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Research Output of Government College University Lahore, Pakistan: A Bibliometric Study Based on Scopus Database from 1908 to 2020

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Abstract

Purpose – The main purpose of the current study was to explore the research output of Government College University, Lahore Pakistan in terms of publications, citation trends, major research areas, co-authorship patterns, preferred journals, keywords used, and funding sponsored.

Design/methodology/approach – Current study used bibliometric analysis methodology for achieving the objectives. Data were extracted from the Scopus database through a query. Query was executed in June 2021 at Prince Sultan University; Saudi Arabia and 6085 publications were retrieved. Inclusion and exclusion criteria were also defined. The results were filtered according to the inclusion/exclusion criteria. Finally, 6008 records were included in the final analysis which included articles, conference papers, reviews, and book chapters from 1908 to June 13, 2021. MS Excel, VOS Viewer, and Biblioshiny software were used for data analysis.

Findings – Findings showed that publications and citation trends of Government College University remained low. However, the progress of publication and citations started in 2005. The top ten research areas were consisted of science subjects. Social Sciences, Arts, and Humanities had no publications in the top ten areas. The majority of collaborated work from GC University authors was observed with the University of the Punjab, Lahore, University of Sargodha, and the University of Agriculture Faisalabad. GC University authors also collaborated with international authors, but this collaboration was less as compared to collaboration at the national level. The top funding sources for research was HEC Pakistan. However, international funding sources were also found.

Originality/Value – Current study is unique because, with the best of research knowledge, no study has been conducted regarding the research productivity of GC University, Lahore in past. The current study has practical implications in the sense that it is helpful for authorities of the University in allocating funds for research. The current study provides a comprehensive and collective picture of the research productivity of GC University, Lahore which helps to identify weak and strong areas related to research.

Keywords: Bibliometric Study, Government College University, Lahore. Research Productivity, Bibliometric Analysis.

1. Introduction:

Research output is considered a major indicator for the development of quality education in the country. Research is an intellectual activity. It plays a vital role in society as it aims to bring out solutions to certain problems. No society and country can't prosper without research. All progressive countries are also advanced in the field of research. Research plays a vital role in shaping a better future for humankind through innovative approaches. It helps policy-makers to

frame better policies in the best interests of people. It meets the needs and ambitions of society (Owen, Macnaghten, & Stilgoe 2012). Research brings innovation in all areas of life including agriculture, marketing, medicine, technology (Rene, 2013). An important function of universities is to create and share new knowledge. Quality of research publications having a societal impact is of great value for the community in general. The research output of the university is an indication of quality learning and the initiation of innovative methods to bring radical changes in all fields and to support national progress.

Government College University Lahore has been spreading quality learning and research for ages. This institution was established on 1st January 1864. As an exemplary institution for all other educational places of Pakistan, GCU Lahore cherishes great historical traditions and applies modern-driven methods and tools to flourish quality learning and research having a societal impact. It is considered as the best institution of Pakistan in the public sector as toppers belonging to all boards and institutions of the country apply for admissions here and feel the pride of becoming the part of 'Ravian legacy'. The university is not only following splendid traditions of the past but also implementing modern technologies to lead from the front among institutions and to set an example for others in all disciplines of life. The university gives great value to research and the research contributions of the faculty members are appreciated and acknowledged. Research produced by the university's faculty is praised around the world. The university has given birth to great economists, bureaucrats, policymakers, government representatives, diplomats, poets, artists, debaters, journalists, scientists, jurists, army officers, etc. This great place of knowledge has left a lasting mark on every area of life. The concerned authorities of the University are very much committed to the dissemination of knowledge and research in an environment in which leading academicians engage their pupils in rigorous intellectual activity.

The research carried out by Government College University's scholars of various departments has been recognized at national and international levels. GC University Lahore has produced quality research in the Sciences. The University is popular around the world due to its research contributions and special focus upon character building and personality grooming of the students and research scholars through various innovative activities. In the field of Physics, the University has the honor of producing a Nobel Laureate named Prof. Dr. Abdus Salam and in the field of Chemistry, another Ravian named Dr. Hargobind Khorana was awarded Noble Prize on account

of remarkable research. Nearly six hundred peer-reviewed papers are published in ISI abstracted journals each year by the University's faculty. Thirteen research journals in various disciplines are being published by the GC University Lahore among which six journals are recognized by the HEC Pakistan. Being a leading university in the region, Government College University Lahore is very much dedicated to promote research to uplift its ranking and to produce research having societal impact through innovative research contributions. Some areas of knowledge are still evolving with the establishment of new departments in the University.

Citation Count is getting popularity in recent times. It is considered a useful phenomenon in evaluation research (Garfield and Welljams-Dorof, 1992). Citation Index is formed around the links between citing and cited articles. This is an important indicator for knowing the growth of research. Through citation index, the research output of the institutions is evaluated and measured (Garfield, 1979). Citation analysis is a very good approach to quantify research contributions. This helps in promoting the ranking of a university around the world's leading institutes (Van Raan, 2003). Research produced by the faculty of a university has value for the uplift of the ranking of the institute. Times Higher Education also values citation as one of the important indicators for deciding about the ranking of a university. (Times Higher Education, 2018). Research indexed in Scopus is given twenty percent weight.

The present study has revealed the research output of Government College University Lahore which has been indexed in Scopus Databases. This study has analyzed different aspects of research output such as growth in research contributions, widely used journals, collaboration patterns, most productive departments of the university, etc. This research will help top management of the university to reframe policies regarding research and strength weak areas to uplift the ranking of the university at the international level.

2. Research Objectives:

The following objectives of the study were set:

- To investigate research performance/productivity of authors from Government College University Lahore
- To reveal major areas of research being produced by authors from Government College University Lahore
- To find out co-authorship patterns of authors from Government College University Lahore
- To reveal collaboration patterns of the authors from Government College University Lahore
- To know the most preferred journals for publications
- To identify country-level collaboration of authors from Government College University Lahore
- To reveal the Three-Fields Plot (Authors-Sources-Countries)
- To determine the keywords used
- To enlist Funding sources for authors from Government College University Lahore

3. Review of Relevant Literature:

Bibliometrics is defined as “the application of mathematics and statistical methods to books and other media of communication.” This type of research method is getting popularity all around the world. Belter (2018) stated that bibliometrics study covered the areas of research output, collaboration, topics, and impact of citations. It may be regarded as "science of science". It quantifies the research contributions. It shows the impact of specific researchers in their specific fields. It reveals major topics chosen for the research and patterns of research-based collaborations. According to Singh & Chander (2014), bibliometric studies are highly valuable for knowing the research output of the researchers, institutions, agencies, universities, and patterns of collaboration among researchers. In any university, research is a core area that is always focused and it plays a leading role in the uplift of the ranking of the universities among the educational institutions of the world.

Erfanmanesh et al. (2010) indicated that evaluative research plays a great role in knowing the weak areas of research in the particular field of any institute and strengths in any field are also revealed. These evaluations assist in taking certain actions by the authorities and policies may be redesigned to promote research culture by the organizations. Many researchers are adopting bibliometrics to reveal the research output by individuals and institutions. Bibliometrics are being utilized in many areas of knowledge. Latif & Haq (2020) stated that many authors have used bibliometrics methodology to know the research output produced by authors, educational institutions, agencies, and countries. Specific periods are targeted to know research output produced by different institutes and researchers. Bibliometric is an integration of mathematical and statistical techniques. This method of research is highly dynamic in revealing publication trends, most popular areas of research, and mostly utilized journals. Kumar (2019) emphasized that bibliometrics are important indicators to flourish research culture among academicians. These metrics also assist in the appointment of research-minded faculty members who can play an innovative role in the uplift of the university through dedicated research contributions.

Baskaran, C. (2013) identified the research contributions of Alagappa University. It was found out whether which departments were producing more research output. Preferred journals for publishing were also identified. Findings of the research indicated that research trends had been increased among the faculty members of Alagappa University. Top authors producing research in high-quality journals were shown. The study recommended some measures to be implemented to increase the research culture among faculty members of the university. Maharana, Rabindra & Sethi, and Bipin. (2013) found out the research growth of Sambalpur University. Publications of both faculty members and the students were assessed. It was identified as how much faculty is involved in research. Growth of research on annual basis was found out. Scopus Database was utilized to identify the research output of the university. The degree of collaboration was also found out.

Bakri, et al. (2015) mentions that multiple techniques are utilized to measure the trends of publications. Scopus Database is frequently utilized to know the research productivity, societal impact of the research output, patterns of collaboration among researchers, and the research performance of different universities. Scopus is a multidisciplinary database that provides access to research-related publications worldwide. It provides several bibliometric parameters to the

researchers. Sanchez (2017) stated that Google Scholar provides valuable citations. It assists in knowing the impact of a document. It provides valuable information beyond traditional zones. It helps in identifying required metrics. It is of great value in showing patterns of citation for researchers. It is of great help for concerned policymakers to re-shape their policies to uplift the research culture in the institutions. Google Scholar Data provides an understanding of scholarly works and the impact of research.

Bakri et. al. (2017) indicated that bibliometrics are useful indicators for finding out research productivity. All types of publications may be identified through metrics. Top cited articles may be known through this type of study. This methodology is valuable in measuring the impact of research outputs. This shows that how a university is growing up in terms of research publications and how new theories are being generated and tested. Findings show that most of the research publications are produced through the departments of Natural Sciences, Physical Sciences, and Life Sciences. An increase in research outputs also leads towards national progress if recommendations of the research-based studies are implemented on a practical basis. Collaborations with other universities and countries are assessed through bibliometrics.

Kumar, A. (2019) explored the research productivity of Guru Jambheshwar University of Science and Technology. Scopus Database was utilized to get the required data. The growth of research produced by the university faculty was found out. Types of publication, collaboration patterns, preferred journals, citation index, and top-ranked articles of the university were identified. The findings of the study show that the number of research publications was rising quickly. Research culture was being increased due to the interest of top management in maximizing research productivity. Citations of the papers were increasing. Departments of Pure Sciences and Life Sciences were producing more publications. Parabhoi, Lambodara & Sahu, Ramani. (2019) identified the research output of Himachal Pradesh University having utilized Scopus. This database was used as a source of getting the required data. Extracted data were analyzed to identify the types of manuscripts, research trends, patterns of collaboration, and the most productive authors. Findings of the study show that there was an increase every year in terms of research output by different departments. Collaboration between researchers at the national level was a common phenomenon. Most of the papers were produced in the disciplines of Physics and Astronomy.

Ahmed, Aquil, and Al-Reyae, Sulaiman (2019) carried out research on the research productivity of Al-Jouf University. The growth of research contributions of the university was identified. Authorship patterns were investigated. Microsoft Excel was utilized for data analysis. National and international collaborations were found out through this study. The findings of the study showed that the university was growing regarding research. Both quantity and quality of the research output were increasing consistently. Faculty members of the university were being more and more attracted towards the production of research to play their vital contribution to the university's ranking through the productive works. Riaz & Naveed (2019) conducted a citation analysis of the documents of the National University of Science and Technology (NUST). The findings of the study revealed that almost 325 documents were produced by NUST per year. These manuscripts received the impact of citation more than seven. More than 60 articles were given an h-index scale. Iqbal, Mahmood, and Iqbal (2018) conducted a study on the research productivity of the researchers belonging to Pakistan through the Web of Science Database. According to the found results, Quaid e Azam University was at the top on account of research output. The University of Karachi stood second. It is pertinent to mention here that the highest impact of research was of the National Centre of Physics, Islamabad, Capital of Pakistan. Authorship patterns were diverse in nature. Collaborative research projects were brought to completion through international universities including John Hopkin University, and King Saud University. Most research publications were produced in the disciplines of Life Sciences and Physical Sciences.

Javed, Ahmed & Khahro (2020) measured the research productivity of 17 universities of 10 years. These universities existed in Islamabad, Pakistan. The data was extracted through Scopus Database. There were thirty-six thousand, five hundred and seventy-seven documents. These documents were equal to the 34% of publications that were produced by the whole country. Findings of the study showed that COMSATS University Islamabad and Quaid e Azam University had produced the most number of publications during the 10 years. These universities were rich in research-based tasks. These education places were taking a lead in research from other institutions. Research produced by Quaid e Azam University; Islamabad had found the maximum citations. The average of the citations received to the Quaid e Azam University was 11.27 per document. These universities had set a standard in research to become an exemplary research-lead seat of

learning. Matrix of other important things was also measured i.e. authorship patterns, priority to the journals, most productive departments of the university, etc. Quaid e Azam University had produced more research publications than private sector universities.

4. Methodology:

a. Method

The researchers used the bibliometric analysis method to 1) investigate research performance, 2) reveal major research areas, 3) determine most productive authors, 4) know preferred journals, 5), know co-authorship patterns, 6) know funding sponsors, and 7) reveal collaboration patterns associated with Government College University, Lahore. Bibliometric is a quantitative/statistical method for analyzing publishing trends of scholarly documents, including research articles, conference papers, reviews, etc. Conceptual (co-occurrences of authors/keywords), and social (collaboration network) structures of retrieved data were also studied.

b. Database Selection

Data were extracted from the Scopus database because of its comprehensive coverage in the field of social sciences. Scopus is regarded as a popular source for identifying the research output of institutions. Researchers have been using it as a bibliometric data source for large-scale. (Bass et.al. ,2020)

c. Search Query

The researchers ran the following search query using the main search interface of Scopus in the search field type: "Affiliation" to retrieve the bibliographic data for Government College University, Lahore. The complete query is given below:

```
AF-ID ("Government College University Lahore" 60037950) AND ( LIMIT-TO ( DOCTYPE,"ar" ) OR LIMIT-TO ( DOCTYPE,"cp" ) OR LIMIT-TO ( DOCTYPE,"re" ) OR LIMIT-TO ( DOCTYPE,"ch" ) )
```

Researchers found that in Scopus, Affiliation ID: 60037950 is associated with Government College University, Lower Mall, Katchehri Road, Lahore. Punjab, Pakistan, and other name formats are Gc University, Government College University, Government College, GC University Lahore, Government College University Lahore, GC University, Govt. College University, G. C. University Lahore, and G. C. University.

A total of 6,085 documents and 1993 authors were found with this affiliation.

d. Date of Data Extraction:

The query was run on 14 of June 2021 at Prince Sultan University, Saudi Arabia. A total of 6,085 publications were found against the search query.

e. Inclusion/Exclusion Criteria

Document type filter was applied and a total of 6008 documents were found. The search was limited to the article, conference paper, review, and book chapter. Year of publication, Language, or geographical filters were not applied. Excluded document types are letter, erratum, note, editorial, retracted, short survey, and undefined. From the initial search results of 6,085 documents, 77 records were excluded after applying the document type filter. The final 6008 records consisting of Articles (N=5621), Conference Papers (N=167), Reviews (N=163), and Book Chapters(N=57) appeared in the period from 1908 to June 13, 2021.

To standardize the selection of items and ensure the accuracy of data, steps in this process were repeated by two researchers from Prince Sultan University, Riyadh.

f. Data Analysis

Different bibliometric analysis tools were used to get meaningful data from the 6008 documents. MS Excel was used to know the publications and citation trends. MS Excel (version 16.0), VOSviewer (version 1.6.15), and Biblioshiny (version 2.0) were used by the authors in visualizing networks, such as journals, researchers, and individual publications. The tools were also used in finding the relations in citations.

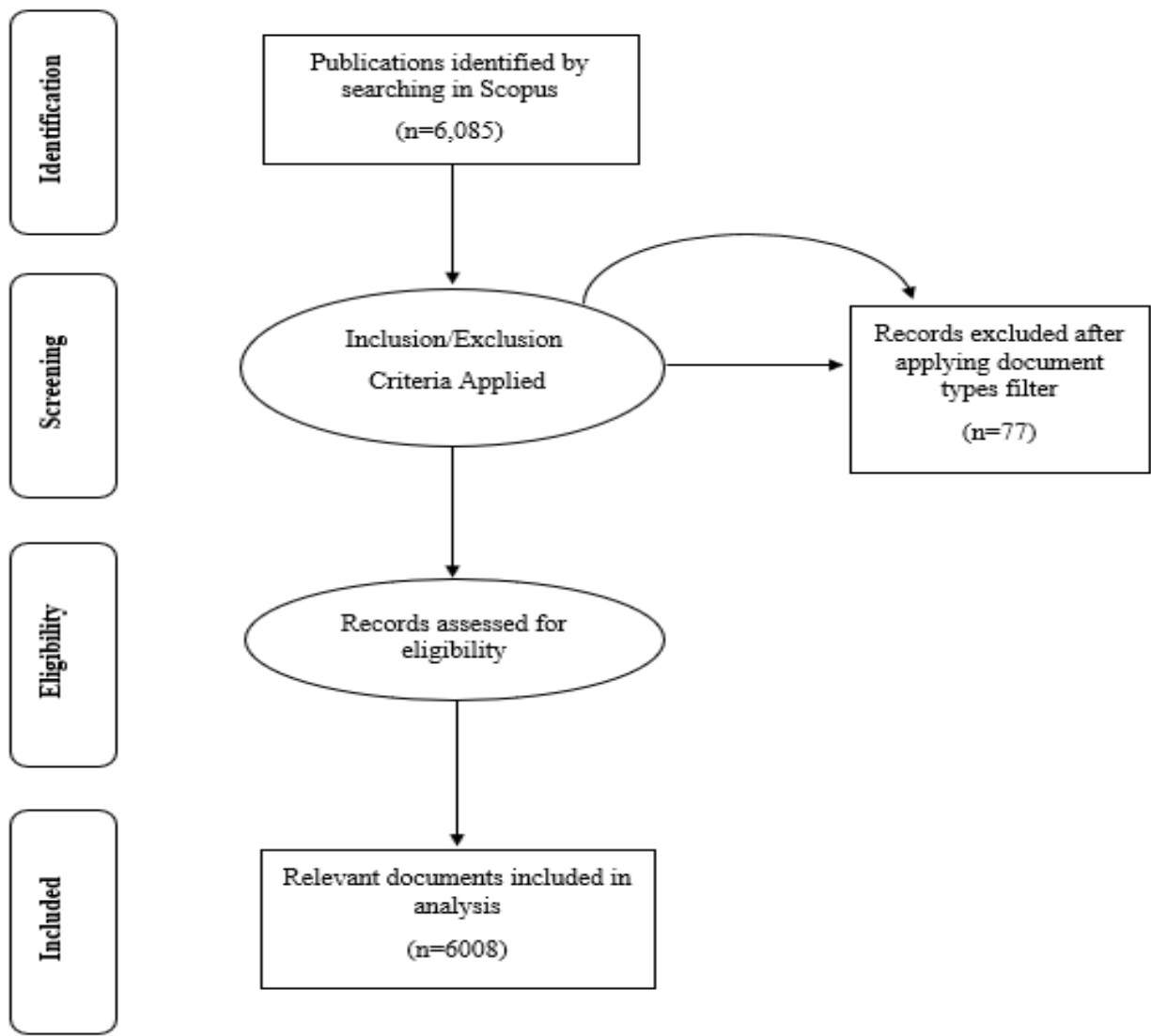


Figure 1: Diagram of 4-phase for extraction and filtration of data-process

5 Data Analysis, Results, and Interpretations:

5.1 Research Productivity of GCU Lahore

Figure 2 shows the annual research productivity of GCU in terms of publications and citations. The document appeared in 1908 were able to get 3 citations. Research productivity of GCU progressively increased over the past year. The major increase is observed during 2020, 2019, 2018 where the publications were 641, 515, and 467 respectively. The authors did not include the year 2021 as data for the complete year was not available. 408 publications that appeared in 2012 were able to get the highest citations which were 3869, followed by 3774 citations for 367 publications in 2016. In 2011, 372 publications got 3756 citations.

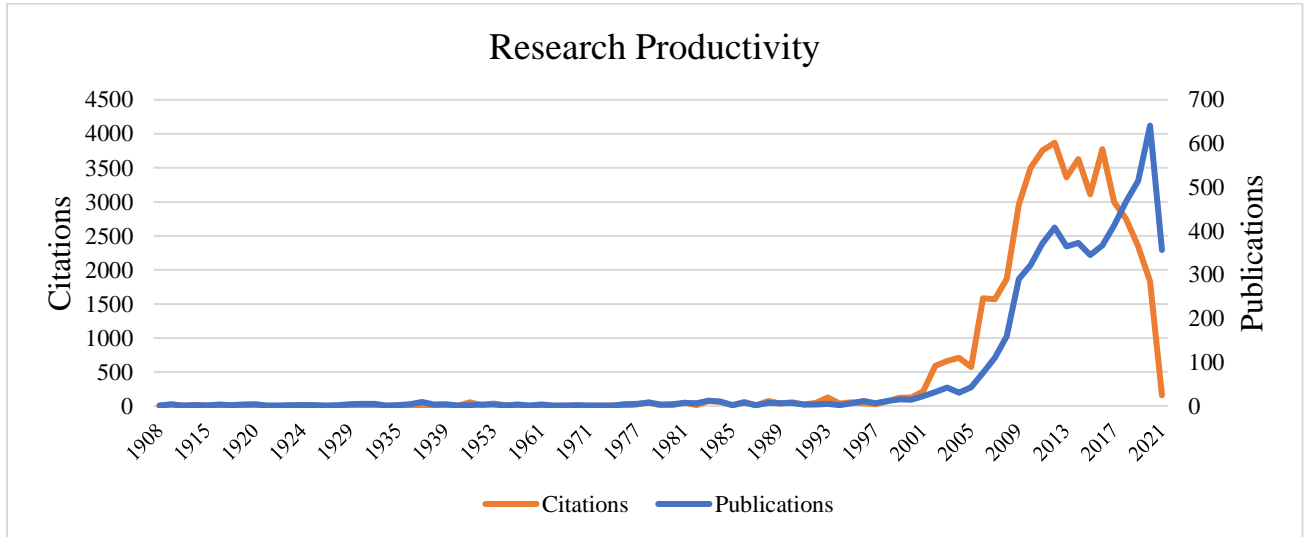


Figure 2: Publications and citation trends from 1908-2021

5.2 Major Research Areas

Scopus has 27 predefined subject areas. Some publications are categorized under more than one subject area at the same time. "Physics and Astronomy" with 1540 publications is the main subject area for GCU authors, followed by Chemistry with 1346 publications. After chemistry, 1194 publications appeared in the Materials Science subject category. Figure 3 depicts the top 10 subject areas for GCU publications.

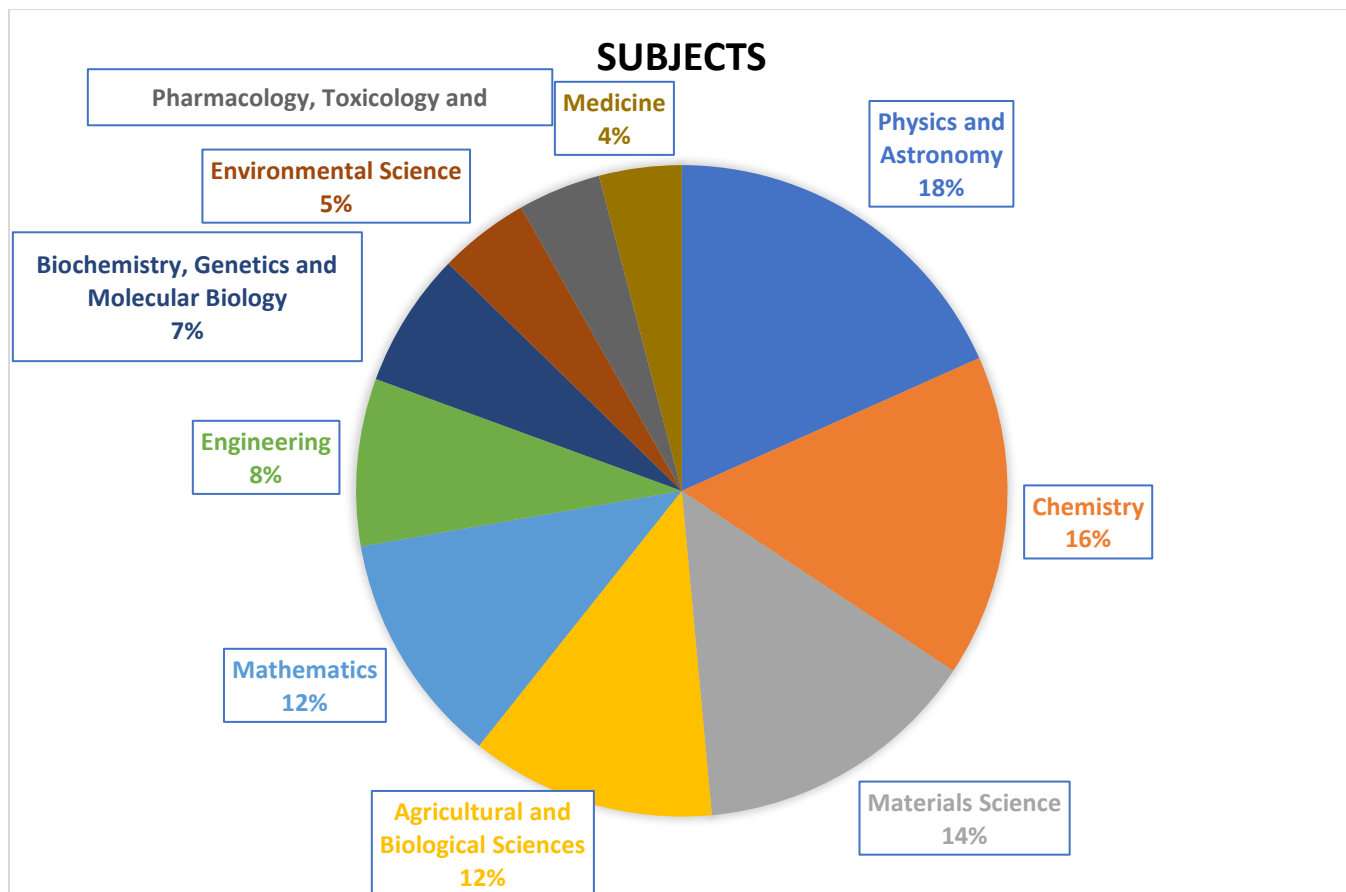


Figure 3: Percentage of publications in predefined subject areas (Top 10)

5.4 Co-Authorship Patterns

Co-authorship map based on bibliographic data, and the unit of analysis was authors, with a maximum number of (a) authors per document: 25, (b) documents of an author: 40, and (c) Citations of an author: 30 was created in VOSviewer software. There are 86 items in 8 clusters that meet the threshold. These clusters can be distinguished by their colors. *Links* and *total link strength* are two weight attributes, which are studied during this process. 853 *links* attribute indicates the number of co-authorship links of GCU researcher with other researchers, and 4793 *total link strength* attribute indicates the total strength of the co-authorship links of a GCU researcher with other researchers. Figure 4 gives the complete co-authorship patterns for GCU authors.

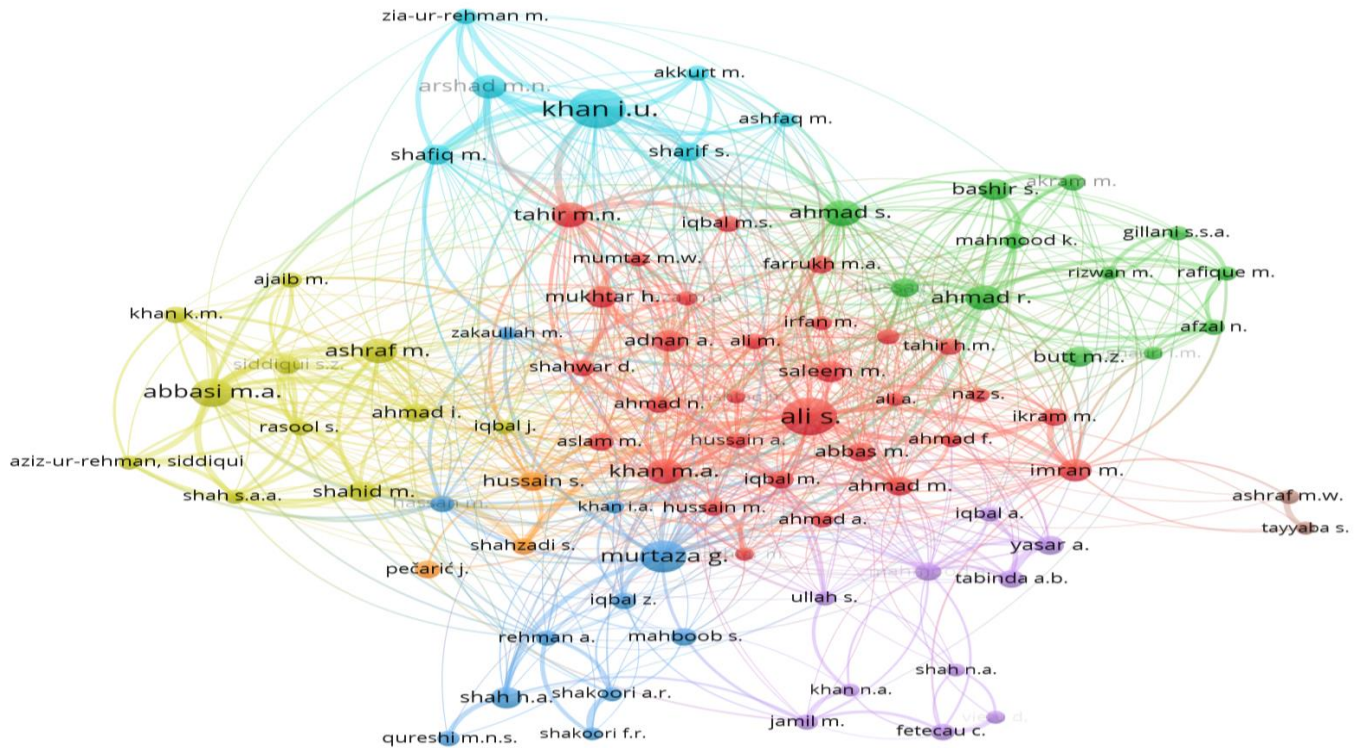


Figure 4: Co-Authorship mapping through VOSviewer

5.5 Research Collaborations Patterns

In 6008 publications, GCU authors mostly collaborated with local Pakistani universities. The University of Punjab is the main collaborative of GCU authors. The University of Sargodha, and the University of Agriculture, Faisalabad are following PU with 317 and 304 publications respectively. At the international level King Saud University, Riyadh, Saudi Arabia is at the top with 186 collaborative publications, followed by King Abdul Aziz University (117) and King Saud University College of Science (117) from Saudi Arabia. Chinese Academy of Sciences collaboration with GCU in 113 research publications. Figure 5 provides a clear idea about collaborated publications with local universities.

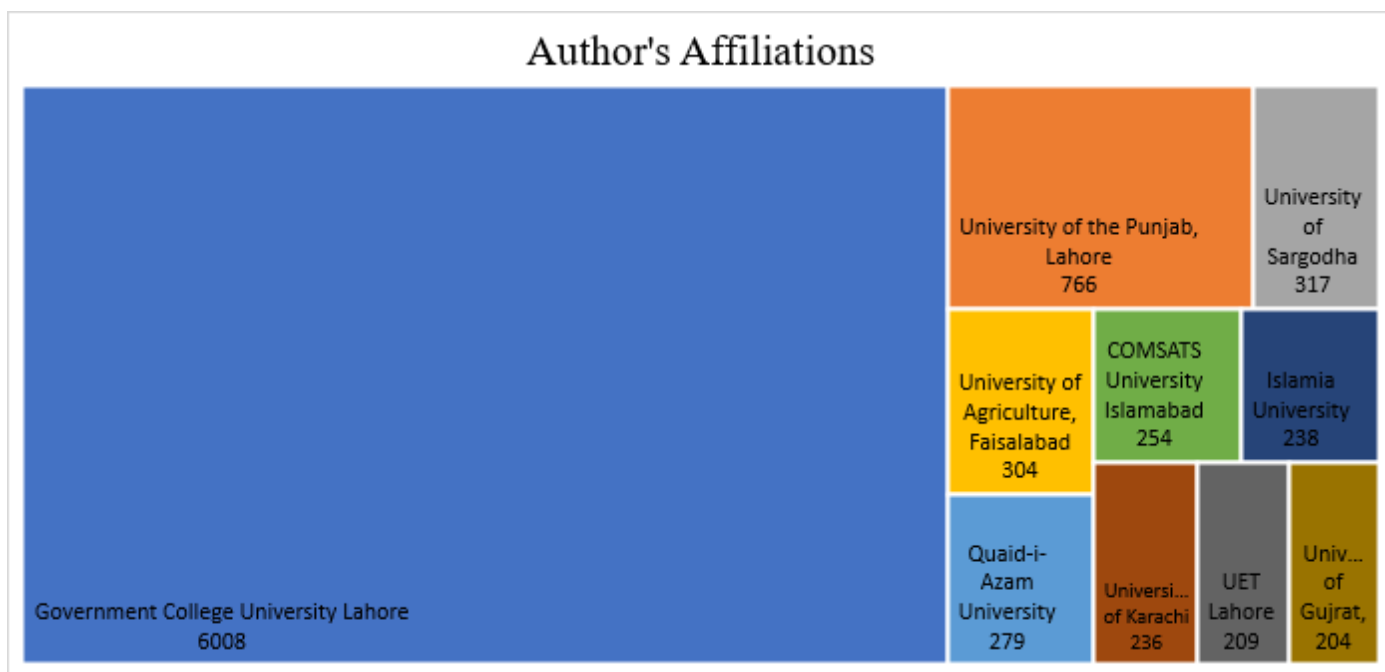


Figure 5: Co-authors from other academic institutes

5.6 Preferred Journals

Table 2 presents the top 10 research journals that published most of the documents from GCU authors. *Acta Crystallographica Section E Structure Reports Online* is the most favorite journal for GCU authors. A total of 339 publications can be seen in this journal. Scopus covered this journal from 2003 to 2015. At number 2 and 3, two Pakistan journals, *Pakistan Journal of Botany* (188), and *Pakistan Journal of Zoology* (185) respectively can be seen. Table 2 enlists the top 10 journals with noticeable information about them. The impact of these 10 journals is explained in table 3.

Table 2:
Preferred journals for Authors affiliated with GCU, Lahore

Source Title	TP	ISSN	Coverage	Publisher	CS	SJR	SNIP
Acta Crystallographica Section E Structure Reports Online	339	1600-5368	2003 to 2015	International Union of Crystallography	0.8 (2016)	0.136 (2018)	0.209 (2018)
Pakistan Journal of Botany	188	0556-3321	1978 1984 to 1986 1996 to Present	Pakistan Botanical Society	1.7	0.316	0.735
Pakistan Journal of Zoology	185	0030-9923	1975 1979 to 1982 1994 to Present	Zoological Society of Pakistan	1.5	0.293	0.789
Physics of Plasmas	138	1070-664X	1994 to Present	American Institute of Physics	3.9	0.75	0.961
Asian Journal of Chemistry	127	0970-7077	1996 to Present	Chemic Publishing Co.	0.7	0.145	0.298
Pakistan Journal of Pharmaceutical Sciences	103	1011-601X	1995 2005 to Present	University of Karachi	1	0.223	0.415
Journal of the Chemical Society of Pakistan	100	0253-5106	1996 to Present	Chemical Society of Pakistan	0.6	0.15	0.242
Journal of Animal and Plant Sciences	92	1018-7081	2008 Present	Pakistan Agricultural Scientists Forum (PAS FORUM)	1	0.224	0.506
Environmental Science and Pollution Research	50	0944-1344	1994 to Present	Springer Nature	5.5	0.845	1.114
Materials Research Express	47	2053-1591	2014 Present	Institute of Physics Publishing	2.5	0.383	0.524

Table 2 shows top journals, which published most of the documents contributed by GCU, Lahore authors. It also shows total publications (TP) of GCU authors in that journal, Scopus covered years, Cite Score (CS), SCImago Journal Rank (SJR), and Source-normalized Impact per Paper (SNIP) of these journals.

Table 3:

Source impact of top 10 Journals

Source	PY Start	TP	TC	H Index	G Index
Acta Crystallographica Section E: Structure Reports Online	2006	339	963	11	14
Pakistan Journal of Botany	1999	188	1543	21	29
Pakistan Journal of Zoology	1996	185	696	12	15
Physics of Plasmas	2000	138	2400	25	41
Asian Journal of Chemistry	2006	127	314	8	12
Pakistan Journal of Pharmaceutical Sciences	2011	103	389	11	15
Journal of the Chemical Society of Pakistan	2002	100	360	8	13
Journal of Animal and Plant Sciences	2008	92	338	9	11
Environmental Science and Pollution Research	2012	50	362	12	16
Materials Research Express	2016	47	206	8	10

The table shows data about the first GCU affiliated publication that appeared (PY Start), total publications (TP), total citations (TC) to those publications, and H-index (Hirsch index).

5.7 Country Level Collaboration

Figure 6 shows the collaboration level between countries. GCU authors published 545 documents in collaboration with Saudi Arabia, followed by China (506 documents). United Kingdom in collaboration with GCU authors have 281 documents. Malaysia, Romania, and the USA produced 278, 226, and 202 publications respectively in collaboration with GCU authors.

Country Collaboration Map

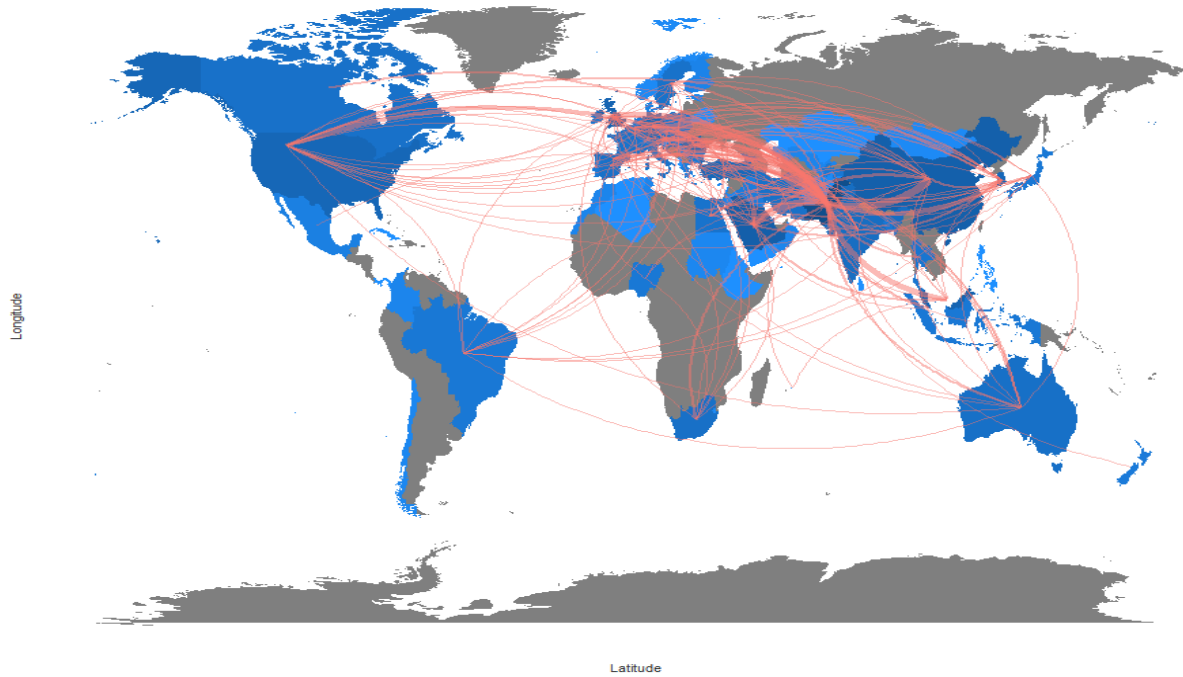


Figure 6: Country collaboration map

5.8 Three-Fields Plot (Authors-Sources-Countries)

Figure 7 visualizes the items of three fields (authors, sources, and countries), and explains how these three items are related to each other. It shows that five countries (Turkey, Romania, Malaysia, Saudi Arabia, and the United Kingdom) published in top ten journals with authors mentioned in the left column. Major collaborations are with IU Khan, MN Tahir, and MN Arshad with authors from these countries.

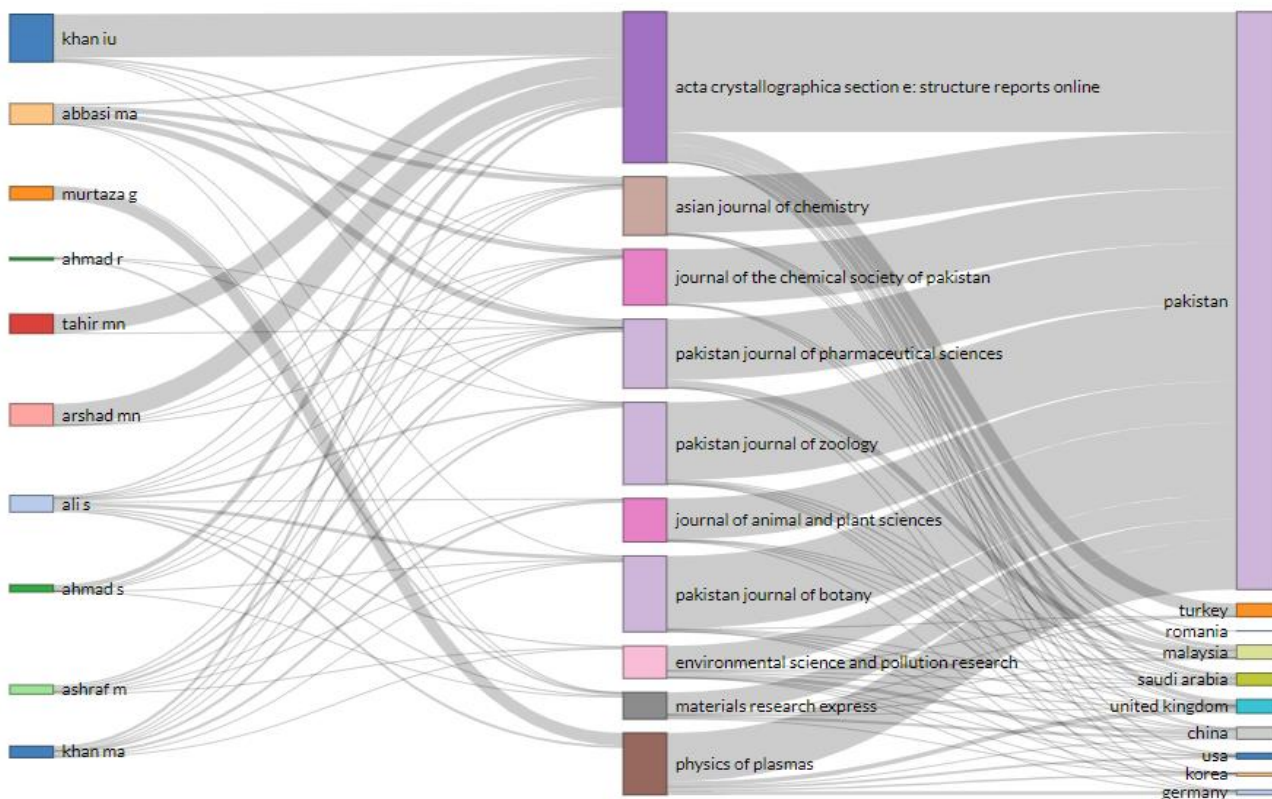


Figure 7: Three-Fields Plot (Authors-Sources-Countries)

5.9 Keywords Used

In documents (publications), the authors used different keywords. The word cloud in figure 8 shows the frequency of keywords used by the GCU authors. Pakistan is used 437 times as a keyword, Synthesis (98), Drug Synthesis (111), and Synthesis (chemical) is used for 77 times. Study (Controlled, 426), Study (Major Clinical, 76), Study (Comparative, 73), and Study (In Vitro, 65) appeared in understudy publications.

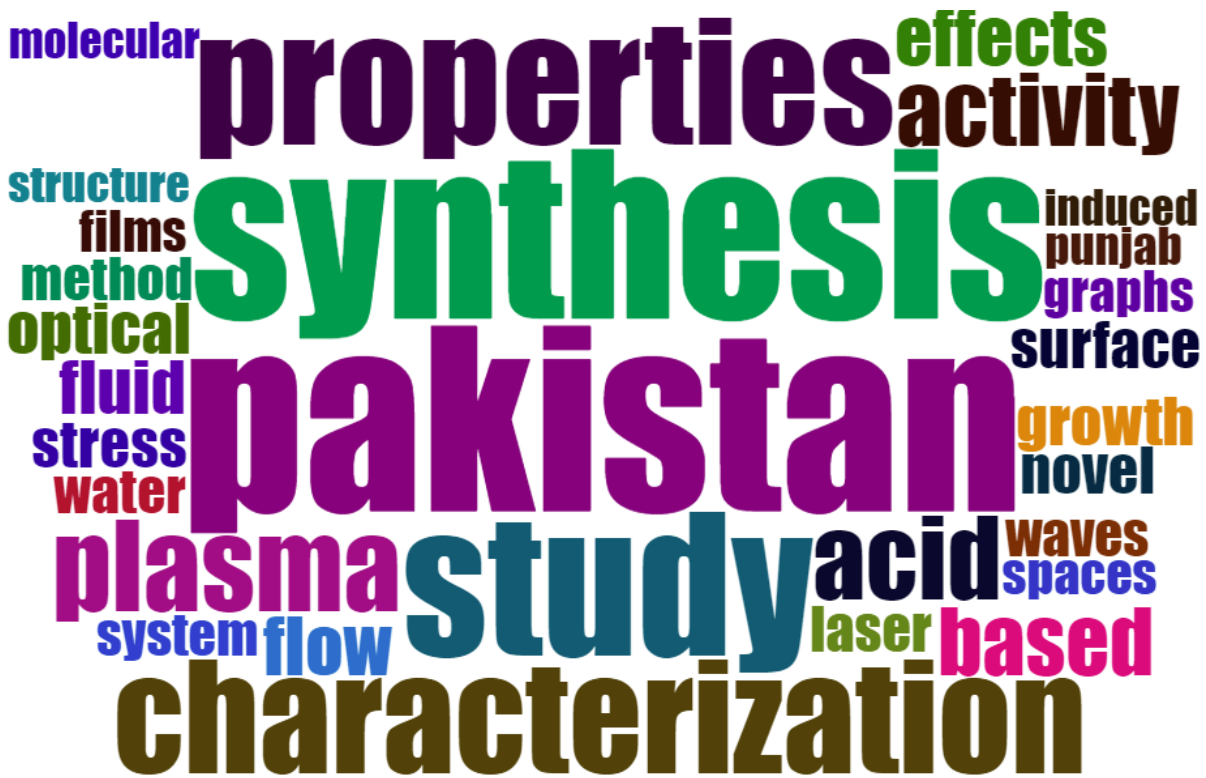


Figure 8: Word cloud of frequently used keywords

5.10 Funding Sponsor

Table 4 reveals the funding sources for GCU publications. Higher Education Commission of Pakistan is at the top. The authors of this paper assume that due to a spelling mistake the funding of HEC is recorded at two places. If two funding agencies are considered as one, ignoring the spelling mistake of "commision" then a total of 480 researchers were funded by the Higher Education Commission (HEC) of Pakistan. Three funding organizations are from Saudi Arabia, followed by two from Pakistan, and United States, while one is from China and Korea.

Table 4:

Top ten funding sponsor appeared in Scopus

Funding Sponsor	Country	Total Publications
Higher Education Commission, Pakistan	Pakistan	282
Higher Education Commission, Pakistan	Pakistan	198
Alabama Commission on Higher Education	United States	137
National Natural Science Foundation of China	China	97
King Saud University	Saudi Arabia	75
Deanship of Scientific Research, King Saud University	Saudi Arabia	61
Government College University, Lahore	Pakistan	49
King Fahd University of Petroleum and Minerals	Saudi Arabia	35
National Research Foundation of Korea	Korea	33
National Science Foundation	United States	33

6. Discussion and Conclusion:

The current study is a bibliometric analysis of 6008 documents published by researchers affiliated with GC university Lahore. The publications included in this bibliometric study were articles, conference papers, reviews, and book chapters published within the period from 1908 to 2022. The main purpose of the current study was to find out the research productivity of GC University Lahore in terms of publications and citation trends, major research areas, co-authorship patterns, preferred journals, keywords used, and funding sponsored.

The research productivity of GC University Lahore showed an increasing position in recent years. The publication trend remained low from 1908 to 2005. However, the significant increase in publications and citations started in 2005. One possible reason for low research productivity from 1908 to 2001, because previously, GC University has a college status namely "Government College Lahore" and in 2002 Government College got university status and its research productivity graph started increasing after getting university status. Another possible reason, the availability of the digital resources in the form of the HEC digital library.

The top ten research areas were consisted of science subjects. Social Sciences, Arts and Humanities have no publication in the top ten areas. A possible reason may be the lack of availability of Scopus indexed journals for Social Sciences, Arts and Humanities. Almost all the available journals for languages other than English such as Urdu, Punjabi, and Persian are not Scopus indexed. On the other hand, many national journals are indexed by Scopus.

The majority of collaborated work from GC University authors is with the University of the Punjab, Lahore, the University of Sargodha, and the University of Agriculture Faisalabad. GC university authors also collaborated with international authors but this collaboration was less as compared to collaboration at the national level.

Local funding sources were Higher Education Commission, Pakistan, and Government College University, Lahore. Other funding sources belonged to United States, China, Saudi Arabia, and Korea. However, a major funding source was Higher Education Commission, Pakistan. Based on extracted data from Scopus, it is forecasted that the number of publications (Articles, Conference Papers, Reviews, and Book Chapters) will be 757 in 2025 (804, and 710 with 50% confidence interval).

Year	Publications	Forecast (Publications)	Lower Confidence Bound (Publications)	Upper Confidence Bound (Publications)
2011	372			
2012	408			
2013	365			
2014	373			
2015	345			
2016	367			
2017	413			
2018	467			
2019	515			
2020	641	641	641	641
2021		664	638	690
2022		687	655	720
2023		710	672	749
2024		734	691	776
2025		757	710	804

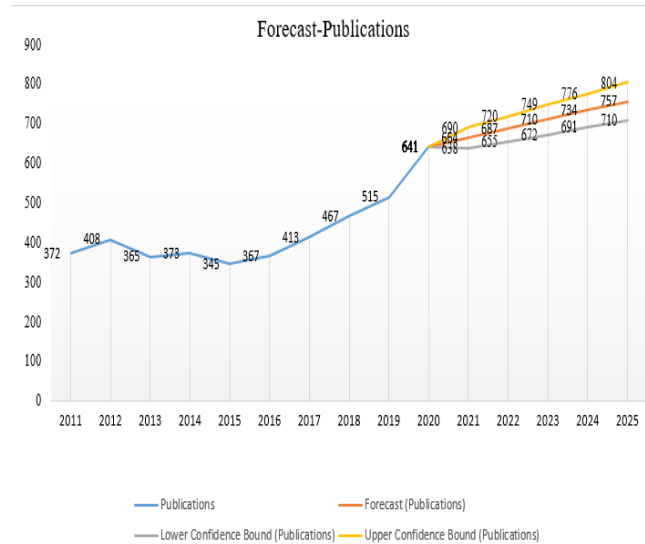


Figure 9: Forecast about publications

7. Limitation

Current study is based on bibliometric data extracted from Scopus Database only.

8. Recommendations:

Following recommendations are furnished to further strengthen the research culture in Government College University, Lahore:

- 1) ORIC must conduct workshops related to research, article writing, research methods, creative writing skills, steps of research, citation management, etc.
- 2) Awareness should be given related to ORCID among the faculty of the university to register research contributions at ORCID.
- 3) The Library should conduct more and more workshops related to searching for information resources for the write-up of a very good literature review.
- 4) All researchers of the university must make a profile at Scopus Database so that visibility of the research output may be made to uplift ranking of the university.
- 5) All researchers of the university should make their account at Research Gate to be in touch with the research community.
- 6) The university should award special incentives to the most productive researchers on annual basis.
- 7) Researchers whose articles receive more citation counts should be appreciated through reward in the historic Bokhari Auditorium of the university for encouraging others to produce quality conscious research.
- 8) Co-authors should be given an honorarium along with the Corresponding Author.
- 9) Information Literacy (IL) sessions should be conducted to promote research culture.
- 10) HEC, Islamabad should provide more funds to carry out research projects having a societal impact.
- 11) Action Research should be encouraged to be conducted to make practical solutions to the challenges being faced by the university.
- 12) Case Studies should be conducted to provide insight related to specific programs, systems, and tasks.
- 13) International Collaborations in research activities need to be promoted.

- 14) MoU should be inked with other leading national and international universities for collaborative research projects.
- 14) Findings of the researches produced by the researchers of the university should be applied on a practical basis.
- 15) Significant research areas should be investigated.
- 16) New theories should be generated and tested for introducing new trends, approaches, and patterns.
- 17) The university should publish an institutional book of research abstracts annually produced by the researchers.
- 18) Administrative Staff should be encouraged to produce research and play a vital role in the uplift of research culture.
- 19) Year-wise growth of research output should be checked through Bibliometric studies.
- 20) The university should provide funds from its resources to the dedicated researchers by receiving proposals and making an evaluation of the received applications.
- 21) Remote access to HEC Digital Library Resources should be provided to the researchers and faculty members of the university through a Virtual Private Network (VPN). Directorate of IT needs to take practical steps in this connection.
- 22) High Tech Lab should be established by the Ministry of Education in the University.
- 23) Government should provide a special budget for research-based projects.

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