Visibility and Ethical Considerations of Pakistani Universities Researchers on Google Scholar

Muhammad Asghar Khan[1], Tariq Rahim Soomro[2]

College of Computer Science and Information Systems Institute of Business Management

Karachi, Pakistan

Abstract—**Maximizing visibility by using academic profiling sites is very crucial in the academic world to improve the readership of research papers published and constant evaluation of research quality. In this article, the authors focused on the visibility of Pakistani University scholars on Google Scholar (GS). An intelligent Web Bot (MAKGBOT) was developed to collect the scholarly data of all Pakistani scholars, whose data is publicly available on Google Scholar. The findings of this research show that 87% of Pakistani universities have a presence on Google Scholar. It analyzes the research performance of scholars based on the last five years' data from 2016 to 2020. Furthermore, the analysis reports the level of scholarly activities of all provinces and autonomous areas of Pakistan. This paper concludes by discussing the ethical issue of misrepresentation of information on the public profile and its consequences on the rankings of legitimate scholars.**

Keywords—Google scholar; research visibility; Pakistani researchers; ethical considerations; web bot; research in Pakistan

I. INTRODUCTION

The establishment of a research University is an expensive task compared to a typical educational institute. Research Universities are expensive because they need to attract good researchers and provide state-of-the-art infrastructure for teaching and research environment. In developed countries, governments and organizations are investing an enormous amount of resources in research and development. Multinational companies sponsor research-funded projects at Universities to get the solution to the real-life problem they are facing at a lower cost compared to the establishment of their research and development team. However, in developing countries, the establishment of a research University is even a more difficult task due to the scarcity of resources. Pakistan as a third-world country is also facing a shortage of research Universities. Regulatory bodies, such as, the Higher Education Commission (HEC) of Pakistan is working hard to improve the research culture in existing Universities of Pakistan.

Researchers produce research papers to highlight their contribution to the domain of their specialization. In the last few years, there is a great motivation to measure the quality of research of individuals based on different indicators [1]. Two most common indicators are the number of the paper published by an author and the number of citations [2]. There is an interesting discussion within bibliometrics that either researcher focuses on productivity or on the impact of the paper? [3] [4]. One of the major challenges for a researcher is to secure funding for a research project. Different higher education funding bodies provide sponsorship based on publication count (such as the Australian Funding System [3], whereas others focused on the quality of paper e.g. Netherlands national research assessment [4].

The scarcity of resources for research projects is a common issue, especially in developing economies. Funding organizations, such as, governments and R&D wings of multinational companies require to select competent researchers for their projects. The selection criteria are normally based on innovative idea and their impact on society after the completion of projects, however, the researcher's academic rankings and historical history of completion of projects were also considered when multiple competitors have the same level of creativity in their proposed projects. Different Indexing and abstracting services, such as, Scopus, Clarivative Analytics (Web of Science), and Google Scholar (GS) maintain the ranking of researches through different performance indicators, such as, the number of articles published, total citations, h-index, i10-index, Impact factor, etc. Google Scholar is a free and popular tool that helps to find scholars and their published articles along with performance indicators. Most University scholars create their Google Scholar profile to make their work visible over the Internet. In general, tight integration between Google Scholar and search engine improves the appearance of relevant search results from existing articles and helps to improve the number of a citation for authors of those papers.

This project extracts the important research matrices (for example, number of citations, the paper published, H-index, etc.) for all Pakistani university scholars whose profile is publicly available on GS. The authors of this study rank the universities based on their presence on GS and highlight the region of Pakistan where universities are more research-oriented. One of the contributions of this study is to list down the top researches of Pakistan and their academic affiliations. Furthermore, this study discusses the ethical issue of misrepresentation of information on academic profiles and its consequences on the ranking of legitimate scholars. The following sections provide a brief literature review, research methodology, limitation of the study, results & findings, ethical consideration, and finally discussion and future work.

II. LITERATURE REVIEW

Most of the scientific work nowadays is published in the form of research papers in journals or conferences, which can be easily found in bibliographic databases [5]. PubMed, ScienceDirect, Scopus, Web of Science, and Google Scholar are among the most famous bibliographic databases used to

find authors' profiles and relevant articles of interest by researchers. GS is a freely available academic search engine [6] that indexes scientific literature from a wide range of disciplines, record types, and languages, providing an outstanding set of additional offerings at the same time. The fact that it shows the number of citations obtained by each paper, irrespective of their origin, opened the door to a new type of bibliometric study, revolutionizing the comparison between academic performance, especially in the Humanities and Social Sciences [7]. Today, the majority of students and scholars are beginning to scan educational information in GS [8] [9]. Therefore, publications that are absent from the consequences pages of Google Scholar may also result in large readership losses and maybe even a decline in citations [10]. Anne-Wil Harzing in [11] claimed that GS can be used as a tool for citation analysis and described the benefits of GS over the ISI Web of Science along with the advantages and disadvantages of each tool.

Digital profiles are increasingly being used to assess potential writers, reviewers, and journal editors to exchange and collaborate on scholarly articles, and set up academic networks. Subsequently, simultaneous searches through the bibliographic databases and Websites, such as MEDLINE, Scopus, the Web of Science, and Google Scholar, make it possible to retrieve relevant items and navigate their extensive comparison through the author's profiles [12]. Editors of journals also refer to the profiles of their contributors in their editorial management systems, connected to bibliographic databases and search engines, in order to improve their quality and encourage the best contributors [13]. Furthermore, editors are strongly inspired to evaluate their contributors' academic profiles and Researcher IDs to avoid commenting on 'false' reviewers and misconduct of various types [14]. Alastair Smith [15] studied New Zealand's Performance-Based Research Funding (PBRF) evaluation system for universities and determined a very high correlation between PBRF output and the total number of citations return by GS. To improve the chance to secure more funding or to publish a paper in a reputed journal, few authors include fake papers in their profiles to increase the h-index and other research indicates or not verifying auto-generated papers suggested by Google Scholar, which results in more citations and number of publications. Such behavior raises many questions of ethical values, norms of societies, and financial pressures on researchers.

III. Methodology

A list of Pakistani Universities was retrieved from HEC [16]. HEC is the official body whose main responsibility is to regulate, fund, and accredited Universities and Degree Awarding Institutes (DAI) in Pakistan. There were 217 Universities/degree awarding institutes found in HEC accredited Universities database. HEC divided Pakistan into 4 provinces (Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan) and three autonomous areas (Gilgit Baltistan, Azad Jammu & Kashmir, and Islamabad Capital Territory).

The main aim of this study is to collect the data from Google Scholar profiles for all Pakistani University researchers, whose data is publicly available. The collection of

scholarly data for the whole country is a difficult task if performed manually. Therefore, there is a need to automate this data collection process. Authors of the paper have developed a Web Bot called "MAKGBOT", which crawls all University scholars profile automatically and collect the following attributes from the publicly available profiles of the researchers on Google Scholar:

1) Google Scholar ID.
2) Google Scholar Name.
3) Total Citations.
4) Affiliation.
5) h-index.
6) i10-index.
7) Citations in the year 2016.
8) Citations in the year 2017.
9) Citations in the year 2018.
10) Citations in the year 2019.
11) Citations in the year 2020.
12) Citations in the last five year.
13) Total papers published by Scholar (complete).

MAKGBOT is a Python script, which uses the beautifulsoup [17] library to scrape information from the Google Scholar Website. Beautifulsoup is a very useful tool for searching, iterating, and modifying parse trees. MAKGBOT is similar to Scholarly [18], but it differs in a way that MAKGBOT can retrieve information for a University rather than a single author. Universities list along with URL can be fed to MAKGBOT as a comma-separated values (CSV) file instead of passing one University name at a time. Furthermore, MAKGBOT provides extra information, such as, total papers published by scholars who were not present in Scholarly.

IV. Limitations of the Study

The authors of this paper are aware that many Pakistani researchers have not created an account on Google Scholar or they have not set their profiles public. In this scenario, authors are unable to collect information about such researchers as the study focused was on the scholars whose profiles are publically available and visible. Furthermore, the authors noticed that a few authors have not changed their affiliation after switching their job to another institute. Therefore, the research contribution of such scholars will be counted towards their affiliation institute, which is verified, rather than where they are working currently. Furthermore, the authors are aware that the total number of papers and citations by a particular scholar may not be correct, as several authors set their profiles on the auto-generate mechanism and not annually verified the statistics and papers suggested by GS against their names.

Searching and collecting information for all researchers of a country is a time-consuming task. MAKGBOT restricted itself to limit the number of papers published by any author to 3000. As soon as a counter for the number of papers published by a single author reached 3000, MAKGBOT moved to the next scholar of that University on the list. Paper publication and the addition of new scholars on Google Scholar is a continuous process. Therefore, it is entirely possible that authors may miss a few scholars and papers, which were added

after 10 January 2021. There is a need for a system, which is capable to deals with continual queries and updates the existing records as soon as there are changes that exist on Google Scholar. Adding this capability in MAKGBOT is considered as future work.

V. RESULTS AND FINDINGS

Based on the data selected by MAKGBOT until 10 January 2021, the following results are observed:

The pie chart in Fig. 1 shows the percentage share of scholars by provinces of Pakistan. Punjab is the largest province with the highest population and the maximum number of recognized Universities. Therefore, it is clear that the majority (33%) of the participants are from the Punjab region followed by Sindh (26%), Khyber Pakhtunkhwa (21%), Islamabad (12%), Balochistan (4%), Azad Jammu & Kashmir (3%) and Gilgit Baltistan (1%). Results from MAKGBOT illustrate that the visibility of researchers on Google Scholar is proportional to the population of those areas. The only exception is Islamabad capital territory, where the numbers of scholars on GS are relatively higher if compared to other autonomous areas of Pakistan. This variation is might due to the fact that Pakistan's best universities are located in Islamabad (HEC ranking [19], QS Ranking [20], Times University ranking [21]). Furthermore, Universities from the capital region have the highest Google Scholar visibility rate (100%) along with Gilgit Baltistan (100%), where only two Universities are situated.

Fig. 2 displays the top ten Pakistani Universities on Google Scholar based on the total number of scholars available and/or visible. Universities with the highest representation on Google Scholar are located either in Islamabad or Punjab. National University of Sciences and Technology ranked top with 764 active participants followed by the University of Lahore, University of Management & Technology, and Quaid e Azam University.
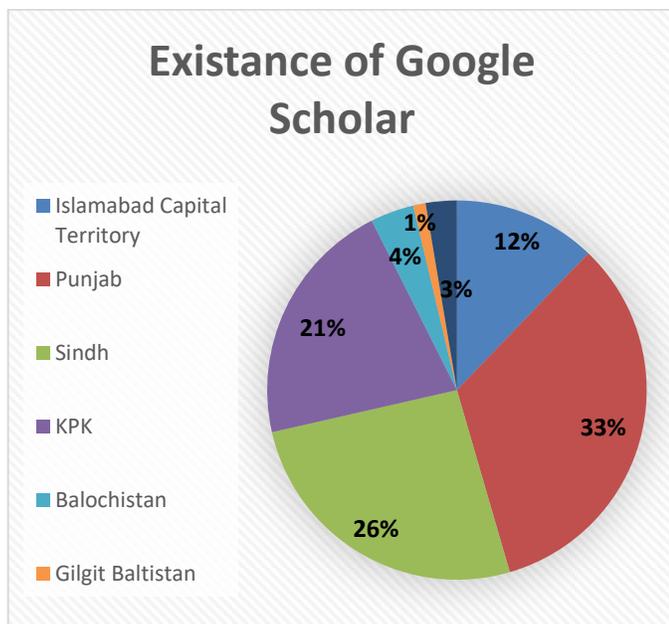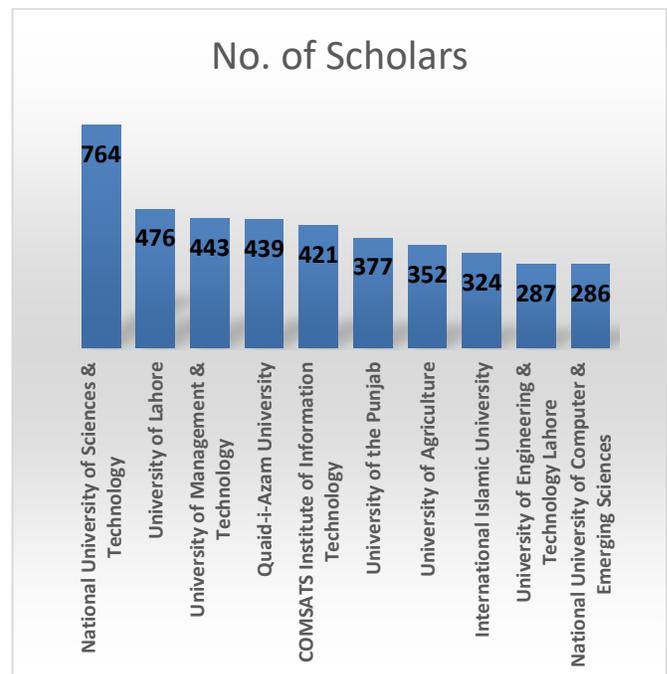
Fig. 2. Top Ten Pakistani Universities on Google Scholar by Number of Scholars.

The top three Universities in Punjab province by scholars count are the University of Lahore, University of Management and Technology, and the University of Punjab. The University of Lahore and the University of Management and Technology belong to the private sector. The University of Punjab is the oldest active University in Pakistan [22]. The top three Universities in Punjab are located in the provincial capital Lahore. There is a total of ten universities in the province of Punjab, which are not visible on GS. Table I shows the list of all Universities in Punjab province sorted by the total number of scholars visible.

The trend in Sindh province is slightly different as two out of three top positions are secured by public sector Universities. Aga Khan University ranked first, followed by Mehran University of Engineering and Technology and Univerity of Sindh, with scholar count 272, 255, and 244 respectively. Twelve Universities have no scholar whose profile is publically visible on Google Scholar. Table II illustrates the details of all Universities in the province of Sindh.

The visibility of scholars of Khyber Pakhtunkhwa Universities has resemblance with Sindh province as the top three positions were secured by public Universities. The number of scholar count difference between Abdul Wali Khan University and University of Engineering and Technology is only 23. Only one University of Khyber Pakhtunkhwa province is not visible at GS. Table III demonstrates the nitty-gritty rundown of all Universities in the region of Khyber Pakhtunkhwa.

Balochistan is the least populated province of Pakistan and only ten Universities are located in this region. A total of the three universities of Balochistan province are not visible on GS. Table IV highlights the important Google Scholar indicators.

Fig. 1. The Percentage Share of Scholars by Provinces of Pakistan.

TABLE I.   LIST OF ALL OF THE UNIVERSITIES OF PUNJAB PROVINCE

University Name	Total Number of Scholars Visible	Max of h-index	Max of i10-index	Sum of total Citation	Sum of Total Paper Published
University of Lahore	476	92	354	123322	10322
University of Management & Technology	443	76	691	145506	17461
University of the Punjab	377	76	689	249661	23499
University of Agriculture	352	59	351	282540	23808
University of Engineering & Technology Lahore	287	81	780	141087	12379
Lahore University of Management Sciences	272	66	649	117894	9556
Government College for Women University	261	65	267	186651	15075
University of Sargodha	244	73	723	124734	12245
Bahauddin Zakariya University	239	71	638	213984	20075
University of Engineering & Technology Taxila	208	20	37	34790	4209
Islamia University	208	64	546	153240	14664
University of Gujrat	183	60	362	94814	9218
University of Veterinary & Animal Sciences	161	70	766	126843	14963
University of Central Punjab	160	39	123	28374	3851
Pir Mehr Ali Shah Arid Agriculture University	139	64	432	117638	9699
Government College University Lahore	127	45	138	62838	5533
University of Education	127	109	416	65497	4474
Lahore Garrison University	104	48	374	20068	3251
Information Technology University of the Punjab	95	33	75	17183	1519
Khawaja Freed University of Engineering & Information Technology	91	32	108	14860	2013
Lahore College for Women University	81	18	23	11384	1717
Forman Christian College	72	126	298	57448	2150
The Superior College	72	51	218	29610	2986
National Textile University	71	85	934	59762	7632
Muhammad Nawaz Shareef University of Agriculture	62	27	70	19868	3948
National University of Medical Sciences	52	51	477	39097	5086
Government College for Women University Sialkot	44	13	19	7499	859
University of Okara	40	14	20	5110	758
HITEC University	39	32	89	14197	1119
Fatima Jinnah Women University	38	16	37	6405	889
University of Wah	35	66	431	36505	3832
Minhaj University	30	14	23	2559	552
National College of Business Administration & Economics	29	15	19	2706	474
NFC Institute of Engineering & Technology	28	14	17	2318	359
King Edward Medical University	28	12	13	3540	670
University of Health Sciences	27	33	48	13823	1173
GIFT University	27	18	25	3850	360
Ghazi University	26	36	538	22951	3794
Kinnaird College for Women	26	13	18	2763	545
Cholistan University of Veterinary and Animal Sciences Bahawalpur	26	21	178	11073	2681
The University of Faisalabad	25	12	12	2361	606
Namal Institute Mainwali	24	17	32	6667	695
The Women University	23	13	16	2012	238
University of South Asia	21	73	625	31340	3125
University of Sialkot	18	35	104	11703	943

University of Sahiwal	16	16	19	2059	236
Institute of Southern Punjab	15	28	81	6360	791
Government Sadiq College Women University	12	10	10	1266	161
Lahore Leads University	10	6	4	363	78
Beaconhouse National University	9	29	50	6105	433
University of Narowal	6	8	5	369	64
Imperial College of Business Studies	5	16	19	1731	112
Muhammad Nawaz Sharif University of Engineering & Technology	5	24	61	2443	209
Rawalpindi Women University	4	4	1	126	29
Pakistan Institute of Fashion & Design	3	3	1	75	15
University of Home Economics Lahore	2	5	3	87	27
National College of Arts	2	10	12	390	55
Institute for Art and Culture	2	1	0	4	3
Institute of Management Sciences	2	32	106	4106	294
Nur International University	1	7	3	195	82
Fatima Jinnah Medical University Lahore	1	2	0	9	12
Qarshi University	1	1	0	4	1
University of Mainwali	1	18	30	1077	70
Ali Institute of Education	0	0	0	0	0
Hajvery University	0	0	0	0	0
Institute of Management Sciences	0	0	0	0	0
Lahore School of Economics	0	0	0	0	0
Punjab Tianjin University of Technology Lahore	0	0	0	0	0
Rawalpindi Medical University	0	0	0	0	0
Virtual University of Pakistan	0	0	0	0	0
Global Institute Lahore	0	0	0	0	0
Faisalabad Medical University Faisalabad	0	0	0	0	0
Times Institute Multan	0	0	0	0	0
Grand Total	**5615**	**126**	**934**	**2754844**	**267677**

TABLE II. LIST OF ALL OF THE UNIVERSITIES OF SINDH PROVINCE

University Name	Total Number of Scholars Visible	Max of h-index	Max of i10-index	Sum of total Citation	Sum of Total Paper Published
Aga Khan University	272	77	768	285556	22921
Mehran University of Engineering & Technology	255	27	54	46032	6319
University of Sindh	244	57	224	66177	7736
University of Karachi	227	76	769	208561	22388
Sukkur Institute of Business Administration	166	26	67	23311	4763
NED University of Engineering & Technology	141	23	36	25188	2907
Institute of Business Management	137	17	28	13298	2207
DOW University of Health Sciences	113	44	224	44058	4687
Quaid-e-Awam University of Engineering Sciences & Technology	96	14	16	11771	1747
Institute of Business Administration	73	11	11	5581	894
Iqra University	68	29	70	10060	1212
Shah Abdul Latif University	68	15	21	8694	1531
Sindh Agriculture University Tandojam	66	16	29	15273	2657
Shaheed Zulfikar Ali Bhutto Institute of Science & Technology	64	16	23	5669	790
Hamdard University	37	12	15	2601	692

Sir Syed University of Engineering & Technology	37	18	31	5020	821
Liaquat University of Medical & Health Sciences	37	15	30	7254	1470
Karachi Institute of Economics & Technology	36	12	13	4447	734
Sindh Madresatul Islam University	34	16	22	3413	498
Zia-ud-Din University	34	62	448	26485	3606
Dawood University of Engineering & Technology	27	21	29	5488	457
Jinnah Sindh Medical University	25	34	65	8891	822
Isra University	25	31	131	10317	1307
Indus University	24	14	18	1230	227
Shaheed Benazir Bhutto University Shaheed Benazirabad	24	7	6	919	279
Habib University	22	15	21	3465	407
Mohammad Ali Jinnah University	20	5	3	309	103
Barret Hodgson University	19	8	8	1604	265
Jinnah University for Women	16	10	12	1708	425
Benazir Bhutto Shaheed University Lyari	15	25	69	2895	297
KASB Institute of Technology	13	11	15	1053	158
Baqai Medical University	10	28	51	6574	593
Preston University	10	20	36	3107	317
Peoples University of Medical & Health Sciences for Women	9	10	14	869	212
Begum Nusrat Bhutto Women University Sukkur	6	15	21	805	88
Shaheed Mohtarma Benazir Bhutto Medical University	5	15	19	1343	73
Sindh Institute of Medical Sciences	4	25	74	3743	496
Karachi School for Business & Leadership	4	17	24	1957	121
Benazir Bhutto Shaheed University of Technology & Skill Development Khairpur Mirs	4	7	6	330	14
Shaheed Benazir Bhutto University of Veterinary & Animal Sciences	3	11	13	1924	72
University of Sufism and Modern Sciences Bhitshah	3	2	0	15	34
ILMA University	2	3	1	45	32
Newport Institute of Communications & Economics	1	1	0	1	16
Nazeer Hussain University	1	1	0	2	7
Shaheed Zulfiqar Ali Bhutto University of Law	1	5	1	154	61
Government College University Hyderabad	1	7	5	155	18
Textile Institute of Pakistan	1	2	1	17	8
Dadabhoy Institute of Higher Education	1	8	7	556	41
Emaan Institute of Management & Sciences	1	4	0	35	23
Gambat Institute of Medical Sciences	0	0	0	0	0
Greenwich University	0	0	0	0	0
Indus Valley School of Art & Architecture	0	0	0	0	0
Pakistan Naval Academy	0	0	0	0	0
Preston Institute of Management Science & Technology	0	0	0	0	0
Shaheed Benazir Bhutto City University	0	0	0	0	0
Shaheed Benazir Bhutto Dewan University	0	0	0	0	0
Shaheed Benazir Bhutto University	0	0	0	0	0
Sindh Institute of Management & Technology	0	0	0	0	0
Commecs Institute of Business & Emerging Sciences	0	0	0	0	0
The Shaikh Ayaz University Shikarpur	0	0	0	0	0
Sohail University Karachi	0	0	0	0	0
Grand Total	**2502**	**77**	**769**	**877960**	**97553**

TABLE III.   LIST OF ALL OF THE UNIVERSITIES OF KHYBER PAKHTUNKHWA PROVINCE

University Name	Total Number of Scholars Visible	Max of h-index	Max of i10-index	Sum of total Citation	Sum of Total Paper Published
Abdul Wali Khan University	203	65	224	125957	12436
University of Engineering & Technology	180	42	209	42800	4771
The University of Agriculture Peshawar	167	69	668	242562	22600
University of Malakand	101	28	71	48273	4766
Hazara University	97	69	548	69170	7201
Ghulam Ishaq Khan Institute of Engineering Sciences & Technology	96	29	96	23788	2510
Kohat University of Science and Technology	91	51	500	56387	6122
University of Haripur	66	77	282	40119	2331
Gomal University	59	66	535	72979	8813
University of Peshawar	50	74	725	60776	5118
Islamia College University	48	26	64	19194	1506
Sarhad University of Science & Information Technology	47	18	42	8955	1287
University of Swat	46	26	39	12282	1015
University of Swabi	46	47	153	20023	1721
Institute of Management Sciences	42	61	545	29263	3921
Khyber Medical University	41	15	23	10418	1245
Shaheed Benazir Bhutto University	38	47	223	24598	2796
Abasyn University	33	27	56	7647	949
Bacha Khan University	31	53	484	23242	3508
CECOS University of Information Technology & Emerging Sciences	28	34	102	15183	966
Qurtaba University of Science & Information Technology	21	22	55	4089	255
University of Science & Technology	19	24	34	8164	450
Iqra National University	15	13	19	1291	336
Khushal Khan Khattak University	15	15	23	3066	552
University of Engineering & Technology (UET) Mardan	15	14	16	2170	546
Shaheed Benazir Bhutto Women University	14	9	8	1234	266
Abbottabad University of Science and Technology (AUST)	14	26	52	6448	561
Pak-Austria Fachhochschule Institute of Applied Sciences and Technology Haripur	12	20	41	4452	345
Northern University	10	65	564	26231	2947
Preston University	10	20	36	3107	317
Women University Swabi	8	18	28	2354	166
University of Chitral	8	10	10	327	66
University of FATA	7	12	12	1229	110
The University of Lakki Marwat	5	10	11	585	96
Shuhada-e-Army Public School University of Technology Nowshera	4	11	12	734	97
University of Buner	2	12	15	1155	41
Women University Mardan	1	2	0	14	3
City University of Science and Information Technology	1	1	0	3	3
Brains Institute Peshawar	1	1	0	4	3
Gandhara University	1	4	0	26	14
Pakistan Military Academy	0	0	0	0	0
Grand Total	**1693**	**77**	**725**	**1020299**	**102756**

TABLE IV.   LIST OF ALL OF THE UNIVERSITIES OF BALUCHISTAN PROVINCE

University Name	Total Number of Scholars Visible	Max of h-index	Max of i10-index	Sum of total Citation	Sum of Total Paper Published
Balochistan University of Information Technology Engineering & Management Sciences (BUITEMS)	115	21	41	18383	2185
University of Balochistan	40	35	120	12518	1910
Lasbela University of Agriculture Water & Marine Sciences	19	21	40	3561	611
Balochistan University of Engineering & Technology	11	8	8	603	135
University of Turbat	7	11	14	1386	120
University of Loralai	6	6	4	740	78
Sardar Bahadur Khan Women University	3	4	1	100	33
Al-Hamd Islamic University	0	0	0	0	0
Mir Chakar Khan Rind University Sibi	0	0	0	0	0
The Bolan University of Medical & Health Sciences	0	0	0	0	0
Grand Total	**201**	**35**	**120**	**37291**	**5072**

Islamabad is the capital of Pakistan and most of the top-ranked universities of Pakistan are located in the Capital Territory. By and large the public visibility of researchers on Google Scholar is higher whenever contrasted with different areas of Pakistan and all 23 universities have visibility on Google Scholar. Table V shows the quick summary of all Universities in Islamabad.

Azad Jammu & Kashmir is an autonomous region of Pakistan. Mirpur University of Science & Technology and the University of Azad Jammu & Kashmir are two major Universities in this region. Two universities of Azad Jammu &

Kashmir area are not visible on GS. Table VI features significant Google Scholar pointers of this state.

Gilgit Baltistan is a remote area of Pakistan with a limited population. Just two Universities are situated in this locale. Table VII shows the number of academicians publically visible on Google Scholar.

One of the main purposes of this study to identify the best researchers in Pakistan. Table VIII shows the list of top ten Pakistani Researchers based on their total number of citations.

The h-index is one of the main indicators to reflect the quality of research papers. Table IX displays a list of the top ten Pakistani researchers based on the Google Scholar h-index.

TABLE V.   LIST OF ALL OF THE UNIVERSITIES OF ISLAMABAD CAPITAL TERRITORY

University Name	Total Number of Scholars Visible	Max of h-index	Max of i10-index	Sum of total Citation	Sum of Total Paper Published
National University of Sciences & Technology	764	54	239	202514	20809
Quaid-i-Azam University	439	79	695	423528	36318
COMSATS Institute of Information Technology	421	69	688	282658	19610
International Islamic University	324	81	822	207479	17095
National University of Computer & Emerging Sciences	286	45	198	57590	6449
Bahria University	200	29	94	30839	4658
Pakistan Institute of Engineering & Applied Sciences	157	75	815	110381	10823
Riphah International University	150	74	613	65224	7783
Air University	134	91	711	77741	5177
Shifa Tameer-e-Millat University	129	26	99	17318	2276
Foundation University Islamabad	97	36	69	19577	1735
National University of Modern Languages	76	17	34	6350	1082
Institute of Space Technology	65	34	66	25886	2026
Capital University of Science & Technology	49	22	60	15760	1468
Allama Iqbal Open University	45	24	47	11672	1172
National University of Technology (NUTECH) Islamabad	31	37	134	10563	937
Pakistan Institute of Development Economics (PIDE)	22	23	46	12498	729

Health Services Academy HSA Islamabad	14	53	74	43911	710
National Defense University	12	15	21	1572	358
Shaheed Zulfiqar Ali Bhutto Medical University	9	22	43	3778	892
Federal Urdu University of Arts Sciences & Technology	8	11	15	1328	191
Sir Syed (CASE) Institute of Technology	4	10	11	893	127
Muslim Youth University	4	2	0	11	7
Grand Total	**3440**	**91**	**822**	**1629071**	**142432**

TABLE VI. LIST OF ALL OF THE UNIVERSITIES OF AZAD JAMMU AND KASHMIR REGION

University Name	Total Number of Scholars Visible	Max of h-index	Max of i10-index	Sum of total Citation	Sum of Total Paper Published
Mirpur University of Science & Technology	91	34	151	25648	2570
University of Azad Jammu & Kashmir	71	75	669	98498	5329
University of Poonch	47	23	40	13217	3245
University of Kotli Azad Jammu and Kashmir	21	8	6	1357	202
Women University of Azad Jammu & Kashmir	9	10	11	1390	257
AlKhair University	0	0	0	0	0
Mohi-ud-Din Islamic University	0	0	0	0	0
Grand Total	**239**	**75**	**669**	**140110**	**11603**

TABLE VII. LIST OF ALL OF THE UNIVERSITIES OF GILGIT BALTISTAN

University Name	Total Number of Scholars Visible	Max of h-index	Max of i10-index	Sum of total Citation	Sum of Total Paper Published
Karakurum International University	68	78	770	58333	6253
University of Baltistan Skardu	11	13	13	2645	197
Grand Total	**79**	**78**	**770**	**60978**	**6450**

TABLE VIII. LIST OF TOP TEN PAKISTANI RESEARCHERS BASED ON TOTAL CITATIONS

Google Scholar ID	Scholar Name	Affiliation	Total Citations	h-index	i10-index	Citations in last 5 Years	Total Paper Published
vUSWHc8AAAAJ	Dr. Muhammad Naeem Ahmed	University of Azad Jammu & Kashmir	77300	75	669	27181	2904
_3WBQxYAAAAJ	Muhammad Arshad Sajjad	Air University	53397	91	711	41529	2002
B6TB8IEAAAAJ	Prof. Dr. Hidayatur Rahman	The University of Agriculture Peshawar	47277	69	668	28537	2978
ByAexSYAAAAJ	Muhammad Akbar Zafar Khan	Islamia University	41810	60	546	31374	2799
nAFs720AAAAJ	Aysha Habib Khan	Aga Khan University	41479	77	768	20955	2980
E82kqSgAAAAJ	Ejaz Khan	Health Services Academy HSA Islamabad	41218	53	74	40108	130
upXMs64AAAAJ	Prof. Dr. Muhammad Tahir Hussain	National Textile University	39567	85	934	20767	2979
Vqh3MKMAAAAJ	Dr. Farooq Ahmad	University of Engineering & Technology Lahore	38209	81	780	23245	2957
Hy-zuEwAAAAJ	SAIF UR REHMAN	University of Management & Technology	37991	76	691	19400	2976
-wnLx6gAAAAJ	Dr. Tania Ahmed Shakoori	University of Lahore	37938	92	354	18399	947

TABLE IX.   LIST OF TOP TEN PAKISTANI RESEARCHERS BASED ON H-INDEX

Google Scholar ID	Scholar Name	Affiliation	h-Index	Total Citations	i10-index	Total Paper Published
9l8oSH0AAAAJ	Kauser Abdulla Malik	Forman Christian College	126	37925	298	622
QjPoerMAAAAJ	MA Saeed	University of Education	109	37220	416	1030
-wnLx6gAAAAJ	Dr. Tania Ahmed Shakoori	University of Lahore	92	37938	354	947
_3WBQxYAAAAJ	Muhammad Arshad Sajjad	Air University	91	53397	711	2002
upXMs64AAAAJ	Prof. Dr. Muhammad Tahir Hussain	National Textile University	85	39567	934	2979
Vqh3MKMAAAAJ	Dr. Farooq Ahmad	University of Engineering & Technology Lahore	81	38209	780	2957
KqaU3UMAAAAJ	Asma Hussain	International Islamic University	81	34537	822	2977
b_VQd2EAAAAJ	Amjad Khan	Quaid-i-Azam University	79	33803	586	2889
TqhlyQMAAAAJ	Asif Khan	Karakurum International University	78	36430	770	2985
nAFs720AAAAJ	Aysha Habib Khan	Aga Khan University	77	41479	768	2980

VI. ETHICAL CONSIDERATIONS

Ethical consideration is one of the most important parts of any kind of research. According to Bryman and Bell [23], it is mandatory for the author of a research paper to acknowledge the works of other researchers by use of the referencing system recommended by the publication committee of the journal, where the paper is supposed to be published. It is highly unethical if a scholar claimed the authorship of a paper, which is not written by him/her. In the previous section, Tables VIII and IX highlighted the top researchers of Pakistan based on total number of citations and highest h-index rankings respectively, which are currently updated on GS. The authors of this paper believe that many of the scholar's names shown in these tables did not verify their paper lists on GS, which is causing misrepresentation of profiles. Furthermore, such actions restraining other legitimate researchers to become visible on top of the list. There might be many reasons why scholars on GS are not validating their paper on GS. Two common reasons are mentioned in the remainder of this section.

1) GS automatically generate the list of citations and paper published by a scholar based on its ranking algorithms. Scholars are either to set manual update and verify each entry before being added to his/her profile, or scholars are supposed to deleted papers that are not written by them and mistakenly added to their profile due to similarity of name or co-author affiliations. However, due to time constraints and busy schedules, scholars are not visiting GS to verify their profiles regularly.

2) Scholars might deliberately add a few high-quality papers with higher citations in their profiles to improve their visibility on GS. According to the GS ranking algorithm [24], profiles with higher citations appear first in the university's GS list, as well as, on the Google search engine. It is a high probability that papers that appear in the top position might get more citations compared to new papers that get less attention from the visitors of GS as these papers hide at the bottom of the list. Other possible motives for adding non-legitimate papers are to impress peers or to gain research funding as most

of the sponsors are looking for GS research indicators to select the best researchers for their projects.

VII. DISCUSSION AND FUTURE WORK

The Google scholar is a very popular and useful tool to showcase the author's profile over the internet. Many universities are using Google Suite for email and other administrative tasks, therefore, it is easier for them to integrate university faculty research profiles with GS. In this study, the authors collected the GS scholar data (total 13769 Scholars) of all 217 Pakistani recognized universities. Twenty-eight universities have no representation on Google Scholar at all. Results showed that universities from Islamabad Capital Territory have high visibility compared to other autonomous areas of Pakistan. In general, the number of scholars' visibility on GS is logical and it is representing the population of the four provinces of Pakistan, where, Punjab is leading followed by Sindh, Khyber Pakhtunkhwa, and Baluchistan. However, individual academic indicators of many top researchers of Pakistan from their public profiles are misrepresenting and they contained papers and citations, which may not belong to specific scholars.

Misrepresentation of information on public profiles is a serious ethical issue. This misrepresentation of data might be the result of the auto-generation of citation by GS or any other social stress on the scholar by the academic environment. It is the responsibility of the scholars to make sure that they frequently check their GS profiles and remove papers that were added by GS automatically in authors' profiles, which were not written by them. As a responsible citizen of the research community, scholars should only take ownership of those papers on public profiles that were produced by them and not those whose authors' names are similar to them. Furthermore, there is a need for strict control on GS, which makes sure only legitimate papers are added on GS public profiles, both by scholars and auto-recommendation features of GS. The GS may add the feature of verifying from one of the co-authors the legitimation ownership of the scholar.

Research plays a vital role in the ranking of universities. Universities evaluating bodies that issue university rankings, such as, Higher Education Commission of Pakistan, QS, and Time university rankings required universities to provide them

their research outcomes on a yearly basis. GS is a very useful tool for universities to publicly present their research achievement systematically. As a regulatory body, HEC has a good influence over Pakistan universities. Therefore, it is easier for HEC to advise universities to maintain their research activities on GS. Universities can make sure that all scholars affiliated with their university have legitimate public profiles visible on GS and scholars update their profiles regularly to avoid ethical and social issues, which were discussed in the previous section. Universities/DAI make sure that scholars will not get any benefit because of his/her incorrect GS profile.

Limitations of this study are already discussed in a dedicated section. The authors are planning to add two more features in MAKGBOT to overcome these limitations. Firstly, MAKGBOT should support real-time or periodic updates. As soon as, the new university is added to the HEC repository or the paper is published in the public profile of a Pakistani scholar, the system will update the results and provide basic reports. Secondly, MAKGBOT should check the legitimacy of the papers by verifying the scholar's name in the published paper, which is added to the public profile of GS.

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