IOSR Journal Of Humanities And Social Science (IOSR-JHSS)
Volume 26, Issue 12, Series 4 (December. 2021) 59-67
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

A scientometrics analysis in Google Scholar of University of Sri Jayewardenepura (USJ)

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Abstract:
The objective of this study was to analyze the research performance of academics of the University of Sri Jayewardenepura (USJ) using Google Scholar (GS). This article provided an analysis of citation, h- index and number of publications of academics from USJ to achieve the main objective. Simple tabulation of data with percentage in different range values was used to analyze the data. There were 46327 total citations, 1218 total h-indexes and 9740 total number of publications in GSs of USJ profile. It was observed that 82.5% (312) of the academics of USJ have received at least one citation, while 17.5% (66) were un-cited. The academics from the Faculty of Applied Sciences (FAS) were having the best research performance with 30279 total citations, 4613 total publications, 556 total of h – indexes and 639 i10 – indexes in GS. The next was the Faculty of Medical Sciences (FMS); having 6570 citations, 239 h – indexes and 170 i10 – indexes with 2119 total publications in GS. Third one was the Faculty of Management Studies and Commerce (FMSC); having 4106 citations, 215 h – indexes and 118 i10 – indexes with 1751 total publications in GS. Most performed researchers were M. Vithanage, A.U. Rajapaksha and Isuru Wijesekara; were from the FAS. Their total citations were 5297, 3591 and 3064 and h- index were 33, 23 and 17 respectively. Their publications in GS were about 294, 72 and 65 respectively. The outcome of this research will be disseminated among the university community with a view to encourage them to do more research publications and it will help the other faculties which have made slow progress in publishing to look for more possibilities of inculcating a publishing culture.

Key Words: Google Scholar (GS), Citation analysis, h-index, Publications, Academics, Research output, University of Sri Jayewardenepura (USJ)

Date of Submission: 06-12-2021 Date of Acceptance: 21-12-2021

I. INTRODUCTION

Academic scholars or researchers receive recognition, promotion and funding for future research through their publication. Researchers and administrators at many academic institutions worldwide make use of citation data for hiring, promotion, and tenure decisions, among others (Wallin, 2005).

Citation counts provide researchers and administrators with a reliable and efficient indicator for assessing the research performance of authors, projects, programs, institutions, and countries and the relative impact and quality of their work (Cronin, 1997; van Raan, 2005). The h-index was introduced by Hirsch (2005) and is defined as follows: "A scientist has index h if h of his / her Np papers have at least h citations each, and the other (Np – h) papers have no more than h citations each" (Hirsch, 2005) It aims to measure the cumulative impact of a researcher's output by looking at the number of citations his/her work has received. Hirsch argues that the h-index is preferable to other single-number criteria, such as the total number of papers, the total number of citations and citations per paper.

The use of citation counts for evaluating research is based on the assumption that citations are a way of giving credit to and recognizing the value, quality, and significance of an author's work (Borgman & Furner, 2002; van Raan, 1996). It has value as an analytical tool, as Baird and Oppenheim (1994)) stated, "Whatever measure you take for the eminence of an individual scientist or of a journal or of an institution, citation counts provide strong correlation with that result". They further declared that "high citation counts mean a statistical likelihood of high quality research" (Baird and Oppenheim, 1994). The advantage of the h-index is that it combines an assessment of both quantity (number of papers) and quality (impact, or citations to these papers) (Glanzel, 2006). An academic cannot have a high h-index without publishing a substantial number of papers.

For many years, the Institute for Scientific Information (ISI) citation indexes has been the standard tools for identifying citations and citation counts. These indexes cover three major disciplinary groups; Arts and Humanities, Science and Social Sciences and are provided online by Thomson Reuters via the Web of Science database (WoS). The November 2004 launches of Elsevier's Scopus (ScopusInfo, 2004) and Google

Scholarbeta (Butler, 2004) tripled the number of tools available to scholars for conducting citation analysis. Scopus covers a much larger number of sources than WoS.

Google Scholar (GS) is a free web-based database that covers journals, books, conference proceedings, dissertations, technical reports, preprints and post prints, and other scholarly documents from all areas of science. Documents are collected from various academic publishers, preprint and post print servers, bibliographic databases and from digital repositories of several universities, research organizations and government agencies. GS can be searched for citations using two methods: Author search and exact match (or exact phrase) search. The Author search usually retrieves items published by an author and ranks the items in a rather inconsistent way. The exact match search approach was used to ensure that citations were not missed due to errors in GS's Author search algorithm. The search interface of GS is simple and easy to use. Search options include some limiting criteria such as author, article title, journal title, publication year and subject area. Results are returned in a relevance-ranked order, which relies primarily on the full text of each document and its citation count. Thus, results highlight documents that are cited more often, creating a bias towards older literature. In this regard, some options would be helpful.

GS is rich in content, "from different angles, including coverage, variety in source and journal base, size and currency" (Jacso, 2008). Pauly and Stergiou (2005) compared WoS and GS citations across nine science and two social science disciplines and determined that GS can serve as a replacement for WoS. GS provides a more comprehensive landscape of a researcher's impact. In addition to identifying citations not covered in GS, it can also provide "a more comprehensive picture of the extent of international and interdisciplinary nature of scholarly communication of and among researchers" (Yang and Meho, 2006).

II. OBJECTIVES

This study was aimed to evaluate the research performance on the basis of citations, h- index and publication output of the academics of USJ through GS. In addition, identifying the utility of GS as a citation analysis tool and examining the citation retrieval strengths and weaknesses of GS were formulated as sub objectives of this study.

III. METHODS

The total number of citations received by academics was considered as their quality indicator and h-index of academics as quality & quantity indicator in this study. Likewise, the number of publications in GS by academics was considered as the index of publication output. Balaram (2008) opined that the practice of using citation counts to quickly gauge a scientist's performance was commonplace. H- Index is a factor that is used widely for measuring the research output of individual researcher, faculty and university in terms of publications and citations received. Guan and Gao (2008) showed that the number of publications is one of the indicators for the assessment of scientific activities.

In this study, academics from the various faculties of the USJ were evaluated individually on the basis of three important indicators i.e. citation count, h-index and number of publications. Sample of this study covers all permanent academics with a GS account with citations who were working in the USJ as at January 2020. For the analysis of citation counts, all publications published in all years by each author were retrieved. GS accounts were individually accessed for collecting the data. The searching process for this work was done during 01-30 of January, 2020. If USJ GS accounts reflected current active academics and their names inaccurately, the data of this study would be consequently inaccurate to a certain degree.

IV. RESULTS

There were 453 individual Google Scholar Accounts (GSA) in the USJ Google Scholar profile. Only 378 GSAs of the total GSA, were verified. The remaining 75 GSAs belonged to Temporary Research Assistants, Temporary Assistant Lectures or Retired Academics and un- verified emails. The verified GSAs were mapped under three indicators, i.e. total citations, h – index and number of publications. Simple tabulation of data with percentage in different range values was used to analyze the academic's performance.

Citation Analysis

The first indicator is the total number of citations. Citation based analysis of researchers (permanent staff members) working in the USJ is presented in Table 01.

Table 01: Distribution of GSAs of USJ on the basis of citation

Faculty										%
Citation Range	**FHHS**	**FAS**	**FMSC**	**FMS**	**FOE**	**FOT**	**FAH**	**LIB**	**Total**	
00-010	14	17	29	10	2	3		2	77	24.7
11-020	2	9	11	8		3	1	1	35	11.2
21-030	3	11	7	5	1	2	1		30	9.6
31-040	1	4	1	5	1	1	1		14	4.5
41-050	3	7	4	3		1			18	5.8
51-060	1	6	1	3			1		12	3.8
61-070	1	4	2	4		2		1	14	4.5
71-080		7	3	1	3	2			16	5.1
81-090		3	1		1	1		1	7	2.2
91-100		7	3	1			1		12	3.8
101-200		13	6	7	1	4			31	9.9
201-300	1	6	4	3		1			15	4.8
301-400	1	2	1	2					6	1.9
401-500		4		2					6	1.9
501-1000		8	1	3					12	3.8
1001-3000		3				1			4	1.3
> 3001		3							3	1.0
Total	27	114	74	57	9	21	5	5	312	100
%	8.65	36.54	23.72	18.27	2.88	6.73	1.60	1.60	100	

Among verified GSAs, it was observed that 82.5% (312) of the researchers of USJ have received at least one citation, while 17.5% (66) were un-cited. Citation range of 3001-5000 is the highest value for science corresponding to 1% of researchers, while about 1.3% of researchers received citations in the range of 1001-3000. In addition, 3.8% received total citation in the range of 501-1000, while 18.5% received 101-500 and 75.3% received 01-100.All these figures are summarized in the figure 01 and it indicated that most of the researchers (about 75.8% of total no of 77 GSAs) were in the citation range of 1-100. Majority of the GSAs having more than 100 citations were from the FAS (about 50.64%) while, 22% were from the FMS and 15.58% from the FMSC.

Figure 01: Citation percentage of USJ according various ranges

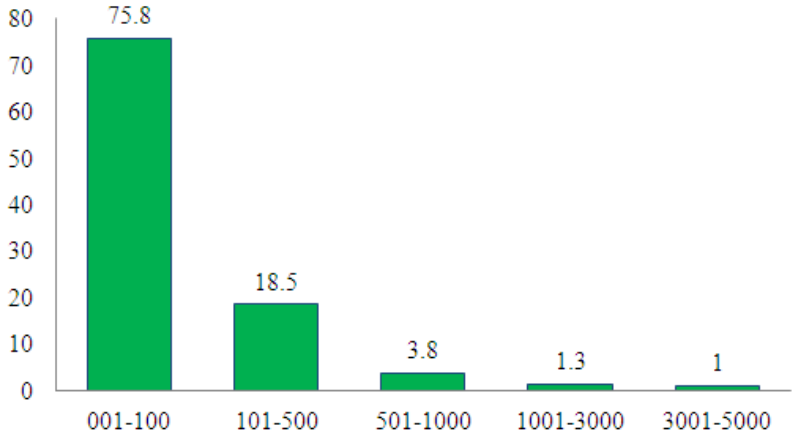
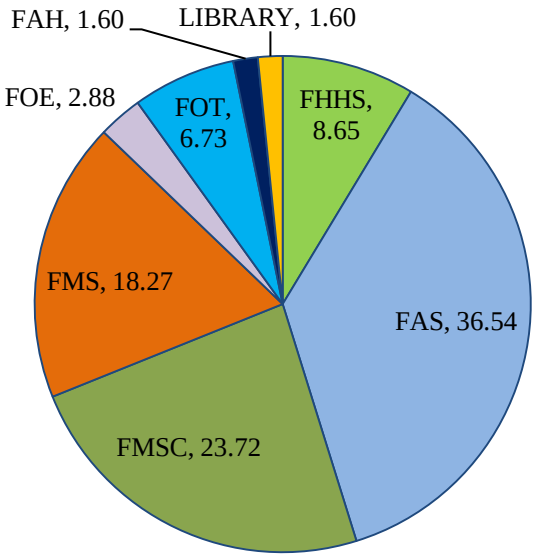


Figure 02: Faculty-wise percentages of GSs with citations



According to the Figure 02 most of the GSs with citation were from the Faculty of Applied Sciences (FAS) and it was about 36.54%. The Faculty of Management Studies and Commerce and the Faculty of Medical Sciences ranked 2nd and 3rd places with 23.72% and 18.27% respectively.

According to the Table 2, there were 46327 total citations in the USJ profile out of which, 65.36% were from the FAS, 14.18% from the FMS and 8.86 from the FMSC. The lowest contributions were from the library academics, the Faculty of Allied Health Sciences, and the Faculty of Engineering respectively.

Table 02: Total citations of USJ

Faculty	Citation
FAS	30279
FMS	6570
FMSC	4106
FOT	3369
FHHS	1026
FOE	526
FAH	273
LIBRARY	178
TOTAL	**46327**

H-index analysis

According the Choi et al. (2013) h-index has become a widely utilized measure of quantifying an individual's research output. In this study, the h-index was used as a measure of academics' performance. The h- index analysis was conducted only for researchers who had received at least one citation. Table 3 lists the h-index of academics under different range values for each faculty; the h – index range values vary from a high range of 31-35 to a low range of 1-5 in this table.

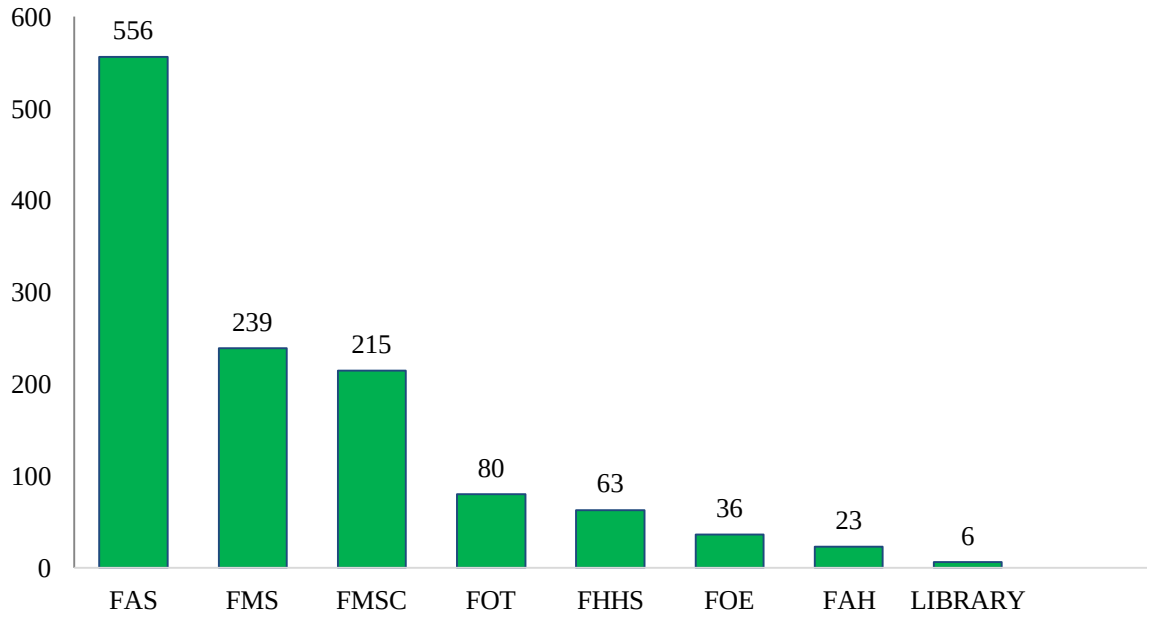
Table 03: GSAs of USJ on the basis of h-index

	Faculty								
h-index range	**FHHS**	**FAS**	**FMSC**	**FMS**	**FOE**	**FOT**	**FAH**	**LIB**	**Total**
1-5	25 (92.6)	73 (64)	61 (82)	44 (77)	7 (77.8)	18 (85.7)	4 (80)	5 (100)	237 (75.96)
6-10		22	12	10	2	2	1		49

		(19.3)	(16)	(17.5)	(22.2)	(9.5)			
11-15	2 (7.4)	12 (10.5)	1 (1.35)	2 (3.5)					17
16-20		4 (3.5)		1 (1.75)					5
21-25		2 (1.75)				1 (4.8)			3
26-30									0
31-35		1 (0.88)							1
Total	27	114 (100)	74	57	9	21	5	5	312

The FAS has the highest range value (31-35) of h-index with 0.88%. Second and third highest range values (21-25) were represented by science and technology faculties with 1.75%, 4.8% respectively. The h-index in the range value 16-20, was about 3.5% in science and about 1.75% in Medical Science. Most of the GSAs (about 237 or 75.96% of the total GSAs) were in the h index range of 0 – 5. Majority of the academics in all the faculties have h-index in the range value 1-5, which, in the case of library academics is about 100%, humanities about 92.6%, technology 85.7%, Management 82%, allied health sciences 80%, engineering77.8%, Medical sciences 77% and science about 64% of the total number of researchers. According to the total h-index count of various faculties, it is obvious that the performance of academics in the Library, Allied Health science, Engineering Technology and Humanities are comparatively low followed by Management and Medical Science are showing a higher and science is showing the highest in terms of h-index. (See figure 03)

Figure 03: Most performed faculty based on h- index



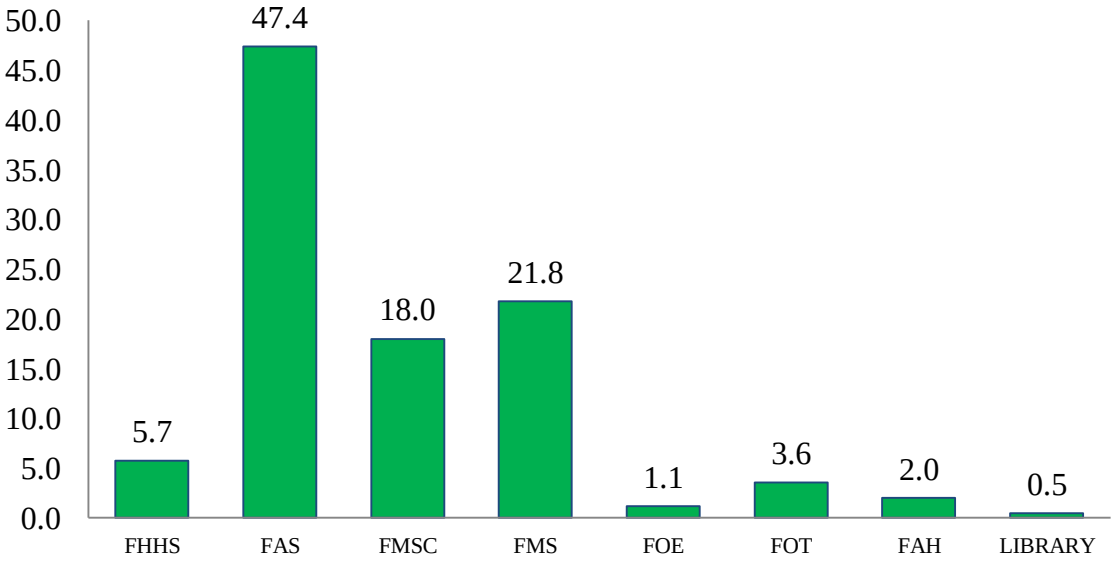
Publication Output

Table 04 and Figure 04 present the counts of publications published by academics of each faculty. The FAS is the best faculty in term of number of publications with the count of 4613. Second place acquired by the FMS and the third by the FMSC. It was observed that highest numbers of research papers were published by the FAS about 47.7%; while 21.8% by the FMS and 18% by the FMSC.

Table 04: Publication output of GS

Faculty	Publications No. (%)
FHHS	557 (5.7)
FAS	4613 (47.4)
FMSC	1751 (18)
FMS	2119 (21.8)
FOE	112 (1.1)
FOT	348 (3.6)
FAH	194 (2)
LIBRARY	46 (0.5)
Total	**9740 (100%)**

Figure 04: Publication output of GS



Majority of researchers from all faculties have published research papers in the range value of 1-50. According the academics, those who have in citation more than 100; 45.45% in the output range of 1-50; while 35% of 50-100, 15.58% of 100-150, 1.3% of 150-200 and 3.89% in the range of >200.

Summary of the Results

The highest number of GSAs about 144 were from the FAS while, 74 from the FMSC, 59 from the FMS, 27 from the FHHS and 21 from the FOT respectively.

According the GS profile of USJ, had a total of 46327 citations, 1218 total of h – indexes and 9740 total number of publications. In the table below it show according the Faculty vise.

Table 05: Summary of research output

Faculty	Citation	h-index	Publications
FAS	30279	556	4613
FMS	6570	239	2119
FMSC	4106	215	1751
FOT	3369	80	348
FHHS	1026	63	557
FOE	526	36	112

FAH	273	23	194
LIBRARY	178	6	46
Total	**46327**	**1218**	**9740**

The academics from the FAS were having the best research performance with 4613 total publications in GS. It had a total of 30279 citations, 556 total of h – indexes and 639 i10 – indexes. The next was the Faculty of Medical Sciences; having 6570 citations, 239 h – indexes and 170 i10 – indexes with 2119 total publications in GS. Third one was the Faculty of Management Studies and Commerce; having 4106 citations, 215 h – indexes and 118 i10 – indexes with 1751 total publications in GS.

Most performed researchers were M. Vithanage, A.U. Rajapaksha and Isuru Wijesekara; both were from the Faculty of Applied Sciences (FAS). Their total citations up to 2019 were 5297, 3591 and 3064 respectively and h- indexes were 33, 23 and 17 respectively. According to the GS they have published 294, 72 and 65 research papers respectively.

V. CONCLUSIONS AND RECOMMENDATIONS

It seems that in relative terms FAS and FMS are the most research productive faculties among the eight faculties in the USJ. It has the most prolific researchers, showing a considerably higher performance in research and development activities than in the other faculties. The next position was acquired by researchers of the FMSC. Academics in the library and the FHSS had the lowest number of publications as well as citations. This will explain why they showed poor performance in terms of said indicators in this study.

In the promotion scheme for academics in Sri Lanka, publishing research articles in the refereed / peer reviewed / high impact journals is not compulsory, but several marks are allocated for an article published in these journals. In addition, academics can get the minimum score for publications required for the promotion by publishing books with ISBN, which is an easy way to achieve the required score in Sri Lanka. Majority of the University academics in the FHSS choose to publish books instead of publishing articles in the high impact / peer reviewed journals for their promotion. In fact, this is one of the important reasons for the low productivity among the academics in the FHSS; further, lack of interest in publishing research articles in the journals is a fact; a tendency towards publishing books and books chapters are also a common practice among them.

Language barrier is another reason for this scenario. Local language journals provide a more popular platform for the research communication of academics in humanities and social sciences, but they are not covered and indexed in Google Scholar and other citation databases. There is a mechanism provided by the Sri Lankan government but it is limited to science subjects only. The Presidential Award for outstanding researchers based on the Science Citation Index (SCI) is an opportunity to promote and evaluate researchers at the national level. This award system, however, is restricted to sciences and is not suited to management, social sciences, humanities and arts related disciplines. This does not mean that academics in humanities and social sciences are weaker performers. It is recommended that research output in humanities and social sciences and others across the university faculties must be strengthened and mechanism should be introduced by the authorities in order to promote research in those fields.

However, a higher growth rate of research is expected due to the emerging research culture in the university. Creating a vibrant research culture and promoting the individual researchers in order to enhance their quality and quantum of research is well understood by the authorities and policy makers of the university. Researchers are encouraged by the university in many ways such as sponsoring publications in recognized indexed journals, providing overseas travel grants to the lecturers to attend conferences and present the research findings in the way of conference papers or posters and rewarding researchers by conducting annual research awards event etc. These facilities are streamlined and backed up by the Research Centres established under the Research Council and Innovations, Inventions and Venture Creation Council of the university.

The outcome of this research will be disseminated among the university community with a view to encourage them to do more research publications by utilizing the facilities and services provided by the university to the maximum. Further it is hoped that it will inspire the other faculties which have made slow progress in publishing to look forward to more possibilities of establishing a publishing culture.

However during the analysis, following disadvantages of the GS have been identified,

- Its records are retrieved in a way that is very impractical for use with large sample sizes, requiring a very tedious process of manually extracting, verifying, cleaning, organizing, classifying, and saving the bibliographic information into meaningful and usable formats.
- Another major disadvantage of GS is that it duplicates citations (e.g., counting a citation published in two different forms, i.e. preprint and journal article, as two citations).
- Lack of information about document type, document language, document length, and the refereed status of the retrieved citations. In many cases, especially when applying the Exact Phrase search method, the

item for which citations are sought is retrieved and considered a citation by GS (in such cases, these citations were excluded from the search results).

- GS sometimes includes non-scholarly citations, such as student handbooks, library guides or editorial notes. However, incidental problems in this regard are unlikely to distort citation metrics, especially robust ones such as the h-index.
- GS does not work with older publications, as these publications and the sources that cite them have not (yet) been posted on the web.
- GS's processing is done automatically without human intervention and hence sometimes provides nonsensical results.
- GS is not updated as often as Thomson ISI WoS. Whilst GS does not provide information about its update frequency, our experience suggests it is updated at least every 2 to 3 months, whilst more recently minor updates seem to have been done more frequently.
- Google Scholar did provide significantly more citations from conference papers than Web of Science and Scopus combined.

Certainly, GS is an important service for those who do not have access to expensive multidisciplinary databases such as the Thomson Scientific Citation Indexes or Scopus. Web of Science has long been the only tool for citation analysis. Scopus and Google Scholar, while still new to the market, are complementary to Web of Science and in some cases can provide a more nuanced view of the importance of scholarly articles in the social sciences. However, GS currently processes its sources in an unsystematic, unpredictable and fragmentary manner. Due to the lack of adequate options for browsing, searching and saving, it is difficult to make even elementary bibliometric analyses efficiently. At least in its beta version, Google Scholar is not yet a useful choice for citation analysis, but it may develop into a sophisticated tool.

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J.G. Chandani. "A scientometrics analysis in Google Scholar of University of Sri Jayewardenepura (USJ)." *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, 26(12), 2021, pp. 59-67.