Scientometric Analysis of Research Output among Central Universities of North-East India during 2012-2021

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Abstract

The evaluation of research output in the universities and other R & D institutions is essential for the overall development of the institutions. This study aims to analyse the research output of the nine selected central universities in northeast India. The required bibliographic information was obtained from an online Web of Science database, using an affiliation field tag with publication date range [query (OG=university Name) AND date range 01-01-2012 to 31-12-2021)].The dataset was carefully examined in the MS-Excel and analysed using R-package bibliometrix. A total of 8848 research contributions and 97107 citations have been observed. It is found that Tezpur University is the highest research publications (2875), followed by NEHU (1609)and Assam University (1436),respectively. A total of 1942 articles from all the selected universities were published in open access. The 'Current Science' and "RSC Advance' were the most common sources, and 'Chemistry' is the most prominent research area among selected central universities.

Keywords: Authorship Pattern, Bibliometrix-R, Central University, Citation, Research Output, Research Productivity, Scientometric

1. Introduction

Research productivity is the main key component to measuring the research contribution of any university from an academic perspective. The higher education system in India has practised measuring all the universities annually and released the NIRF ranking of the educational institutions. Nowadays, various online tools are available to measure the impact of research, among which Web of Science and Scopus are very well-known online abstracting databases. Scientometric measurements have been recognised as an indispensable tool for intelligent judgment of academic institutes' research activities and scientific behaviour. The northeastern region of India comprises eight states Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland, Sikkim, and Tripura (Wiki, 2021). The study is undertaken to understand the research productivity of selected central universities of northeastern India, which are listed in table 1 below:

Table 1: NAAC accreditation status of central universities of the northeastern region

Sl. No	Name of Central University	NAAC Accreditation Status
1	Assam University	'B' Grade
2	Tezpur University	'A' Grade
3	Rajiv Gandhi University	'B' Grade
4	North Eastern Hill University	'A' Grade
5	Mizoram University	'A' Grade
6	Manipur University	'A' Grade
7	Nagaland University	'B' Grade
8	Sikkim University	'B' Grade
9	Tripura University	'B' Grade

2.   Review of related literature

Lundberg (2006) carried out doctoral research on bibliometrics and found that both co-authorship and funding indicators provide incomplete results in assessments of industry-university collaboration at the maximum level. Kalita (2012) conducted a study on research productivity and its impact analysis on central universities of northeast India from 2006 to 2015. He has found that the total cumulative publications were 4011, and Tezpur University was top in research publications with more citations and 43 H-Index. Baskaran (2013),on the research productivity of Alagappa University from 1999-to 2011,found that the growth of the research productivity was significantly increased, and the relative growth rate fluctuated. Cancinoet al.(2017) conducted a bibliometric study on leading universities in innovation research using the web of Science to identify the most productive and influential universities in innovation research. Bapte and Gedam (2018) conducted a scientometric profile of Sant Gadge Baba Amravati university from 1996-to 2017 from the Scopus online database. The study evaluated the total research output of 1130 publications with the 10.65 average citations per paper. Halder and Karmakar (2021) conducted a bibliometricanalysis on the Journal of Indian Library Association from 2016 to 2020 and found that the authorship trends of articles are collaborative, and the majority belong to the state of Karnataka. Pandya et al. (2021) analysed the research productivity of newly established central universities in India using the Scopus database from 2010-to 2019. They found that the considerable growth in scholarly publication and the Central University of Rajasthan contributed the highest number of 765 articles among the 12 universities.

Thus, it is found that various studies have been carried out to measure the research productivity of academic institutions within a limited period using Scopus and the Web of Science database. At the same time, there is no attempt taken to measure the research productivity of Central Universities of North

East India within the proposed period.

3. Scope and limitation of the study

The scope is limited to the scholarly literature available in the online database published in the web of science database based on selected scientometric parameters. The present study is limited to the chosen central university of northeast India. Further, the study is limited to the data source exported on December 31 2021, from the web of science database from 2012 to 2021 only. The study is not covering the metric details of print books, book chapters, theses and dissertations, number of Ph.D. awarded, etc. The study is limited to the nine selected central universities. In contrast, two central universities that focus on the specific subject area, namely Central Agricultural University and National Sports University, are excluded from the present study.

4. Objective of the study

The main objective of this study is to analyse the research productivity of selected Central Universities of northeast India based on bibliometric and scientometric parameters. The objectives of the study are:

- To measure the growth and impact of research productivity of all the central universities of north-east India during 2012-2021

- To determine the citation impact on the research outputs

- To identify the most productive authors from the universities

- To find out the top five publication sources published by each central university under this study.

- To identify the prominent research areas among selected central university

- To analyse the top ten institutional and country-wise collaborations of all central universities of north-east India

- To find out the top ten funding sources among the faculty members of the central universities of north-east India.

5. Methodology

The secondary data have been taken into consideration for the conduct of this study. The Web of Science data source has been selected, and the publications data indexed from all the nine selected central universities are being used for the present study. The data on the research publications by Assam University, Tezpur University, Rajiv Gandhi University, NEHU, Manipur University, Mizoram University, Nagaland University, Sikkim University and Tripura University were exported from the WoS core collection for the ten years 2012-2021. The bibliographic information was retrieved from an online Web of Science database using an affiliation field tag with a publication date range [query (OG=Assam University, OG=Tezpur University, OG= Rajiv Gandhi University, Itanagar, OG= North Eastern Hill University, OG= Mizoram University, OG= Manipur University, OG= Nagaland University, OG= Sikkim University, OG=Tripura University) AND date range 01-01-2012 to 31-12-2021)] on December 31 2021.All the variables used in the dataset were carefully examined, and the authenticity of collected data was observed in the MS-Excel and then analysed the dataset using the bibliometrix package- An R-tool (Aria &Cuccurullo, 2017). The collected datasets have been prepared, verified and checked the authenticity of the downloaded data from the data source.

6. Date analysis and major finding

6.1 *Growth in research publications*

The growth analysis of the publications for each university is shown in table 2.

Table 2: Year-wise distribution of research publications

Year	AU	TZU	RGU	NEHU	MZU	MU	NU	SU	TU	Total
2012	92	206	17	126	44	68	19	10	26	608
2013	110	251	31	155	44	65	14	12	45	727
2014	147	339	22	133	45	70	15	8	52	831
2015	135	288	12	145	59	47	10	26	45	767
2016	150	293	21	145	98	44	9	29	58	847
2017	146	349	29	164	86	62	25	39	85	985
2018	164	304	24	192	79	43	17	45	66	934
2019	134	297	37	193	105	51	26	60	84	987
2020	170	271	39	187	155	57	21	70	89	1059
2021	188	277	39	169	173	66	24	68	99	1103
Total	1436	2875	271	1609	888	573	180	367	649	

AU= Assam University, TZU= Tezpur University, RGU= Rajiv Gandhi University, NEHU= North Eastern Hill University, MZU= Mizoram University, MU= Manipur University, NU= Nagaland University, SU= Sikkim University, TU= Tripura University

It is found that Tezpur University is the highest number of research publications (2875) and the least publications from Nagaland University(180).The growth of research publications has been constant and progressively increasing over the years. The year 2021 is the most productive year for Assam University with 188 articles, Rajiv Gandhi University with 39 articles, Mizoram University with 173 articles, and Tripura University with 99 articles. The year 2016 is the most productive year for Tezpur University, and 2019 is the most productive for North Eastern Hill University.

6.2   *Impact of citations*

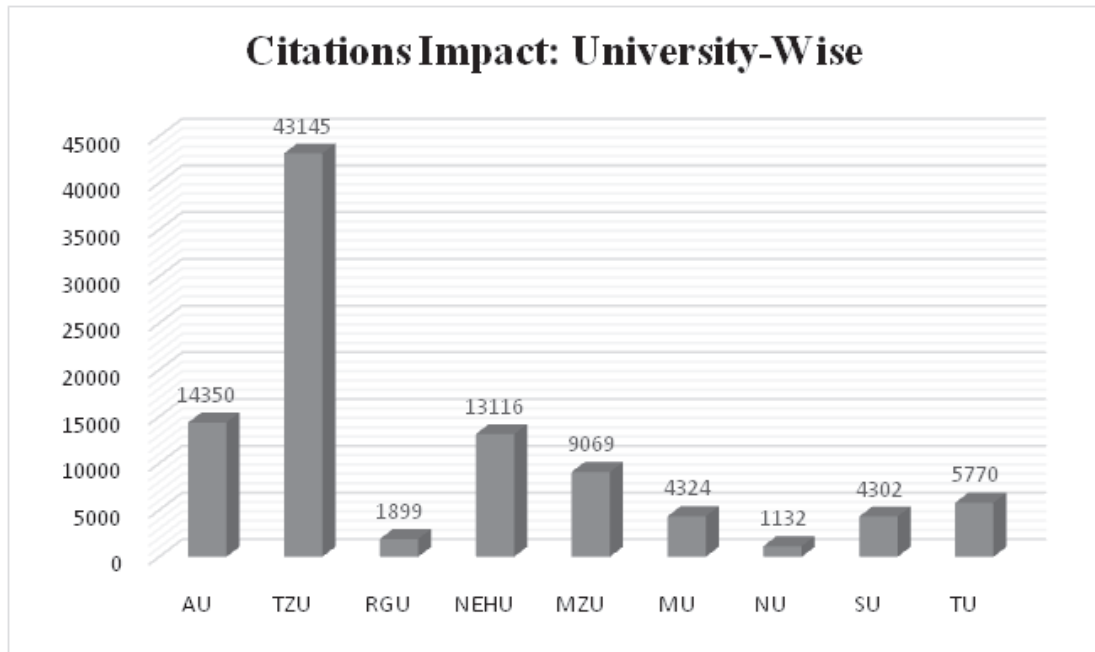The citation impact of the universities is visualised in the figure 1.

Figure 1: University-wise citations received

It is found that the citation impact of Tezpur University is highest (43145), which is followed by Assam University (14350), NEHU (13116), Mizoram University (9069), Tripura University (5770), Manipur University (4324), Sikkim University (4302), RGU (1899), andNagaland University (1132)respectively.

The highest mean citation per year (8.98) and the highest mean citation per article (44.93) occurred at Sikkim University in 2016. Tezpur University received the average citations per document (14.71).
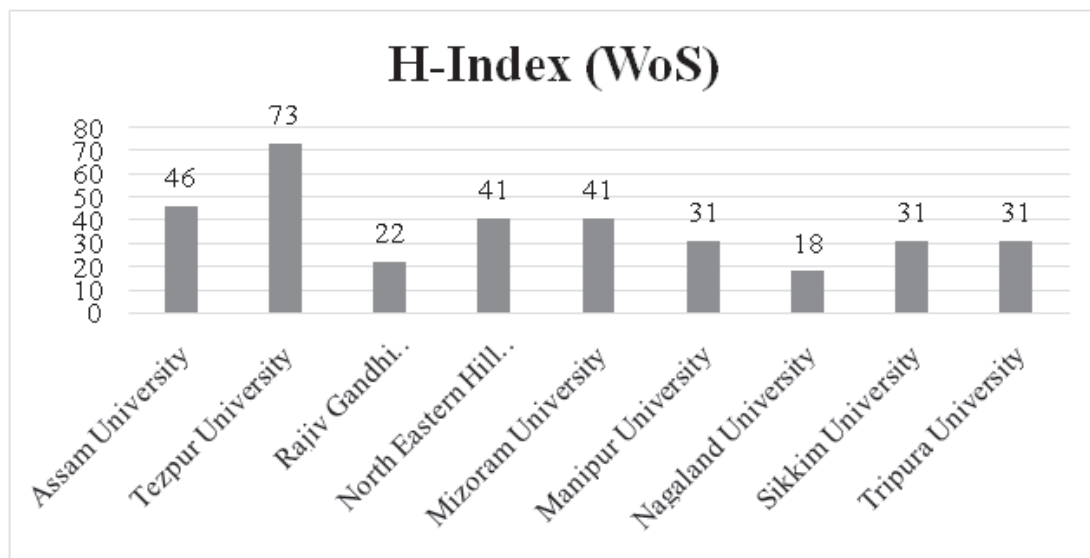
6.3 *H-index calculation*

Figure 2: H-Index of the central universities

Figure 2 shows that Tezpur University has received the highest H-index (73), which is followed by Assam University (46), NEHU&Mizoram University (41 each), Manipur (31), SikkimandTripura University (31 each), RGU (22), Nagaland University (18) respectively.

6.4 *Top ten most productive authors*

Table 3: University-wise most prolific authors

Assam University		Tezpur University		Rajiv Gandhi University		NEHU	
Authors	**Article**	**Authors**	**Article**	**Authors**	**Article**	**Authors**	**Article**
Chakraborty, S	96	Karak, N	156	Hazarika, B	63	Tripathi, T	70
Bhattacharjee, A	95	Deka, R C	149	Borah, D	18	Joshi, S R	68
Ghosh, S K	90	Kumar, A	126	Das, A	18	Kumaria, S	67
Borah, A	60	Dolui, S K	88	Kumar, S	14	Tandon, P	61
Das, S	59	Mukherjee, A K	81	Rashid, M H	14	Kumar, A	58
Das, A K	57	Maji, T K	76	Arab, R	13	Chandra, A K	56
Roychoudhury, S	56	Bora, U	74	Mohiuddine, SA	13	Kollipara, M R	55
Sarkar, U	56	Deka, S C	72	Tag, H	12	Lal, R A	49
Nath, A J	54	Mohanta, D	72	Das, D N	11	Velusamy, M	49
Uddin, A	54	Gogoi, N	71	Saikia, N	11	Mitra, S	48

Mizoram University		Manipur University		Nagaland University		Sikkim University	
Authors	Article	Authors	Article	Authors	Article	Authors	Article
Rai, D P	108	Singh, N R	47	Sinha, D	18	Ray P P	44
Kumar, N S	90	Vishwanath, W	43	Singh, A K	13	TamangJp	37
Thapa, R K	67	Singh, O M	28	Sinha, U B	13	Tiwari A	31
Tiwari, D	59	Singh, S D	25	Deb Cr	10	Tripathi A	23
Lee, S M	52	Sharma, H B	22	Supong A	10	PathakAp	19
Singh, B P	51	Laitonjam, W S	21	Bhomick Pc	9	Das S	17
Gurusubramanian, G	43	Singh, L R	20	Dey S	9	Roy S	17
Khenata, R	43	Phanjoubam, S	17	KonwarBk	9	Roy Bg	16
Maity, N P	37	Singh, T I	16	Karmaker R	8	Dash D	15
Shankar, A	36	Singh, T P	15	Gupta Rc	7	Banerjee P	14
Tripura University							
Authors	Article	Authors	Article	Authors	Article	Authors	Article
Bhattacharjee, D	65	Chattopadhyaya, S	39	Debnath, B	35	Dinda, B	30
Hussain, S A	56	Das, R	37	De, B K	34		
Guha, A	48	Bhattacharjee, S	36	Das, A	31		

Table 3 indicates the most productive authors from each university. It is found that Chakraborty, S (96) from Assam University, Karak, N (156) from Tezpur University, Hazarika, B (63) from RGU, Tripathi, T (70) from NEHU, Rai, D.P.(108) from Mizoram University, Singh, N.R.(47) from Manipur University, Sinha, D (18) from Nagaland University, Ray, P.P (44) from Sikkim University, Bhattacharjee, D (65) from Tripura University are the most prolific authors during this period of study.
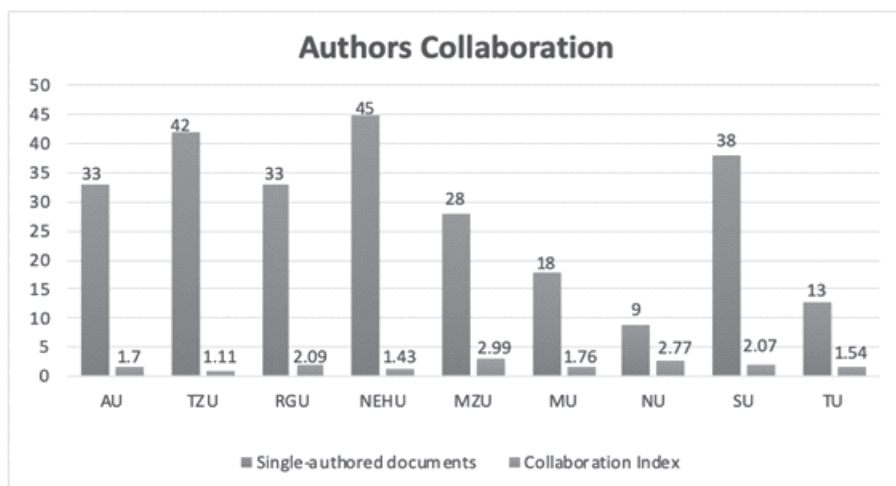
6.5   *Author collaboration*

Figure 3: University-wise author collaborations

Collaboration is one of the fundamental phenomena in academic research. Figure 3 shows that the highest number of single-authored documents are published from NEHU (45), which is followed by Tezpur University (42), and Sikkim University (38), respectively. Figure 3 also shows that the highest authorship collaboration index is Mizoram University (2.99), which is followed by Nagaland University (2.77) and Rajiv Gandhi University (2.09), respectively.

6.6 *Most preferred publication source*

Table 4: University-wise most preferred publication source

Assam University			Tezpur University			Rajiv Gandhi University		
Publication Source	Paper	Pub Year	Publication Source	Paper	Pub Year	Publication Source	Pub Year	Pub Year
Current Science	32	2012	RSC Advances	71	2012	Journal of Intelligent & Fuzzy Systems	13	2013
Liquid Crystals	27	2012	Journal of Food Science And Technology-Mysore	42	2012	Filomat	10	2012
RSC Advances	24	2014	New Journal of Chemistry	41	2012	Phytotaxa	9	2018
PLoS One	20	2012	Chemistry select	36	2016	Current Science	8	2012
Indian Journal of Medical Microbiology	19	2013	Journal of Food Processing And Preservation	31	2013	National Academy Science Letters-India	7	2013
North Eastern Hill University			**Mizoram University**			**Manipur University**		
Publication Source	Paper	Pub Year	Publication Source	Paper	Pub Year	Publication Source	Pub Year	Pub Year
Journal of Organometallic Chemistry	34	2012	Zootaxa	24	2012	Zootaxa	25	2012
Journal of Molecular Structure	27	2012	Environmental Science And Pollution Research	20	2013	Indian Journal Of Chemistry Section B	13	2012
RSC Advances	23	2012	Journal of Environmental Biology	19	2014	Ichthyological Exploration Of Freshwaters	12	2012
Journal of Chemical Sciences	21	2012	RSC Advances	16	2014	Indian Journal Of Physics	12	2012
PLoS One	20	2012	Current Science	14	2012	Integrated Ferroelectrics	12	2015
Nagaland University			**Sikkim University**			**Tripura University**		
Publication Source	Paper	Pub Year	Publication Source	Paper	Pub Year	Publication Source	Pub Year	Pub Year
Current Science	9	2013	Frontiers in Microbiology	14	2016	Current Science	19	2013
Indian Journal of Animal Sciences	9	2012	Current Science	13	2012	SpectrochimicaActa Part A-Molecular And Biomolecular Spectroscopy	12	2012
Geological Journal	4	2018	Indian Journal of Traditional Knowledge	9	2012	Advances in Space Research	10	2014
Indian Journal of Agricultural Sciences	4	2012	Dalton Transactions	5	2015	Journal of Molecular Structure	9	2012
Indian Journal of Traditional Knowledge	4	2014	Journal of Scientific & Industrial Research	5	2013	RSC Advances	9	2014

Table 4 reflects the top five ranked publication sources for each university under the study. The 'Current Science' is the most used source among Assam University, Nagaland University, and Tripura University, whereas 'Zootaxa' is the most used source among Mizoram University and Manipur University.

6.7 *Prominent research areas among the central universities*

It is found from the analysis that 'Chemistry', 'Physics', 'Engineering', 'Environmental Science', 'Material Science', 'Biochemistry', 'Plant Science', and 'Pharmacology' are the most prominent research area among the central universities of northeast India.

6.8 *Institutional and country-wise collaborations*

Table 5: Country-wise collaborations of the central university

Assam University		Tezpur University		Rajiv Gandhi University		NEHU	
Country	Article	Country	Article	Country	Article	Country	Article
USA	222	USA	227	China	56	China	154
Slovakia	67	UK	82	Saudi Arabia	20	USA	124
UK	49	South Korea	76	Thailand	18	UK	59
Japan	47	Japan	69	Iran	16	Saudi Arabia	46
France	45	Germany	61	Brazil	13	Japan	45
China	43	China	50	South Korea	13	Australia	41
Czech Republic	34	France	38	Japan	10	South Korea	38
Saudi Arabia	32	Australia	30	UK	10	Germany	34
South Africa	28	Sweden	28	Germany	9	Canada	23
Iran	24	Singapore	24	Turkey	9	Switzerland	19
Mizoram University		**Manipur University**		**Nagaland University**		**Sikkim University**	
Country	Article	Country	Article	Country	Article	Country	Article
USA	217	China	59	Germany	6	USA	42
Iran	145	South Korea	31	Brazil	4	China	23
South Korea	139	USA	23	Australia	3	South Korea	19
Algeria	89	Saudi Arabia	21	China	3	UK	19
China	88	Germany	7	South Korea	3	Germany	12
UK	88	Australia	6	Japan	2	Brazil	10
Australia	87	UK	6	Canada	1	France	10
Saudi Arabia	87	Bangladesh	5	Finland	1	Italy	9
Germany	71	Italy	5	Italy	1	Japan	9
Vietnam	68	Oman	4	Kenya	1	Saudi Arabia	9
Tripura University							
Country	Article	Country	Article	Country	Article	Country	Article
USA	57	Australia	13	Canada	10	Greece	9
China	18	Hungary	13	Japan	10		
UK	16	Saudi Arabia	13	Singapore	10		

The institutional collaboration is analysed in table 5, and it is found that Assam University, Tezpur University, Mizoram University, Sikkim University, and Tripura University havethe highest collaboration with the USA, while the Rajiv Gandhi, Manipur University and NEHU havethe highest collaboration with China.

6.9 *Top funding sources among the faculty members of central universities*

Funding is the most crucial aspect of academic endeavours among all the universities of India and around the globe. The DST and UGC are the highest funding sources, followed by CSIR, DBT, and SERB, India's funding source among the central universities under this study. A total of 6.19% of research publications from all nine selected universities have been published with the UGC India's financial support, while 5.82% of research papers have received financial assistance from the DST, India.

7. Discussion and conclusion

The present study analyses the research productivity of nine general Central Universities of North Eastern region. The result is the witness to the progress and significant contributions in all the perspectives of research activities in academia. The findings of the study proved that Tezpur University is the highest research productivity in all academic parameters among all central universities in northeast India. NEHU and Assam University are the second in position. At the same time, Mizoram University, Tripura University, Manipur University, Sikkim University, Rajiv Gandhi University, and Nagaland University have to produce more research, particularly on the web of Science indexed journals. Chemistry, Physics, Engineering, and Materials Science are the most contributed subject area. The following suggestions and recommendations are made for the central universities of northeast India, which may help each university improve their research productivity and compete with the research levels of other top universities of India.

- The central universities in northeast India must focus on publishing more quality research journals with good impact factors or at least indexed in the Web of Science or Scopus database.

- For scoring good NAAC accreditations and ranking, central universities of northeast India must be facilitated with more findings opportunities by the major agencies.

- The faculty members have to produce more Ph.D. with quality research, copyrights, and patents, which directly benefits the NAAC and Ranking framework.

- The university has to focus on strengthening the central library, which plays a significant role in boosting the university's research work among the faculty members. Providing access to Online Journals, Databases, Research Tools assistance, and extensive training and motivation of the faculty members and research scholars can impact the university's research productivity.

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