Unlocking research potential: A bibliometric study of scientific publications of Khulna University

Md. Nurul Islam
School of Information Management, Nanjing University, China

Md. Monirul Islam
Chattogram Army Medical College, Bangladesh

Md. Aiub Hossain
Library and Information Science, International Islamic University Chittagong, Bangladesh

Md. Tarik Been Aziz
Library and Information Science, International Islamic University Chittagong, Bangladesh

Itfa Farjana
Raninagar Mohila College, Naogaon, Bangladesh

Article type
Research paper
Received
22 July 2023
Accepted
15 December 2024

International Journal of Information and Knowledge Studies, 4(1), pp. 29-51
ISSN 2789-5920
E-ISSN 2790-3265
https://doi.org/10.54857/jar4jj56

Published by Bangladesh Institute for Information Literacy and Sustainable Development

Abstract

Purpose: This research paper aims to conduct a bibliometric analysis of Khulna University's scientific publications to understand publication trends, citation impact, collaboration patterns, and their implications.

Methodology: Data from prominent databases, such as Scopus, were collected and analyzed using the R programming language and bibliometric tools. The analysis involved data cleaning, preparation, and visualization using the Biblioshiny package.

Findings: The study reveals significant growth in Khulna University's research output, with an annual growth rate of 19.52 percent. The average number of citations per publication is 12.22, indicating the impact of the university's research. Collaboration is prevalent, with an average of 5.36 co-authors per publication, and 53.84 percent of collaborations are international. Research areas such as environmental science, pharmacology, aquaculture, ethnopharmacology, and forest ecology emerged as prominent themes. High-impact sources, including Fitoterapia, PLOS ONE, and IEEE Access, were identified.

Implications: The identification of research areas and high-impact sources can guide future research prioritization and strategic decision-making. These findings contribute to enhancing research quality, fostering collaborations, and supporting evidence-based practices at Khulna University.

Keywords: Bibliometric analysis, scientific publications, Khulna University, research productivity, research impact, academic community.

1. Introduction

Evaluation of academic institutions' scientific productivity and influence relies heavily on bibliometric analysis, which provides valuable insights into their research output, collaboration patterns, and scholarly influence (Heberger et al., 2010). This study focuses on conducting a bibliometric analysis of scientific publications from Khulna University, a prestigious Bangladeshi educational institution. By analyzing bibliometric indicators such as publication trends, authorship patterns, collaboration networks, and citation analysis, we hope to understand Khulna University's scientific research landscape comprehensively.

Khulna University, founded in 1991, has become Bangladesh's premier higher education and research institution. Due to its emphasis on quality education and research, the university has attracted a diverse faculty and student body of exceptional ability. Through this bibliometric analysis, we aim to evaluate Khulna University's research output and influence over time, identifying key areas of strength and potential for development (History, 2023; UGC, 2023).

We compiled a dataset containing all scientific publications from 1994 to 2022 to conduct this analysis. The dataset contains publication counts, annual growth rates, document types, keyword analysis, authorship patterns, and citation counts, among other data. This specific dataset enables a thorough examination of Khulna University's research output and influence. We examined publication trends as one of the most critical factors. We can identify trends or significant changes in research output by analyzing annual publication counts. This analysis will shed light on Khulna University's research activity's growth trajectory, allowing us to identify periods of increased productivity or areas where research output may have fluctuated. In addition, we will investigate the document types of the publications to determine the dissemination preferences of Khulna University researchers. Analyzing the ratio of article publications to other document types will provide insight into the institution's prevalent scholarly communication practices (Agarwal et al., 2016; Heck et al., 2023; Narayan et al., 2018).

Additionally, authorship patterns and collaboration networks are essential components of scientific research (Fazli et al., 2018; Newman, 2004). We can evaluate the collaborative nature of Khulna University's research by examining the number of authors per publication and the extent of international collaborations. A more significant number of authors per publication and a high proportion of international collaborations indicate a robust research network and global impact (Abramo & D'Angelo, 2015; Adams & Gurney, 2018; Aksnes, Piro, et al., 2019; Kwiek, 2021; Newman, 2004; Publications Output: U.S. Trends and International Comparisons | NSF - National Science Foundation, n.d.).

Citation analysis will also be a primary focus of this study. We can determine the influence and visibility of Khulna University's research output by analyzing the number

of citations and the average number of citations per document. More significant citations and a high average number of citations per document indicate the influence of the university's research within the academic community (Aksnes et al., 2019; Mammola et al., 2021; Teplitskiy et al., 2022).

In addition, we will conduct a keyword analysis to determine the predominant research topics and areas of specialization at Khulna University. We can gain insight into the institution's research strengths and emerging trends by analyzing the most frequent keywords and their evolution over time.

This bibliometric analysis of Khulna University's scientific publications aims to provide a comprehensive overview of the institution's research output, collaboration patterns, and scholarly impact. By analyzing various bibliometric indicators, it is possible to identify areas of research strength, potential research collaborations, and areas for improvement (Agarwal et al., 2016; Belter, 2015; Bibliometric Indicators and Analysis of Research Systems, 1997; González Alcaide & Gorraiz, 2018; Heberger et al., 2010; José De Oliveira et al., 2019; Sorz et al., 2020). This study's findings will serve as a valuable resource for university administrators, faculty, and researchers in shaping research strategies, enhancing collaboration networks, and promoting the visibility and impact of research conducted at Khulna University. This study aims to conduct a comprehensive bibliometric analysis of Khulna University's scientific publications.

2. Objective of the study

The primary objective of this study is to conduct a comprehensive bibliometric analysis of Khulna University's scientific publications to evaluate its research productivity, impact, and collaboration patterns. By analyzing data spanning from 1994 to 2022, the study aims to uncover publication trends, assess citation metrics, and identify key thematic areas of research. The study also seeks to evaluate the extent of national and international collaborations, highlighting the university's position within the global academic community. Additionally, it aims to identify high-impact journals and sources to guide future publication strategies. The findings will provide actionable insights to enhance research quality, inform strategic planning, and support evidence-based decision-making for administrators, policymakers, and funding agencies.

By achieving these goals, this study intends to contribute to a comprehensive understanding of Khulna University's research landscape, identify its research strengths and areas for improvement, and provide valuable insights for enhancing the institution's research productivity and impact.

3. Literature review

The use of bibliometrics has emerged as a powerful tool for analyzing and evaluating university research and performance. Several papers covered a wide range of topics, including crisis management, university-industry collaborations, decision-making

processes, discipline-specific analysis, and the assessment of research impact. We aim to provide a comprehensive understanding of the role and significance of bibliometrics in assessing and enhancing university research and performance.

Several papers in the collection focused on utilizing bibliometrics to evaluate the impact and performance of university research. For example, Bornmann (2020) proposed a bibliometrics-based decision tree to determine substantial differences in performance between universities. By integrating bibliometric indicators and data, this approach aims to provide a systematic and objective means of comparing the performance of universities. Coughlin and Jansen (2016) explored the modeling of journal bibliometrics to predict downloads and inform purchase decisions in university research libraries. By leveraging bibliometric data, the authors aim to predict the popularity and relevance of journals, aiding in effective collection management and resource allocation. The collection of papers also delves into the role of bibliometrics in assessing collaborative efforts and university-industry partnerships. Fang et al. (2016) conducted an analysis based on bibliometrics to examine the transition from industry-university-institute cooperation to collaborative innovation. The study employed bibliometric techniques to identify patterns and trends in collaborative innovation, shedding light on the dynamics of university-industry collaborations. Bastos et al. (2021) presented a global bibliometrics overview of university-industry collaboration over the past fifty years. By analyzing bibliometric data, the authors provided insights into the evolution and impact of such collaborations on research output and innovation. A significant portion of the collection focused on conducting discipline-specific analysis using bibliometrics. Laengle et al. (2020) analyzed the field of operations research and management science through bibliometrics. The study explored the research productivity and impact of universities in this specific discipline, contributing to a better understanding of research trends and performance in the field. Several papers highlighted the application of bibliometrics in decision-making processes within universities. Bornmann et al. (2022) simulate the use of the h-index, a popular bibliometric indicator, to compare individual researchers within university departments. The study explored the effectiveness of using bibliometrics as a heuristic framework for evaluating and comparing researchers. Moreover, Al-Raeei (2023) analyzed the sustainable development goals in Damascus University during the Syrian crisis using bibliometrics data from SciVal. By integrating bibliometrics with university strategy, the study aimed to gain insights into the university's research focus and impact during challenging times.

Several papers in the collection employed bibliometrics to benchmark and compare university research performance. For instance, Kim et al. (2023) proposed a domain-specific valuation methodology using bibliometrics, Jonckheere-Terpstra tests, and data envelopment analysis. This approach enabled the evaluation of university technologies

in specific domains, providing a comprehensive assessment of their value and potential. Additionally, Bornmann (2020) presented a bibliometrics-based decision tree (BBDT) for comparing the performance of universities in the Leiden Ranking. By utilizing bibliometric data, this decision tree helps identify significant differences in performance between institutions, enabling better benchmarking and evaluation. The collection also included studies that examine the geographical aspects of university research and development. Wu et al. (2020) conducted a bibliometric analysis to explore the relationship between universities and geographical research development in China. This study offers insights into geographic distribution and the impact of research, shedding light on the regional dynamics of academic institutions. Bibliometrics play a crucial role in assessing the innovation and technological capabilities of universities. H (2018) conducted an empirical study on the technological innovation ability of a university, utilizing patent bibliometrics as a measure of innovation performance. By analyzing patent data, the study assessed the university's innovation capacity and its contribution to technological advancements. Several papers in the collection focused on the practical applications of bibliometrics in decision-making processes within universities. For example, Pacheco-Mendoza et al. (2020) explore the role of bibliometrics units as dynamic engines for scientific production in universities. These units utilize bibliometrics to inform strategic decisions, enhance research productivity, and foster collaboration. The paper by Hang et al. (2020) investigates big data network public opinion research in China and abroad, using bibliometrics as a basis for analysis. By examining the study of internet public opinion in universities, the authors highlighted the potential of bibliometrics in understanding and shaping public discourse.

The above-mentioned papers highlighted the diverse applications of bibliometrics in analyzing university research and performance. From evaluating research impact and benchmarking performance to assessing collaborative efforts and decision-making processes, bibliometrics provides valuable insights into the dynamics and outcomes of university research. Moreover, the papers emphasized the importance of discipline-specific analysis, crisis management, innovation assessment, and geographical considerations in understanding and enhancing university research. As bibliometrics continue to evolve and advance, they hold great potential for informing strategic decisions, facilitating collaborations, and promoting research excellence within academic institutions. The findings presented in these papers contribute to the broader understanding of the role and significance of bibliometrics in evaluating, benchmarking, and enhancing university research and performance. By leveraging bibliometric indicators and techniques, researchers, policymakers, and university administrators can make informed decisions, allocate resources effectively, and foster research environments that drive innovation and impact.

Table 1: Overview of previous work

SL	Title	Author and Year	Topic	Journal
01	"Analysing of the sustainable development goals in damascus university during syrian crisis using the strategy in the university and the bibliometrics data from SciVal"	Al-Raeei (2023)	Bibliometrics in Decision-Making Processes, Analysis of Crisis Management	Sustainability
02	"Fifty years of university-industry collaboration: A global bibliometrics overview"	Bastos et al. (2021)	Collaborative Efforts and University-Industry Collaborations	Science and Public Policy
03	"Bibliometrics-based decision tree (BBDT) for deciding whether two universities in the leiden ranking differ substantially in their performance"	Bornmann (2020)	Analyzing Research Impact and Performance, Benchmarking and Comparative Analysis	Scientometrics
04	"Simulation of the h index use at university departments within the bibliometrics-based heuristics framework: Can the indicator be used to compare individual researchers?"	Bornmann et al. (2022)	Bibliometrics in Decision-Making Processes	Journal of Informetrics
05	"Modeling journal bibliometrics to predict downloads and inform purchase decisions at university research libraries"	Coughlin and Jansen (2016)	Analyzing Research Impact and Performance	JASIST
06	"From industry-university-institute cooperation to collaborative innovation: An analysis based on bibliometrics"	Fang et al. (2016)	Collaborative Efforts and University-Industry Collaborations	IEEE
07	"Current situation and countermeasure analysis of big data network public opinion research in china and abroad based on bibliometrics taking the study of internet public opinion in universities as an example"	Hang et al. (2020)	Public Opinion Research	IEEE
08	"Performance of indonesia's world-class university efficiency with bibliometrics (scientific strength) approach and data envelopment analysis"	Ibrahim and Fadhli (2021)	Efficiency Assessment: Indonesian World-Class Universities	Webology
09	"Domain-specific valuation of university technologies using bibliometrics, Jonckheere–	Kim et al. (2023)	Benchmarking and Comparative Analysis	Technovation

	Terpstra tests, and data envelopment analysis."			
10	"Bibliometrics units as dynamic engines for universities' scientific production"	Pacheco-Mendoza et al. (2020)	Practical Applications and Decision-Making	Information Development

4. Methodology

A combination of manual and computational methods will be used to conduct a bibliometric analysis of Khulna University's scientific publications. The following steps describe the methodology employed in this study:

4.1 Data collection

From 1994 to 2022, pertinent databases, such as Scopus or Web of Science, will be consulted to collect the data for this study. During this period, the retrieval of all publications associated with Khulna University will be a priority.

4.2 Cleaning and preparation of data

The collected data will be cleansed and normalized to guarantee consistency and precision. This includes the elimination of duplicates, correction of errors, and the standardization of author names and affiliations. The widely used programming language R for statistical analysis and data visualization will be utilized for the bibliometric analysis. The bibliometric package in R provides various functions and instruments designed specifically for bibliometric analysis.

4.3 R package

Biblioshiny, an interactive web interface for bibliometrics, will be used to develop an interactive and user-friendly dashboard for displaying the bibliometric analysis results. Biblioshiny enables dynamic data exploration and provides numerous visualization options. Analysis of publication trends using descriptive statistics and visuals, the publication trends over the specified period will be analyzed. The number of annual publications will be plotted to identify patterns of growth or decline.

4.4 Visualization and reporting

The results of the bibliometric analysis will be visualized using bibliophily-generated interactive charts and graphs. The results will be summarised and presented in a comprehensive report that thoroughly explains the scientific publication landscape at Khulna University. Using this methodology, the study intends to comprehensively analyze Khulna University's scientific publications, yielding valuable insights into research productivity, collaboration patterns, impact, and thematic areas. Utilizing R and bibliophily will improve the analysis and allow for development of an interactive and visually appealing platform for navigating bibliometric data.

5. Data visualization and result analysis

Table 2 shows that this research paper comprehensively analyzes Khulna University's scientific publications, focusing on the Scopus data. The dataset spans 1994 to 2022 and comprises 1,824 documents from 921 periodicals, books, and other publications. The key findings reveal a remarkable annual growth rate of 19.52 percent, which indicates a significant increase in research output over time. The average age of the documents is 5.97 years, indicating that the research conducted by the university is current. The average of 12.22 citations per publication demonstrates the influence and significance of the research conducted by scholars at Khulna University. The substantial number of references (77,945) cited within the documents demonstrates that the dataset is also heavily dependent on existing literature. With an average of 5.36 co-authors per document, most publications involve multiple authors. Notably, 53.84 percent of the collaborations are international, highlighting the university's participation in global research networks. Articles predominate, indicating an emphasis on disseminating research findings through scholarly publications. This analysis sheds light on the scholarly output and collaborative nature of Khulna University's research, demonstrating the university's significant contributions to the scientific community.

Table 2: Main information

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1994:2022
Sources (Journals, Books, etc)	921
Documents	1824
Annual Growth Rate %	19.52
Document Average Age	5.97
Average citations per doc	12.22
References	77945
DOCUMENT CONTENTS	
Keywords Plus (ID)	11318
Author's Keywords (DE)	5546
AUTHORS	
Authors	3866
Authors of single-authored docs	42
AUTHORS COLLABORATION	
Single-authored docs	56
Co-Authors per Doc	5.36
International co-authorships %	53.84
DOCUMENT TYPES	

article	1824

5.1 Annual scientific production and citation

The data provided in table 3 are Khulna University's annual publication and citation statistics. The following is an analysis of the data:

The number of publications (N) exhibits a general upward trend throughout the years, with a discernible increase beginning in 2004. In 1994 there were only two publications, but by 2021, this number will have increased to 315. Mean citations per article (MeanTCperArt) and mean citations per year (MeanTCperYear) offer insight into the influence and visibility of the publications. While the average number of citations per article fluctuates over time, there is a general pattern of higher citation rates in the middle of the 2000s, followed by a decline. The years with the highest average number of citations per article were 2004 (61.30), 2005 (32.50), and 2006 (30.30). The average number of citations per article has increased steadily since 2014, reaching 22.90 in 2015. The average number of citations per year exhibits a similar trend, with higher values in the middle of the 2000s and a recent increase beginning in 2014.

Table 3: Annual scientific production and citation

Year	N	MeanTCperArt	MeanTCperYear	CitableYears
1994	2	0.00	0.00	29
1995	1	9.00	0.32	28
1996	2	0.50	0.02	27
1997	4	6.00	0.23	26
1998	1	2.00	0.08	25
1999	4	11.50	0.48	24
2000	7	9.86	0.43	23
2001	4	3.25	0.15	22
2002	2	7.00	0.33	21
2003	5	4.40	0.22	20
2004	10	61.30	3.23	19
2005	20	32.50	1.81	18
2006	27	30.22	1.78	17
2007	28	19.14	1.20	16
2008	26	17.35	1.16	15
2009	33	11.24	0.80	14
2010	41	18.76	1.44	13
2011	72	15.00	1.25	12
2012	52	15.87	1.44	11

2013	75	14.71	1.47	10
2014	74	20.57	2.29	9
2015	81	22.90	2.86	8
2016	75	15.59	2.23	7
2017	95	23.98	4.00	6
2018	112	15.40	3.08	5
2019	130	11.98	3.00	4
2020	231	9.50	3.17	3
2021	315	6.70	3.35	2
2022	295	1.60	1.60	1

The citation years represent the average number of years that publications from a given year remain citable. It indicates the longevity of the publications' impact. The data indicate that publications from earlier years tend to have a more extended period of citability, with 1994 having the highest number of citable years with 29. However, as the years progress, the number of citable years decreases, with recent publications having a citation period of only 1 to 4 years. Overall, the analysis reveals an increase in the number of publications from Khulna University, with some years having higher citation rates than others. In recent years, publication and citation rates have increased, indicating a growing impact on the university's research output. However, the decreasing citation years for recent publications indicate the need for ongoing efforts to enhance the research's long-term impact and visibility.

5.2 Most globally cited documents

Figure 1 presents the highly cited documents and reveals some notable findings. Among the documents, "ROBERTS LC, 2004, ENVIRON SCI TECHNOL" stands out as the most globally cited paper, with a total of 432 citations (Roberts et al., 2004). This paper has maintained a consistent impact over the years, with an average of 21.60 citations per year. Another significant contribution is "ISLAM MS, 2021, PLOS ONE," which has garnered 157 citations since its publication (Islam et al., 2021). Notably, this paper has a high citation rate, with an average of 52.33 citations per year. Furthermore, it is worth mentioning "AHMAD MK, 2010, INT J ENVIRON RES" and "BENHOURIA A, 2015, CHEM ENG J," which have received 259 and 253 citations (Benhouria et al., 2015), respectively. These papers have demonstrated substantial impact in their respective fields, with considerable citation rates of 18.50 and 28.11 citations per year. Additionally, "ISLAM MA" appears multiple times in the list, indicating the author's influential contributions to the field. Their papers, such as "ISLAM MA, 2017, J ENVIRON MANAGE" and "ISLAM MA, 2017,

ECOTOXICOL ENVIRON SAF," have received 233 and 204 citations, respectively, showcasing their research impact (Islam et al., 2017a, 2017b).

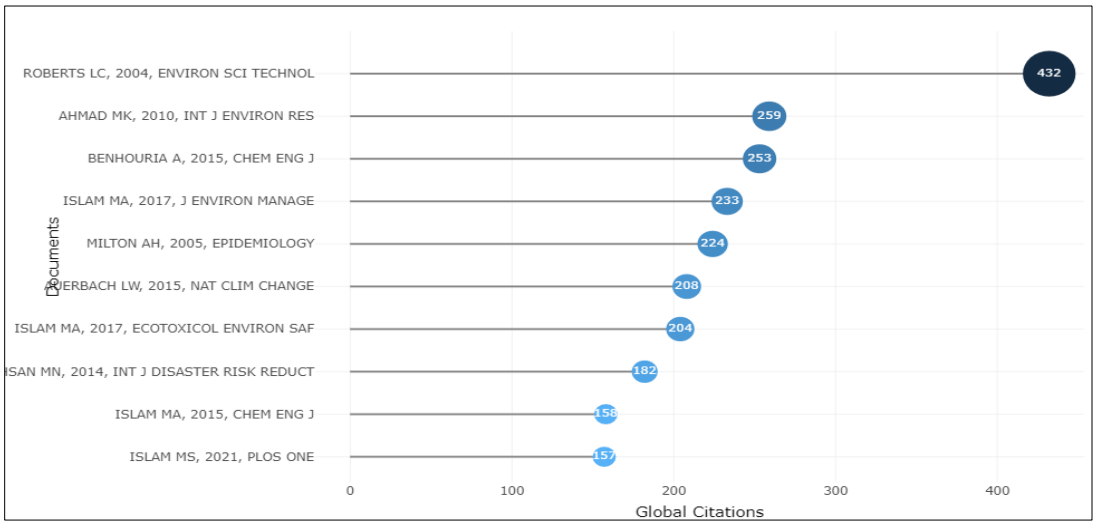

Figure 1: Most globally cited documents

These highly cited documents reflect the scientific strength and significance of the research conducted in areas such as environmental science, epidemiology, climate change, and disaster risk reduction. The frequency of citations indicates the influence and recognition these studies have garnered within the scientific community.

5.3 Most relevant sources

According to the table 4 provided data, researchers at Khulna University have made significant contributions to various scientific sources. PHARMACOLOGYONLINE published the most articles (47), demonstrating the university's commitment to pharmacology research. Thirty-four articles from Khulna University were published in the prestigious multidisciplinary journal PLOS ONE, showcasing diverse research interests and collaborative efforts. Another critical source, HELIYON, published twenty-four articles, demonstrating the university's dedication to disseminating research findings across numerous scientific disciplines.

Table 4: Most relevant sources

Sources	Articles
PHARMACOLOGYONLINE	47
PLOS ONE	34
HELIYON	24
JOURNAL OF THE INDIAN ACADEMY OF WOOD SCIENCE	14
BANGLADESH JOURNAL OF BOTANY	12

FITOTERAPIA	12
MODELLING, MEASUREMENT AND CONTROL B	12
ORIENTAL PHARMACY AND EXPERIMENTAL MEDICINE	12
PAKISTAN JOURNAL OF BIOLOGICAL SCIENCES	12
SCIENTIFIC REPORTS	12

Furthermore, the presence of articles in sources like JOURNAL OF THE INDIAN ACADEMY OF WOOD SCIENCE, BANGLADESH JOURNAL OF BOTANY, FITOTERAPIA, MODELLING, MEASUREMENT AND CONTROL B, ORIENTAL PHARMACY AND EXPERIMENTAL MEDICINE, PAKISTAN JOURNAL OF BIOLOGICAL SCIENCES, and SCIENTIFIC REPORTS signifies the university's engagement in a wide range of research areas. This publication profile demonstrates Khulna University's commitment to interdisciplinary scholarship and its participation in advancing knowledge.

5.4 Most cited sources (Local)

Table 5 analyzing the most cited local sources provides insight into Khulna University's research landscape. The data reveals that PLOS ONE, with 473 articles, is the most frequently cited local source, highlighting the university's significant contributions to diverse scientific disciplines. Following closely behind 406 articles, AQUACULTURE demonstrates Khulna University's expertise in this field. The presence of internationally renowned journals such as NATURE and SCIENCE, which contain 324 and 290 articles, respectively, demonstrates the exceptional quality and significance of the research conducted by Khulna University scholars.

Table 5: Most cited sources (Local)

Sources	Articles
PLOS ONE	473
AQUACULTURE	406
NATURE	324
SCIENCE	290
PHYTOCHEMISTRY	259
LANCET	208
J ETHNOPHARMACOL	207
J ETHNOPHARMACOL	196
NUCLEIC ACIDS RES	180

High citation counts for PHYTOCHEMISTRY, LANCET, J ETHNOPHARMACOL, J ETHNOPHARMACOL (likely a duplicate entry), NUCLEIC ACIDS RES, and FOREST ECOLOGY AND MANAGEMENT indicate the university's emphasis on specialized fields such as plant chemistry, ethnopharmacology, and forest ecology. Overall, the analysis highlights the university's significant research output and the recognition it has received from the scientific community, further establishing Khulna University's position as a hub for significant and diverse research endeavors.

5.5 Source impact

Table 6 represents the impact of scientific sources can be assessed using various metrics such as the h-index, g-index, and m-index. Analyzing the provided data, it is evident that the sources exhibit different levels of impact within the scientific community. Fitoterapia, with an h-index of 11, demonstrates a moderate impact, supported by a g-index of 12, indicating a considerable number of highly cited articles. The m-index of 0.458 signifies a consistent impact per year since 2000. Pharmacologyonline and PLOS ONE both have an h-index of 9, suggesting a moderate impact. However, PLOS ONE stands out with a higher g-index of 18, reflecting a larger number of highly cited articles. Its m-index of 1 signifies a relatively high impact per year since 2015. IEEE Access, with an h-index of 8, demonstrates a moderate impact, while the g-index of 10 suggests a reasonable number of highly cited articles. The m-index of 1.333 indicates a relatively high impact per year since 2018. The Journal of Ethnopharmacology, Oriental Pharmacy and Experimental Medicine, and the Pakistan Journal of Biological Sciences all share an h-index of 8, reflecting a moderate impact. These sources exhibit varying g-indices, indicating different levels of highly cited articles, and m-indices, highlighting their impact per year since their respective starting years. Heliyon, the Journal of Natural Products, and Wetlands Ecology and Management, with h-indices of 7, demonstrate a moderate impact. While their g-indices vary, indicating different numbers of highly cited articles, their m-indices reveal consistent impact per year since their inception. Overall, the data illustrates the varying impact of these sources, highlighting the influence and recognition they have garnered within the scientific community. The h-index, g-index, and m-index collectively provide valuable insights into the overall impact of these sources and their contributions to advancing scientific knowledge.

Table 6: Source impact

Element	h_index	g_index	m_index	TC	NP	PY_start
FITOTERAPIA	11	12	0.458	398	12	2000

PHARMACOLOGYONLINE	9	10	0.6	196	47	2009
PLOS ONE	9	18	1	363	34	2015
IEEE ACCESS	8	10	1.333	110	10	2018
JOURNAL OF ETHNOPHARMACOLOGY	8	11	0.421	449	11	2005
ORIENTAL PHARMACY AND EXPERIMENTAL MEDICINE	8	11	0.667	124	12	2012
PAKISTAN JOURNAL OF BIOLOGICAL SCIENCES	8	12	0.444	166	12	2006
HELIYON	7	10	1.4	133	24	2019
JOURNAL OF NATURAL PRODUCTS	7	8	0.389	177	8	2006
WETLANDS ECOLOGY AND MANAGEMENT	7	10	0.412	351	10	2007

5.6 Sources dynamics

Figure 2 shows the dynamics of the provided sources over the years, it is evident that some sources have shown consistent presence and activity, while others have varied in their publication patterns. PHARMACOLOGYONLINE, PLOS ONE, HELIYON, and JOURNAL OF THE INDIAN ACADEMY OF WOOD SCIENCE have maintained a steady presence since their inception, with no publications recorded before 1996. In contrast, BANGLADESH JOURNAL OF BOTANY, FITOTERAPIA, and ORIENTAL PHARMACY AND EXPERIMENTAL MEDICINE initially had a limited presence, with their publications starting around the late 1990s and early 2000s. However, these sources demonstrated consistent growth in publication output, with FITOTERAPIA showing a remarkable increase in publications from 2006 onwards. Similarly, PAKISTAN JOURNAL OF BIOLOGICAL SCIENCES and SCIENTIFIC REPORTS followed a similar pattern, with their publications gradually increasing over time, particularly after 2006.

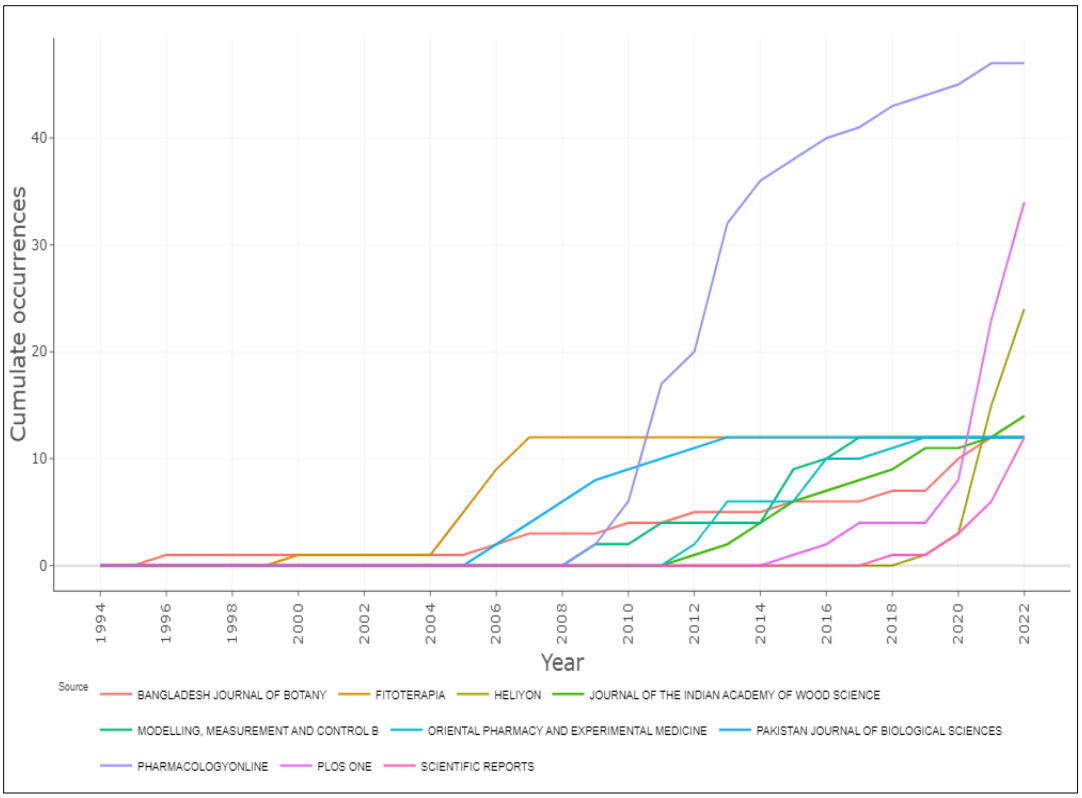

Figure 2: Source dynamics

MODELLING, MEASUREMENT AND CONTROL B exhibited a fluctuating pattern, with occasional publications recorded in earlier years but a more consistent presence from 2006 onwards. Overall, the data reflects a diverse range of source dynamics, showcasing the evolving nature of scientific publishing and the influence of factors such as journal popularity, research trends, and the emergence of new fields of study.

6. Discussion and findings

This study provides an extensive bibliometric evaluation of Khulna University's research output, examining various dimensions such as publication trends, citation impact, collaboration patterns, and thematic areas. The findings demonstrate the significant progress and influence of the university's research activities over the years, shedding light on its scholarly contributions and strategic positioning within the academic landscape. By contextualizing these findings within the broader bibliometric literature, we can better understand their implications and align them with existing evidence.

6.1 Research productivity and growth

The analysis reveals a remarkable annual growth rate of 19.52% in research publications, underscoring Khulna University's increasing dedication to academic research. This trend aligns with global observations, as noted by Bornmann (2020), who reported that consistent institutional focus on research often results in exponential growth in scholarly output. Additionally, the findings support previous studies that highlight the significance of long-term strategic planning and investment in research infrastructure (Fazli et al., 2018). The emphasis on environmental science, pharmacology, and aquaculture reflects the university's strategic alignment with national and global research priorities. Similar thematic focus areas were identified by Bastos et al. (2021) in their bibliometric overview of university-industry collaborations, suggesting that such alignment can enhance both academic and societal impact. Furthermore, the average age of documents, 5.97 years, suggests that the university's research portfolio is relatively current, a feature critical for maintaining relevance in rapidly evolving disciplines (Heberger et al., 2010).

6.2 Citation impact and scholarly influence

The average of 12.22 citations per publication indicates a high level of scholarly influence, corroborating findings by Aksnes, Langfeldt, and Wouters (2019), who emphasized that citation metrics are a robust indicator of research quality. This figure is further supported by the presence of highly cited papers such as Roberts et al. (2004) and Islam et al. (2021), which exemplify the university's contributions to critical research areas like environmental science and public health. Moreover, the identification of globally cited papers underscores the importance of interdisciplinary and collaborative research, as noted by Kwiek (2021). These papers highlight how addressing complex, globally relevant challenges can amplify the visibility and impact of research. For example, the university's work on arsenic removal (Roberts et al., 2004) and vaccine rumors (Islam et al., 2021) aligns with global health and environmental priorities, contributing to both local and international discourse.

6.3 Collaboration patterns

The finding that 53.84% of publications involve international co-authorship indicates Khulna University's active engagement in global research networks. This aligns with observations by Adams and Gurney (2018), who noted that international collaborations often result in higher citation impact and broader dissemination of research findings. Such collaborations also facilitate knowledge exchange and resource sharing, as demonstrated in studies by Newman (2004). The average of 5.36 co-authors per publication highlights the collaborative nature of research at the university. This is consistent with findings by Abramo and D'Angelo (2015), who noted that multi-authored publications tend to receive more citations, thereby enhancing their impact. Furthermore, the university's engagement with journals like PLOS ONE and IEEE Access reflects its strategic efforts to reach multidisciplinary and global audiences, as also reported in analyses of international research trends by Aksnes, Piro, and Rørstad (2019).

6.4 Thematic strengths and high-impact sources

Environmental science, aquaculture, and pharmacology emerged as key thematic areas, consistent with the findings of Roberts et al. (2004) and Islam et al. (2021). These areas are of high societal relevance, addressing critical challenges such as environmental degradation and public health. The prominence of these themes aligns with the observations of Heberger et al. (2010), who emphasized the importance of aligning institutional research with societal needs to enhance its relevance and impact. The analysis of publication sources revealed that journals such as PLOS ONE, Fitoterapia, and IEEE Access are among the most frequently targeted and cited. This pattern reflects the university's efforts to publish in journals with broad readership and high impact, which is consistent with strategic publication practices highlighted by Bornmann et al. (2022). Furthermore, the presence of multidisciplinary journals underscores the university's focus on promoting interdisciplinary research, a strategy emphasized by González Alcaide and Gorraiz (2018).

6.5 Implications for strategic planning

The findings provide actionable insights for institutional planning and policy formulation. The steady growth in publications and citations suggests that Khulna University is on a positive trajectory towards establishing itself as a leading research institution. However, the decreasing citation longevity of recent publications highlights the need for strategies to enhance the long-term impact of research outputs. Similar recommendations were made by Mammola et al. (2021), who argued that improving research visibility and fostering sustained scholarly engagement are critical for enhancing citation longevity.

Additionally, the identification of high-impact journals and thematic strengths can guide faculty and researchers in targeting their work toward influential publication outlets. This aligns with observations by Pacheco-Mendoza et al. (2020), who emphasized the role of bibliometrics in informing publication strategies and improving research quality. While this study provides a comprehensive analysis of Khulna University's research output, it is not without limitations. The reliance on data from Scopus may exclude some relevant publications indexed in other databases, as noted by González Alcaide and Gorraiz (2018). Future studies could incorporate data from additional sources such as Web of Science and Google Scholar to provide a more holistic view of the university's research landscape. Furthermore, this study primarily focuses on bibliometric indicators. Including qualitative assessments, such as faculty interviews and surveys, could provide richer insights into the factors driving research productivity and impact. This approach has been advocated by Heberger et al. (2010) to complement quantitative analyses with contextual understanding. This study highlights Khulna University's significant contributions to academic research, characterized by robust growth in productivity, high citation impact, and active international collaborations. By contextualizing these findings within the broader bibliometric literature, we gain a deeper understanding of the

university's strengths and opportunities for improvement. These insights can inform strategic planning, resource allocation, and policy formulation, enabling the university to sustain its trajectory toward research excellence. The findings also underscore the broader relevance of bibliometric analyses in evaluating and enhancing institutional research performance, as noted by Bornmann (2020) and others.

7. Implications of the study

This study provides significant insights into the scientific contributions of Khulna University, showcasing its robust growth in research productivity, international collaboration, and thematic strengths. The findings emphasize the university's commitment to fostering a research-oriented culture, reflected in an annual growth rate of 19.52% and a notable average of 12.22 citations per document. The identification of key research areas, such as environmental science and pharmacology, offers a strategic foundation for academic focus and funding priorities. The high percentage of international co-authorships (53.84%) underlines the university's global research integration, enhancing its visibility and scholarly impact. Additionally, the analysis of high-impact journals provides a benchmark for faculty and students to target influential publication outlets. Policymakers, administrators, and funding agencies can leverage these insights to optimize resource allocation, support strategic collaborations, and refine institutional policies aimed at sustaining and amplifying research excellence.

8. Future research directions

Future research should delve deeper into Khulna University's interdisciplinary research potential by exploring emerging fields like artificial intelligence, climate change, and biotechnology. Comparative bibliometric analyses with other leading universities could reveal best practices and benchmarks for improvement. Additionally, integrating altmetrics could provide a broader perspective on the societal impact of the university's research. Evaluating the role of faculty development programs and infrastructural support in driving research productivity would be valuable. Furthermore, longitudinal studies tracking the university's research trends post-2022 could assess the long-term effectiveness of strategies implemented based on this study's findings.

9. Conclusion

In conclusion, the purpose of this research was to conduct a comprehensive bibliometric analysis of Khulna University's scientific publications. Examining various aspects of research productivity, collaboration patterns, and citation impact, the study accomplished its objectives. The findings of this analysis provide valuable insights into the university's research environment and have implications for both the institution and the academic community at large. The analysis revealed that over the years, Khulna University's research output has increased, as evidenced by the growing number of publications. This demonstrates the institution's dedication to research and its

contribution to the advancement of knowledge. The annual growth rate underscores the university's progress and its position as a preeminent regional research institution. At Khulna University, collaboration emerged as a prominent aspect of research. The university's engagement with the global research community is demonstrated by the high proportion of international co-authorships. Not only does collaborative research improve the quality and impact of publications, but it also fosters knowledge exchange and promotes interdisciplinary collaboration. These collaborative efforts demonstrate the university's dedication to addressing complex research challenges through international partnerships. The analysis of citations revealed the influence and impact of Khulna University's research output. The average number of citations per document indicates the scholarly community's recognition and visibility of the university's publications. Publications with numerous citations demonstrate the significance of the university's research and its contributions to the advancement of knowledge. There are multiple implications of this research study. The findings can inform strategic planning, resource allocation, and performance evaluation at Khulna University. Identification of research strengths and areas of expertise can help a university capitalise on its competitive advantages and attract research funding. Moreover, the analysis of collaboration patterns can facilitate the formation of strategic partnerships and improve university research networks. The implications of this study extend beyond Khulna University to policymakers, funding agencies, and the broader academic community. The findings can inform research funding allocation, policy formulation, and research prioritisation decisions. Comparative analysis with other universities provides insight into Khulna University's standing and can aid in identifying areas for improvement and possible collaborations. This research study concludes with a comprehensive analysis of Khulna University's scientific publications. The results highlight the research output, collaborative efforts, and citation impact of the institution. The implications of this study can contribute to the growth and development of Khulna University as a leading research institution by informing strategic decisions, enhancing research quality and impact, and contributing to the enhancement of research quality and impact. In addition to contributing to the larger body of knowledge in the field of bibliometrics, the study's findings provide a foundation for future research in this area.

References

1. Abramo, G., & D'Angelo, C. A. (2015). The relationship between the number of authors of a publication, its and the impact factor of the publishing journal: Evidence from Italy. *Journal of Informetrics*, *9*(4), 746–761. https://doi.org/10.1016/j.joi.2015.07.003
2. Adams, J., & Gurney, K. A. (2018). Bilateral and multilateral coauthorship and citation impact: Patterns in UK and US international collaboration. *Frontiers in research metrics and analytics*, *3*, 12. https://doi.org/10.3389/frma.2018.00012
3. Agarwal, A., Durairajanayagam, D., Tatagari, S., Esteves, S. C., Harlev, A., Henkel, R., Roychoudhury, S., Homa, S., Puchalt, N. G., Ramasamy, R., Majzoub, A., Ly, K. D., Tvrda, E., Assidi, M., Kesari, K., Sharma, R., Banihani, S., Ko, E., Abu-Elmagd, M., Bashiri, A. (2016). Bibliometrics: Tracking research impact by selecting the appropriate metrics. *Asian Journal of Andrology*, *18*(2), 296–309. https://doi.org/10.4103/1008-682X.171582
4. Aksnes, D. W., Langfeldt, L., & Wouters, P. (2019). Citations, citation indicators, and research quality: An overview of basic concepts and theories. *Sage open*, *9*(1), 215824401982957. https://doi.org/10.1177/2158244019829575
5. Aksnes, D. W., Piro, F. N., & Rørstad, K. (2019). Gender gaps in international research collaboration: A bibliometric approach. *Scientometrics*, *120*(2), 747–774. https://doi.org/10.1007/s11192-019-03155-3
6. Al-Raeei, M. (2023). Analysing of the sustainable development goals in Damascus University during Syrian crisis using the strategy in the university and the bibliometrics data from SciVal. *Discover Sustainability*, *4*(1), 24. https://doi.org/10.1007/s43621-023-00140-y
7. Bastos, E. C., Sengik, A. R., & Tello-Gamarra, J. (2021). Fifty years of University-industry collaboration: A global bibliometrics overview. *Science and Public Policy*, *48*(2), 177–199. https://doi.org/10.1093/scipol/scaa077
8. Belter, C. W. (2015). Bibliometric indicators: Opportunities and limits. *Journal of the medical library association: JMLA*, *103*(4), 219–221. https://doi.org/10.3163/1536-5050.103.4.014
9. Benhouria, A., Islam, Md. A., Zaghouane-Boudiaf, H., Boutahala, M., & Hameed, B. H. (2015). Calcium alginate–bentonite–activated carbon composite beads as highly effective adsorbent for methylene blue. *Chemical Engineering Journal*, *270*, 621–630. https://doi.org/10.1016/j.cej.2015.02.030
10. *Bibliometric Indicators and Analysis of Research Systems: Methods and Examples* (OECD Science, Technology and Industry Working Papers No. 1997/01; OECD Science, Technology and Industry Working Papers, Vol. 1997/01). (1997). https://doi.org/10.1787/208277770603
11. Bornmann, L. (2020). Bibliometrics-based decision tree (BBDT) for deciding whether two universities in the Leiden ranking differ substantially in their performance. *Scientometrics*, *122*(2), 1255–1258. https://doi.org/10.1007/s11192-019-03319-1
12. Bornmann, L., Ganser, C., & Tekles, A. (2022). Simulation of the h index use at university departments within the bibliometrics-based heuristics framework: Can the indicator be used to compare individual researchers? *Journal of Informetrics*, *16*(1), 101237. https://doi.org/10.1016/j.joi.2021.101237

13. Coughlin, D. M., & Jansen, B. J. (2016). Modeling journal bibliometrics to predict downloads and inform purchase decisions at university research libraries. *Journal of the Association for information science and technology*, *67*(9), 2263–2273. https://doi.org/10.1002/asi.23549
14. Fang, G., Zhou, Q., & Chen, C. (2016). From industry-university-institute cooperation to collaborative innovation: An analysis based on bibliometrics. *2016 International Conference on Management Science and Engineering (ICMSE)*, 44–49. https://doi.org/10.1109/ICMSE.2016.8365117
15. Fazli, F., Karimi, M., & Hamzehei, R. (2018). Co-Authorship patterns and topic networks in the scientific publication of Hamadan university of medical sciences. *Library philosophy and practice (e-Journal)*. https://digitalcommons.unl.edu/libphilprac/1838
16. González Alcaide, G., & Gorraiz, J. I. (2018). Assessment of researchers through bibliometric indicators: The area of information and library science in Spain as a case study (2001–2015). *Frontiers in research metrics and analytics*, *3*, 15. https://doi.org/10.3389/frma.2018.00015
17. H, Y. (2018). The empirical study on technological innovation ability of university based on the patent bibliometrics-taking beijing institute of fashion technology as an example. *Journal of Beijing institute of clothing technology (Natural Science Edition)*, *38*(2), 91–104. https://doi.org/10.16454/j.cnki.issn.1001-0564.2018.02.014
18. Hang, G., Hongru, Z., & Zhiwei, R. (2020). Current situation and countermeasure analysis of big data network public opinion research in China and abroad based on bibliometrics: Taking the study of internet public opinion in universities as an example. *2020 International conference on big data and social sciences (ICBDSS)*, 207–212. https://doi.org/10.1109/ICBDSS51270.2020.00053
19. Heberger, A. E., Christie, C. A., & Alkin, M. C. (2010). A bibliometric analysis of the academic influences of and on evaluation theorists' published works. *American journal of evaluation*, *31*(1), 24–44. https://doi.org/10.1177/1098214009354120
20. Heck, T., Tunger, D., & Rittberger, M. (2023). Scholarly communication over a decade of publications. *Publications*, *11*(1), Article 1. https://doi.org/10.3390/publications11010016
21. *History*. (2023). http://www.ku.ac.bd/history
22. Ibrahim, C., & Fadhli, R. (2021). Performance of Indonesia's World-Class University Efficiency with Bibliometrics (Scientific Strength) Approach and Data Envelopment Analysis. Webology, 18(1), 32–50. https://doi.org/10.14704/web/v18i1/web18003
23. Islam, M. S., Kamal, A.-H. M., Kabir, A., Southern, D. L., Khan, S. H., Hasan, S. M. M., Sarkar, T., Sharmin, S., Das, S., Roy, T., Harun, M. G. D., Chughtai, A. A., Homaira, N., & Seale, H. (2021). COVID-19 vaccine rumors and conspiracy theories: The need for cognitive inoculation against misinformation to improve vaccine adherence. *Plos one*, *16*(5), e0251605. https://doi.org/10.1371/journal.pone.0251605
24. Islam, Md. A., Ahmed, M. J., Khanday, W. A., Asif, M., & Hameed, B. H. (2017a). Mesoporous activated carbon prepared from NaOH activation of rattan (Lacosperma secundiflorum) hydrochar for methylene blue removal. *Ecotoxicology and environmental safety*, *138*, 279–285. https://doi.org/10.1016/j.ecoenv.2017.01.010
25. Islam, Md. A., Ahmed, M. J., Khanday, W. A., Asif, M., & Hameed, B. H. (2017b). Mesoporous activated coconut shell-derived hydrochar prepared via hydrothermal

carbonization-NaOH activation for methylene blue adsorption. *Journal of environmental management*, *203*, 237–244. https://doi.org/10.1016/j.jenvman.2017.07.029
26. José De Oliveira, O., Francisco Da Silva, F., Juliani, F., César Ferreira Motta Barbosa, L., & Vieira Nunhes, T. (2019). Bibliometric method for mapping the state-of-the-art and identifying research gaps and trends in literature: An essential instrument to support the development of scientific projects. In S. Kunosic & E. Zerem (Eds.), *Scientometrics recent advances*. IntechOpen. https://doi.org/10.5772/intechopen.85856
27. Kim, J., Hong, S., Kang, Y., & Lee, C. (2023). Domain-specific valuation of university technologies using bibliometrics, Jonckheere–Terpstra tests, and data envelopment analysis. *Technovation*, *122*, 102664. https://doi.org/10.1016/j.technovation.2022.102664
28. Kwiek, M. (2021). What large-scale publication and citation data tell us about international research collaboration in Europe: Changing national patterns in global contexts. *Studies in Higher Education*, *46*(12), 2629–2649. https://doi.org/10.1080/03075079.2020.1749254
29. Laengle, S., Merigó, J. M., Modak, N. M., & Yang, J.-B. (2020). Bibliometrics in operations research and management science: A university analysis. *Annals of Operations Research*, *294*(1–2), 769–813. https://doi.org/10.1007/s10479-018-3017-6
30. Mammola, S., Fontaneto, D., Martínez, A., & Chichorro, F. (2021). Impact of the reference list features on the number of citations. *Scientometrics*, *126*(1), 785–799. https://doi.org/10.1007/s11192-020-03759-0
31. Narayan, B., Luca, E. J., Tiffen, B., England, A., Booth, M., & Boateng, H. (2018). Scholarly Communication Practices in Humanities and Social Sciences: A Study of Researchers' Attitudes and Awareness of Open Access. *Open Information Science*, *2*(1), 168–180. https://doi.org/10.1515/opis-2018-0013
32. Newman, M. E. J. (2004). Coauthorship networks and patterns of scientific collaboration. *Proceedings of the National Academy of Sciences*, *101*(suppl_1), 5200–5205. https://doi.org/10.1073/pnas.0307545100
33. Pacheco-Mendoza, J., Alhuay-Quispe, J., & Machin-Mastromatteo, J. D. (2020). Bibliometrics units as dynamic engines for universities' scientific production. *Information development*, *36*(2), 301–305. https://doi.org/10.1177/0266666920918466
34. *Publications Output: U.S. Trends and International Comparisons | NSF - National Science Foundation*. (n.d.). Retrieved June 6, 2023, from https://ncses.nsf.gov/pubs/nsb20214/international-collaboration-and-citations
35. Roberts, L. C., Hug, S. J., Ruettimann, T., Billah, M. M., Khan, A. W., & Rahman, M. T. (2004). Arsenic Removal with Iron(II) and Iron(III) in Waters with High Silicate and Phosphate Concentrations. *Environmental Science & Technology*, *38*(1), 307–315. https://doi.org/10.1021/es0343205
36. Sorz, J., Glänzel, W., Ulrych, U., Gumpenberger, C., & Gorraiz, J. (2020). Research strengths identified by esteem and bibliometric indicators: A case study at the University of Vienna. *Scientometrics*, *125*(2), 1095–1116. https://doi.org/10.1007/s11192-020-03672-6
37. Teplitskiy, M., Duede, E., Menietti, M., & Lakhani, K. R. (2022). How status of research papers affects the way they are read and cited. *Research Policy*, *51*(4), 104484. https://doi.org/10.1016/j.respol.2022.104484
38. *UGC*. (2023). Khulna University | University Grants Commission of Bangladesh. http://www.ugc-universities.gov.bd/university-detail/55

39. Xiang, D., Guofei, Z., & Qiong, L. (2019). Research and analysis of the achievements of philosophy in Yunnan universities based on bibliometrics. *Proceedings of the 2019 3rd international workshop on education, Big data and information technology*, 60–65. https://doi.org/10.1145/3352740.3352751
40. 武亚群李双双, & WU Yaqun, L. S. (2020). 中国高校地理研究发展与态势. 地理学报, *75*(2), 302–317. https://doi.org/10.11821/dlxb202002007

Author biography

Md. Nurul Islam is a scholar and educator affiliated with Nanjing University, China, and serves as the Deputy Director of the Library and Information Division at the International Islamic University Chittagong.

Md. Monirul Islam is a doctoral student of University of Dhaka. He is currently working as Librarian in Army Medical College Chattogram. Mr. Islam has accomplished his graduation and prost graduation degree in Information Science and Library Management from the University of Dhaka in 2011 and 2012.

Md Aiub Hossain is a dedicated Lecturer in Library and Information Science at the International Islamic University Chittagong. With his expertise, he plays a crucial role in shaping future professionals in the library sciences, preparing them for meaningful contributions to the field.

Md Tarik Been Aziz is a Lecturer specializing in Library and Information Science at the International Islamic University Chittagong. His efforts contribute to the development of skilled professionals who can cater to the evolving information needs of society.

Itfa Farjana is a Librarian at Raninagar Mohila College, Naogaon. She is an M.Phil research fellow in National University, Bangladesh Department of Library and Information Science. She received Honors and Master degree in Information Science and Library management from the University of Rajshahi. She is actively involved in „bibliotherapy function", a reading program as extra curriculum work for five years.

Corresponding author

Md. Nurul Islam can be contacted at: nurul.islam@iiuc.ac.bd