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Scientometrics Profile of the Banasthali Vidyapith: A Deemed University of Rajasthan, India

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Scientometrics Profile of the Banasthali Vidyapith: A Deemed University of Rajasthan,

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Abstract

The current investigation work utilized bibliometric and visualization techniques. Scopus bibliographic database sources used to retrieve data. Two thousand seven hundred sixty-four (2764) papers retrieved by applying the 'Affiliation' in Scopus' simple search section. Biblioshiny (3.0), MS-Access, Excel, and VOS Viewer software used to analyze data and bibliometric indicator extraction employ to evaluate the research productivity of Banasthali University for a period of twenty-one years from 2000 to 2020. This data analysis leads to monitor the university's past and present status to maps its future perspectives. This study ventured to examine the overall performance of the faculties and researchers of the Banasthali University in research productivity and publications. The study concerned on finding the year-wise distribution of the publications, author's keywords ID, period, average citations per documents, top-ranked subjects, authors, most distinguished and productive author, author appearances, single-authored documents, multi-authored documents, top-ranked publications, co-authors per documents, co-authorship index, degree of collaboration based on the collected data and information gathered.

Keywords: *Bibliometric; Scientometrics; Banasthali Vidyapith; Biblioshiny; Author Impact; Source Impact; Author Collaboration Map; Authorship Pattern.*

Introduction and Literature review

Banasthali Vidyapith is a fully residential female university that offers an integrated system that extends from the basic to the doctorate level. To attain its goal of 'synthesizing East and West spiritual values and scientific achievements,' Five-fold (Panchmukhi Shiksha) education programs have been established comprising of: (i) physical, (ii) practical, (iii) aesthetic, (iv) moral and (v) intellectual. The students thereby build an integrated and healthy character (Banasthali Vidyapith 2020).

Mokhtari et al. (2019) stated that the evaluation of universities from different perspectives is essential for their scientific development. They pointed out that universities can use their bibliometric analyses for being informed of their strengths and weaknesses in the scientific production, researchers and decision-makers can detect possible gaps, regulate grants and research resources and decide on future programs for development. Nonetheless, Abouchdid and Abdelnour (2015) indicated that institutional prestige and reputation are associated with individual faculty publishing productivity, reputation, visibility, and advancement in the academic reward structure. Maurya (2020) affirmed that the publishing behavior of scientists

was for publishing their research results in approvingly specialized journals. The main benchmarks for measuring the performance of a university focuses on many intervening items and influencing parameters that include:

- a) Research productivity and activity (research articles published in peer-reviewed platforms, publications per year, the growth rate of the publications, maximum articles contributed by joint authors, most prolific author, research hotspots, research frontiers, etc.).
- b) Publishing behavior of researchers; determined by an accredited database (Scopus, the web of science-WoS, etc.).
- c) Quality indicators; quantity and Quality of publications concerning institutional excellence and transparency.
- d) Level of knowledge sharing; amongst the faculty members, research scholars, decision-makers, administrators, students, coworkers, community, etc.
- e) Collaborations; International, regional, and national collaboration (joint work, research, publications, conferences, groups, etc.).
- f) Scientific instruments: bibliometric and scientometric indicators used to determine, citation per paper, percent average citation per document, publication activity, impact per number of researchers, H-index, average collaboration coefficient, and so forth.
- g) International University (for example, rankings).

Collaborative Index could found from the relationship presented in equation (1).

$$CI = \frac{\sum_{i=1}^n N \cdot a_i}{N_T} \quad (1)$$

Where:

CI = Collaborative Index

N = the number authors in an article, i.e., 1, 2, 3

a_i = the number of j authored articles

N_T = the total number of articles published in a year, and

i = the total number of authors per articles

The average growth rate of research papers are may be calculated for any university or institution using equation (2). (Mukundan and Narayanan 2019).

$$r = \left(\frac{N_t}{N_o} \right)^{1/n} - 1 \quad (2)$$

Where:

Following formula:

r = Growth rate.

N_t = the Present number of publications.

N_o = Past or previous number of publications.

N = number of years.

H-index or Hirsch-index (2005) simultaneously measures the Quality and sustainability of the impact of a researcher's publication. It based on the quantity (number of papers), Quality (impact or citation), and distribution of citations received in publications of the researcher. Many H-index calculation tools are available that are integrated into the databases Scopus and ISI Web of Science (Repanovici 2011). Annibaldi et al. (2010) confirmed that h could not decrease with time; instead, it continues to increase even after the scientist stops publishing.

The M-Index is the H-Index that was separated by a research experiment for many years.

g-index or Egghe-index proposed to measure the productivity of the researchers based on their publications. The index is calculated on the basis that quotes received by a specific researcher's publications are distributed so that the number of quotes received is in decreasing order in a number of articles. It came in as an endeavor to overcome the deficiencies of the H-index (Egghe and Rousseau 2008.). Generally, the g-index is the unique largest number such that the top g articles received together at least g^2 citations. It can be determined using equation (3).

$$g^2 \leq \sum_{i \leq g}^n C_i \quad (3)$$

Where:

g = G-index or Egghe-index (equivalently defined as the highest number n articles with at least n an average number of quotations).

The main objectives of the study revolved around the following:

- 1) To find out major research areas of the university in terms of published works.
- 2) To find out the relative position of Banasthali University research publication metrics with other research universities in Rajasthan.
- 3) To find out the impact of international collaborations and source of publications on received citations.
- 4) To find out the impact of self-citations on h-index.
- 5) The relative rate of growth (RGR) and doubling time (DT) is determined for research by the Banasthali University.
- 6) To find out the level of collaboration at the national and international level with Banasthali University.

Research Methodology

The current study work used bibliometric and visualization techniques. Scopus database, Indian Citation Index, and other data sources used for data collection. Two thousand seven hundred sixty-four (2764) papers retrieved under Affiliation in the Scopus simple search section. Excel and Vosviewer software used for data analysis and bibliometric indicator extraction for evaluating the research productivity of Banasthali University based on the data collected from Document: 2764 covering a period of twenty years from 2000 to 2020. Search Strategy incorporated the following:

AF-ID ("Banasthali Vidyapith" 60028153) AND (LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR

LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009) OR LIMIT-TO (PUBYEAR , 2008) OR LIMIT-TO (PUBYEAR , 2007) OR LIMIT-TO (PUBYEAR , 2006) OR LIMIT-TO (PUBYEAR , 2005) OR LIMIT-TO (PUBYEAR , 2004) OR LIMIT-TO (PUBYEAR , 2003) OR LIMIT-TO (PUBYEAR , 2002) OR LIMIT-TO (PUBYEAR , 2001) OR LIMIT-TO (PUBYEAR , 2000)) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp") OR LIMIT-TO (DOCTYPE , "re") OR LIMIT-TO (DOCTYPE , "ch") OR LIMIT-TO (DOCTYPE , "ed") OR LIMIT-TO (DOCTYPE , "bk")) AND (LIMIT-TO (LANGUAGE , "English"))

Analysis and mapping of bibliographic data drawn from the Scopus databases conducted using Biblioshiny, MS- Access, Excel, Citespace, and VOSviewer to create overlays maps. These bibliometrics foci on network viewing, data visualization, correctness, statistical completeness of the results, and analysis of data collected in accord to the different levels of analysis (source impact, source dynamics, document analysis, word analysis, etc.) (Derviş 2019).

Results and Discussions

All related data were about the time zone dated: 05/04/2020. This study ventured to examine the overall performance of the faculty members of Banasthali University in research productivity and publications. The present study concentrated on finding the year-wise distribution of publication output, author's keywords plus ID, period, average citations per documents, top-ranked subjects, authors, most distinguished and productive author, author appearances, authors of single-authored documents, authors of multi-authored documents, single-authored documents, documents per author, top-ranked publications, authors per document, co-authors per documents, co-authorship index, degree of collaboration based on the collected data and information gathered. During the study, a total of 2764 documents investigated from around 1196 Sources (Journals, Books, etc.). Table (1) shows a summary of the primary information, tested and addressed within this study.

Table 1: Main Information

Description	Results
Documents	2764
Sources (Journals, Books, etc.)	1196
Keywords Plus (ID)	16718
Author's Keywords (DE)	7638
Period	2000 - 2020
Average citations per documents	6.72
Authors	2985
Author Appearances	10599
Authors of single-authored documents	53
Authors of multi-authored documents	2932
Single-authored documents	152
Documents per Author	0.926
Authors per Document	1.08
Co-Authors per Documents	3.83
Collaboration Index	1.12

Table (1) depicts that the result of the current study has directed that Banasthali University has progressed marvelously in these productive years of research work in terms of scholarly literature and academic investigations. This result agrees with Yadav et al. (2020) scientometric study directed at the research productivity of Mizoram University during the period 2004-2017 based on the Indian Citation Index. On the other hand, the results of Santhakumar et al. (2020) showed that the research productivity from the University of Madras has a fluctuating trend in the pattern of publication growth as downloaded from the Scopus database. The collaboration Index found to be 1.12. This figure is reasonable to compare to other institutions; for example, the Average degree of collaboration reached 0.96 according to the findings of Bapte and Gedam (2018) on their scientometric profile of Sant Gadge Baba Amravati University, Amravati During the period 1996-2017.

Table (2) gives a statistical record of the document type, number of productions, and total citations for authors' research performance of Banasthali University, Jaipur, India. The concentration on the article, conference papers, and review hints towards the inspiration and targeted research pattern of faculty at the university. Influencing parameters of ambition, dynamic scientific deliverables, promotion regulations or university ranking, and status may be playing a paramount part in this regard. Abouchedid and Abdelnour (2015) listed other factors that may have an impact (e.g., institutional factors, budgetary allocation, research policy Formulation, staff satisfaction levels, research climate, university mission, etc.). Silaghi-Dumitrescu and Sabau (2014) argued the importance of linking features and quality indicator percentages for types of national publications (research articles published in journals, proceedings, etc.) with a leading international university (for example ranked in the top 150 according to the Shanghai methodology, <http://www.arwu.org/>).

Table 2: Document Type

DT	NP	TC
Article	1806	12378
Book	2	4
Book Chapter	121	107
Conference Paper	588	1256
Editorial	7	3
Review	240	4825

*DT = Document type **NP = Number of productions ***TC = Total citations

Table 3: Year Wise Production.

Year	TP	TC	MTCA	MTCY	CY
2000	3	27	9.00	0.45	20
2001	5	13	2.60	0.14	19

2002	1	2	2.00	0.11	18
2003	5	125	25.00	1.47	17
2004	6	6	1.00	0.06	16
2005	8	19	2.38	0.16	15
2006	10	93	9.30	0.66	14
2007	19	315	16.58	1.28	13
2008	29	211	7.28	0.61	12
2009	42	525	12.50	1.14	11
2010	74	1356	18.32	1.83	10
2011	169	1758	10.40	1.16	9
2012	184	1528	8.30	1.04	8
2013	280	2270	8.11	1.16	7
2014	280	2476	8.84	1.47	6
2015	245	2609	10.65	2.13	5
2016	311	1926	6.19	1.55	4
2017	262	1286	4.91	1.64	3
2018	352	1297	3.68	1.84	2
2019	387	715	1.85	1.85	1
2020	92	16		0.17	0

*Tc =Total Citations **TP = Total Publication ***MTCA = Mean total citation per article ****MTCY = Mean total citation per year
 *****CY = Citable year

Year-wise production, as reflected by chosen factors of mean total citation per article, mean total citation per year, and the citable year depicted along with the table (3). The year 2015 showed maximum TC 2609 accompanied with the highest mean total citation per year of 2.13. The most significant mean total citation per article of 25.00 occurred during 2003. Most Citable year is 2000 with a CY of 20. The data reflect a fluctuating aspect among the selected measuring tools. This finding agrees with Kumar et al. (2015) for year-wise growth in research publications at the Gujarat University during the ten years of conducted study 2004 to 2013. Generally, no considerable difference found between the publication activity (impact per number of researchers) of the research at Banasthali University and the corresponding. This

result may merit a call for changes in the publication strategies, agrees with Beck and Gáspár (1991). They, for the same reason, encouraged and recommended the research institutes of the Hungarian Academy of Sciences and the corresponding departments of their faculty to explore the implementation of changes in the publication strategies of the different departments. The steady growth of agricultural research in Bangladesh observed by Das et al. (2020). Das and Ghosh (2020) opinion advised authors to focus on Open access publication for better visibility and to the betterment of the end-users as well as the readers.

Table (4) portrayed the top ten authors at Banasthali University. The author's impact for researchers shown with emphasize on h_index, g_index, m_index, total citations, NP, and PY_start. As per chosen bibliometric indexes of h (=41), g (=49) and m (=4.556) index and total citations (TC=3072) Assistant Professor Dr. Navjeet Kaur (Heterocyclic Chemistry¹) would be the most distinguished and productive author in 2012. She is followed next by Sharma V.

Table 4: Author Impact.

Author	h_index	g_index	m_index	TC	NP	PY_start
Sharma V	25	38	1.667	2619	281	2006
Sharma S	17	23	0.85	1009	172	2001
Kaur N	41	49	4.556	3072	119	2012
Kumar D	19	29	1.9	1065	114	2011
Alvi Pa	12	17	1.091	429	105	2010
Kumar S	10	16	0.476	396	97	2000
Paliwal S	11	17	0.786	429	85	2007
Dwivedi J	13	20	1.182	581	91	2010
Kishore D	12	25	0.571	757	82	2000
Singh A	13	21	0.722	597	79	2003

*TC= Total citations **NP= number of productions ***PY_start = Publication Year Start

¹ <https://scholar.google.co.in/citations?user=DapCYjQAAAAJ&hl=en>

Table (5) gives a niche that faculties preferred to publish their papers in international journals. This finding agreed with Santhakumar et al. (2020) when they studied the same issue for faculty members from the Mother of South Indian Universities (University of Madras). Bapte and Gedam (2018) results reflected the proportion of source type of document with a higher portion to research article as the dominant source selected by the academic community for research expression. This followed by conference paper, review, book chapter, book, editorial, items in the press, note, erratum, letter, and short survey, respectively. The results also coincide with those of Parmar and Siwach (2018)

Table 5: Source Impact

Source	Publisher and Country	h_index	TP	RTP	TC	RTC	CS
Synthetic Communications	Marcel Dekker Inc. (US)	34	74	1	2226	1	1.63
Advances in Intelligent Systems and Computing	Springer Science + Business Media (Germany)	6	69	2	119	3	0.54
AIP Conference Proceedings	American Institute of Physics (US)	3	61	3	39	8	0.37
International Journal of Pharmaceutical Sciences Review and Research	Global Research Online (India)	5	36	4	108	4	0.32
Vegetos Communications	Bareilly College (India)	2	25	5	14	10	0.18
in Computer and Information Science	Springer Verlag (Germany)	2	23	6	20	9	0.46
International Journal of	International Journal of Pharmacy and	7	23	6	174	2	0.54

Pharmacy and Pharmaceutical Sciences	Pharmaceutical Sciences (India)							
International Journal of Pharma and BioSciences	International Journal of Pharma and Bio Sciences (India)	5	20	7	68	6	0.35	
Journal of Heterocyclic Chemistry	Wiley-Blackwell (US)	3	20	7	89	5	1.22	
Acm International Conference Proceeding Series	association for computing machinery (US)	5	19	8	58	7	0.56	

*TP = Total Publication **RTP = Rank Total Publication ***TC = Total citations ****RTC = Rank Total Citations *****CS = Cite Score

Table (6) presents the affiliation wise productivity for the author at Banasthali University with selected some other international, regional, and national higher education institutions. Linkages reflected per factor of total publications, total rank publication, total citations, total rank citations, total citations, H5-Index, and R (H5-Index). The leading part for Banasthali University distinctly mirrored by the amount of; and accumulation of total publications, generated by its faculty and research staff. It's Rank Total citations came seventh. Abolghassemi Fakhree and Jouyban (2011) argue that overall ranking and comparison might be normalized based on the number of staff, researchers, students, and budgeting for each university.

Table 6: Affiliation-wise productivity

Affiliations	TP	R(TP)	TC	R(TC)	H5- Index	R(H5- Index)
Banasthali Vidyapith	2634	1	4565	1	24	7
University of Rajasthan	111	2	646	3	45	4
Amity University	76	3	205	8	37	6
Jawaharlal Nehru University	75	4	712	2	41	5

University of Kota	52	5	225	7	8	10
Aligarh Muslim University	39	6	330	4	55	3
University of Delhi	39	6	250	6	83	1
ITM University	32	7	130	10	21	8
Central University of Gujarat	32	7	172	9	18	9
Banaras Hindu University	32	7	266	5	66	2

*TP = Total Publication **R (TP) = Rank Total Publication ***TC = Total citations ****R (TC) = Rank Total citations

The country-wise collaboration brought the top ten rankings presented in table (7). Analysis indicated that researchers had the highest collaboration with the authors from the United States of America, South Korea, and the United Arab Emirates, respectively. It may attribute to linkages, ties, MOUs, and different affecting factors that worth a closer look. Siwach and Parmar (2018) arrived at similar results showing that nearly 47% of the Haryana Agricultural University, Hisar research published in ten journals, and it has collaborated with many institutions at the national and international level in its research publication. The results agree with Jignesh and Yogesh (2019).

Table 7: Country-wise Collaboration.

Country	TP	TP_Rank	TC	TC_Rank
India	2763	1	18573	1
United States	63	2	754	2
South Korea	37	3	333	4
United Arab Emirates	34	4	204	7
Australia	28	5	279	6
Saudi Arabia	26	6	116	10
United Kingdom	21	7	152	8
France	18	8	293	5
Pakistan	16	9	140	9
Fiji	13	10	381	3

*TP = Total Publications. **TP_Rank = Total Publications Rank ***TC = Total Citations ****TC_Rank = Total Citations Rank

Top ten most globally cited documents shown in table (8). It is interesting noting the clear presentation of the full-fold educational program comprising Banasthali Vidyapith University aspects leading in their areas. Total citations are accelerating beyond 200 the commencing year 2010.

Table 8: Most Global Cited Documents.

Document Title	Authors	Source Title	Year	Total Citations
Phenolic Acids Act as Signaling Molecules in Plant-Microbe Symbioses	Mandal SM	PLANT SIGNAL BEHAV	2010	224
Pyrrole: A Resourceful Small Molecule in Key Medicinal Hetero-Aromatics	Bhardwaj V	RSC ADV	2015	212
Mining Microsatellites in Eukaryotic Genomes	Sharma PC	TRENDS BIOTECHNOL	2007	165
Interaction of Engineered Nanoparticles with Various Components of The Environment and Possible Strategies for Their Risk Assessment	Bhatt I	CHEMOSPHERE	2011	145
Differential Response of Salt Stress on Brassica Juncea: Photosynthetic Performance, Pigment, Proline, D1, and Antioxidant Enzymes	Mittal S	PLANT PHYSIOL BIOCHEM	2012	139
Room Temperature Ferromagnetism in Undoped And Fe Doped ZnO Nanorods: Microwave-Assisted Synthesis	Limaye MV	J SOLID STATE CHEM	2011	129
Structural and Functional Alterations in Photosynthetic	Parmar P	BOT STUD	2013	115

Apparatus of Plants Under Cadmium Stress				
Haem Oxygenase (Ho): An Overlooked Enzyme of Plant Metabolism and Defence	Shekhawat GS	J EXP BOT	2010	110
Peroxiredoxins: A Less Studied Component of Hydrogen Peroxide Detoxification in Photosynthetic Organisms				
Physiological Changes Induced by Chromium Stress in Plants: An Overview	Hayat S	PROTOPLASMA	2012	92

Fig. (1) Offers an Author Collaboration Map with selected co-authorship from types of analysis and authors from the unit of analysis. Data analyzed for a total item of 36, with 36 clusters and zero links. The selected fractional method organized the counting method criteria. The chosen minimum number of documents of an author was four (4). There were a total of 2268 authors with only 36 that met the thresholds. For each of these 36 authors, the total strength of the co-authorship links with other authors calculated. The authors, with the highest total link strength, thus selected and picked; therefore, this leads to open more avenues and to explore new opportunities for international research collaboration. This finding corresponds to Kumbar et al. (2008) study, when they gave a call for the same from the developed and the developing countries, especially in the emerging areas of research, such as chemical engineering, energy, immunology & microbiology, and biotechnology.

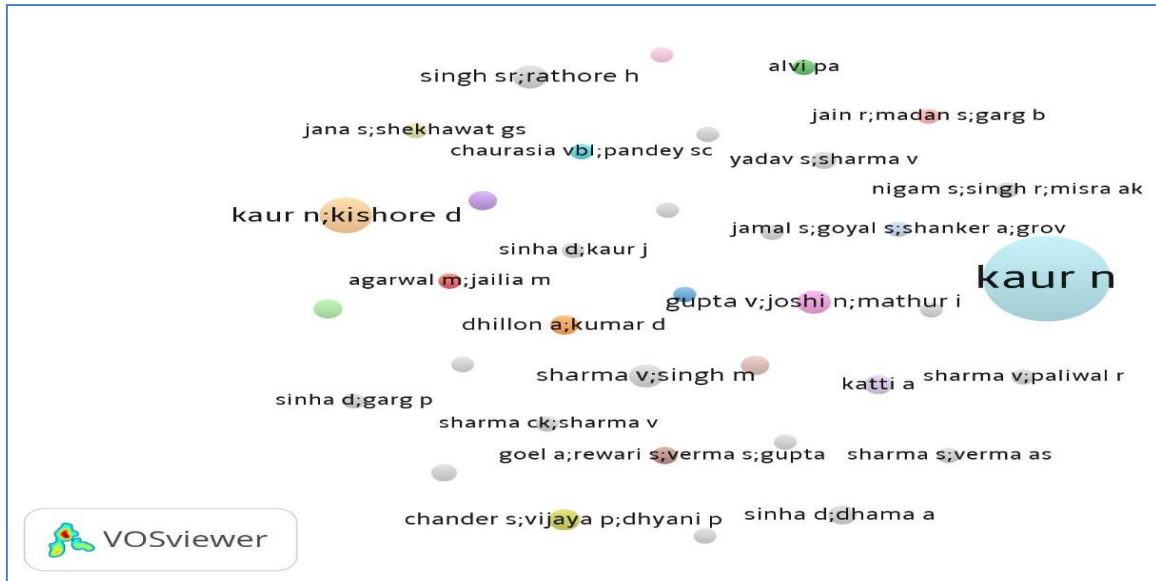


Figure 1: Author Collaboration Map.

Fig. (2) Displays a keywords occurrences map or a visual representation made with clouds of the keywords, with the following criteria:

- Selected Co-occurrences from types of analysis and all keywords from the unit of analysis.
- The selected fractional method in counting method criteria.
- The selected minimum number of occurrences of a keyword was 20. There were a total of 21636 all keywords, and 237 met the thresholds.
- For each of the 237 keywords, the total strength of the co-occurrences links with other keywords calculated. The keywords with the greatest total link strength were selected.
- Total Item was 237, cluster, 7, links 10587, and total link strength 4998.50.

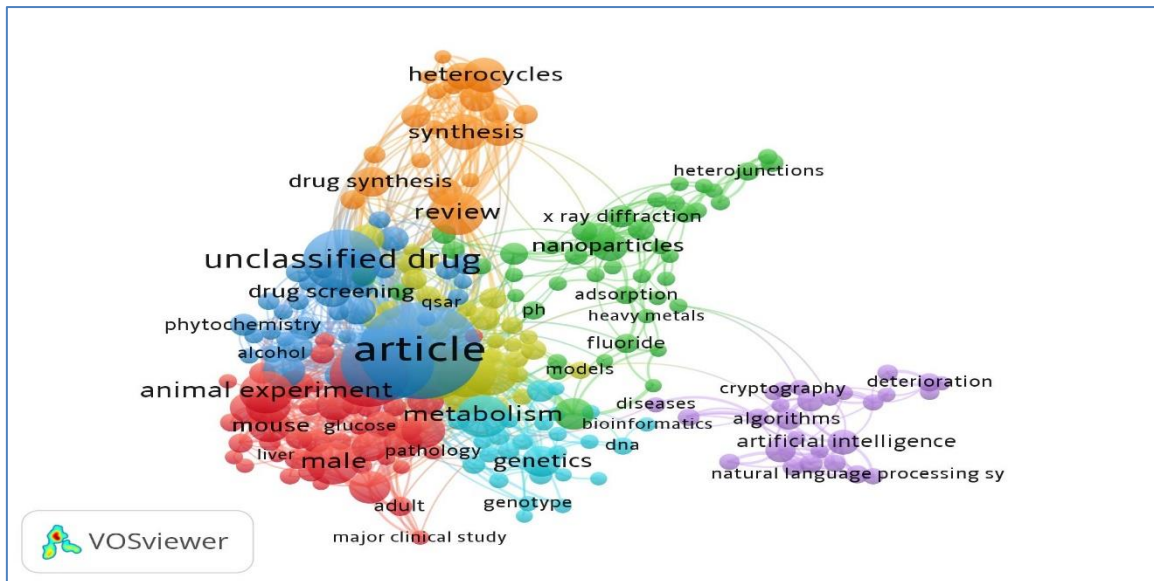


Figure 2: Keywords of occurrences Map

Chihib et al. (2019) signaled that the more interesting data are the keywords College Buildings, which show that BIM is also starting to be applied for the construction of university buildings, while global BIM mainly focused on office buildings. If a visual representation made with clouds of the keywords, they figured where a study must conduct for automation, sustainable development, or industry foundation classes. Du et al. (2019) automatically clustered the author's cooperative network type by a spectral clustering algorithm to obtain a collaborative network diagram of the authors with the number of published papers \geq two from 2008 to 2018.

Fig. (3) Exhibits a Source Collaboration Map for the following elected conditions:

- Selected Citations from types of analysis and source from unit of analysis.
- The selected fractional method in counting method criteria.
- The selected minimum number of documents of a source was 5. There were a total of 1196 sources, and 107 met the thresholds.
- For each of the 107 sources, the total strength of the citations links with other sources calculated. The sources with the greatest total link strength were selected.
- Total Item was 107, cluster, 107, links 0.

A similar figure for international collaborations drawn with multiple lines and multiple arrows indicated the collaboration between more than two countries, viz., India, USA, and Canada, etc. as published by Nagarkar et al. (2015). Comparable maps were presented by Derviş (2020) during his study using the Open-source software Biblio-Matrix R package for bibliometric analysis and co-citation analysis to achieve the research activities. Analogous charts were mounted by Chihib et al. (2019) on their study and Comparative Analysis of Bibliometric Maps of BIM and BIM in Universities. Nair and Yasmin (2019) considered in their study bibliometric methods for education of research performance of Indian Universities for the period of 2017-2019 in the hope of providing a better understanding of researcher work carried out during the period.



Figure 3: Source Collaboration Map

Table (9) and Fig. (4) Furnish a general illustrated authorship pattern of publications tested. It merits this regard, considering the results obtained by Repanovici (2011) and, based on his study that showed an open access institutional repository would significantly add to the visibility of the university's scientific production.

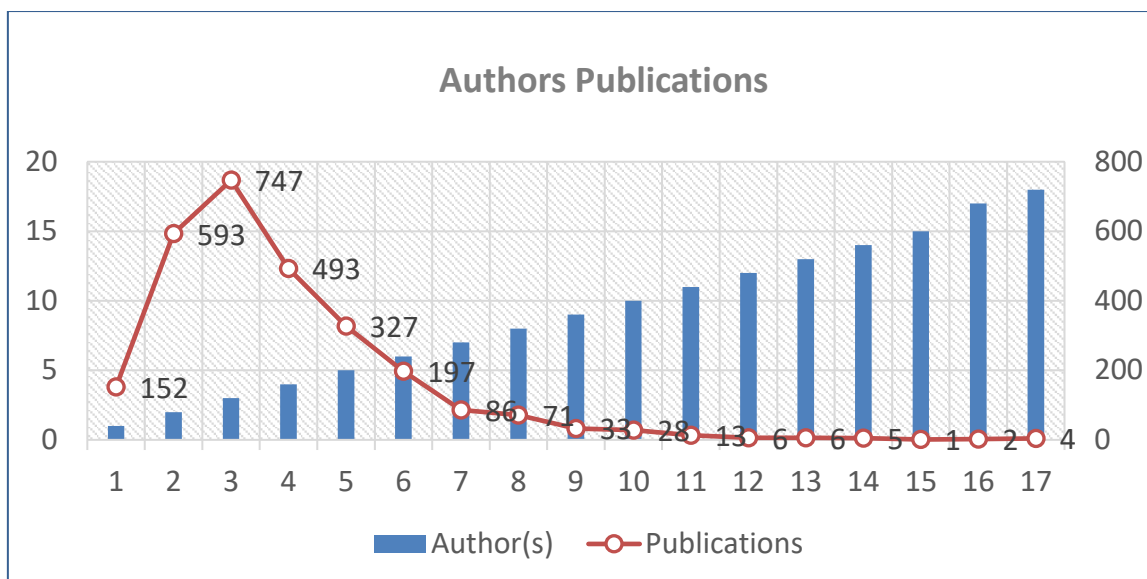


Figure 4: Authors' publications.

Conclusions

The study revealed that there is an increasing growth trend in publications and research production within the Banasthali University, Jaipur, India, especially in recent years. The research findings indicated that researchers published their papers in differently highly cited international and national journals. Attentions went to share, and characteristics of selected favorably cited papers, top productive authors, strong and weak areas of university research, their growth rate, and impact in terms of average citations received. Equally, the study showed the increasing trend of collaborative research beyond Jaipur state for further outreach at both national and international levels, and leading publication mainstreaming at core journals. Similarly, the collaborative share of research output across various subjects whereby the study reflected on major countries involved in international collaboration. The bibliometric package used to review the longitudinal development of graphene between 2000 and 2020 using data acquired from Scopus for building information models in Banasthali University.

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