

Comparative analysis of Dimensions and Scopus bibliographic data sources: an approach to university research productivity

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ABSTRACT

This paper shows a significant comparison of two primary bibliographic data sources at the document level of Scopus and Dimensions. The emphasis is on the differences in their document coverage by institution level of aggregation. The main objective is to assess whether Dimensions offers at the institutional level good new possibilities for bibliometric analysis as at the global level. The results of a comparative study of the citation count profiles of articles published by faculty members of Prince of Songkla University (PSU) in Dimensions and Scopus from the year the databases first included PSU-authored papers (1970 and 1978, respectively) through the end of June 2020. Descriptive statistics and correlation analysis of 19,846 articles indexed in Dimensions and 13,577 indexed in Scopus. The main finding was that the number of citations received by Dimensions was highly correlated with citation counts in Scopus. Spearman's correlation between citation counts in Dimensions and Scopus was a high and mighty relationship. The findings mainly affect Dimensions' possibilities as instruments for carrying out bibliometric analysis of university members' research productivity. University researchers can use Dimensions to retrieve information, and the design policies can be used to evaluate research using scientific databases.

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1. INTRODUCTION

There are recent examples of comprehensive literature comparing academic publication and/or citation coverage for the web of science and Scopus [1]-[14]. However, only a few recent studies have looked into the extent to which new sources of academic publication and citation data are covered by Dimensions [15]-[21]. For research evaluators, there are benefits of the existence of free online citation indexes: i) for many institutions that cannot afford to pay, free alternatives can reduce the cost of evaluations, ii) due to an imperfect of all citation indexes, the availability of alternatives allows data to be cross-checked against citation indexes, and iii) for impact evaluation task, each citation index may have coverage advantages that make it a better fit [21].

Researchers or institutions use citation counts to measure the impact of publications from the author's perspective [11] and evaluate the quality or impact of published research [21]. It is often taken for granted today that citations measure scientific impact and scientific quality in some way [22]-[24]. Citations are increasingly being used in research policy and the research system as performance indicators [25], [26].

Aksnes *et al.* [26] have investigated how citations may relate to various research quality and argued that citations reflect aspects of science's impact and relevance. Lambovsak and Yordanov [27] believe that the motivation of researchers to publish in high-quality journals is crucial to achieving the goals of researchers, universities, and society. The importance of citations for the researchers' reputation is one of the most important motivators for researchers' future publishing [28], [27]. This study analyses and compares Scopus and Dimensions' citations for selected publications output of Prince of Songkla University (PSU) faculty members. Comparing the citations from the two sources should help determine whether one source is better than another or whether a free database such as Dimensions could replace Scopus in PSU published works. Also, citations may be added as a new motivational driver to encourage PSU researchers to publish high-quality journals.

Scopus is an abstract and citation database created by Elsevier in 2004; it is a bibliographic data source providing scientific documents and citation links. Scopus's significant feature is that all article types index all authors, institutional addresses, and bibliographic references for each article. Thus, to date, Scopus remains the leading source for citation data [9] and the most critical multidisciplinary bibliographic databases [12]. Some studies comparing Scopus and free citation databases are mainly focused on two aspects: i) the coverage of the databases and ii) impact at different levels, the accuracy of the databases, ranging from individual researchers to institutes [12], [29].

Dimensions, a free new online access scholarly search database platform for an analysis tool, was launched by Digital Science in January 2018. The links between grants, publications, clinical trials, patents, policy documents, and altimetric information, alongside traditional publications, and citation data, are core to Dimensions [18]; [19]. In September 2020, at the time of publication, the Dimensions database included over 112 million publications and their citations, content types, i.e., such as 582,398 clinical trials, 40 million patents, over 5 million grants, and 542,234 policy documents. The Dimensions platform makes available to research analysts, managers, and policy-makers [16]. Although the new-comer Dimensions was launched in 2018, it is a strong rival of Scopus and is trying to challenge Scopus's dominant role. Only three published studies have investigated Dimensions' coverage and compared it to Scopus. Thelwall in study [21] showed that for publications in Food Science coverage and citation counts of Dimensions were comparable to Scopus's. Harzing [15] studied a detailed comparison across six data sources for an academic's complete publication and citation record in the field of Business and Economics. As demonstrated by Malea and Cózar [20] showed Dimensions' coverage analysis compared to Scopus and Google Scholar to determine whether Dimensions offered the bibliometric indicators have significant enough to be used. The results concluded that Dimensions has coverage of the recent literature superior to Scopus and the number of citations in Dimensions exhibited a strong correlation with Scopus. Also, Dimensions is an alternative for carrying out citation studies competing with Scopus in more generous coverage and free of charge [20]. Singh *et al.* [30] explored the Dimensions features and found two exciting features as a competitor to web of science and Scopus and research assessment. This study [30] has also shown that Dimensions may provide a ready-to-use mechanism for evaluators from a specific country to assess various institutions' research performance using their country journal lists. This study may also classify articles into various subject areas more precisely and subject-specific research performance evaluations more informed.

Dimensions was included in a recent study comparing various aspects until now of several old and new scholarly databases. Some comparative studies have analyzed Dimensions from a scientometric perspective [18]. However, no empirical study has been conducted focusing on citation analysis of PSU publications in Dimensions and Scopus in academic papers. Some questions are interesting for investigation: i) Is Dimensions threatening the dominating role of Scopus?; and ii) do the researchers from different countries and research fields have any preference in choosing these two databases?

Given Dimensions' potential utility in research assessments, it is critical to evaluate its fundamental properties to see if it has enough data to be valid and if its citation counts are accurate [21]. Thus, this study attempts to present an alternative approach to analyzing the two databases' journal coverage (Dimensions and Scopus). We used the direct comparison of overlapping in all two databases and analyzed the impact the coverage variations may have on academic research publication and citation record and affiliation searches in the field "Prince of Songkla University." The following characteristics are of particular interest: i) distribution of digital object identifier (DOIs) across sources, ii) differences recorded by each source in the year of publication, iii) citation counts calculated across sources, and iv) relationship of average citation counts in terms of Spearman's correlation. No study has compared PSU publications output in the two databases. This research aims to fill the gap across the study of PSU as depicted in reputed international university ranking systems. Moreover, to conduct a comparative and empirical analysis focusing on Dimensions and Scopus in PSU research outputs.

2. RESEARCH METHOD

Statistical analysis and a descriptive-analytical method were used to conduct this study. Microsoft Excel software, SPSS, and R statistical programming language were used for data analysis and interpretations. Data were obtained by multiple Dimensions and Scopus searches as shown in Figure 1. Prince of Songkla University was used as a critical term in Dimensions' organization search field and Scopus's affiliation field. Advanced searches through different databases were used to find scholarly papers affiliated with the university. All publications affiliated to the Prince of Songkla University since the initial inclusion of PSU-authored publications were considered for study; there was no sampling. Each of the publications was analyzed for the authors' names and the number of authors and their affiliations.

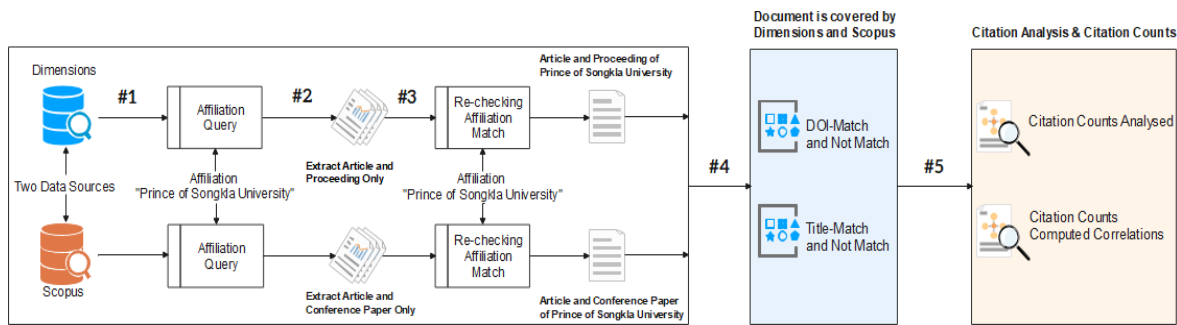


Figure 1. Visual representation of the documents and citation counts analyzed in this study

2.1. Data collection

There was no sampling procedure conducted in this study. By the end of June 2020, articles published in Dimensions and Scopus by scholars at Prince of Songkla University were investigated. The required data were collected from the Dimensions and the Scopus as shown in Table 1. To extract the required data, two significant steps are as follows:

Table 1. Number of documents retrieved by Scopus (1978-2020) and Dimensions (1970-2020)

Scopus (1978-2020)			Dimensions (1970-2020)		
Document Types	No. of Documents	%	Document Types	No. of Documents	%
Article	11,487	84.61	Article	17,977	90.59
Conference Paper	1,430	10.53	Proceedings	845	4.26
Review	362	2.67	Chapter	654	3.29
Book Chapter	106	0.78	Edited Book	238	1.20
Letter	64	0.47	Monograph	67	0.34
Note	43	0.32	Preprint	64	0.32
Erratum	38	0.28	Total	19,846	100
Editorial	24	0.18			
Short Survey	11	0.08			
Book	3	0.02			
Data Paper	3	0.02			
Undefined	6	0.04			
Total	13,577	100			

2.1.1. Data extraction from Dimensions

Prince of Songkla University was searched into the search section based on Dimensions' organizational affiliation to extract the titles. Articles were reviewed due to the variety of writing styles among the writers. The study needs to identify those affiliated with the university. In the papers' availability, 18,822 documents of article and proceedings papers were added to the data extracted, see steps 1 and 2 in Figure 1. The data was cleaned again by examining the university's organizational affiliation (step 3 as shown in Figure 1) 11,412 documents.

2.1.2. Data extraction from Scopus

Research publications by PSU started to be indexed in Scopus in 1978. The literature data used in this study were collected using the Scopus database by searching in Scopus on June 30, 2020. The period time of this study was over 30-years period, 1978-2020, and the specifications searched: AFFILORG

(“Prince of Songkla University” 60006314) OR AF-ID (“Faculty of Medicine Prince of Songkia University” 60025527) AND (LIMIT-TO (DOCTYPE, “ar”) OR LIMIT-TO (DOCTYPE, “cp”). This study brought the dataset to 12,917 documents that met the selection criteria (steps 1 and 2 in Figure 1). Review, book chapter, letter, note, erratum, editorial, short survey, and other document types were excluded. Each article’s information was saved in an excel file [31] to be analyzed in the final stage. The extracted information includes title, authors, author’s affiliations with Prince of Songkla University, year of publication, type of article, name of the journal, and the number of citations of each article.

2.2. Objectives/research questions and statistical analysis

There was no study comparing the productivity and impact of PSU researchers on Dimensions and Scopus. This research aimed to compare the coverage of Dimensions with the coverage of Scopus at the university level for research productivity. The questions posed were as follows:

- a. RQ1: what is the trend of scholarly papers authored or co-authored indexed in Dimensions and Scopus?
- b. RQ2: how much coverage is there between Dimensions and Scopus on articles with DOIs and citation data?
- c. RQ3: are there any meaningful relationships in the average citation counts for educational documents in Dimensions comparable to Scopus?
- d. RQ4: are citation counts of scholarly documents in Dimensions interchangeable with Scopus regarding having a too high correlation?

To reach this study’s aims, descriptive statistics, i.e., geometric mean, exponential regression test, and correlation test, were used to analyze data in Excel and R version 4.0.2. To respond to RQ1, the document types and citation count of the citing documents in our sample (step 4 in Figure 1) were aggregated or averaged by differentiating between unique Dimensions citations and overlapping citations. To reply to RQ2, Dimensions’ coverage was compared to Scopus by measuring the percentage of Scopus documents with DOI that were also in Dimensions per year (step 4 in Figure 1). Moreover, report the size of the overlaps. Additionally, the causes of why these documents were not covered are provided. Publications before 1985 were not considered because of the limited coverage of these publications in Dimensions. The citing documents from both were matched to gather and compute citation overlaps from two different data sets (Dimensions and Scopus). The matching process started with attempting to match publications based on DOI. If no DOI-based match could be obtained, a match was attempted for the title’s name. To answer RQ3, the geometric mean citation counts for Dimensions for each year were compared against Scopus. The geometric mean is stronger than the arithmetic mean because citation data is highly skewed [21]. To answer RQ4, Spearman correlation coefficients were calculated for the citation counts of the citing documents in our sample (step 5 in Figure 1). In this case, citation counts from Dimensions and Scopus were compared for each year using Spearman correlations. For data not found in Dimensions, with and without articles, the correlations were calculated as for RQ3. The raw data, custom functions in Excel, the R code, and several R packages were used for the analysis to carry out all these processes.

3. RESULTS AND DISCUSSION

3.1. What is the trend of scholarly papers authored or co-authored indexed in Dimensions and Scopus?

The total scholarly papers by faculty members of Prince of Songkla University are shown in Table 2, Figure 2, and Figure 3 by year of publication and growth rate. Publications by authors from Prince of Songkla University first appeared in Dimensions in 1970 and 1978 in Scopus. Over the period under consideration, 11,412 documents in Dimensions and 12,915 in Scopus were published by PSU researchers. According to Table 1, 1,503 more publications were indexed by Scopus than were by Dimensions. The number of papers included was low until 1985; the publications’ rate has since increased regularly. A similar growth rate was found in both databases, especially in the later years. An exponential function can describe the yearly growth rate of publications: $y = ae^{bt}$, where a is a constant value, b is the growth rate of publications in t (year), and e is the natural foundation logarithm. R^2 for a nonlinear least-squares regression shows the test results’ significance level. As shown in Figure 2, over the years examined, the number of PSU publications has increased. A 15.32% growth rate for PSU publications in Dimensions and a 14.85% growth rate in Scopus were shown in the exponential regression report. Comparing the two databases shows that the increase rate (exponential trend line) in both data sources is almost identical. Overall, the number of PSU’s publications in Scopus is about 1.13 times higher than that of Dimensions. However, the number of publications is ascending equally in both databases over the last twenty years.

Based on the results in Table 2 and Figure 3, PSU publications in Scopus (168,082) have received more citations than Dimensions’ publications (152,397). However, the number of citations per publication is

slightly higher in Dimensions (13.35) than in Scopus (13.01). This finding is consistent with that of [30] reported a higher cited value for Scopus than Dimensions.

Based on the findings in Table 3 and Figure 4, the number of cited publications in Dimension and Scopus is rising over the years but not in recent years. The results showed that in Scopus, the number of cited publications is slightly higher than in Dimensions. About 79.14% of the total PSU publications in Scopus are cited, while this percentage in Dimensions is about 78.29%. Some papers have never been cited. This status is referred to as a non-cited publication that shows the number of publications that do not affect their associated community. As shown in Figure 4, the number of non-cited publications is growing in both databases. The counts of Table 3 revealed that the number of non-cited PSU publications is slightly higher in Dimensions than Scopus. In 2016, about 87.31% of Dimensions publications were cited, and about 12.69% were non-cited. Overall, about 21.71% of total publications in Dimensions are non-cited, while this percentage in Scopus is about 20.86%.

Table 2. Publications and citations by scholars in Dimensions (1970-2020) and Scopus (1978-2020)

Year	Dimensions (1970-2020)			Year	Scopus (1978-2020)		
	No. of Publications	No. of Citations	Citations per Publication		No. of Publications	No. of Citations	Citations per Publication
1970	1	0	-	1970	-	-	-
1971	0	0	0	1971	-	-	-
1973	1	4	4.00	1973	-	-	-
1974	0	0	0.00	1974	-	-	-
1975	0	0	0.00	1975	-	-	-
1976	0	0	0.00	1976	-	-	-
1977	0	0	0.00	1977	-	-	-
1978	2	25	12.50	1978	2	18	9.00
1979	0	0	0.00	1979	2	27	13.50
1980	7	63	9.00	1980	11	76	6.91
1981	1	19	19.00	1981	4	32	8.00
1982	4	60	15.00	1982	6	59	9.83
1983	2	16	8.00	1983	8	27	3.38
1984	0	0	0.00	1984	4	3	0.75
1985	3	2	0.67	1985	5	46	9.20
1986	7	100	14.29	1986	10	132	13.20
1987	9	35	3.89	1987	14	221	15.79
1988	7	126	18.00	1988	8	143	17.88
1989	11	207	18.82	1989	15	240	16.00
1990	35	317	9.06	1990	37	365	9.86
1991	36	409	11.36	1991	37	490	13.24
1992	27	174	6.44	1992	29	218	7.52
1993	45	445	9.89	1993	49	553	11.29
1994	32	627	19.59	1994	40	906	22.65
1995	43	913	21.23	1995	46	1,157	25.15
1996	40	1,172	29.30	1996	56	1,572	28.07
1997	78	1,183	15.17	1997	87	2,211	25.41
1998	66	1,529	23.17	1998	83	2,048	24.67
1999	88	1,682	19.11	1999	99	2,258	22.81
2000	103	2,166	21.03	2000	111	2,504	22.56
2001	123	1,982	16.11	2001	114	2,235	19.61
2002	134	3,713	27.71	2002	135	4,166	30.86
2003	157	3,680	23.44	2003	166	4,510	27.17
2004	173	4,592	26.54	2004	159	5,414	34.05
2005	247	6,147	24.89	2005	251	7,148	28.48
2006	319	8,591	26.93	2006	389	9,838	25.29
2007	372	8,698	23.38	2007	504	9,459	18.77
2008	458	9,756	21.30	2008	568	11,408	20.08
2009	417	14,410	34.56	2009	487	16,075	33.01
2010	471	9,997	21.23	2010	559	11,291	20.20
2011	543	11,365	20.93	2011	650	12,479	19.20
2012	645	11,225	17.40	2012	736	12,311	16.73
2013	750	9,348	12.46	2013	850	9,702	11.41
2014	722	8,922	12.36	2014	853	9,684	11.35
2015	716	8,925	12.47	2015	806	8,980	11.14
2016	725	7,480	10.32	2016	849	6,819	8.03
2017	936	6,040	6.45	2017	1,006	5,635	5.60
2018	990	3,956	4.00	2018	1,133	3,592	3.17
2019	1,094	2,015	1.84	2019	1,230	1,838	1.49
2020	772	281	0.36	2020	707	192	0.27
Total	11,412	152,397	13.35	Total	12,915	168,082	13.01

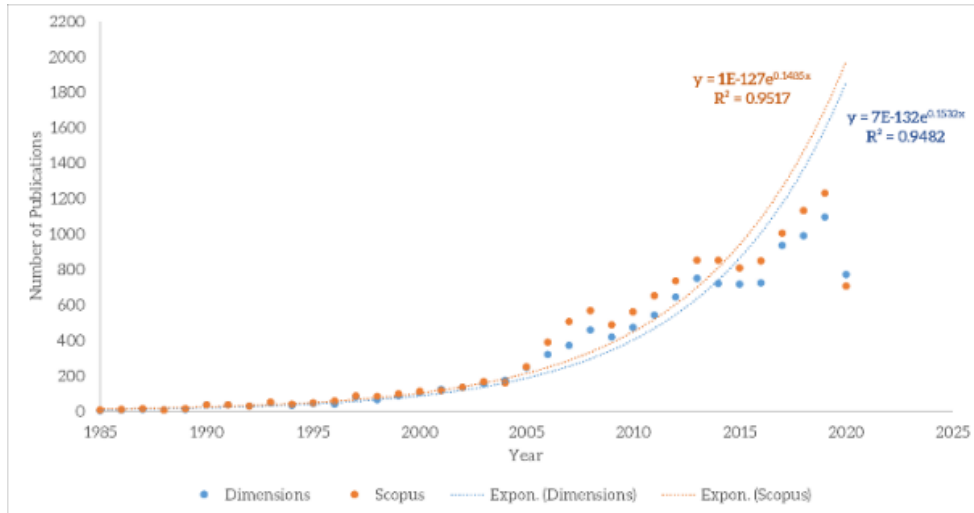


Figure 2. The growth rate of scholarly publications in Dimensions vs Scopus

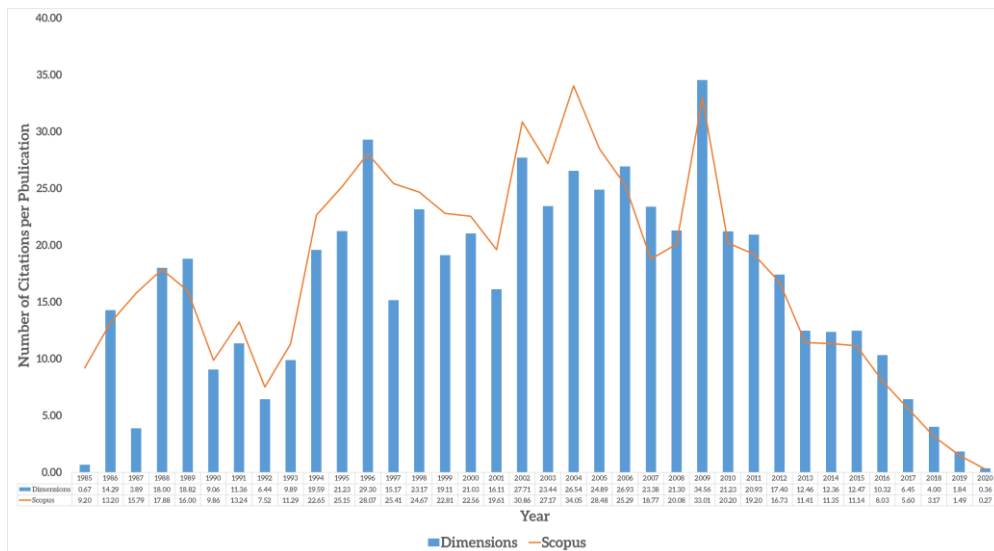


Figure 3. Number of citations per publication in Dimensions vs Scopus

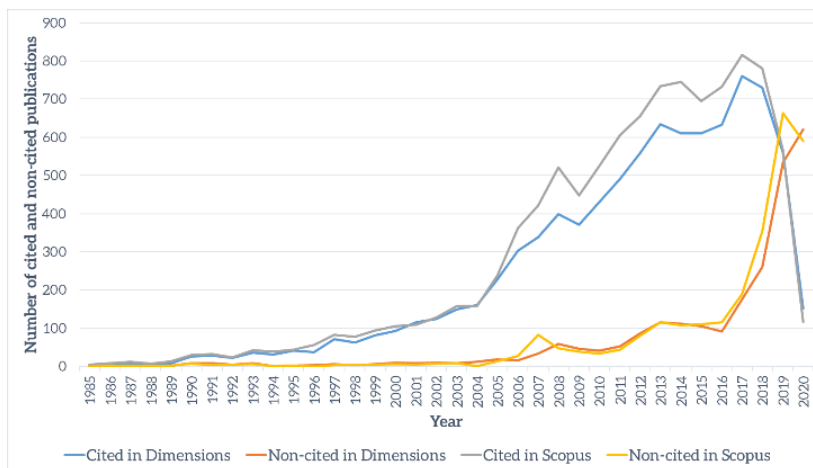


Figure 4. Number of cited and non-cited publications in Dimensions vs Scopus

Table 3. Number and percentage of cited and non-cited publications by scholars in Dimensions (1970-2020) and Scopus (1978-2020)

Dimensions (1970-2020)					Scopus (1978-2020)				
Year	Cited publication	% of the total publication	Non-cited publication	% of the total publication	Year	Cited publication	% of the total publication	Non-cited publication	% of the total publication
1970	0	0.00	1	100.00	1970	-	-	-	-
1971	0	0.00	0	0.00	1971	-	-	-	-
1972	0	0.00	0	0.00	1972	-	-	-	-
1973	1	100.00	0	0.00	1973	-	-	-	-
1974	0	0.00	0	0.00	1974	-	-	-	-
1975	0	0.00	0	0.00	1975	-	-	-	-
1976	0	0.00	0	0.00	1976	-	-	-	-
1977	0	0.00	0	0.00	1977	-	-	-	-
1978	2	100.00	0	0.00	1978	2	100.00	0	0.00
1979	0	0.00	0	0.00	1979	2	100.00	0	0.00
1980	7	100.00	0	0.00	1980	11	100.00	0	0.00
1981	1	100.00	0	0.00	1981	4	100.00	0	0.00
1982	3	75.00	1	25.00	1982	5	83.33	1	16.67
1983	1	50.00	1	50.00	1983	5	62.50	3	37.50
1984	0	0.00	0	0.00	1984	2	50.00	2	50.00
1985	2	66.67	1	33.33	1985	5	100.00	0	0.00
1986	6	85.71	1	14.29	1986	8	80.00	2	20.00
1987	8	88.89	1	11.11	1987	12	85.71	2	14.29
1988	6	85.71	1	14.29	1988	7	87.50	1	12.50
1989	9	81.82	2	18.18	1989	13	86.67	2	13.33
1990	26	74.29	9	25.71	1990	30	81.08	7	18.92
1991	28	77.78	8	22.22	1991	33	89.19	4	10.81
1992	22	81.48	5	18.52	1992	24	82.76	5	17.24
1993	36	80.00	9	20.00	1993	43	87.76	6	12.24
1994	31	96.88	1	3.13	1994	39	97.50	1	2.50
1995	41	95.35	2	4.65	1995	44	95.65	2	4.35
1996	37	92.50	3	7.50	1996	56	100.00	0	0.00
1997	72	92.31	6	7.69	1997	83	95.40	4	4.60
1998	62	93.94	4	6.06	1998	78	93.98	5	6.02
1999	82	93.18	6	6.82	1999	94	94.95	5	5.05
2000	93	90.29	10	9.71	2000	105	94.59	6	5.41
2001	115	93.50	8	6.50	2001	109	95.61	5	4.39
2002	124	92.54	10	7.46	2002	128	94.81	7	5.19
2003	149	94.90	8	5.10	2003	158	95.18	8	4.82
2004	161	93.06	12	6.94	2004	158	99.37	1	0.63
2005	228	92.31	19	7.69	2005	238	94.82	13	5.18
2006	303	94.98	16	5.02	2006	362	93.06	27	6.94
2007	338	90.86	34	9.14	2007	421	83.53	83	16.47
2008	399	87.12	59	12.88	2008	521	91.73	47	8.27
2009	371	88.97	46	11.03	2009	448	91.99	39	8.01
2010	430	91.30	41	8.70	2010	525	93.92	34	6.08
2011	491	90.42	52	9.58	2011	606	93.23	44	6.77
2012	559	86.67	86	13.33	2012	656	89.13	80	10.87
2013	635	84.67	115	15.33	2013	734	86.35	116	13.65
2014	610	84.49	112	15.51	2014	745	87.34	108	12.66
2015	610	85.20	106	14.80	2015	695	86.23	111	13.77
2016	633	87.31	92	12.69	2016	733	86.34	116	13.66
2017	760	81.20	176	18.80	2017	816	81.11	190	18.89
2018	730	73.74	260	26.26	2018	780	68.84	353	31.16
2019	560	51.19	534	48.81	2019	566	46.02	664	53.98
2020	152	19.69	620	80.31	2020	117	16.55	590	83.45
Total	8934	78.29	2478	21.71	Total	10221	79.14	2694	20.86

3.2. How much coverage is there between Dimensions and Scopus on articles with DOIs and citation data?

To assess the extent to which the Dimensions and Scopus coverage overlap, each scholarly document was classified in the three following categories: Dimensions only (educational documents that are indexed in Dimensions but not in Scopus), overlap (educational documents that are indexed in both Dimensions and Scopus), and Scopus only (educational documents that are indexed in Scopus but not in Dimensions). Figure 5(a) shows that out of the 12,915 documents displayed in Scopus, 1,559 (12.07%) were not covered in Dimensions. In contrast, 3,062 (26.83%) of the 11,412 documents were displayed in Dimensions but not covered in Scopus. Among these, 9,853 documents were covered in Dimensions and Scopus: 9,357 documents with a DOI-based match and 496 documents with a title-based match. In total,

3,062 documents were not covered by Dimensions. Among these, 1,043 were DOI-based matches, and 2,019 were title-based matches in Scopus.

Regarding these 1,559 documents, 1,500 documents were DOI-based matches, and 59 documents were title-based matches covered by Dimensions. Figure 5(b) shows that out of 168,082 citation counts in Scopus and 152,397 in Dimensions, 19,105 citation counts were not covered, and 13,236 citation counts were not covered in Scopus. Also, there was 148,977 coverage of citation counts in Scopus, and 139,161 coverage of citation counts in Dimensions in the two databases overlap.

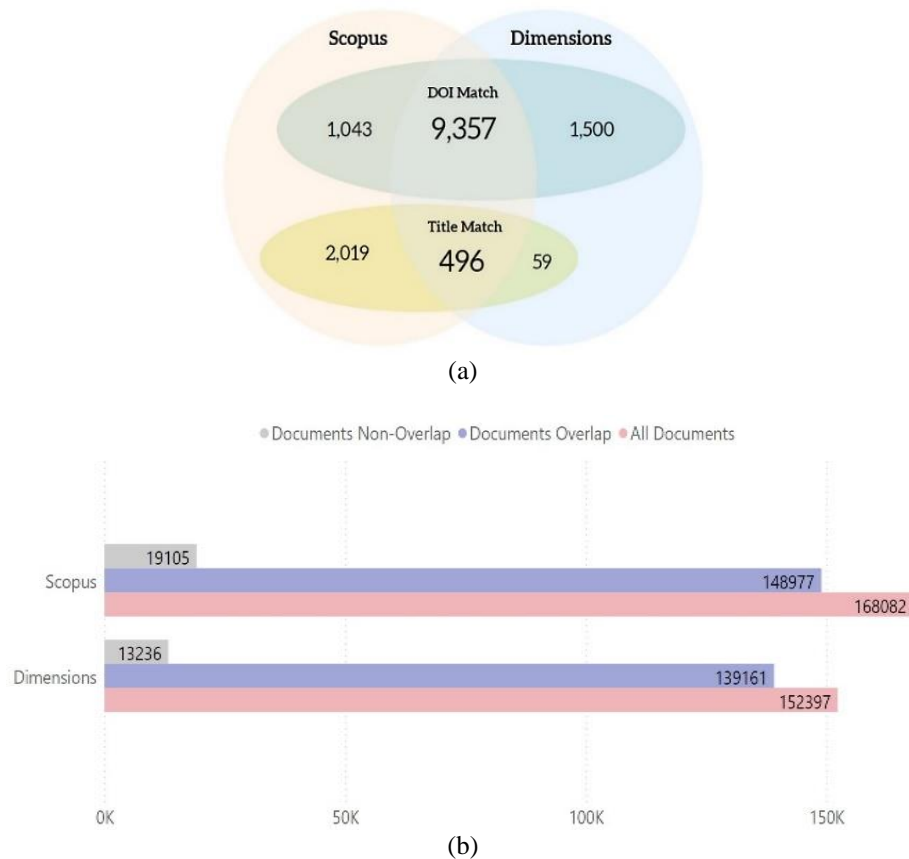


Figure 5. The number of coverages in Dimensions and Scopus by: (a) articles with DOIs, (b) articles with citation counts

Dimensions and Scopus's significant differences in coverage were found across the year publication as shown in Figure 6. More documents were missing from Dimensions than Scopus in the year 1985 (28.5% in Dimensions, 57.14% in Scopus), the year 1987 (6.67% in Dimensions, 40.0% in Scopus), the year 1996 (9.68% in Dimensions, 35.48% in Scopus) and the year 2007 (8.53% in Dimensions, and 32.49% in Scopus). Moreover, Dimensions seemed to be missing documents in 2006 (6.94%) and 2016 (8.51%). However, the coverage of these three years, i.e., the year 2020, the year 2004, and 2001 in Dimensions, seemed to be better (20.11%, 17.62%, and 17.99% missing documents, respectively). Additionally, from 1985 to 2020, the average percentage of document coverage overlap in Dimensions and Scopus was 66.8575%.

In Figure 7, for the number of citations counts in overlap documents, the percentage of average citation counts in Scopus was 44.05% (in light orange color). The average citation counts in Dimensions were 40.78% (light blue). These findings seemed that the percentage of citation counts coverage overlap in Scopus was much higher than Dimensions (3.27%). The percentages of citation count in Scopus were higher than Dimensions in the year 1985 (91.67%), the year 1987 (70.70%), and the year 1997 (25.84%) respectively (in dark orange color). The result showed that Dimensions seemed not to index impact articles highly. However, the differences in percentages of citation count in Dimensions were higher than Scopus during 2016 to 2020 with 4.59%, 4.36%, 3.20%, 2.39%, and 5.92%, respectively (in dark blue color). These findings displayed that Scopus seemed to missing index impact articles.



Figure 6. Document's coverage overlaps in Dimensions and Scopus by year publication

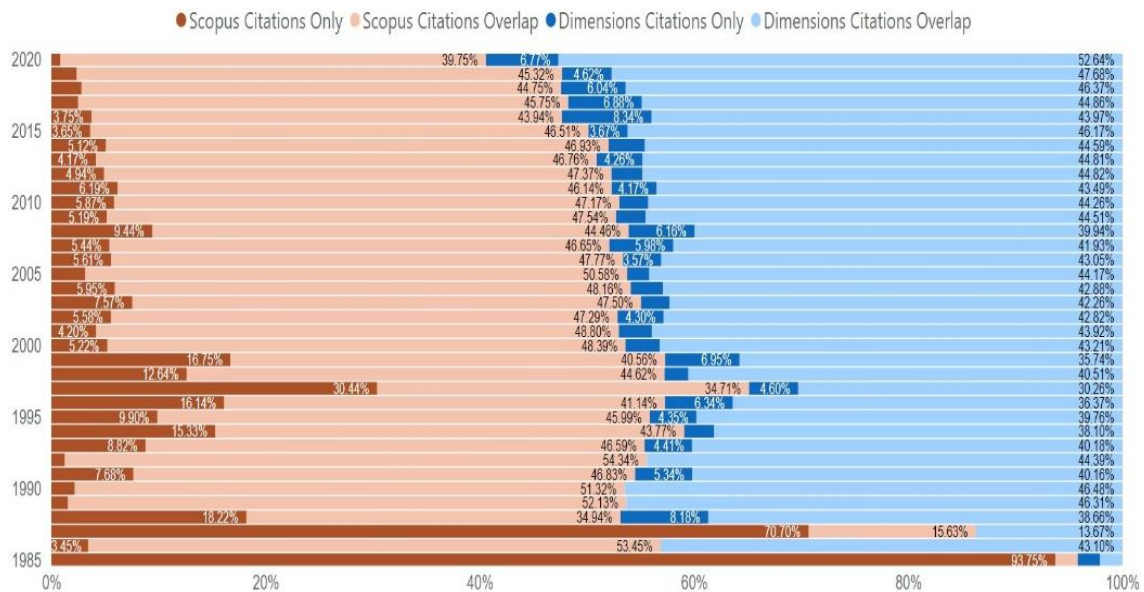


Figure 7. Citation counts coverage overlap in Dimensions and Scopus by year publication

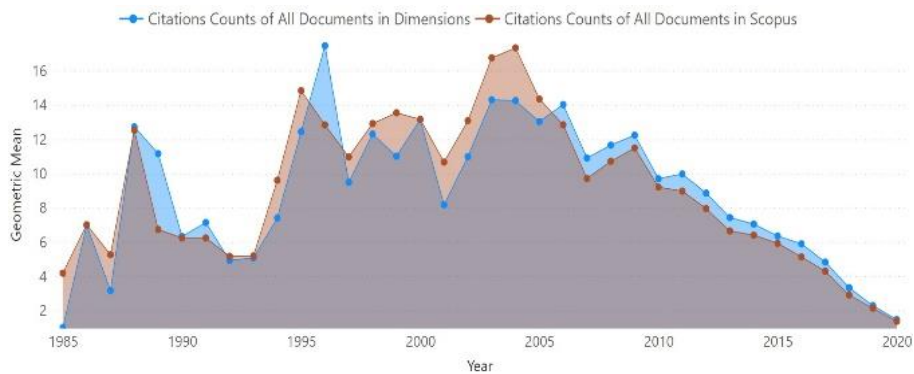
Among the causes of citation, documents were not covered in Dimensions and Scopus as shown in Table 4; the most frequent was that the journal where the documents were published was not covered in key term search (36.80%). 35.60% of the missing DOI documents in Dimensions did not index in Scopus, and 22.78% of the most DOI-based unmatched documents were found in Scopus but were not indexed in Dimensions. Documents were being indexed in journals, but coverage was missing from the database (2.87%) or the source title missing (3.33%). The findings found many articles in Dimensions for which there was no matching document in the matching procedure. Dimensions appear that any document published in a journal is classified as an article [32]. Scopus consistently contains more records and citations than Dimensions as documents are aggregated by institutional association [33]. Although Dimensions and Scopus contain errors such as duplicate documents and citations, incomplete and incorrect bibliographic information [9], [21], these issues do not seem to be a problem for this study because the authors justify dismissing citation counts as unreliable on account of the bibliographic errors present in Dimensions and Scopus.

Table 4. Causes of documents not being matched in Dimensions and Scopus

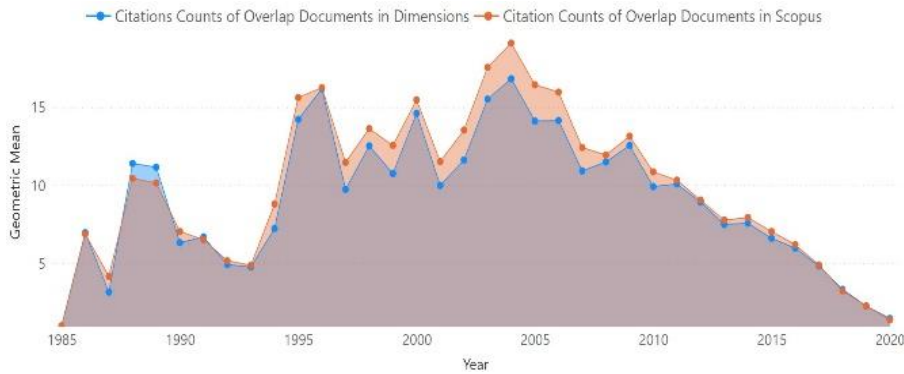
Causes	N	Examples of Journal	n	%
Search for organizational affiliation in Dimensions but found irrelevant data	7,410	The documents indexed in Critical Care in Dimensions	2,727	36.80
		The documents indexed in Tobacco Induced Diseases	964	13.00
The most DOI-based unmatched documents were found in Scopus but not indexed in Dimensions	2,019	Found in Songklanakarin Journal of Science and Technology	460	22.78
		Found in Journal of Medical Association of Thailand	222	11.00
Documents with no DOI-based match in Dimensions were not indexed in Scopus	59	Found in Journal of the Medical Association of Thailand (Chot Mai Het Thang Phaet)	21	35.60
		The Dimensions database did not cover documents	1,043	7.67
Documents were being indexed, but coverage was incomplete (some source title, volume, or issues were missing)	1,500	Found in ScienceAsia	67	6.42
		Found in Asian Social Science	57	5.47
		The source title was missing	50	3.33
		Found in ChemInform	43	2.87

3.3. Are there any meaningful relationships in the average citation counts for educational documents in Dimensions comparable to Scopus?

This section analyzed any relationships in the average citation counts of the 152,397 citation counts in Dimensions versus the 168,082 citation counts in Scopus, and the 139,161 citing documents match extracted from Dimensions and 148,977 citing documents match extracted from Scopus. Citation counts of Scopus documents are higher than citation counts in Dimensions as shown in Figure 8(a) and (b). The results showed that geometric mean citation counts are approximately the same as Scopus citation counts for Dimensions documents to answer this research question as shown in Figure 8(b).



(a)



(b)

Figure 8. Geometric mean scores of citations for Dimensions and Scopus for (a) all documents, (b) documents overlap

A similar linear increase in the coverage of citation counts in Dimensions comparable to those of Scopus. There is a remarkably high relationship between Dimensions and Scopus's citation counts for publications indexed in both. This study indicates that citation counts are closely related between Dimensions and Scopus, reflected in the respective scatterplots as shown in Figure 9.

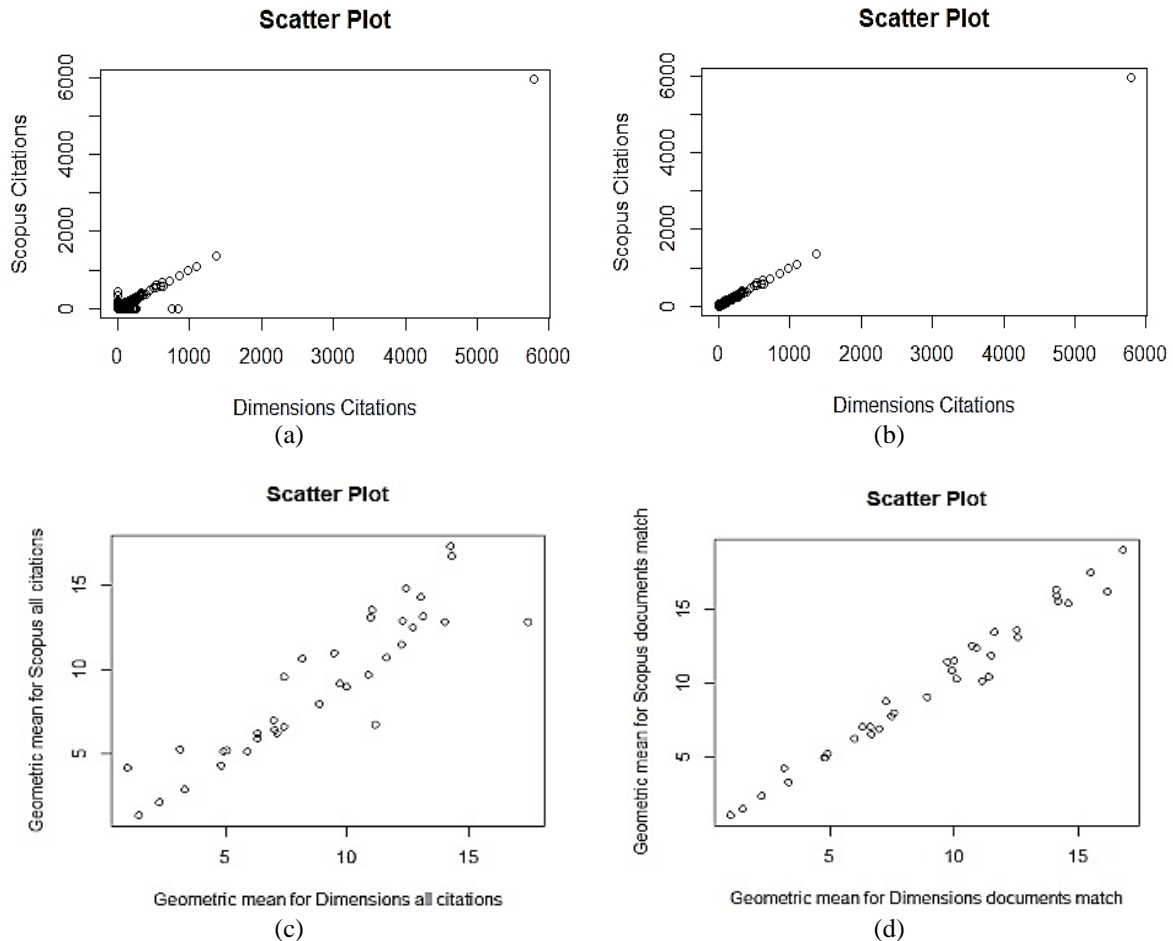


Figure 9. Scatter plot of (a) all Dimensions citations against Scopus citations, (b) the number of documents match by Dimensions against Scopus, (c) geometric mean citation counts of all documents in Dimensions against Scopus, and (d) geometric mean citation counts of documents match by Dimensions against Scopus

3.4. Are citation counts of scholarly documents in Dimensions interchangeable with Scopus in terms of having a too high correlation?

Spearman correlations between Dimensions and Scopus' citation counts ranged from 0.93 to 0.99 during 1986-2020 as shown in Table 5. The Spearman correlation coefficients are over 0.90 except one in 2020, which is 0.86. This study suggested that correlations between Dimensions and Scopus are strong. The weakest correlation is 0.86 in the year 2020, and the strongest is 0.99 over the past ten years, i.e., 2016, 2015, 2014, 2012, and 2011.

Figure 10 showed the correlation between the citation counts of scholars' documents in Dimensions and Scopus based on the Pearson correlation coefficient and the Spearman correlation coefficient. As shown in Figure 10(a), the correlation between Dimensions and Scopus document citation counts was 0.9985, and the correlation between Dimensions and Scopus geometric mean citation counts was 0.9768 as shown in Figure 10(b) based on the Spearman correlation coefficient at a significant 0.01 level. This correlation shows a positive relationship and a strong correlation between the two databases. This evidence corresponds to the results of other studies [7], [9], [13], [15], [29], [34]-[37]. These findings match the results found in [21]. It can be concluded that Dimension and Scopus are exchangeable as citation data sources in terms of coverage and citation counts [21].

Table 5. The correlation between the number of citations in Dimensions and Scopus is based on the Spearman correlation coefficient

Year	Spearman correlation coefficients*(r)	Geometric mean Dimensions	Geometric mean Scopus	Geometric mean of	
				■ Dimensions	■ Scopus
1986	0.941395052	6.97	6.87		
1987	0.93027147	3.16	4.17		
1988	0.994680977	11.40	10.44		
1989	0.97954658	11.16	10.15		
1990	0.976437981	6.33	7.04		
1991	0.988915792	6.69	6.52		
1992	0.960226722	4.92	5.17		
1993	0.97891264	4.77	4.88		
1994	0.998179446	7.23	8.80		
1995	0.991522684	14.21	15.62		
1996	0.982248558	16.18	16.25		
1997	0.980228722	9.74	11.47		
1998	0.980223286	12.53	13.63		
1999	0.983241177	10.75	12.56		
2000	0.989660197	14.60	15.47		
2001	0.991868361	9.99	11.52		
2002	0.998788446	11.62	13.53		
2003	0.986946466	15.52	17.55		
2004	0.991812391	16.82	19.10		
2005	0.991224402	14.12	16.44		
2006	0.994004436	14.15	15.96		
2007	0.996193088	10.92	12.42		
2008	0.99193793	11.49	11.94		
2009	0.999892631	12.56	13.14		
2010	0.9987192	9.92	10.86		
2011	0.997639859	10.08	10.33		
2012	0.997114912	8.92	9.05		
2013	0.983240018	7.49	7.77		
2014	0.998500317	7.58	7.93		
2015	0.998713079	6.61	7.04		
2016	0.992948008	5.97	6.20		
2017	0.973731637	4.84	4.89		
2018	0.980075241	3.33	3.24		
2019	0.980546973	2.27	2.27		
2020	0.861211192	1.47	1.39		

*Confidence level of Spearman correlations: 99%; p-values < 0.01

```

Pearson's product-moment correlation

data: DiSpMatched$`Dimensions Citations` and DiSpMatched$`Scopus Citations`
t = 1869.6, df = 9851, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.9985372 0.9986482
sample estimates:
      cor
0.9985938
    
```

(a)

```

Spearman's rank correlation rho

data: Geomean$`Geometric mean Dimensions (match)` and Geomean$`Geometric mean Scopus (match)`
s = 180, p-value < 2.2e-16
alternative hypothesis: true rho is not equal to 0
sample estimates:
      rho
0.976834
    
```

(b)

Figure 10. The correlation between the citation counts of scholars' documents in Dimensions and Scopus by: (a) the Pearson correlation coefficient, (b) the Spearman correlation coefficient

4. LIMITATIONS AND FURTHER RESEARCH

There are a few drawbacks to this research. First, the researchers used a strict and conservative matching technique to prevent false positives. A few articles are spelled differently in separate lists not captured by our matching protocol. Second, the research study focused exclusively on analyzing the coverage of two different databases in PSU research publications, and the analysis of other kinds of publications such

as books and conferences were not in the comparative scope. This study might be an interesting future work in analyzing how much books and conferences cover both databases. Also, the Web of Science was not part of the study. It can be taken as a work for the future [9]. Moreover, to make it more helpful to researchers for the importance of citations for the researchers' reputation, the interesting future work can be considered a motivation model for top-quality publications in [28], [27] as a new motivational driver in existing literature models.

This analysis created a portrait of Dimensions and Scopus journal coverage based on PSU's research productivity. According to the findings, Dimensions and Scopus' journal scope in the Humanities and Social Sciences is still very limited [9]. Further study should examine whether national publications that concentrate on local issues are well reflected in Dimensions and Scopus in the Humanities and Social Sciences. This research also focused on using specific data sources to solve citation-based ranking. This research could examine how bibliographic sources affect various performance evaluations, including citations as a performance metric.

University ranking is considered a measure of quality, effectiveness, and the universities' research performance [9], [38]. Further studies might need to compare citation data and the coverage of Dimensions and Scopus of a sample of scholars in different research fields. Additionally, future research scope might examine and compare samples from other institutions or other countries to a more accurate assessment of scholars' impact. Moreover, as the importance of citations for the researchers' reputations is one of the most important for researchers' future publishing [27], [28], future work might add a theoretical framework motivation model for top-quality publications to existing models to encourage researchers to publish high-quality journals.

5. CONCLUSION

As reflected in this study's results on the same population of documents, Scopus can recover several citations exceeding Dimensions. However, the number of citations per publication in Dimensions slightly higher than in Scopus. Also, the analysis was made on articles published by PSU researchers. In this sense, Scopus includes more scholars' publications than Dimensions in scopes of coverage and citation counts correlation. Based on citations per publication, the number of citations per publication in Scopus is 13.01, but it is 13.35 citations per publication for Dimensions. However, the findings show that the number of citations per publication decreases in Dimensions and Scopus from 2010 to 2020.

Regarding the percentage of cited publications in Table 3, about 79% of Scopus's total publications are cited, while this percentage in Dimensions is about 78%. It is noteworthy that, under review, the number of cited publications in Dimensions and Scopus has increased over the years. The number of non-cited publications is increasingly growing in both citation databases. The growth rate of scholars' publications in Dimensions is more than Scopus. The exponential regression test findings show a 15.32 % annual growth rate in Dimensions for scholars' publications and a 14.85% annual growth rate in Scopus. For this finding, a possible explanation could be that Dimensions covers substantially more publications than Scopus.

Although Dimensions has more excellent raw coverage of documents than Scopus, almost half of the Dimensions documents lack details on a country or institutional affiliation. Concerning findings in Table 4, although Dimensions and Scopus contain errors such as duplicate documents and citations and incomplete and incorrect bibliographic details, these problems do not seem to be a concern for this study because the authors justify dismissing citation counts as inaccurate due to the bibliographic errors found in Dimensions and Scopus.

The findings show that Dimensions and Scopus citation counts are significantly related, regardless of the difference in the number and average of citations. The results indicate that a positive correlation between the two citation databases is not entirely apart and has similarities. Spearman correlations between Dimensions and Scopus citation counts are robust. Thus, Dimensions seems to be substantially compatible with Scopus regarding coverage and citation counts.

Dimensions increase the number of citations per publication slightly higher Scopus (RQ1). The Dimensions scholarly database seems nearly equivalent to Scopus for citation analysis (RQ2). Moreover, Citation counts from scholarly database Dimensions correlate positively with Scopus (RQ3 and RQ4). Thus, using Dimensions and Scopus and other bibliographic tools helps researchers have a more complete and precise information retrieval and provides the possible grounds for doing a more comprehensive assessment of the quantity and quality of publications. Dimensions would be a helpful tool for researchers not to access expensive Scopus.

The number of publications and citation counts, Dimensions, and Scopus's use reveals a more comprehensive and the extent of the institution's scholarly productivity regarding the findings from the evaluation standpoint. This situation mainly affects Dimensions' possibilities as instruments for carrying out

bibliometric analyses at university members' research productivity. These considerations are highly pragmatic for knowledge collection and policy formulation to use scientific databases as part of research assessment.

This research might support the university libraries' services and increase universities' research productivity. Following are some recommendations that the universities can implement to increase the research productivity: i) to increase university awareness of ranking structures and the value of study performance and citations to achieve higher rankings, ii) educate the university community about the publications indexed by Scopus and Dimensions, which feed data into rating systems, in order to maximize the amount of research published in them, iii) rise researchers' understanding of Bibliometrics and Altmetrics, as well as their effect on increased citations, iv) provide free access to knowledge services, analysis methods, and data management for research, and v) encourage researchers to use their university affiliations to establish their Research Identities through several channels, such as ResearchGate, ORCID, and others. Both data sources have concerns with inconsistency and inaccuracy with prospective bibliometric studies. However, we hope that this analysis will further advance this method and this data in the future.




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