURNAL OF CHEMISTRY	67	1.727	764	2.16	0.54
5	SYNTHETIC COMMUNICATIONS	63	1.624	349	5.54	2.007
6	TETRAHEDRON LETTERS	62	1.598	757	12.21	2.415
7	INDIAN JOURNAL OF HETEROCYCLIC CHEMISTRY	60	1.547	59	0.98	0.32
8	JOURNAL OF HETEROCYCLIC CHEMISTRY	55	1.418	296	5.38	2.193
9	INDIAN JOURNAL OF CHEMISTRY SECTION B ORGANIC CHEMISTRY INCLUDING MEDICINAL CHEMISTRY	52	1.341	152	2.92	0.592
10	LETTERS IN ORGANIC CHEMISTRY	41	1.057	117	2.85	0.867

5.6 Most Productive Research Areas

JNTUH is largely devoted to science and technological studies and continually strives to introduce new courses in its academic programs and be innovative in research activities. The study found that JNTUH is contributing in 67 interlinked subject domains, the table 5.6 shows the top five highly productivity subjects, which are contributing for major publication role during the period 2007-2021. It is observed that the highest numberof publications are from "Engineering" discipline having 1128 articles at the percentage of 29.08 %, followed by "Chemistry" contributing to 1026 articles at 26.45 %. The table briefs the sum of citations and average citations per item of each subject domain.

Table: 5.6 Most Productive Research Areas

Sl	Research Areas	No. of Publications	% of 3,879	Sum of times Cited	Avg. citations per item
1	Engineering	1128	29.08	7553	6.7
2	Chemistry	1026	26.45	8785	8.56
3	Computer Science	736	18.974	2013	2.74
4	Materials Science	484	12.477	4343	8.97
5	Pharmacology Pharmacy	304	7.837	3859	12.69

5.7 Citations Analysis

The table 5.7 highlights theJNTUHoverview of citations report during the period of 2007-2021. The study found a total of 3879 various publications, and the total sum of citations are 34272. The average citations per article is 8.84, and the h-index of JNTUH research publications are 64.

Table 5.7: Overview Citation Report (as on 22-04-2022) of JNTUH

Sl. No.	Citations details	Total
1	Total Publications during 2007-2021(Articles, Proc. Papers, meeting abstracts, reviews etc.)	3879
2	Total Citations	34272
3	without self-citations	28267
4	Citing documents	29245
5	Citing articles without self citations	32312
6	Average Citations per item	8.84
7	*h-index*	*64*

Table 5.8: Top Five highly cited articles of JNTUH

Sl	Title	Authors	Source title	Pub. Year& Vol (I)	Total Citations	Avg. citations per Year (2007-2021)
1	Power Loss Minimization in Distribution System Using Network Reconfiguration in the Presence of Distributed Generation DOI:10.1109/TPWRS.2012.2197227	Rao, R. Srinivasa; Ravindra, K.; Satish, K.; Narasimham, S. V. L.	IEEE TRANSACTIONS ON POWER SYSTEMS	2013& 28(1)	555	55.5
2	Assessing risk of heavy metals from consuming food grown on sewage irrigated soils and food chain transfer DOI:10.1016/j.ecoenv.2007.04.013	Chary, N. Sridhara; Kamala, C. T.; Raj, D. Samuel Suman	ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY	2008 & 69(3)	502	33.47
3	Green synthesis of silver nanoparticles using Coffea arabica seed extract and its antibacterial activity DOI:10.1016/j.msec.2015.08.018	Dhand, Vivek; Soumya, L.; Bharadwaj, S.; Chakra, Shilpa; Bhatt, Deepika; Sreedhar, B.	MATERIALS SCIENCE & ENGINEERING C-MATERIALS FOR BIOLOGICAL APPLICATIONS	2016 & 58	300	42.86
4	Optimal Network Reconfiguration of Large-Scale Distribution System Using Harmony Search Algorithm DOI:10.1109/TPWRS.2010.2076839	Rao, Rayapudi Srinivasa; Narasimham, Sadhu Venkata Lakshmi; Raju, ManyalaRamalinga; Rao, A. Srinivasa	IEEE TRANSACTIONS ON POWER SYSTEMS	2011 & 26(3)	276	23
5	Hybrid nanofluids preparation, thermal properties, heat transfer and friction factor - A review DOI:10.1016/j.rser.2016.09.108	Sundar, L. Syam; Sharma, K. V.; Singh, Manoj K.; Sousa, A. C. M.	RENEWABLE & SUSTAINABLE ENERGY REVIEWS	2017 & 68	270	45

6. CONCLUSION

The study reflects that JNTUH is one of the largest affiliating technological university at the global publication's status in the field of science and technology. The study found out some of the significant insights. The study focused on various aspects of bibliometric parameters to find out the exact results which are reflecting on the growth of publications as well as in the annual growth rate. The International collaboration of articles are increasing year by year, which clearly indicates that the research community are sharing their research work with similar academic and research institutes at national and international level. It is observed that most of the researchers are interested to publishthe papers at the national level due to their intend to publish as early, which creates their profile at low level, and lacking their research to fill the gaps of the earlier studies. The study identified that JNTUH most thrusted area of publications are found in “Engineering” and its related subjects. The study further analysed the citation overview and highly cited articles of JNTUH during the study period.

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