

# The Research Productivity of the Allama Iqbal Open University, Pakistan: A Bibliometric Appraisal

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## Abstract

**Purpose:** This study aimed to explore the publication output and research tendencies of Allama Iqbal Open University (AIOU), Pakistan from 1989 to 2020 as reflected in the Scopus database.

**Design/methodology/approach:** A bibliometric method was used to quantify the publications and their characteristics. The dataset for the study was extracted on June 10<sup>th</sup>, 2021, from Elsevier's Scopus database. The affiliation search query was used and "Allama Iqbal Open University" was written in the query box. The Microsoft Excel and VOSviewer software were used to analyze and present the data in tabular and graphic formats.

**Research limitation(s):** The bibliographic information of publication, as well as citations count, were downloaded, that was indexed in the Scopus database until December 31<sup>st</sup>, 2020.

**Key finding(s):** More than half of the documents were published during the last five years of study (2016-2020). Only 3.27% of the work was produced by a single author pattern. Chemistry was found to be the preferred area of research, and among the productive authors, the top 5 authors all belonged to the chemistry department of AIOU. Quaid-e-Azam University and China were found to be the top research collaborative organization and country, respectively.

**Practical implication(s):** The findings had reflected some implications. Albeit, the research growth was enhanced during the last few years, the authorities of the university require to revisit their research policies to cultivate the research culture and increase the publication growth in under researched areas in AIOU.

**Contribution to knowledge:** This study contributed to the bibliometric studies of distance learning higher institution in Pakistan as no study has been carried out so far.

**Paper type:** Research.

**Keywords:** Bibliometrics; Research output; Allama Iqbal Open University; Pakistan.

## Introduction

The prime tasks of the higher educational institutions are to impart in-depth learning, provide a conducive environment for study, offer up-to-date learning resources and above all, to develop critical thinking to the students, which is crucial to carrying out innovative research (Sedlacek, 2013). The academic performance of the university is directly linked with its research productivity. Furthermore, quality research contributes to improving the socio-economic outlook and the living standard of the community. The long-term sustainable development of the society relates to the strong linkage of academic research with the industries. (Meo, 2015; Iqbal, Mahmood & Iqbal 2018). Well-educated human resource is considered as an intellectual capital that significantly contributes to an ever-changing knowledge-based competitive market (Rowley, 2000; Haq & Ahmad, 2012). New horizons of knowledge and upgraded theories are continuing to emerge through the application of systemic research methods that is an integral part of university education (Pervez, Thakur & Farhan 2018). The life of human beings is improving by getting the solution to everyday problems. Research-based knowledge and information have been regarded as substantial resources not only for the specific subject, knowledge-producing organization and country but for the whole world as well (Haq & Tanveer, 2020).

Devenport, DeLong and Beers (1998) highlighted the four tasks of the university in the knowledge management process, i.e., to develop new knowledge with bibliographic control, easy accessibility, improving research environment, and allocation of financial research support. Due to the advancement of

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information communication technologies, the reserve of knowledge has been amplifying remarkably, and simultaneously a need to evaluate the research outcomes also getting popularity (Bhatt, Ghuman&Dhir, 2020). The bibliometric is one of the common methods that is used to evaluate the research growth (Al Fouzan, Haq & Al Fouzan 2019). This term was coined by Prichard (1969), earlier known as a statistical bibliography. It is a quantitative method to examine the various properties of scientific and scholarly publications that varies from the outcome of a single institution to country and even global level (vaRaam, 1998). Usually, in the bibliometric studies, the raw data was extracted from the databases, i.e., Web of Science, Scopus and PubMed, to analyze the publication growth, citation impact, collaboration pattern and subject dispersion, etc. (Senel, Demir & Alkan 2017). The findings of these studies are very helpful to review the research policies, allocation of funds and decision-making process (Ahmad, Rehman & Ashiq 2021).

Allama Iqbal Open University (AIOU) a public sector university was established in 1974, as a pioneer in non-formal and distance learning education in Pakistan (Iqbal & Ahmad, 2010). AIOU, being a mega university of the country has been offering a vast variety of courses, with 44 regional campuses spreading all over Pakistan to support the students as well as tutors. It provides off-campus and remote educational facilities to the students who are beyond the geographical reach of the university and even its clientele coverage spread in the Middle East countries. AIOU has been offering 1,380 courses, 124 programs from basic to the doctorate level with 700,000 students (Bibi & Khan, 2018). AIOU has also been utilizing the digital technologies for teaching/learning in a distance learning environment and prepared to correspond the future challenges. (Noreen & Malik 2020).

## Literature Review

Bibliometric analysis is a very popular area of research among Library and Information Science (LIS) professionals (Naseer & Mahmood, 2009). The method is used to assess the research performance of the authors affiliated to any country, region and even a single organization (Haq & Alfouzan, 2017).

Iqbal et al., (2018) analyzed the research growth of Pakistan produced in the 35 years from 1981 to 2015. A total of 74,755 documents were found and 5,073 (6.78%) were written by a single author pattern. More than one-third of the documents were the result of international collaboration (n=27,299; 36.51%). The highest number of documents were contributed by the Quaid-e-Azam University (QAU), followed by University of Karachi and Aga Khan University. The United States and King Saud University were found most collaborative country and organization, respectively. The documents with more than four authors' collaboration gained the maximum citation impact. The highest number of documents were written on chemistry (15.1%), followed by plants and animal sciences (14.6%) and clinical medicine (13.7%).

Haq and Faridi (2021) examined the research growth of Pakistan during the first two decades of the 21<sup>st</sup> century. A total of 1,48,678 documents were found in the Web of Science database and 60% (n=90,256) of the documents were published during the last five years of the study. COMSATS University Islamabad (CUI) was found most productive, followed by QAU and University of Agriculture Faisalabad. The majority of research was collaborative with China, followed by the United States and Saudi Arabia. The study concluded that although a remarkable research growth was identified but as compared to the population of the country, there is a dire need to enhance the research activities and promote the research culture.

Shahzad et al., (2021) examined the research growth of Government College University, Lahore Pakistan from 1908 to 2020. A total of 6,008 were identified by the Scopus database and the majority of the publications (27%) were produced during the last three years of study. The documents published in 2012 gained the maximum citation impact. Physics and Astronomy (18%), and Chemistry (16%) were found preferred areas of research. The highest number of research collaborations was done with the University of the Punjab. The maximum international research collaboration was found with Saudi Arabia followed by China and United Kingdom.

Javed, Ahmad and Khahro (2020) reviewed the research growth of the 17 higher education institutions located in the Capital city of Pakistan, Islamabad from 2008 to 2017. CUI produced the

highest number of documents. The share of AIOU was 429 (1.26%) documents. The study concluded that 11% of the total degree-awarding institutions of Pakistan were in Islamabad and these institutions contributed 34% (n=33,769) of the total research productivity of Pakistan.

Ahmad, Javed, Khahro & Shahid (2020) compared the research productivity of four Pakistani and one Indian University as indexed in the Scopus database. The University of the Punjab (PU) Pakistan contributed the maximum documents (n=10,990; 30.90%), followed by University of Karachi (n=10,154; 28.55%) and University of Allahabad (n=8,248; 23.19%). The study reflected that 92% of the total research of the PU were published during the last two decades and engineering was found the preferred area of research. University of Karachi had the highest number of citable documents while the highest citation impact had been gained by the University of Peshawar.

Haq (2020) analyzed the publication growth of University of Peshawar Pakistan. A total of 4,820 publications were found from 1957 to 2019. More than 80% of the publications were published during the last decade from 2010 to 2019. Chemistry was found a most preferred area of research. The highest number of papers were written by four-author pattern, but the highest citation impact had gone to the publications with more than nine-author pattern. Abdul Wali Khan University and China emerged most collaborative research organization and country.

Latif and Haq (2020) assessed the 231 documents produced by the authors affiliated with Shifa Tameer-e-Millat University, Pakistan from 2012 to 2018. More than half of the documents (58%) were published during the last two years of study. About 7% of the papers were contributed by a single author pattern while pharmacy and medical education were found favorite areas of research. Twenty-one percent of the documents (n=49) were the results of international collaboration.

Ali, Gatiti and Haq (2021) analyzed the publication metrics of 3,707 documents produced by Aga Khan University Medical College from 2010 to 2019. The highest number of documents were contributed by the three-author pattern. The ratio of open and toll-based documents was 40% and 60%, respectively. Toll-based documents gained a higher citation impact. The United States was on the top preference in international research collaboration. Zulfiqar A. Bhutta has emerged the most productive author with 543 (15%) documents.

AIOU is publishing 22 research journals. Jawwad, Soroya and Ahmad (2021) presented a bibliometric study of one of the research journal, Journal of Social Sciences and Humanities (JSSH), published from AIOU. The study covered the period of 25 years from 1995 to 2019. A total of 378 research articles were contributed by 573 authors and the highest number of articles (62%) were contributed by a single author pattern. Mahmudur Rehman and Rashid A. Naeem were found the most productive authors with 10 articles each. The majority of articles were contributed by the researchers of AIOU followed by Islamic International University, Islamabad. A total of 10,072 references were used in 378 articles with an average of 26.64 references/citations per article. The review of literature exposed that no study was conducted on the research productivity of AIOU. Therefore, the present study intended to examine the research growth of AIOU and its bibliometric indicators, as reflected in the Scopus database. This study would serve as the benchmark not only for the future studies on the publication growth of AIOU but the findings of the present study also support to the other universities, offering distance learning education in the developing countries.

## Research Objectives

Following research objectives were set on the retrieved dataset produced by the authors affiliated with AIOU:

1. To examine the periodic growth of publications and citations
2. To review the authorship pattern and citation impact
3. To analyze the most productive authors
4. To segregate publications by subject, produced by AIOU.
5. To elucidate the most preferred sources of publications
6. To highlight the top research collaborative organizations and countries
7. To assess the frequently used keywords

## Methodology

For this bibliometric analysis, the dataset of all types of publications produced by the authors of AIOU till the date of 31<sup>st</sup> December 2020 was extracted from the Elsevier's Scopus database on 10<sup>th</sup> of June 2021.

The affiliation search query was applied and "Allama Iqbal Open University" was written in the query box. The Scopus database indexed all the publications with at least one author affiliated with AIOU under affiliation ID No. 60046149. Following search query was used, (AF-ID("Allama Iqbal Open University" 60046149) AND (EXCLUDE ( PUBYEAR,2021))) All types of publications were included and the bibliographic details of 856 records were download, indexed upto the 31<sup>st</sup> of December 2020. The Microsoft Excel and VOSviewer software were used to analyze and present the data in tabular and graphic formats. VOSviewer is an open access software used to visualize the publication data into graphic format (<https://www.vosviewer.com/>). The citation counts of publications by subject, departments, journals, research collaborative countries and keywords were obtained by VOSviewers.

The Scopus database offers toll-based inclusive coverage of multidisciplinary research data with abstracts and bibliographic details which have been published in more than 40,000 sources/journals (Alhibshi, et al. 2020). The data of publications and citations was limited to Scopus indexed publication only.

## Results

### *Periodic Growth of Publications and Their Citations*

A total of 856 documents were identified in the Scopus databases. Table 1 and Figure 1 present the breakdown of documents by year, as the first paper was indexed in Scopus under the affiliated address of AIOU in 1989 (Saleemi, 1989), and then after the gap of four years, the second paper was indexed in 1993 (Abbas, 1993). Very slow progress was observed from 1989 to 2005, only 26 papers were indexed. The researchers of AIOU were succeeded to publish 149 papers with an average of 29.8 papers per year from 2006 to 2010 and 201 papers were found in the next five years (2011-2015) with an average of 40.2 papers per year. More than half of the total papers (n=480; 56%) were published in the last five years from 2016 to 2020. The highest number of the papers (n=148; 17.28%) were published in the last year of study, 2020 and this number was even higher than the total publication output (n=118; 13.78%) of the first 21 years (1989 to 2009) of study. The explicit fluctuation in the number of publications was observed from 2010 to 2016 but the growing tendency was visible during the last five years of the study.

The ratio of citable and non-citable documents was 80% (n=687) and 20% (n=169), respectively. However, all the 856 documents received 6,982 citations with an average of 8.16 citations per document. The papers published during the year 2005, which had gained the highest citation impact, with an average of 29.88 citations per paper, followed by papers published in 2006, had received an average of 18.83 citations per paper.

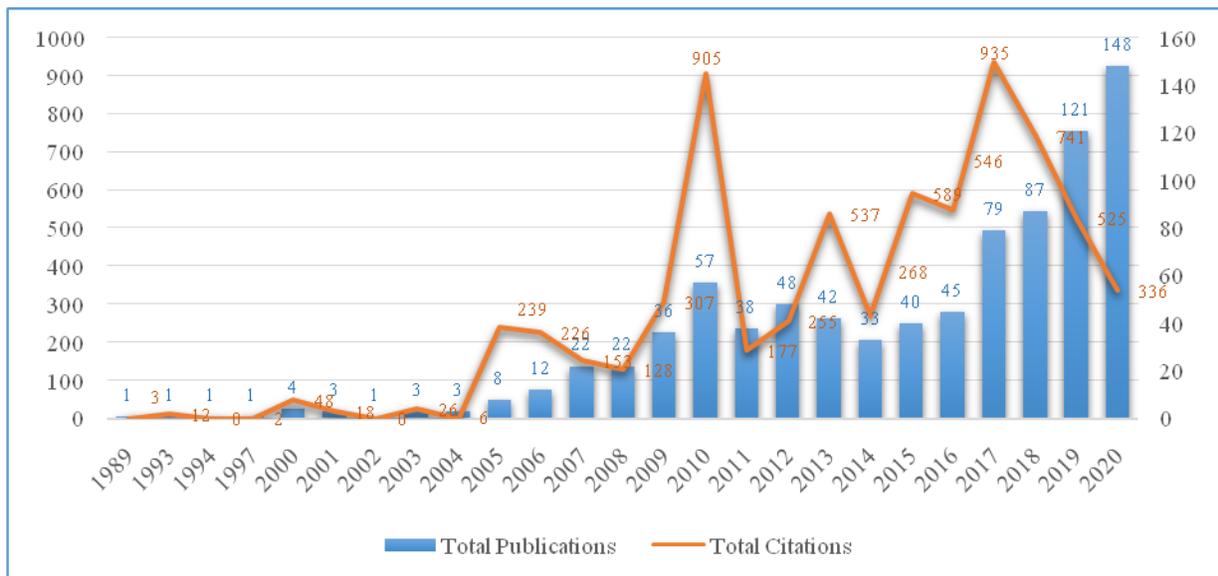
All the targeted documents had cited 30,086 references belonged to 13,535 sources/journals in 856 documents with a mean of 35.14 references per document.

*Table 1. Distribution of Publications and Citations by Year (n=856)*

Year	Total publication(s)	Total citations	Average citations per publication
1989	1	3	3.00
1993	1	12	12.00
1994	1	0	0.00
1997	1	2	2.00
2000	4	48	12.00
2001	3	18	6.00

2002	1	0	0.00
2003	3	26	8.67
2004	3	6	2.00
2005	8	239	29.88
2006	12	226	18.83
2007	22	153	6.95
2008	22	128	5.82
2009	36	307	8.53
2010	57	905	15.88
2011	38	177	4.66
2012	48	255	5.31
2013	42	537	12.79
2014	33	268	8.12
2015	40	589	14.73
2016	45	546	12.13
2017	79	935	11.84
2018	87	741	8.52
2019	121	525	4.34
2020	148	336	2.27
<b>Total</b>	<b>856</b>	<b>6982</b>	<b>*8.16</b>

\*Average citations per publication



*Figure 1. Growth of publications and citations by year*

### Authorship Pattern and Citation Impact

A total of 4,880 authors including the multiple counts were found in 856 papers with an average of 5.70 authors per paper. Figure-2 demonstrates the authorship patterns and only 28 (3.27%) papers were found in a single-authorship, whereas 96.73% (n=828) of the papers were the result of collaborative efforts. The four-author pattern was found most preferred with 149 (17.40%) papers, followed by a five-author pattern (n=135; 15.65%). Seventy-six papers with a seven-author pattern had gained the highest citation impact with 12.91 citations per paper followed by a five-author pattern with an average of 11.42 citations per document. About 70% (n=597) of the papers were written by two to six authorship patterns. Only 63 papers were found with ten or more than ten authors collaboration.



Figure 2. Authorship pattern with citations

### Broad Subject Dispersion

Scopus database classified all the AIOU's affiliated papers into 26 categories. Usually, the Scopus database assigned more than one subject category to one paper. More than one-third of the papers (n=297; 34.35%) were written on the subject of Chemistry, followed by Material Science (n=202; 23.60%), Physics and Astronomy (n=165; 19.28%), Social Sciences (n=114; 13.32%), Engineering (n=110; 12.85%) and Agriculture and Biological Sciences (n=108; 12.62%). The top six subjects have more than 100 documents each. The detail of the other 20 subjects were given in Table 2.

Table 2. Distribution of Publications by Subject (n=26)

Sr#	Subject	Total publications (%)
1	Chemistry	294 (34.35%)
2	Materials Science	202 (23.60%)
3	Physics and Astronomy	165 (19.28%)
4	Social Sciences	114 (13.32%)
5	Engineering	110 (12.85%)
6	Agricultural and Biological Sciences	108 (12.62%)
7	Biochemistry, Genetics and Molecular Biology	92 (10.75%)
8	Mathematics	81 (9.46%)

9	Computer Science	77 (9.00%)
10	Chemical Engineering	59 (6.89%)
11	Pharmacology, Toxicology and Pharmaceutics	52 (6.07%)
12	Medicine	41 (4.79%)
13	Environmental Science	40 (4.67%)
14	Business, Management and Accounting	23 (2.69%)
15	Economics, Econometrics and Finance	21 (2.45%)
16	Energy	20 (2.34%)
17	Immunology and Microbiology	20 (2.34%)
18	Arts and Humanities	19 (2.22%)
19	Multidisciplinary	15 (1.75%)
20	Decision Sciences	13 (1.52%)
21	Earth and Planetary Sciences	13 (1.52%)
22	Nursing	10 (1.17%)
23	Veterinary	10 (1.17%)
24	Health Professions	9 (1.05%)
25	Psychology	6 (0.70%)
26	Neuroscience	1 (0.12%)

### ***Productive Authors***

As a distinct author, a total of 1805 names were found and about two-thirds of the total authors, (n=1149; 64%) contributed in one document each while 273 (15%) and 137 (8%) authors contributed in two and three papers each, respectively. In the list of influential authors, only 69 (4%) authors were found with 10 or more than 10 documents each. Table-3 elucidates the detail of the top 10 most productive authors/contributors. Nagmana Rashid was found the most productive author with 63 papers, followed by Moazzam H. Bhatti, Zaman Ashraf, Sohail Saeed and Nasima Arshad with 60, 60, 53, and 41 papers, respectively. All top 5 authors belonged to the department of chemistry, AIOU. Muhammad Sher of Sargodha University, Saqib Ali and Aamir Saeed of Quaid-e-Azam University, served as active collaborative authors with AIOU's authors were occupied the 6<sup>th</sup>, 7<sup>th</sup> and 9<sup>th</sup> ranked. Although, Zaheer Ahmad of the Department of Environmental Design Health & Nutritional Sciences, AIOU was in the 10<sup>th</sup> position but had got the highest average of citations per document among the top 10 authors.

*Table 3. Author' Affiliation and Citation Impact (n=10)*

<b>Sr#</b>	<b>Name of the author</b>	<b>Department and university</b>	<b>Total documents</b>	<b>Total citations</b>	<b>Citation impact</b>
1	Nagmana Rashid	Department of Chemistry, AIOU	63	793	12.58
2	Moazzam H. Bhatti	Department of Chemistry, AIOU	60	702	11.70
3	Zaman Ashraf	Department of Chemistry, AIOU	60	691	11.51
4	Sohail Saeed	Department of Chemistry, AIOU	53	593	11.18
5	Nasima Arshad	Department of Chemistry, AIOU	41	418	10.19
6	Muhammad Sher	Institute of Chemistry, Sargodha University	41	346	8.43
7	Saqib Ali	Department of Chemistry, Quaid-e-	41	391	9.53

		Azam University			
8	UzmaYunus	Department of Chemistry, AIOU	38	290	7.63
9	Aamir Saeed	Department of Chemistry, Quaid-e-Azam University	37	387	10.45
10	Zaheer Ahmed	Department of Environmental Design Health & Nutritional Sciences, AIOU	32	645	20.15

### Preferred Sources of Publications

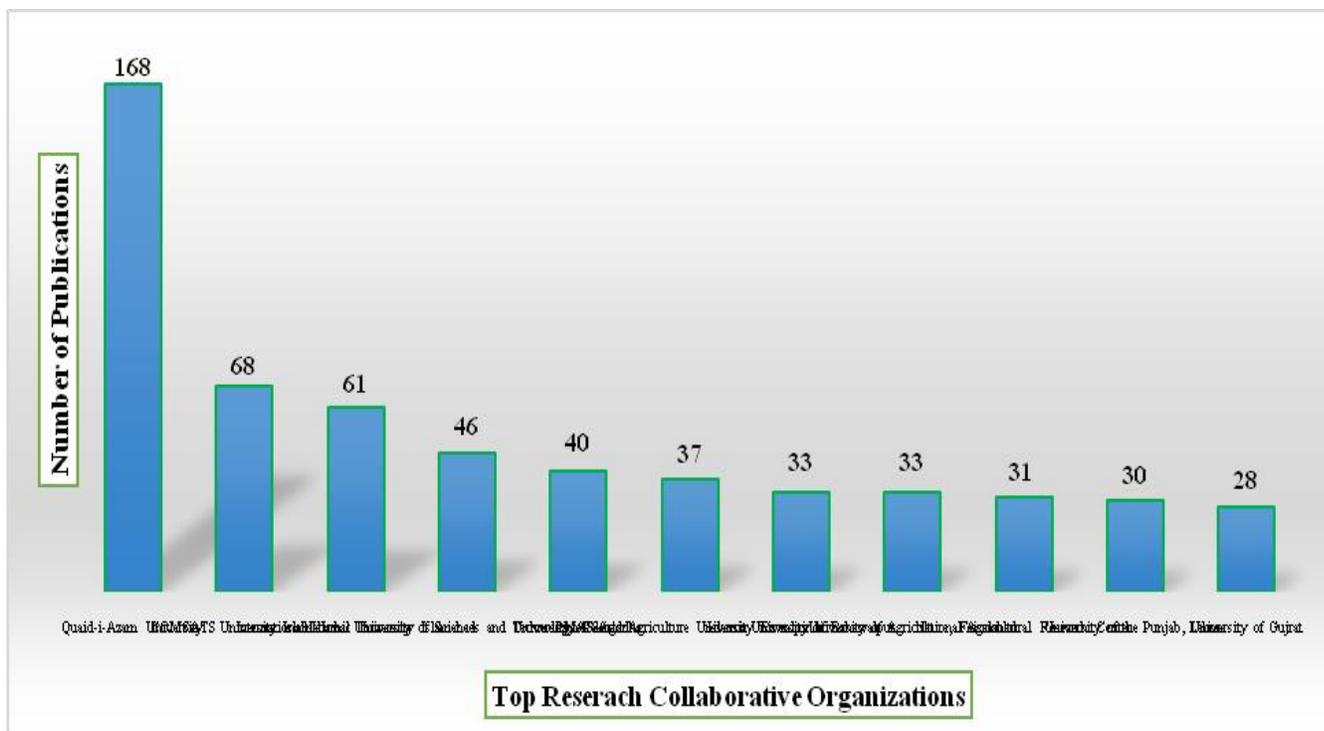
All the documents were published in 447 different sources and only one document each was published in 302 (67.58%) sources/journals. The top 10 most preferred sources/journals are mentioned in Table 4. About one-fifth of the documents (n=170; 19.85%) were published in top 10 sources/journals and these documents had gained 1,000 (14.32%) citations. The highest number of documents (n=57; 6.65%) were published in Acta Crystallographica Section E Structure Reports Online, followed by Journal of Molecular Structure (n=24), Turkish Online Journal of Distance Education (n=22), and Journal of the Chemical Society of Pakistan (n=14). The 8 documents, published in Ceramics International had received the highest citation impact, with an average of 21.87 citations per document, followed by the Turkish Journal of Chemistry, 10.3 citations per document.

Table 4. Preferred Sources/Journals and Citation Impact (n=10)

Sr#	Name of sources/journals	Total publications	Total citations	Citation impact
11	Acta Crystallographica Section E Structure Reports Online	57	191	3.35
12	Journal of Molecular Structure	24	220	9.16
13	Turkish Online Journal of Distance Education	22	58	2.63
14	Journal of the Chemical Society of Pakistan	14	80	5.71
15	Pakistan Journal of Botany	11	92	8.36
16	Turkish Journal of Chemistry	10	103	10.3
17	Applied Ecology and Environmental Research	8	15	1.87
18	Ceramics International	8	175	21.87
19	Chemistryselect	8	28	3.50
20	Journal of Coordination Chemistry	8	38	4.75

### Research Collaborative Organizations

Only 52 (6%) documents were identified in which all authors belonged to the AIOU or without the collaboration of any other organizations, while 804 (94%) documents were the results of the collaboration with 1,867 organizations. Scopus database indexed document under the AIOU affiliation ID, with at least one author, mentioned the affiliated address of AIOU. Forty-two influential organizations were having 10 or more than 10 documents each as co-authors with the AIOU and the top 10 collaborating organizations listed in Figure 3. About one-fifth of AIOU's research was the result of the collaboration of Quaid-i-Azam University, followed by COMSATS University Islamabad (n=68), and International Islamic University Islamabad (n=61). All top 10 research collaborative organizations belonged to Pakistan.



*Figure 3. Most collaborative organizations (n=10)*

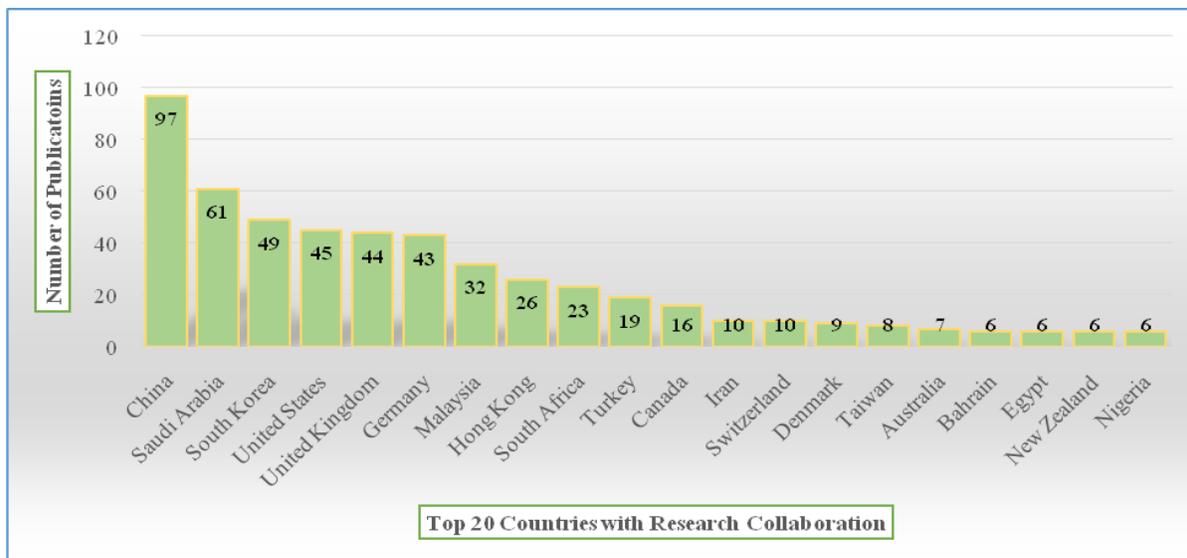
**International Research Collaboration**

As noted above, 52 documents were exclusively written by AIOU’s researchers as indexed in the Scopus database, while AIOU’s researchers performed research collaboration at the national level in 371 (43.34%) documents. Slightly more than half the research (n=433; 50.58%) of the publications were the result of international research collaboration with 57 countries of the world. China was found on the top with 97 publications, followed by Saudi Arabia, South Korea, United States and the United Kingdom with 61, 49, 45 and 44 publications, respectively. Albeit, Germany occupied the 6<sup>th</sup> rank in the number of publications but had the highest citation impact in the top 20 countries. Thirteen countries were having 10 or more than 10 research collaborative publications. The detail of publications, citation and citation impact of top 20 countries is shown in the Table-5.

*Table 5. Research Collaborative Countries and Citation Impact*

Sr#	Country	Total publications	Total citations	Citation impact
21	China	97 (11.33%)	1153	11.88
22	Saudi Arabia	61 (7.12%)	573	9.39
23	South Korea	49 (5.72%)	598	12.20
24	United States	45 (5.25%)	426	9.46
25	United Kingdom	44 (5.14%)	323	7.34
26	Germany	43 (5.02%)	631	14.67
27	Malaysia	32 (3.78%)	179	5.59
28	Hong Kong	26 (3.03%)	99	3.88
29	South Africa	23 (2.68%)	216	9.39
30	Turkey	19 (2.21%)	44	2.31
31	Canada	16 (1.86%)	180	11.25
32	Iran	10 (1.16%)	84	8.40

33	Switzerland	10 (1.16%)	144	14.4
34	Denmark	9 (1.05%)	55	6.11
35	Taiwan	8 (0.93%)	20	2.50
36	Australia	7 (0.81%)	85	12.14
37	Bahrain	6 (0.70%)	44	7.33
38	Egypt	6 (0.70%)	33	6.60
39	New Zealand	6 (0.70%)	29	4.83
40	Nigeria	6 (0.70%)	13	2.16



*Figure 4. Top 20 research collaborative countries with publications*

**Frequently Used Keywords**

A total of 7,584 keywords were written in 856 documents. The occurrence of the three-fourth (n=5,792; 76.37%) of the total keywords used only one time, whereas 969 (12.77%), and 332 (4.37%) keywords were found twice and thrice each, respectively. Four hundred and ninety-one (6.41%) keywords were applied more than three times each and only 105 keywords occurred 10 or more than 10 times. The keyword of “article” was found 122 times, followed by Pakistan (n=77), unclassified drug (n=71), controlled study (n=62), human (n=62), nonhuman (61), chemistry (59%) and drug synthesis (n=53). The occurrence of these top keywords was more than fifty times each.

Figure 5, generated through VOS viewer software further identified the co-occurrence network of frequently used 44 keywords in 856 publications.



productivity of the various universities of Pakistan endorsed the same findings. A paper on the 63-year publication records of University of Peshawar reported that 87% of the research was published during the last 13-year of study (Haq, 2020) and similarly, distinct publication growth was observed during the last two decades at Government College University Lahore (Shahzad et al., 2021). A study on Army Medical College Pakistan showed that 25% of the research was published from 1977 to 2008 and 75% of the total research was published during the last ten years from 2009 to 2018 (Haq et al., 2020).

Citation count is one of the quality indicators of published research. It indicates that how many times a particular paper has been cited by the other authors in their research. Google Scholar, Scopus, Web of Science and PubMed databases have been providing the citation counts (Yang & Meho, 2006). A study that was consisted of 10 years of research performance of 17 institutions located in Islamabad, Pakistan stated that AIOU produced 429 documents and these publications gained 2,008 citations with an average of 4.68 citations per document (Javed et al., 2020). Ahmad et al., (2020) conducted a comparative study on the research output and their citation impact of five universities of the sub-continent. This study exposed that the University of Punjab contributed 92% of its total research during the last two decades and engineering was found the preferred area of research. University of Karachi had the highest number of citable documents while the highest citation impact had been gained by the University of Peshawar.

The documents produced by AIOU had gained 6,982 citations with an average of 8.16 citations per document. Iqbal et al., (2018) reported that among the top 20 research producing institutions of Pakistan, National Centre for Physics gained the highest citation impact with an average of 13.04 citations per paper, whereas the University of Punjab, University of Karachi and University of Peshawar had gained 5.59, 5.88 and 6.41 citations per paper, respectively.

The analysis of authorship pattern revealed that the majority of the work was the result of collaborative research and a four-author pattern was found preferred collaboration design. The maximum number of papers were written on the subject of chemistry, followed by materials science. The top five authors belonged to the chemistry department of AIOU. Almost 20% of the total documents were published in the top ten preferred sources. There is a similarity in the results of authorship pattern (four-author) and preferred area of research (chemistry) between AIOU and the University of Peshawar.

The results of the current study are useful for the decision and policy-makers as well as the administration of the AIOU. They can assess their efforts in research productivity. The paper highlighted the strong and weak areas of research, national and international collaboration, and authorship patterns.

There is a dire need to conduct problem-solving research that would be beneficial not only for the local community but for the whole of humanity. To achieve this goal, the research activities of universities should be integrated with the industrial segment, this collaboration contributes significantly to the socio-economic development of the country.

A good number of research journals are being published from AIOU, the university administration should try to get them indexed in renowned databases like Web of Science, PubMed and Scopus for wider visibility.

## **Conclusion**

Scholarly and scientific communication, as well as the innovative research activities, are essential components for the sustainable development of higher education institutions. The lifecycle of research evolves around proficient research supervisors and young scholars. When the research culture has been developed in the institution, then everyone contributes their dynamic role, directly or indirectly, in this productive process. AIOU has prosperously completed the journey of 46 years. During this period, new courses have been started to fulfill the educational needs of the Pakistan community with the adaptation of emerging technologies. AIOU produced valuable research in different fields of knowledge, especially during the last five years of study. Even then, it is required to escalate their research activities and enhance the financial support for research to stand respectfully with other universities of the world. AIOU has enormous potential of accumulating its publications as well as influencing the global research community.

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