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BIBLIOMETRIC ANALYSIS OF THE PAKISTAN JOURNAL OF BIOTECHNOLOGY

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ABSTRACT

This is the first bibliometric report about the Pakistan journal of biotechnology (PJBt), which was launched in 2004. Total number of publications was found to be 825. Statistically, a random yearly growth rate was observed (varied per year) and the doubling time was found to be 4.7 (years). From 2008 to 2017, the data of 501 publications was retrieved from Scopus. Precisely, 1224 authors, 714 institutions and 29 countries were directly involved in (501) research publications. In author's category, Prof. Dahot M.U. was found with highest number of publications i.e. sixteen (16). Institute of Biotechnology and Genetic Engineering, University of Sindh, Jamshoro, Pakistan is the top university with (29) publications. While, India is the top ranked country with maximum (271) number of publications. We also provided the list of top ten most cited documents. Last but not the least, the detail graphical maps are provided for the co-words analysis of titles, abstracts and all keywords of the manuscripts (Vosviewer analysis). This will significantly help to describe the overall theme of the journal.

Keywords: Scopus, PJBt and Bibliometry

INTRODUCTION

The Pakistan Journal of Biotechnology (P-ISSN: 1812-1837 and E-ISSN: 23127791) was launched in 2004 and regularly published research articles, reviews and short communications. It covered relevant areas of basic and applied biotechnology. As per Scimago journal ranking, PJBt is categorized in biochemistry, genetics & molecular biology, immunology and microbiology.

Bibliometric analysis can be defined as a statistical evaluation of published scientific articles, books, chapters of a book, journals, any broad research area, institutions and any specific country (Schubert, et al., 1989, De Moya-Anegón et al., 2007). The analysis of literature is a very important source of sharing about the quantity and quality of scientific work (De Moya-Anegón, et al., 2007, Chemdem et al., 2016).

The present project is designed to perform the 1st bibliometric analysis of PJBt. On the basis of co-authorships and citations, we focused on the most productive scientists, institutes and countries. The graphical overview of the bibliographic data of PJBt is provided by using visualization of similarities (VOSviewer) software. We also performed statistical analysis to determine the growth rate and doubling time.

2.0 MATERIALS AND METHODS

2.1 Source of information: The yearwise details were obtained from the journal's home page i.e. https://www.pjbt.org/Journal-Information.html. While data for the years 2004-2017 was retrieved from Scopus (Elsevier BV Company, USA), the largest database of scientific literature. In May 2020, the data was collected, downloaded and quantitatively analyzed in Microsoft Excel for access type, year, author name, document type, key words, affiliations and country.

2.2 VOSVeiwer analysis or visualization maps: VOSviewer version 1.6.9 was used for viewing and creating the desired bibliometric maps.

2.3 Statistical analysis:

Relative growth rate and doubling time: The relative growth rate and the doubling time for publications were calculated by the following equations:

$$RGR_{(1-2)} = Log_e\ {}_2w - Log_e\ {}_1w / 2^T - 1^T$$

Where;

RGR (1-2) is mean Relative Growth Rate over the specified period
$Log_e\ {}_2w$ = log of initial number of publications
$Log_e\ {}_1w$ = log of final number of publications
$2^T - 1^T$ = The Unit difference between the Initial time and Final time

And;

$$DT = Log_e\ {}^2 / GR$$

Where;
GR= Growth rate

3.0 RESULTS AND DISCUSSIONS

3.1 Analysis of publication outputs: In total (from 2004 to May 2020), PJBt has completed publications of 825 documents as shown in Figure 1. We can divide the total years in three time spans.

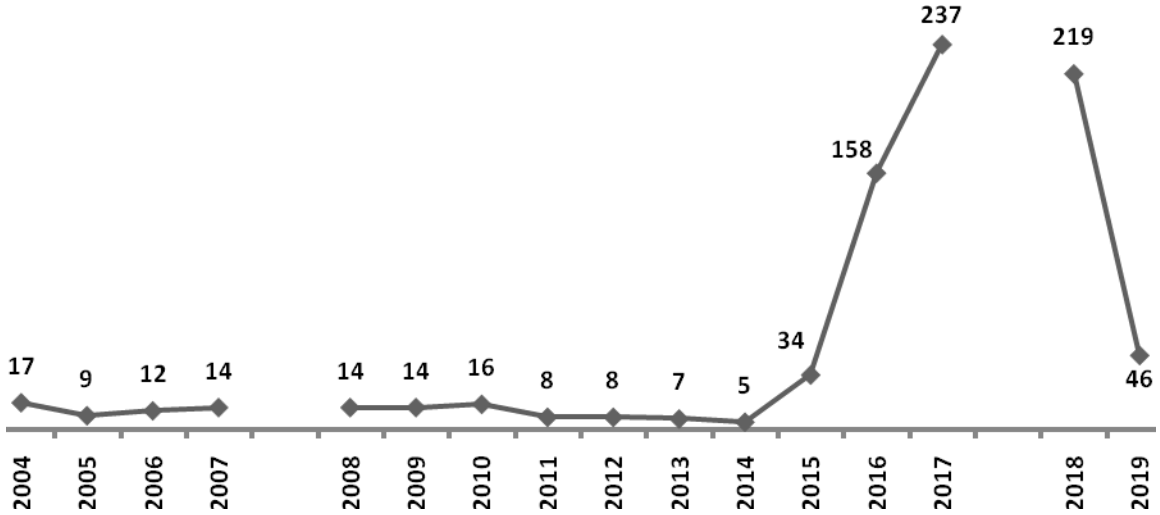

Figure 1: List of per year publications.

1. From 2004 to 2007, total 52
2. From 2008 to 2017, 501 and
3. From 2018 to 2019/2020, 272 documents were published.

In 501 publications, the most frequently published documents were articles (332), followed by conference papers (159), reviews (7), editorials (2) and short survey (1). Statistically, the highest growth rate was recorded for the years 2015-17, with 85, 78 and 33 % growth was noted (Table 1).

Table 1: The relative growth rate (RGR) of publications from 2004 to 2020

Year	No of Publications (#)	%age	RGR	% Growth
2004	17	1.21		
2005	9	0.64	-0.47	-47.06
2006	12	0.85	0.33	33.33
2007	14	1.00	0.17	16.67
2008	14	1.00	0.00	0.00
2009	14	1.00	0.00	0.00
2010	16	1.14	0.14	14.29
2011	8	0.57	-0.50	-50.00
2012	8	0.57	0.00	0.00
2013	7	0.50	-0.13	-12.50
2014	5	0.36	-0.29	-28.57
2015	34	2.42	5.80	580.00
2016	158	11.24	3.65	364.71
2017	237	16.86	0.50	50.00
2018	219	15.58	-0.08	-7.59
2019	46	3.27	-0.79	-79.00
2020	7	0.50	-0.85	-84.78

The doubling time was found to be 5.1 as shown in Table 2.

Table 2: The publications doubling time

Years	Numbers	Cumulative	W1	W2	R(a) W2-W1	Mean R(a) (1-2)	Doubling Time Dt(a)	Mean Dt(a) (1-2)
2004	17	17	0.0	2.8	2.8	0.4	0.2	5.1
2005	9	26	2.8	3.3	0.4		1.6	

2006	12	38	3.3	3.6	0.4		1.8	
2007	14	52	3.6	4.0	0.3		2.2	
2008	14	66	4.0	4.2	0.2		2.9	
2009	14	80	4.2	4.4	0.2		3.6	
2010	16	96	4.4	4.6	0.2		3.8	
2011	8	104	4.6	4.6	0.1		8.7	
2012	8	112	4.6	4.7	0.1		9.4	
2013	7	119	4.7	4.8	0.1		11.4	
2014	5	124	4.8	4.8	0.0		16.8	
2015	34	158	4.8	5.1	0.2		2.9	
2016	158	316	5.1	5.8	0.7		1.0	
2017	237	553	5.8	6.3	0.6		1.2	
2018	219	772	6.3	6.6	0.3		2.1	
2019	46	818	6.6	6.7	0.1		12.0	
2020	7	825	6.7	6.7	0.0		81.3	

3.2 Co-authorship and citations analysis for researchers, institutions and countries: It's worthy to note that bibliometric methods can be properly added in several categories. One of the group can be termed as evaluative techniques which includes productivity measures i.e. number of papers per year or number of papers per author etc. In 1960, the idea of co-authorship analysis was introduced. This can be used to determine the regional, national or international cooperation. The co-authorship analysis can be applied to individual researchers, sources or journals, subjects or geographical regions (4). In the present work we principally focused on exploring the number of publications per author, organization and country. This may help in exploring the co-authorship pattern. It is one of the most substantial and well documented forms of scientific collaboration. It can help in tracking almost every aspect of collaboration. Similarly, citation analysis is an important tool to examine the impact and quality of an article. It can also help in measuring the importance of an author or article i.e. by counting the number of times it has been cited. It will further help in identifying seminal work in that particular area.

Its worthy to note that total 1224 authors have contributed in 501 research publications in PJBt. Based on the number of publications, the top three authors were found to be Dahot M.U. (16), followed by Sadik A.S. (15) and Prasanna S.C. with 11 publications. However, based on the number of citations, Prasanna S.C. is top ranked researcher with 52 citations, followed by Karthe M. (27) and Prof. Dahot M.U. (23). The details are listed in Table 3.

Table 3: List of top 10 authors, organizations/universities and countries with maximum number of publications or documents (Docs) and citations (Cits).

S#	List of Top 10 Authors			List of Top 10 Universities			List of Top 10 Countries		
	Author	**Docs**	**Cits**	**Organization/University**	**Docs**	**Cits**	**Country**	**Docs**	**Cits**
1.	Dahot M.U.	16	23	Institute of Biotechnology and Genetic Engineering, University of Sindh, Jamshoro, Pakistan	16	21	India	271	254
2.	Sadik A.S.	15	12	Department of Mechanical Engineering, m. Kumarasamy College Of Engineering, Karur, India	13	10	Pakistan	74	110
3.	Prasanna S.C.	11	52	Department of Mechanical Engineering, m. Kumarasamy College of Engineering, Karur, Tamilnadu, India	10	28	Iraq	60	61
4.	Mohamed S.H.	7	7	Department of Biology, Faculty of Science, Taif University, Taif, Saudi Arabia	6	7	Egypt	37	33

5.	Naqvi S.H.A.	7	7	Department of Biology, Faculty of Mathematics and Natural Sciences, Bogor Agricultural University, Bogor, Indonesia	5	11	Indonesia	28	50
6.	Rafiq M.	7	10	Institute of Plant Sciences, University of Sindh, Jamshoro, Pakistan	5	8	Saudi Arabia	18	12
7.	Saravanan D.	7	9	Department of Information Technology, Sri Krishna College of Technology, Coimbatore, India	4	7	Iran	13	40
8.	Christal K.	6	15	Dept. Agric. Microbiol., Institute of Soil, Water and Environment Research, Arc, Giza, Egypt	4	4	China	10	7
9.	Jatoi G.H.	6	6	Biotechnology Study Program, Graduate School, Bogor Agricultural University, Indonesia	3	4	Australia	4	9
10.	Karthe M.	6	27	Centre for Molecular Biotechnology, School of Life science, Queensland University of Technology, Brisbane, Qld, Australia	3	3	Malaysia	2	1

Note: The name of university or country does not mean a direct affiliation of authors.

In institutional category, it was noted that total 714 universities, departments or organizations were involved in 501 publications. Institute of Biotechnology and Genetic Engineering, University of Sindh, Jamshoro, Pakistan, Department Of Mechanical Engineering, M. Kumarasamy College of Engineering, Karur, Tamilnadu, India and Department of Biology, Faculty of Science, Taif University, Taif, Saudi Arabia were the top three ranked institutes' with 29, 10 and 6, publications, respectively. Nineteen (19) institutes have contributed atleast 3 publications with 3 citations. Similarly, the list of top 10 institutes is given in **Table 3**. In "collaboration between countries" category total 29 countries were directly involved in 501 publications. The highest contribution (271 publications) was found for India, followed by Pakistan (74) and Iraq with 60 publications as shown in Table 3.

It's worthy to note that the data about the top ten authors, institutes and countries are compiled in a single table (Table 3). This does not mean a direct affiliation of authors, institutes or countries.

3.3 The list of most cited documents: The list of the top ten (10) most cited documents with titles and citations are provided in Table 4.

Table 4: List of top 10 most cited documents.

S#	Document	Titles	Citations
1.	Vijayakumar P. (2017)	Efficient implementation of decoder using modified soft decoding algorithm in Golay (24, 12) code (Vijayakumar et al., 2017).	**20**
2.	Muthu F. (2017)	Design of CMOS 8-bit parallel adder energy efficient structure using sr-cpl logic style (Muthu et al., 2017).	**19**
3.	Keerthivasan S. (2017)	Design of low intricate 10-bit current steering digital to analog converter circuitry using full swing GDI (Keerthivasan et al., 2017).	**19**
4.	Yuvaraj P. (2017)	Design of 4-bit multiplexer using sub-threshold adiabatic logic (stal) (Yuvaraj et al., 2017).	**17**
5.	Karthe M. (2017)	Property evaluation of super hard alloys (Karthe et al., 2017).	**12**
6.	Sahne F. (2016)	Extraction of bioactive compound curcumin from turmeric (Curcuma longa L.) via different routes: A comparative study (Sahne et al., 2016).	**11**
7.	Manickam C. (2017)	Influence of particle size on the thermal conductivity of graphene composites (Manickam et a., 2017).	**10**

8.	Abbas M.H. (2017)	Prevalence of Staphylococcus Aureus among gingivitis in patient with orthodontic wires in Kufa City/Iraq (Abbas et al., 2017).	**9**
9.	Othman B.A. (2008)	Characterization of virulent bacteriophages for Streptomyces griseoflavus isolated from soi (Othman et al., 2008).	**9**
10.	Kowsigan M. (2017)	Heart disease prediction by analysing various parameters using fuzzy logic (Kowsigan et al., 2017).	**8**

3.4 Co-occurrence of words in titles, abstracts and keywords: In this part, we focused on co-occurrence of words in titles, abstracts and keywords of the publications. This will significantly help to describe the overall theme of the journal.

In titles, total 1755 terms were collected. 71 terms were repeated at least 3 times as shown in Figure 2. Some of the words are system (49), effect (40), analysis (30), design (24), optimization (24), production (21), application (20), study (19), detection (18) and evaluation (18).

While, in abstract total 11365 words were recorded. 150 of them repeated at least 10 times as shown in Figure 3. Some of words are system (137), paper (128), effect (88), process (62), performance (60), concentration (56), plant (56), problem (52), activity (49) and production (48).

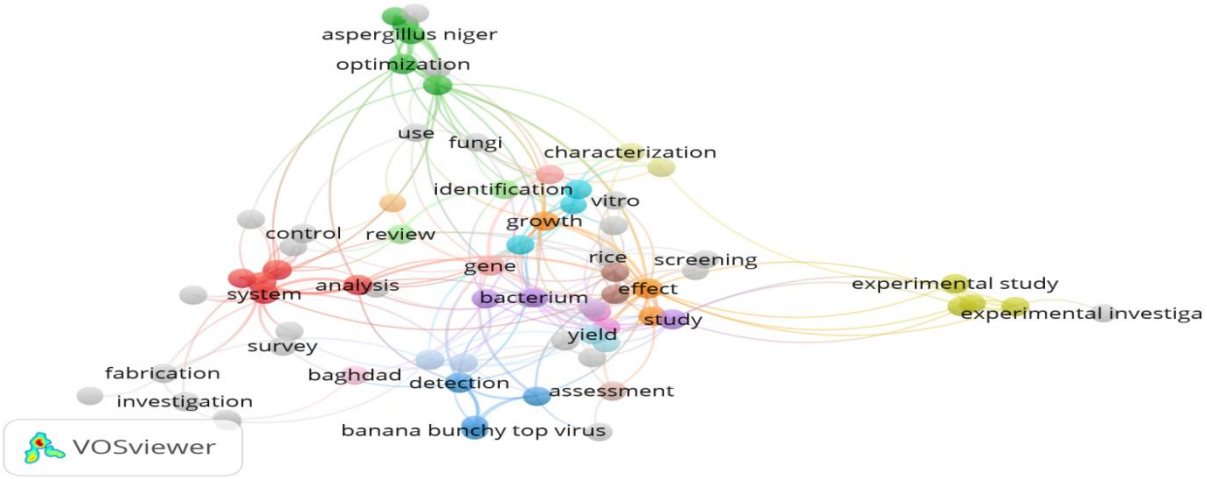

Figure 2: Collection of different words in titles of all manuscripts

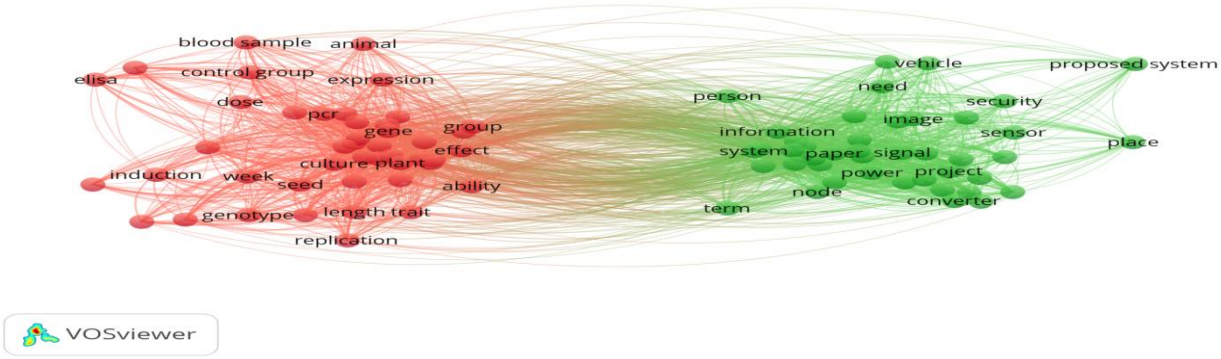

Figure 3: Collection of different words in abstracts of all manuscripts

It's worthy to note that in total publications (501), 2635 keywords are reported. For analysis we selected those words which appeared atleast ten (10) times. Similarly, other keywords like "article, conference papers and clinical articles" are also excluded. They are compiled in six (6) categorized as shown in Table 5.

Table 5: The proposed six (6) categories of keywords with number of times of appearance denoted by (#).

Category (1) Subjects	**#**	**Category (2) Animals and Bacteria**	**#**	**Category (3) Plants**	**#**
Nonhuman	202	Plant Growth	20	Animal Experiment	17
Human	108	Plant Height	19	Polymerase Chain Reaction	27
Male	36	Plant Leaf	15	Bacterium Isolation	22
Female	32	Plant Seed	14	Bacterium Isolate	16
Adult	26	Extraction	11	Bacterial Strain	15
		Plant Root	11	Escherichia Coli	15
		Wheat	11	Animal Tissue	14
		Shoot	11	Bacterium Culture	14
		Tensile Strength	11	Bacterial Growth	13
				Streptomyces	12
				Antibacterial Activity	11
				Fungus Growth and Inoculation	22
Category (4) Technology	**#**	**Category (5) Types of study & Methodology**	**#**	**Category (6) Genetic and Enzymatic**	**#**
Simulation	49	Controlled Study	137	Genotype	16
Algorithm	24	Unclassified Drug	45	Enzyme Activity	14
Software	24	Comparative Study	37	Gene Expression	13
Electric Potential	23	Concentrations	20	Enzyme Linked Immunosorbent Assay	12
Wireless Communication	20	In Vitro Study	20	Enzyme Synthesis	12
Process Optimization	14	PH	20	Genetic Variability	12
Surface Property	14	Temperature	16		
Internet	13	Nitrogen	17		
Machine	13	Major Clinical Study	14		
Computer	11	Blood Sampling	13		
Electricity	11	Carbon Source	13		
Videorecording	12	Glucose	13		
Frequency	11	Sucrose	12		
Sensor	11	Carbon	11		

The major categories are subjects, animals & bacteria, plants, technology, types of studies or methodology and genetic & enzymatic studies. While in Vosviewer (keywords co-occurrence analysis) 4674, words were found. 79 words appeared atleast 10 times. Some of the examples are articles, nonhuman, human, conference paper, simulation, adult, algorithm, software, velocity, pH, and animal experiments. The keyword co-occurrence network is presented in Figure 4.

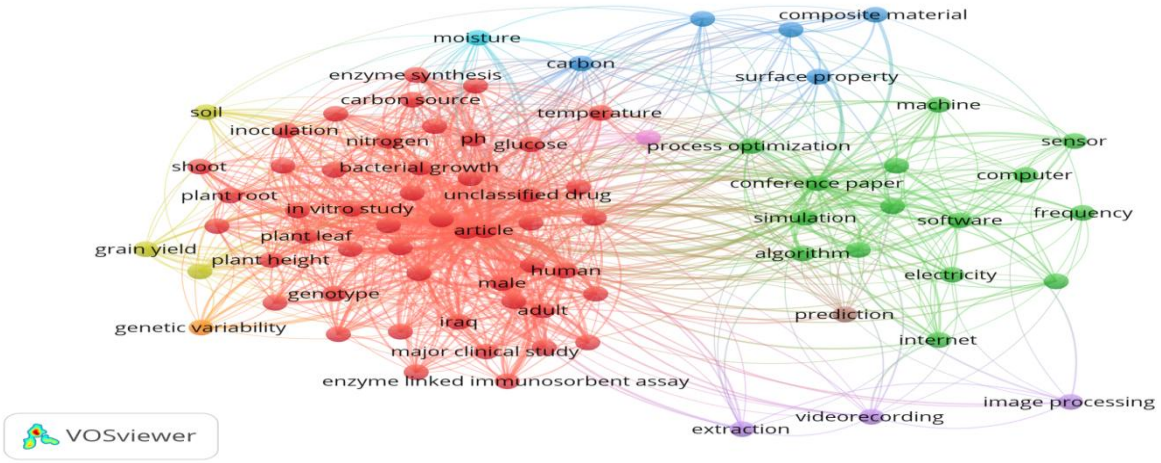

Figure 4: Collection of different words in keywords of all manuscripts

Conflict of Interest

The authors declare no conflict of interest.

Author's Contributions

All authors collectively worked in designing and writing the manuscript. They also jointly worked in statistical analysis and drawing maps by Vosviewer software.

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