Evaluating the Publications Growth of the University of Baluchistan, Pakistan:
A Bibliometric Analysis

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ABSTRACT

The University of Baluchistan (UoB) is the pioneer degree-awarding, higher educational institution of Baluchistan, Pakistan. This study aims to evaluate the bibliometric parameters of publications contributed by the researchers affiliated with UoB as reflected in Scopus database. A bibliometric research method was applied to the dataset retrieved with affiliated address of UoB from the Scopus database. The bibliographic detail of publications was downloaded in Microsoft Excel format for analysis. Periodic growth of publications with the citation metric and authorship pattern were examined. Further, subject dispersion, productive authors, frequently used journals, contributing institutions and the trends of international research collaboration were also analyzed. Microsoft Excel was used for data analysis. A total of 1,850 documents were identified from which were published from January 1974 to December 2022. These publications gained an average of 11.19 citations per document. More than two-thirds of the documents were published in the last decade. The average ratio of authors per document increased significantly over time. Two-author's documents gained the highest citation impact. The maximum research was done on "agriculture and biological sciences" while the highest number of documents were published in the Pakistan Journal of Zoology. Most of the documents (94%) were written in collaboration and the four-author pattern was found most frequent. Tareen, RB and Yaqoob, M emerged as the most prolific authors with 130 and 100 documents, respectively. Most of the research collaboration was performed with University of Karachi, followed by Baluchistan University of Information Technology Engineering and Management Sciences. Malaysia has been the top preference in international research collaboration. The research productivity reflects the quality of teaching and learning at the University. Ob. produced remarkable research during the last decade and it is needed to enhance this momentum.

Keywords: Bibliometric, University of Baluchistan, Research Productivity, Publications, Pakistan

Introduction

This study describes the status of research documents contributed by the authors affiliated with the University of Baluchistan (Ob.). A bibliometric research technique has been employed to formulate this paper. Ob. located in downtown of Quetta, it is the oldest seat of higher education in the province of Baluchistan Pakistan, and it is a public sector general university. Baluchistan is the largest province of the country by land area and consists of 44% of the total area of Pakistan but the least populated in terms of population. It is rich in mineral resources and has deep-rooted tribal traditional systems. An indigenous system of education prevailed in this area before the introduction of the modern western system of education by the British before independence. After 1947, colleges located in Baluchistan were affiliated with University of the Punjab. In 1970, UoB was established with three departments, Physics, Chemistry and Geology only.

Now there are eight faculties comprising 50 departments, five centers, one constituent law college and several affiliated colleges (http://web.uob.edu.pk/).

Universities are providing a congenial environment for higher studies and nourish the young and seasoned scholars in the field of research (Habib et al., 2021). The university's research productivity has a direct impact on its academic achievement. Quality research helps to raise the socio-economic prospects and living standards of the community. The close relationship between academic research and industries is important for the long-term sustainable growth of society (Meo, 2015; Iqbal et al., 2018). In a constantly evolving knowledge-based competitive economy, highly educated human resources are regarded as intellectual capital that contributes significantly in every sphere of life (Rowley, 2000). The use of systematic research techniques, which is a crucial component of academic training, is continuing to extend the boundaries of knowledge and improve the existing theories (Pervez et al., 2018). Human life is being improved by finding solutions to common challenges. Research-based knowledge and information are considered valuable resources, not just for the particular subject, knowledge-producing institution and nation but for the entire world (Haq&Tanveer, 2020). The university's performing four tasks in the knowledge management process, including, the creation of new knowledge with bibliographic control, simple accessibility, improving the research environment, and allocating financial research support (Devenport et al., 1998). Due to the development of information and communication technology, the body of available knowledge has increased substantially, while at the same time, the need to evaluate the outcomes of the research productivity is becoming more and more frequent (Bhatt et al., 2020).

The growth of universities was very slow in Pakistan. There were only 20 universities in 1986 and this number reached 57 in 2001, but remarkable growth has been observed in the first two decades of the 21st Century. Similarly, the research culture was not adequately flourished. The slow progress was recorded till 1990. The research activities have been exhilarated in the 21st century especially after the restructuring of the higher education system of Pakistan in 2002, by virtue of the open accessibility of scientific resources in digital format and increasing financial support in the higher education institutions. (Javed et al., 2020).

The assessment of the research productivity is one of the vital parameters to evaluate the quality of education and reputation of the institution. The bibliometric research method is employed to evaluate the various characteristics of publications output (Haq&Alfouzan 2017, Latif &Haq 2020). Alan Prichard presented the term bibliometric in 1969, it is an application of mathematics and statistics on written items (Prichard 1969). Earlier, this method was known as statistical bibliography. The findings of these studies highlight several characteristics of scholarly publications such as the subject dispersion exposed the strong and weak areas of research, periodic growth, authorship and collaboration patterns, citation analysis and frequently used channels for publications. The outcomes of these studies are very supportive in strategic decision-making, preparing the research policies and allocation of research grants (Javed et al., 2020; Shahzad et al., 2021). Iqbal et al., (2018) examined the research productivity of Pakistan from 1981 to 2015 and concluded that Pakistan contributed the nominal share of global research output. The study suggested that more collaborative research activities at a national and international levels would be conducted that would have improved the visibility and standard of research. Another study analyzed the research growth by medical universities in Pakistan from 2007 to 2010 (Mushtaq et al., 2012). One more study

evaluated the research progress of universities located in Islamabad Pakistan (Javed et al., 2020). Individual bibliometric case studies on University of Punjab, Government College University Lahore, University of Peshawar, Allama Iqbal Open University, Aga Khan University, and Shifa Tameer-e-Millat University were conducted (Ahmed et al., 2020; Shahzad et al., 2021; Haq 2020; Haq 2021; Ali et al., 2021; Latif &Haq 2020). No study was carried out on the research performance of UoB. The present study indented to fill this gap and the findings of this study would be considered a benchmark for future studies. The prime aim of the present study is to examine the Scopus-indexed publications produced by the authors and researchers of UoB from 1974 to 2022.

Review of Relevant Literature

A research study was conducted by Ahmed et al., (2020) based on the dataset retrieved from the Scopus database. Primarily, the study was focused on the research output of University of the Punjab, but it also made a comparison with the other three universities in Pakistan including UoB and one university from India. Among the total output of five universities, University of the Punjab contributed the highest number of publications (30.90%), followed by University of Karachi (28.55%), University of Allahabad (23.19%), and University of Peshawar (13.56%). The share of UoB was recorded at 3.78%. Most of the UoB's research was published in subscription-based sources (82.43%) while 17.57% of the research was published in open-accessed sources. Iqbal et al., (2018) discussed the factors that contribute to research productivity and visibility in Pakistan. The data for this study was obtained from the Web of Science database. Under the parameter of research publications in 10 years (2006-2015) produced by the universities fall in the general category of the Higher Education Commission (HEC), Quaid-i-Azam University contributed the maximum number of papers (11.4%) followed by COMSATS Institute of Information Technology (8.6%). The share of UoB was found very nominal (0.8%).

Another study reported that Pakistan produced an average of 7,434 documents per year from 2000 to 2019 and COMSATS University Islamabad contributed the highest number of documents. Medicine was the preferred area of research followed by Engineering and Plant Sciences. The study suggested increasing enrollment in higher education, improving the quality of teaching and enhancing the financial support for research (Haq&Faridi, 2020). A study on the research progress of Government College University Lahore exposed that a maximum number of documents were published after 2005. The study recommended that special incentives should be given to productive and influential researchers to motivate others (Shahzad et al., 2021). Nagarkar (2014) examined the Web of Science indexed research contributed by the Chemistry Department of Pune University India from 1999 to 2012. The selected papers gained an average of 11.03 citations per paper and the four-author pattern was the most frequent. Doulani (2020) analyzed the publication growth of one of Alzahra University Iran from 1986 to 2019 and it was reported that 80% of the research contributed by 20% of the total authors and among the top 10 authors, six and four authors belonged to Chemistry and Physics, respectively. A bibliometric study on Al-Imam Mohammad Ibn Saud Islamic University Saudi Arabian revealed that 82% of its research was published in subscription-based journals but the research published in open-accessed gained slightly more citations as compared to subscription based papers. Egypt and Tunisia were at the top of international research collaboration (Al-Fouzan et al., 2019). Another study measured the Scopus-indexed research of Iraq-

Kurdistan universities from 1970 to 2012. Overall, the citation impact was recorded as low (2.23 cites/paper) and more than half (52%) of the research was the result of international collaboration. The study concluded that most of the faculty members contributed their research in non-Scopus indexed journals and to comprehensive visibility of this research, institutional repositories should be established (Noruzi&Abdekhoda 2014).

Zhu et al., (2014) compared the quantity and quality of research produced by Chinese universities with that of American and European universities. Although Chinese universities produced more research in terms of citation analysis and international collaboration the American and European universities gained a higher citation impact and more international co-authorship. Boamah and Ho (2018) analyzed the publication growth of Ghana, a West African country, from 1936 to 2016 as indexed in the Web of Science. The research publications gained momentum after 1998 and the research with international collaboration got a higher citation impact. Public, environmental and occupational health was the most preferred area of research followed by tropical medicine and infectious diseases. Another study focused on the scholarly portfolio of Nigerian authors from 1901 to 2016. About two-thirds of the research (66%) was published from 2001 to 2016 and 20% research was contributed by the University of Ibadan. The ratio of international collaboration increased sustainably from 13.2% during the period of 1991-2000 and reached 24.2% during the period of 2011-2016.

Objectives

The study is conducted to achieve the following objects:
1. To review the periodic growth of publications.
2. To assess collaboration patterns at university, national and international levels in terms of number of publications and citation impact.
3. To analyze the authorship pattern with citation counts.
4. To highlight the most and least preferred areas of research.
5. To point out the top-20 most productive authors.
6. To examine the frequently used sources of publications.
7. To presents research collaboration at institutional and country levels.

Research Methodology

A bibliometric research method has been applied to the data extracted from the Scopus database under the affiliated address of the University of Baluchistan on 15th of February 2023. Only the Date filter was used to exclude the data of publications published in 2023. The bibliographic detail of all kinds of documents published until 31st of December 2022 has been downloaded in Comma Separated Value (CSV) file. Microsoft Excel was used to analyze the bibliometric characteristics of the data.

Results

A total of 1,850 documents have been indexed under the affiliated address of UoB. The first Scopus-indexed paper was published in 1974. Slow progress has been found during the first 27 years from 1974 to 2000 and in this period a total of 141 documents were published with an average of 5.22 documents per year. A gradual rise in documents was seen in the next ten years (2001 to 2010) with an average of 26.9 documents per year. More than three-fourths of the documents (n=1,440; 77.83%) were published in the last 12 years. The highest number of documents (n=192) was published in the year 2022.

The analysis of collaboration has been segregated into three sections. The documents having all the authors belonging to various departments of UoB without any external collaboration were found 283 (15.29%). The ratio of collaboration at a national level was found in 733 (39.62%) documents. The proportion of international research collaboration was in 834 documents (45.08%). Table-1 and Figure-1 demonstrate the details of collaboration by year.

Table 1: *Distribution of publications by period/year*

Year/Period	UoB Authors Only	National Collaboration	International Collaboration	Total
1974-2000	67	37	37	141
2001-2010	71	120	78	269
2011	8	36	24	68
2012	22	37	32	91
2013	15	48	41	104
2014	16	43	47	106
2015	5	37	40	82
2016	6	27	53	86
2017	13	28	82	123
2018	12	49	75	136
2019	18	66	62	146
2020	12	46	65	123
2021	9	85	89	183
2022	9	74	109	192
Total	283	733	834	1,850

Table-2 elaborated on the citation analysis with the level of collaboration. There was a slight difference in average citations per document against the document contributed by UoB authors only and collaboration at a national level, but the documents having research collaboration at the international level gained the ratio of citations more than double than national and only UoB collaboration. Overall, 1,850 documents gained 20,701 citations with an average of 11.19 citations per document.

Table 2: *Citation Analysis by level of collaboration*

Level of Collaboration	Number of Publications	Total Citations	Average Citations per publications
UoB Authors Only	283	2,133	7.54
National Collaboration	733	5,549	7.57
International Collaboration	834	13,019	15.61
Total/Average	1,850	20,701	11.19

Table-3 displays the number of authors including multiple counts against the total publications published in each period/year. The lowest ratio of average authors with 3.47 authors per document was found during the period of 1974 to 2000. This ratio

was a bit increased from 2001 to 2010. The highest ratio of average authors per document (7.57) was found against the documents published in 2020. Overall, a total of 10,930 authors contributed to 1,850 documents with an average of 5.91 authors per document.

Table 3: *Distribution of publications with number of authors*

Period/Year	Total Publications	Total Authors	Average Authors per publications
1974-2000	141	489	3.47
2001-2010	269	1176	4.37
2011	68	349	5.13
2012	91	455	5.00
2013	104	548	5.27
2014	106	612	5.77
2015	82	466	5.68
2016	86	515	5.99
2017	123	796	6.47
2018	136	989	7.27
2019	146	935	6.40
2020	123	931	7.57
2021	183	1279	6.99
2022	192	1390	7.24
Total/Average	1,850	10,930	5.91

The examination of the authorship pattern reveals that the maximum number of documents (n=295; 15.94%) was written by a four-author pattern, followed by five-author (n=245; 13.24%) and two-author (n=222; 12%) patterns. Although, 148 (8%) documents were written by a two-author pattern, this pattern got the highest citation impact with 16.88 citations per document and the lowest citation impact, 5.99 citations per document was gained by a single-author document. Table-4 presents the authorship detail with a number of documents, citations and citation impact in the tabulated format while Figure-2 shows the graphic outlook of authorship patterns with citation counts.

Table 4: *Distribution of documents by authorship patterns*

Authorship Patterns	Total documents	Total Citations	Citation Impact
Single-Author	71	425	5.99
Two-Author	148	2,498	16.88
Three-Author	222	2,586	11.65
Four-Author	295	2,777	9.41
Five-Author	245	3,064	12.51
Six-Author	219	2,222	10.15

Seven-Author	171	1,957	11.44
Eight-Author	144	1,358	9.43
Nine-Author	121	1,304	10.78
Ten and more than 10 Authors	214	2,510	11.73
Total	1,850	20,701	11.19

The Scopus database divided all 1,850 documents into 27 broad themes/subjects and the highest number of documents was written on Agricultural and Biological Sciences followed by Chemistry and Medicine. The detail of themes/subjects and their percentage highlighted the strong and weak areas as listed in Table-5.

Table 5: *Distribution of documents by major subjects*

Serial No	Subjects	Percentage of Publications
1.	Agricultural and Biological Sciences	15.19%
2.	Chemistry	12.68%
3.	Medicine	10.38%
4.	Biochemistry, Genetics and Molecular Biology	9.07%
5.	Pharmacology, Toxicology and Pharmaceutics	7.94%
6.	Environmental Science	5.46%
7.	Earth and Planetary Sciences	4.88%
8.	Engineering	4.50%
9.	Materials Science	3.78%
10.	Computer Science	3.68%
11.	Social Sciences	3.47%
12.	Physics and Astronomy	3.19%
13.	Immunology and Microbiology	2.71%
14.	Chemical Engineering	2.30%
15.	Multidisciplinary	1.68%
16.	Veterinary	1.14%
17.	Health Professions	1.10%
18.	Business, Management and Accounting	1.06%
19.	Energy	1.06%
20.	Mathematics	1.06%
21.	Economics, Econometrics and Finance	0.75%
22.	Nursing	0.68%
23.	Arts and Humanities	0.65%
24.	Psychology	0.55%
25.	Decision Sciences	0.37%
26.	Neuroscience	0.20%

27.	Dentistry	0.06%

Table-6 illustrated the top-20 authors. The actual number of documents of these authors may be more than this number. These numbers are limited to Scopus Indexed under the affiliation ID of UoB. According to present data Tareen, R. B. was found to be the most productive author with 130 documents followed by Yaqoob, M., Saleem, F., and Nabi, A., with 100, 96 and 93 documents, respectively. Only the top seven authors have more than fifty documents each against their name.

Table 6: *Top-20 most productive authors*

Serial No	Author's Name	Number of Publications	Serial No	Author's Name	Number of Publications
1.	Tareen, R.B.	130	11.	Hassali, M.A.	42
2.	Yaqoob, M.	100	12.	Shafee, M.	40
3.	Saleem, F.	96	13.	Malik, A.	38
4.	Nabi, A.	93	14.	Raza, S.M.	37
5.	Akbar, A.	69	15.	Achakzai, A.K.K.	36
6.	Tariq, M.M.	64	16.	Iqbal, F.	36
7.	Waseem, A.	58	17.	Ali, I.	35
8.	Jan, S.U.	46	18.	Barozai, M.Y.K.	35
9.	Ahmad, N.	45	19.	Baber, J.	32
10.	Abbas, F.	44	20.	Gul, S.	32

Twenty-two journals were having 10 or more than 10 documents each and 578 (31.24%) of the documents were published in these journals. The highest number of documents was published in Pakistan Journal of Zoology followed by Pakistan Journal of Botany, Journal of the Chemical Society of Pakistan and Pakistan Journal of Pharmaceutical Sciences. These top-6 journals have more than 24 documents each and all these journals are published in Pakistan.

Table 7: *Top-22 most frequently used sources of publications*

Serial No	Name of Journal	Total Publications
1.	Pakistan Journal of Zoology	91
2.	Pakistan Journal of Botany	84
3.	Journal of the Chemical Society of Pakistan	81
4.	Pakistan Journal of Pharmaceutical Sciences	58
5.	Journal of Animal and Plant Sciences	36
6.	Journal of Chemical Society of Pakistan	25
7.	Luminescence	21
8.	Applied Ecology and Environmental Research	19

9.	Plos One	16
10.	Biomed Research International	14
11.	Journal of Himalayan Earth Sciences	13
12.	Analytical Letters	12
13.	Arabian Journal of Geosciences	12
14.	International Journal of Agriculture and Biology	12
15.	Chemistry of Natural Compounds	11
16.	International Journal of Disaster Risk Reduction	11
17.	Journal of Asian Natural Products Research	11
18.	Latin American Journal of Pharmacy	11
19.	Analytical Sciences	10
20.	International Journal of Advanced Computer Science and Applications	10
21.	Journal of the Pakistan Medical Association	10
22.	Tropical Journal of Pharmaceutical Research	10

The highest number of research collaborations was done with the researchers of the University of Karachi, followed by BUITEMS - Balochistan University of Information Technology, Engineering and Management Sciences, Quaid-i-Azam University and University of the Punjab. The research collaboration output has been more than 100 each against these top-4 universities. Overall, the UniversitiSains Malaysia was ranked five but in international research collaboration at the institutional level, this university has been on top followed by the Asian Institute of Technology Thailand and King Saud University.

Table 8:*Top-20 preferred institutions/universities for research collaboration*

Serial No	Name of Institutions/Universities	Total Publications
1.	University of Karachi	155
2.	BUITEMS - Balochistan University of Information Technology, Engineering and Management Sciences	132
3.	Quaid-i-Azam University	119
4.	University of the Punjab	107
5.	UniversitiSains Malaysia	84
6.	The Islamia University of Bahawalpur	78
7.	School of Pharmaceutical Sciences, UniversitiSains Malaysia	78
8.	Sardar Bahadur Khan Women's University	68
9.	University of Veterinary and Animal Sciences, Lahore	67
10.	Asian Institute of Technology Thailand	66
11.	BahauddinZakariya University	54

12.	University of Peshawar	52
13.	COMSATS University Islamabad, Abbottabad Campus	51
14.	Gomal University	49
15.	University of Sargodha	41
16.	Punjab University College of Pharmacy	41
17.	PCSIR Laboratories	36
18.	King Saud University	35
19.	University of Agriculture, Faisalabad	35
20.	National University of Sciences and Technology Pakistan	32

Figure-3 presents the details of top-20 research collaborative countries. The authors of UoB mostly collaborated with the authors of Malaysia followed by China, United Kingdom and United States. These top-4 countries had more than 100 documents each and Saudi Arabia ranked fifth with 92 documents.

Discussion

The quality and quantity of UoB's publications have enhanced over time, but still, UoB needs to produce more research. The present study endorses the findings of earlier bibliometric studies carried out on various universities in Pakistan as well as developing countries (Haq 2021; Ahmad et al., 2020; Shahzad et al., 2021). The outcomes of the current study confirmed that the availability of electronic resources through the HEC National Digital Library in Pakistani universities has positively contributed to the domain of research productivity. Further, the commencing of the M.Phil. and Ph.D. programs as well as the provision of scholarships to faculty and students help to develop the research culture (Haque et al., 2018).

The analysis of the periodic growth of UoB's publications demonstrates that the ratio of research publications has increased abruptly in recent years. More than two third of the total publications (69%) were published during the last decade (2013-2022) with an average of 128.10 publications per year, as compared to the contribution (31%) of early 39 years (1974-2012) with an average of 14.58 publications per year. These outcomes supported the findings of Iqbal et al., (2018) study, whichindicated that the tendency of research in Pakistan increased over time as only 21% of the research was published from 1981 to 2005 and a large amount of the research (79%) was published from 2006 to 2015. The study appreciated the pivotal role of HEC to develop the research culture in Pakistan.

The ratio of collaborative research and an average number of authors per publication increased after the year 2000. The publications with international research collaboration gained almost double citations. It shows that collaborative research especially with international authors improves the quality of publications based on citation count.The citation metric is one of the quality indicators of research (Moed 2010). The analysis of authorship patterns reveals that a single author publication gained the lowest proportion of average citations and among the other authorship patterns, two author patterns gained the highest citation impact.

The subject dispersion shows that the maximum number of publications were written on the subject area of "Agriculture and Biological Sciences" followed by "Chemistry" and "Medicine". A large number of populations of Balochistan are living in rural areas and agriculture is the main source of their income. The research in agriculture helps to produce better products and these products would improve

the socio-economic condition of the community. The findings of the bibliometric study on the Islamia University of Bahawalpur also reported that "Agriculture and Biological Sciences" and "Chemistry" were the most preferred areas of research in Southern Punjab (Haq 2021a).

In the international research collaboration, Malaysia has been atthe top, followed by China, United Kingdom, United States and Saudi Arabia. This shows the strong research ties of UoB with the authors of these countries. Haq and Faridi (2020) reported the almost similar findings that most Pakistani researchers collaborated with China, United States, Saudi Arabia, United Kingdom and Malaysia, whereas Iqbal et al. (2018) elaborated that mostly Pakistani authors collaborated with the United States during the period of 1981 to 2015. Haq and Faridi (2020) study is limited to the first two decades of the 21st Century that exposed the shift of international research collaboration from United States to China. Zhu et al., (2014) stated that although Chinese universities have been producing more research as compared to American and European universities, Chinese authors need to improve the quality of their research, as their research gained low citation metric.

The growth of research is fully dependent on the cooperation and support of all stakeholders, the dedication of researchers, competent supervision, provision of financial backing, up-to-date technologies, fully equipped laboratories and well-stocked libraries and most importantly the conducive environment for conducting research. Although, UoB has meticulous history spread over a half-century but due to the law and order situation, brain drain and paucity of funding, the research culture has not fully flourished. Siddiqi (2012) identified that security dynamics, religious activism and ethnic clash sparked heavily in Baluchistan during War against terrorism. These factors put a negative impact on research productivity.

The study has some limitations, firstly, the source of data is the Scopus database and most of the journals published from Pakistan and especially from UoB are not indexed in this database, so the coverage of research is restricted. Although, this study does not depict a comprehensive snapshot of UoB's research profile but helps to understand the trends and patterns of research. The findings of the present study would serve as a benchmark for future studies.

The research section of UoB could compile and evaluate the various metrics of research productivity of all faculty members and students. The findings of these efforts would assist in re-visit the research priorities and policies. The appropriate usage of research grants would not only increase the ranking of the university but also enhance the socio-economic condition of Baluchistan.

Conclusion

The evaluation of the research profile has been a significant indicator to assess the quality of teaching in the degree awarding institution. The worthy faculty of UoBhas been nurturing the power of critical thinking among the community which has been considered a key to conducting creative and innovative research. UoB striving hard to develop the ability that transformed conceptual knowledge into applied technologies. Research activities increased during the last decade in UoB, there is a need to enhance this momentum.

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