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TRENDS IN ACADEMIC MOBILITY IN THE UNIVERSITY OF NORTH BENGAL (2011-2020): A SCIENTOMETRIC STUDY

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ABSTRACT

The paper examines the bibliographic data of 1436 documents published by the University of North Bengal and retrieves the data for a span of ten years, which was indexed in the Scopus database from 2011 to 2020 on various parameters. The average number of documents published per year was 143.6. The highest number of publications 166 was published in 2020, while the lowest number of publications was 108 in 2011. The relative growth rates (RGR) have decreased in 2019 (-0.34) and highest in 2012 (0.756) for last 10 years. The doubling time (Dt) increased during 2012 to a maximum of 231. Throughout the study, 9907 citations were recorded and a maximum of 2280 citations was noted in 2020. The majority of the documents came from articles, with 1333 coming from journals, and the source of the most funds was from UGC (12.67). Most of the co-authors came from the United States (8.22 per cent), and P Ghosh was the most prolific author, with 118 contributions.

Keywords: Scientometrics; Annual growth rate; Compound annual growth rate; Relative growth rate; Doubling time, Citations; authors; Document type; University of North Bengal.

1. INTRODUCTION

Russian inventors invented the word "Scientometric", for quantitative methods of studying the progress of science. With an evaluation of goals, viewpoints, and capacity, scientometrics is becoming a more important instrument of science policy around the world, evaluating to a large extent the path of a project and institutional funding. It implies quantitative research through scientific practices, such as editing, and therefore overlaps to some extent bibliometric. The quality of the research is determined by the information used and generated as a result of the research. The studies play an important role in understanding the evolution of a field and raising the standard of the study. The researchers attempted to study the effectiveness of research literature at the University of North Bengal.

2. SCOPE OF THE STUDY

The study is limited to contributed publications from the University of North Bengal that were indexed

in the Scopus database during the study period. The research was also restricted to ten years from 2011 to 2020.

3. LITERATURE REVIEW

A and Kannappanavar¹ examined the Relative Growth Rate and Doubling Time of publications and citations through a quantitative study. There is a decreasing trend in the Relative Growth Rate (RGR) of both publications and citations, and a correspondingly growing trend in Doubling Time (DT). Ul Haq, Ullah, and Tanveer² used the Scopus database to conduct a bibliometric analysis of publications by authors affiliated with Army Medical College in Pakistan. Methodology: All publications by the authors associated with the study, published between 1977 and 2018. However, to maintain a respectable position in the world, it is essential to significantly increase research activities and cooperation with international organizations where Nagarkar, Veer, and Kumbhar³ was to analyze the research productivity of life sciences faculty members at the Savitribai Phule Pune University (SPPU), Maharashtra, India. Research is carried out to determine the productivity of research. The faculty members have collaborated with prominent international researchers and have extended interdisciplinary research. Nagarkar⁴ used bibliometric parameters including several papers, several citations received, institutional collaborations, the productivity of journals, subject categories and authorship pattern have been used to carry out the analysis of the research contributions made by the faculty members of the Department of Chemistry at the University of Pune. Tripathi and Garg⁵ studied India's cereal crop publication production as measured by its coverage in the Scopus international database from 1965 to 2010. Pradhan and Ramesh⁶ examined the bibliographic data of 72,940 research papers published by six Indian Institutes of Technology between 2006 and 2015 and indexed in the Scopus database. Mukherjee worked on Professor. Lalji Singh, in the field of genome analysis, DNA fingerprinting, and other fields, has bibliometric characteristics that included authorship pattern, citations obtained, and relative results and Trivedi⁸ analyzed of global Agriculture Big Data research and Science⁹ from 2002 to 2011, Gupta, Kaur, and Kshitig¹⁰ observed the growth, global publications share, citation effect, the share of international collaborative articles, the contribution of major collaborative partner countries, the contribution of various subject fields and by the form of dementia, productivity, and impact of most productive institutions and authors from India. Gupta¹¹ studied examines Pakistan's research output from 2001 to 2010 in terms of growth and share of global research output, the pattern of research communication in core domestic and international journals, geographical distribution of publications, and share of international collaborative publications at the national level and across subjects and characteristics. Kumar and Kaliyaperumal¹² from 2000 to 2013, the growth and advancement of mobile technology research in the world's publications production on Web of Science. Viswanathan, Tamizhchelvan¹³ aimed of this study was to look at the research productivity of the Indian Journal of Pediatrics. The research was focused on citable documents that were published in a Scopus-indexed journal. This research statistically examined the yearly distribution of publications with growth analysis, authorship trend with its essence of collaboration, citation analysis with citations per article, uncited ratio, and top 20 authors ranking. Mooghali¹⁴ attempted to provide a comprehensive view of the history of the field of Scientometrics based on literature published between 1980 and 2009 using bibliographic records from the Social Science Citation Index, Science Citation Index, and Arts & Humanities Citation Index.

4. METHODOLOGY

Scopus is a comprehensive database of peer-reviewed abstracts and citations from a variety of disciplines that includes smart resources for research monitoring, analysis and visualization. It belongs to Elsevier and is only available as a subscription. For data collection, use the following search string (AF-ID:60000712 (“University of North Bengal”) AND (LIMIT-TO (PUBYEAR, 2011 to 2020))). During the reporting period, 1,436 publications were published. These records were extracted from the Scopus

database, along with complete bibliographic information such as title, year, document type, geographical distributions, and so on. To achieve the objectives, the data were compiled in MS Excel and checked

YEAR	NP (%)	CAGR (%)	AGR
2011	108 (7.52)	0	0
2012	122 (8.49)	0.063 (6.28)	12.96
2013	137 (9.54)	0.039 (3.94)	12.29
2014	161 (11.21)	0.041 (4.12)	17.52
2015	141 (9.82)	-0.026 (-2.62)	-12.42
2016	163 (11.35)	0.024 (2.44)	15.60
2017	142 (9.89)	-0.019 (-1.95)	-12.88
2018	164 (11.42)	0.019 (1.82)	15.49
2019	132 (9.19)	-0.024 (-2.38)	-19.51
2020	166 (11.56)	0.023 (2.32)	25.76

using scientometric tools.

5. OBJECTIVES OF THE STUDY

The main objectives of the study are:

- To evaluate the year wise growth rate and Citations-wise growth rate of the publications
- To determine the annual and compound annual growth rates of publications.
- To assess the relative growth rate and doubling time of publications and Citations.
- To find out the Mean value of relative growth rate and doubling time of publications & Citations.
- To determine the distribution of publications based on their type.
- To find out the distribution of publications based on the type of source.
- To explore the publication's source of funding.
- To find out the most productive authors.
- To identify the co-authors of the publication by country.
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6. DATA ANALYSIS

Table 1: Compound Annual Growth Rate and Annual Growth Rate of Publication

Abbreviation: CAGR= Compound Annual Rate Growth of Publication; AGR= Annual Growth Rate of Publication; NP= No. of Publication

6.1 Compound Annual Growth Rate and Annual Growth Rate of Publication

6.1.1 Year Wise Distribution of Publication

Table 1 depicts the year-wise distribution of publication from the 2011 to 2020 period of study. The publication output in the ‘University of North Bengal’ research expanded from 108 in 2011 to 166 in 2020. Out of a total of 1436 publications, 166 (11.56 %) were maximum recorded in the year 2020, followed by 164, constituting (11.42 %) of publications were published in the year 2018 and the minimum 108 (7.52 %) of publication recorded in the year 2011. The overall year-wise distribution of publication data shown in Table 1.

6.1.2 Annual Growth of Publications

Table 1 depicts the annual growth rate of publications. It has been clearly shown that the maximum AGR 25.76 recorded in the year 2020, followed by 17.52 AGR recorded in the year 2014 and the minimum AGR

-19.51 was recorded in the year 2019. Table 1 shows all the AGR data year-wise. The Annual Growth Rate

YEAR	NP	CS	W1	W2	RGB®	Dt	Mean ®	Mean (Dt.)
2011	108	108	0	4.682	0	0		
2012	122	230	4.682	5.438	0.756	0.917		
2013	137	259	5.438	5.557	0.119	5.823		
2014	161	298	5.557	5.697	0.140	4.950	0.257	16.240
2015	141	302	5.697	5.710	0.013	53.308		
2016	163	304	5.710	5.717	0.007	99.000		
2017	142	305	5.717	5.72	0.003	231.000		
2018	164	306	5.720	5.724	0.004	173.250		
2019	132	296	5.724	5.690	-0.034	-20.382		
2020	166	298	5.690	5.697	0.007	99.00	-0.003	116.373

(AGR) is calculated using the formula given by Kumar and Kaliyaperumal (2015).

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

6.1.3 Compound Annual Growth of Publications

Table 1 describes the Compound Annual Growth Rate (CAGR) of publications (2011-2020). The compound annual growth rate is calculated by taking the n th root of the total percentage growth rate, where n is the number of years in the period being considered. The highest CAGR was recorded in 2012 i.e., 6.28%, followed by 3.94% in the year 2013, and the lowest CAGR (-2.64%) recorded in the year 2015. The CAGR data is shown in table 1. The compound annual growth rate was calculated by the following formula.

$$CAGR = [(Ending\ Value / Beginning\ Value)^{1/n} - 1]$$

Table2: Relative Growth Rate and Doubling time of publication

Abbreviation: NP= No. of Publication; CS= Cumulative Sum; W1=Log (Initial number of Contribution); W2= Log Final number of Contribution); RGB®= Relative Growth Rate; Dt = Doubling Time

6.2 Relative Growth Rate and Doubling Time of Publication

Table 2 depicts the relative growth rate and doubling time of publication from the affiliation of “The University of North Bengal” from the marked period of study. The maximum 0.756 RGR was recorded in the year 2012, followed by 0.140 RGR was recorded in the year 2014. The growth rate of all publications has been measured based on RGR and Dt model, the particular model is developed. RGR is calculated to analyse the increase in the number of publications on time and the Dt is directly related to RGR. The mathematical representation of the mean relative growth rate of articles over a specific period is derived from the following formula:

$$RGR = \frac{W2 - W1}{T2 - T1}$$

Where RGR = Growth Rate over the specific period of the interval

W1 = Log (natural log of the W1 initial number of contributions)

W2 = Log (natural log of the final number of contributions)

T1 = the unit of initial time

T2 = the unit of the final time

6.2.1 Doubling Time

From the calculation, it is defined that there is a direct equivalence existing between the RGR and Dt. If the number of contributions of a subject double, during the period of study, then the difference between the logarithm of the numbers at the starting and the last of the period must be the logarithms of the number 2. If one uses a natural logarithm, this difference has a value of 0.693. The formula of corresponding Dt for contributions and page measurement.

$$Dt = 0.693/R$$

The maximum 231 doubling time was recorded in 2017, followed by 173.250 Dt recorded in the year 2018. The overall data of relative growth rate and doubling time is as shown in Table 2.

6.2.2 Mean Relative Growth Rate & Mean doubling time.

The mean relative growth rate Mean ® was 0.257 in the first five years (2011 to 2015) and was reduced to -0.003

in the last five years i.e., from 2016 to 2020. The corresponding mean of doubling time [Dt (C)] for 2011 to 2015 was 16.240 and 116.373 was for 2016-2020.

Table3: Relative Growth Rate and Doubling time of Citations

YEAR	NC (%)	CS[C]	W1©	W2©	RGB®[C]	Dt[C]	Mean ®[C]	Mean (Dt.) [C]
2011	21 (0.21)	21	-	3.044	-	-		
2012	123 (1.24)	144	3.044	4.969	0.288	2.407		
2013	380 (3.84)	503	4.969	6.220	0.783	0.886		
2014	584 (5.89)	964	6.220	6.871	1.314	0.527	0.992	1.065
2015	864 (8.72)	1448	6.8710	7.278	1.581	0.438		
2016	1253 (12.65)	2117	7.278	7.658	1.948	0.355		
2017	1294 (13.06)	2547	7.658	7.843	2.126	0.326		
2018	1527 (15.41)	2821	7.843	7.945	2.225	0.311		
2019	1581 (15.96)	3108	7.945	8.041	2.317	0.298		
2020	2280 (23.01)	3861	8.041	8.259	-0.001	-544.972	1.723	-108.736

Abbreviation: NC= No. of Citation; CSC] = Cumulative Sum of Citation; W1©=Log (Initial number of Citation); W2©= Log Final number of Citation); RGB®[C]= Relative Growth Rate of Citation; Dt[C] = Doubling Time of citation.

6.3 Relative Growth Rate and Doubling time of Citations

Table 3 depicts the year-wise distribution of citations from the 2011 to 2020 period of study. The citation is from 21 in 2011 to 2280 in 2020. Out of a total of 9907 citations, 2280 (23.01%) were maximum recorded in the year 2020, followed by 1581, constituting (15.96 %) of citations were in the year 2019 and the minimum 21 (0.21 %) of citation recorded in the year 2011.

Table 3 shows the relative growth rate and doubling time of citation from the affiliation of “The University of North Bengal” from the 2011-2020 period of study. The maximum 2.317 RGR of citation was recorded in the year 2019, followed by 2.225 RGR was recorded in the year 2018 and the minimum was -0.001 in the year 2020. The maximum 2.407 doubling time of citation was recorded in 2012, followed by 0.886 recorded in the year 2013. The overall data of relative growth rate and doubling time of citation is as shown in Table 3. The mean relative growth rate Mean RGR was 0.992 in the first five years (2011 to 2015) and was increased to -1.723 in the last five years i.e., during 2016 to 2020. The corresponding mean of doubling time [Dt (C)] of citations for 2011 to 2015 was 1.065 and -108.736 was for 2016-2020.

Table 4: Distribution of Documents by Type

S.N.	DT	NP (%)
1.	Article	1259 (87.67)
2.	Review	60 (4.18)
3.	Conference Paper	53 (3.69)
4.	Book Chapter	38 (2.65)
5.	Book	9 (0.63)
6.	Editorial	8 (0.56)
7.	Note	3 (0.21)
8.	Erratum	2 (0.14)
9.	Letter	1 (0.07)
10.	Short Survey	1 (0.07)
11.	Retracted	1 (0.07)
12.	Undefined	1 (0.07)

Abbreviation: S.N. =Serial Number; DT =Document Type; NP= No. of Publication

6.4 Document wise Distribution of Publication

Table 4 illustrates the document-wise distribution of publications during the period of 10 years i.e. (2010-2020). The maximum 1259 (87.67 %) of publications were ‘Article’ type documents, followed by Review type document with 60 (4.18 %) of publications and 53 (3.69 %) of publication was Conference paper type documents.

Table 5: Distribution of Documents by Source Type

S.N.	ST	NP (%)
1.	Journal	1333 (92.82)
2.	Book	47 (3.27)
3.	Conference Proceeding	36 (2.50)
4.	Book Series	19 (1.32)
5.	Trade Journal	1 (0.07)

Abbreviation: S.N. =Serial Number; ST=Source Type; NP= No. of Publication

6.5 Source type-wise distribution of the publication

Table 4 exhibits the distribution of publications by source type for 10 years. The maximum 1333 (92.82 %) of publications were ‘Journals’ followed by ‘Book’ with 47 (3.27%) of publications and 36

(2.50 %) were Conference and Proceeding documents.

Table 6: Documents by funding Sponsor greater than 10

S.N.	FS	NP (%)
1.	University Grants Commission	182 (12.67)
2.	Department of Science and Technology, Ministry of Science and Technology, India	123 (8.57)
3.	University Grants Committee	121 (8.43)
4.	Science and Engineering Research Board	61 (4.25)
5.	Council of Scientific and Industrial Research, India	58 (4.04)
6.	Department of Science and Technology, Government of Kerala	20 (1.39)
7.	Department of Biotechnology, Government of West Bengal	17 (1.18)
8.	Northern Border University	13 (0.91)
9.	U.S. Department of Agriculture	12 (0.84)
10.	Department of Biotechnology, Ministry of Science and Technology, India	11 (0.77)
11.	National Institute of Food and Agriculture	11 (0.77)
12.	Russian Foundation for Basic Research	11 (0.77)

Abbreviation: S.N. =Serial Number; FS= Funding Sponsor; NP= No. of Publication

6.6 Documents by funding Sponsor greater than 10

Table 6 lists the names of the funding sponsors who funded more than ten publications. The highest number of sources of the fund was obtained from the University Grants Commission i.e., 182 (12.67%). Similarly, the Department of Science and Technology, Ministry of Science and Technology 123(8.57%) and University Grants Committee 121 (8.43%) have been obtained funds, respectively.

Table 7: Country-wise Co-Author of Publication (>=10)

S.N.	Country	NP
1.	India	1436
2.	United States	89(0.062)
3.	Poland	41(0.029)
4.	Russian Federation	30(0.021)
5.	Germany	29(0.020)
6.	Tunisia	27(0.019)
7.	France	18(0.013)
8.	Japan	18(0.013)
9.	China	16(0.011)
10.	Saudi Arabia	15(0.010)
11.	Algeria	13(0.009)
12.	Netherlands	13(0.009)
13.	United Kingdom	12(0.008)
14.	Nepal	11(0.007)
15.	Canada	10(0.006)
16.	Italy	10(0.006)

Abbreviation: S.N. =Serial Number; NP= No. of Publication

6.7 Country Wise Distribution of not less than ten Publication.

Table 8 depicts the distribution of publications by the countries during the study period. All of the authors are from India and with the Co-Author, the maximum 89 (0.062) publications were contributed by the United States, followed by Poland with 41 (0.062) contributions and 30(0.029) publications contributed by Russian Federation. Germany and Tunisia contributed 29 and 27 publications, respectively.

Table 8: Top ten most productive authors

S.N.	Author Name	Department	Contribution (%)
1.	Ghosh, P.	Chemistry	118 (8.22)
2.	Roy, M.N.	Chemistry	96 (6.69)
3.	Sen, A.	Botany	73 (5.08)
4.	Chaudhuri, T.K.	Zoology	61 (4.25)
5.	Chakraborty, R.	Biotechnology	49 (3.41)
6.	Sinha, B.	Chemistry	46 (3.20)
7.	Das, M.K.	Physics	45 (3.13)
8.	Mandal, P.K.	Physics	45 (3.13)
9.	Misra, A.	Chemistry	44 (3.06)
10.	Panda, A.K.	Chemistry	38 (2.64)

Abbreviation: S.N. =Serial Number

6.8 Top ten most productive authors

Table 5 shows the top ten most prolific authors, with Ghosh, P. contributing the most 118 (8.22%) of publications, followed by Roy, M.N. with 96 (6.69%) publication and Sen, A. contributed 73 (5.08%) publication during the period of study. The majority of the authors are from the Department of Chemistry. Figure 1 depicts the organizational co-authorship network. The cumulative intensity of co-authorship relations with other authors is to be determined for each of the 113 authors who have a minimum of ten publications. The authors with the highest overall connection strength are chosen. With the aid of VosViewer software, figure 1 was created with 113 authors (each of whom has at least 10 publications) and there are a total of eight clusters, which are represented as 32, 20, 14,12,11,10,8,6.

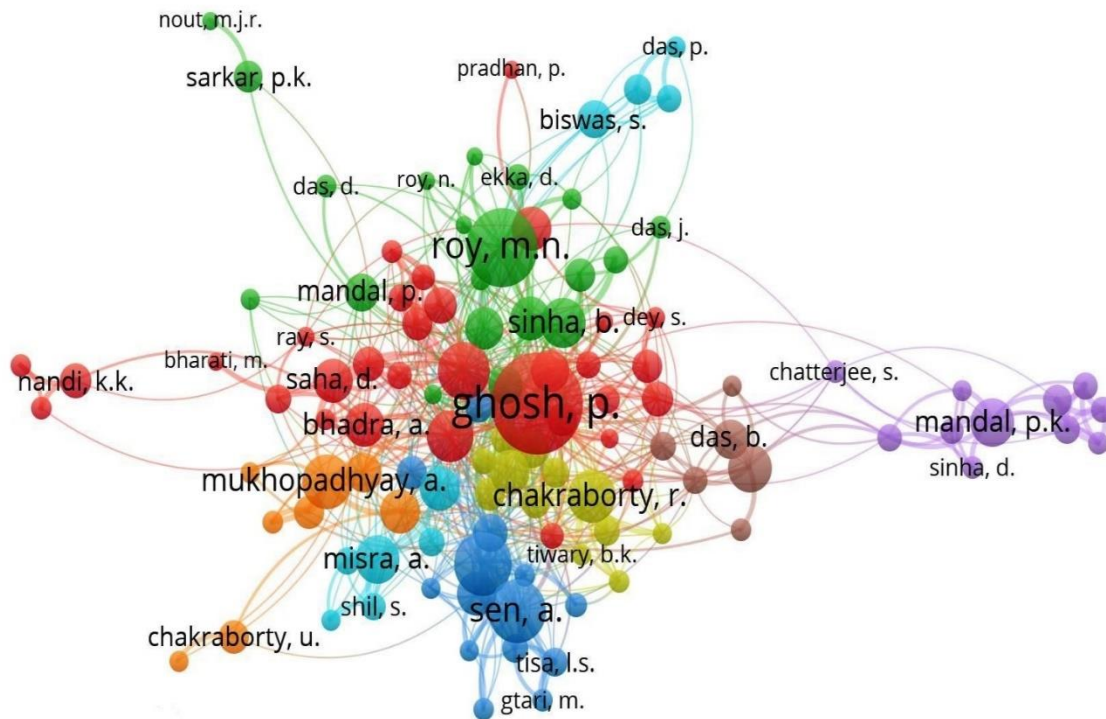


Figure 1: Authorship analysis in publications during 2011-2020

7. Finding

1. A total of 1436 contributions from the University of North Bengal have been reported over ten years (2011-2020). The University contributed the most publications (166) in the year 2020 and had the highest annual growth rate (25.76), compound annual growth rate (0.063) and maximum relative growth rate (0.756) were reported in the years 2020 and 2012 and 2012. In addition, the publication's maximum doubling time was 231 in 2017.
2. Throughout the analysis, 9907 citations were recorded. In the year 2020, the maximum citation was 2280, which is a significant increase over the minimum citation in 2011 (21). The years 2019 and 2012 had the highest relative growth rate of citations (2.317) and doubling time of citations (2.407).
3. During the study period from 2011 to 2020, the highest and lowest mean values of relative growth rate and doubling time of publications were 0.257 (during the year 2011 to 2015) and 16.240 (during the year 2011 to 2015), respectively.
4. The highest and lowest mean values of relative growth rate and doubling time of citations during the study period of 2011 to 2020 were 0.992 (over the year 2011 to 2015) and 1.065 (across the year 2011 to 2015), respectively.
5. It was found that 1259 (87.6 percent) publications belong to the article group and with 60 (4.18 percent) number of documents belonging to the review group.

6. It was observed that a majority of the documents' sources came from journals, with 1333 (92.82 percent) and 47 came from books (12.67 percent).
7. The University Grants Commission provided the most funding (182 (12.67), followed by the Department of Science and Technology with 123 (8.57 percent).
8. The University of North Bengal had the highest percentage of co-authors with the United States (8.22%), followed by Poland (0.062).
9. The most prolific author is P Ghosh, who has 118 contributions, followed by M Roy, who has 96 publications during the study period. Both the authors are from the Chemistry department.

8. CONCLUSION

The quality of research plays a significant role in the success of a university. Although high-quality research publications can be extremely beneficial to the world. There is evidence that research success can make a major contribution to a university's credibility, as well as serve as important feedback to policymaking.

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