Impact of the scientific production of the Top 15 universities in Colombia

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Abstract.

Colombia ranks fifth in Latin America in scientific production, with a contribution of 0.24% of its GDP to research and development in 2019, much lower than the 0.71% of the Latin American average. Even so, this country has stood out in the last decade for the increase in its scientific production and improvements in its international positioning. The universities corresponding to the Top15 of the SIR2020 ranking are analyzed, using four scientometric indicators compiled from the SirIber 2020 report. There is a high correlation between International Collaboration (IC), Normalized Impact (NI), and High-quality publication (Q1). The Universidad Nacional de Colombia, Universidad de Antioquia, Universidad de Los Andes, and Pontificia Universidad Javeriana together account for 63% of the country's scientific production.

Keywords: universities, Colombia, SirIber, scientific impact, scientific impact, ranking.

I   Introduction

The scientific productivity of universities is measured mainly by the number of articles published in recognized scientific journals, and also the citations received on these articles [1][2][3][3][4]. In the case of Colombia, in the period 1996 to 2019, it ranks 49th worldwide with 114495 documents indexed in the Scopus database, representing 0.2% of the world production in that period [5], with a GDP investment for research and development of 0.24%, which is very low considering that the Latin American regional average is 0.71% [6].

University research has been measured in recent years through university positioning rankings, which classify universities by their academic and research quality [7][8], through scientific production indicators, which positively impact the prestige of the institutions [7]. The current importance of quality scientific production and its impact is currently highly valued by universities, as a factor of recognition and international positioning in global rankings and as a component in institutional accreditation systems [9], which in the case of Colombia is governed by the Ministry of Science and Technology (formerly known as Colciencias) [10][11]. This is why the positioning of universities is part of the strategies defined for

them to be internationally recognized for their academic and research quality.

This paper describes the performance of Colombian universities positioned in the first fifteen positions (Top50) of the SIR 2020 Ranking [12] concerning the impact of their scientific production (output) and its impact through the analysis of three scientometric indicators contained in SirIber 2020 [13], reporting an evaluation of the performance of universities in the five years from 2014 to 2018, both years inclusive. This report is an annual publication made by Scimago, based on the articles indexed in Scopus® considering a five-year study period.

2   Methodology

For the year 2020, Colombia has 36 institutions listed by Scimago Institutions Ranking (SIR) [12] at the international level. To perform this descriptive analysis of the impact of Colombian universities, those that are positioned in the Top15 Colombia of SIR2020 (Table 1) are compiled, then the indicators to be used are described in Table 2, corresponding to the SIRiber 2020 report (Table 3), which presents scientometric indicators from 2014 to 2018, by country and by the university.

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Table 1. Colombian Universities in the Top15 of SIR 2020.

| SIR2020 | SIR IBER 2020 | | | | |
	IBE	LAC	COL	ACRONYM	University
1	32	14	1	UNAL	Universidad Nacional de Colombia
2	68	34	2	UdeA	Universidad de Antioquia
3	114	62	4	PONTIFICIA	Pontificia Universidad Javeriana
4	81	43	3	UNIANDES	Universidad de los Andes
5	166	105	7	UROSARIO	Universidad del Rosario
6	347	259	30	UT	Universidad del Tolima
7	228	154	12	UAN	Universidad Antonio Nariño
8	262	184	18	UCALDAS	Universidad de Caldas
9	130	74	5	UNIVALLE	Universidad del Valle
10	283	203	20	UNBOSQUE	Universidad El Bosque
11	150	91	6	UIS	Universidad Industrial de Santander
12	242	168	15	UNISABANA	Universidad de La Sabana
13	206	135	9	UNINORTE	Universidad del Norte
14	226	152	11	UNICARTAGENA	Universidad de Cartagena
14	338	251	28	USTA	Universidad Santo Tomas
15	295	214	23	CUC	Universidad de la Costa
15	419	328	39	UDES	Universidad de Satander

Table 2. Innovation and scientometric indicators.

Label	Indicator	Description
IC	International collaboration	Percentage of an institution's production where the institutional affiliation of the authors corresponds to different institutions and at least one of them is from a different country. This indicator shows the capacity of an institution to create scientific collaboration networks.
Q1	High-quality publications	Percentage of an institution's papers published in journals that rank in the top 25% of each knowledge category. It is considered a reflection of the institutional capacity to achieve a high expected level of impact.
Ni	Standardized impact	This indicator reflects the impact of the knowledge generated by an institution on the international scientific community. It takes as its central point the world average impact (value 1). Thus, if an institution has an NI of 0.8, it means that its production is cited 20% below the world average.

Source: Scimago SirIber2020 [13].

3   Results

3.1   Performance of universities concerning scientometric indicators

The performance of the universities that make up the Top 15 of the SIR 2020 is described, showing the values of the scientometric indicators collected for the selected universities (Table 3) and the characterization clusters, considering the volume of published documents (output), classified in four quartiles (Table 4)).

Table 3. Scientometric Data of the Universities positioned in the TOP15 of SIR 2020

SIR2020	SIrIber2020	ACRONYM	Output	IC	Ni	Q1
1	1	UNAL	10937	40,46	0,45	26,95
2	2	UdeA	5541	44,7	0,51	33,95
3	4	PONTIFICIA	3166	49,37	0,48	29,44
4	3	UNIANDES	4603	60,33	0,71	47,27
5	7	UROSARIO	1717	47,23	0,6	40,59
6	30	UT	487	47,23	0,46	29,16
7	12	UAN	1038	76,11	0,79	59,44
8	18	UCALDAS	814	35,75	0,37	20,64
9	5	UNIVALLE	2638	47,31	0,47	31,65
10	20	UNBOSQUE	706	48,44	0,57	34,84

11	6	UIS	2064	49,09	0,54	26,11
12	15	UNISABANA	946	34,88	0,45	23,04
13	9	UNINORTE	1256	50,08	0,55	29,78
14	11	UNICARTAGENA	1052	35,74	0,37	22,15
14	28	USTA	505	43,37	0,55	18,42
15	23	CUC	656	51,83	0,66	19,21
15	39	UDES	302	55,63	0,45	35,76

Table 4. Clusters by percentages of the volume of articles published by Colombian universities according to SIRiber2020

by output			Published articles				
Cluster		Universities	Average	Min	Maximum	Total	%
Q1	>3000	4	6062	3166	10937	4416	11%
Q1	<3000 y >1000	6	1628	1038	2638	9765	25%
Q3	<1000	7	631	302	946	24247	63%

Universidad Nacional de Colombia, Universidad de Antioquia, Universidad de Los Andes, Pontificia Universidad Javeriana group together 63% of the scientific production of this group of universities (Table 4). On the other hand, it is observed that there is a high correlation between International Collaboration (IC), Normalized Impact (NI), and High-Quality publication (Q1). Likewise, this group of universities exhibits a high correlation between NI and Q1. The volume of publications (output) does not correlate significantly with the rest of the indicators. Fig. 4 shows the relationship of the indicators, it is observed that the Universidad Antonio Nariño (UAN) and the Universidad de Los Andes (UNIANDES) present the highest values of the indicators, and among them, they present the highest impact of their scientific production for citations, publications of excellence, and international contribution.

Correlations

		IC	Ni	Output	Q1
IC	Pearson Correlation	1	,830	-,105	,824
	Sig. (2-tailed)		,000	,687	,000
	N	17	17	17	17
Ni	Pearson Correlation	,830	1	-,057	,677
	Sig. (2-tailed)	,000		,828	,003
	N	17	17	17	17
Output	Pearson Correlation	-,105	-,057	1	,085
	Sig. (2-tailed)	,687	,828		,746
	N	17	17	17	17
Q1	Pearson Correlation	,824	,677	,085	1
	Sig. (2-tailed)	,000	,003	,746	
	N	17	17	17	17

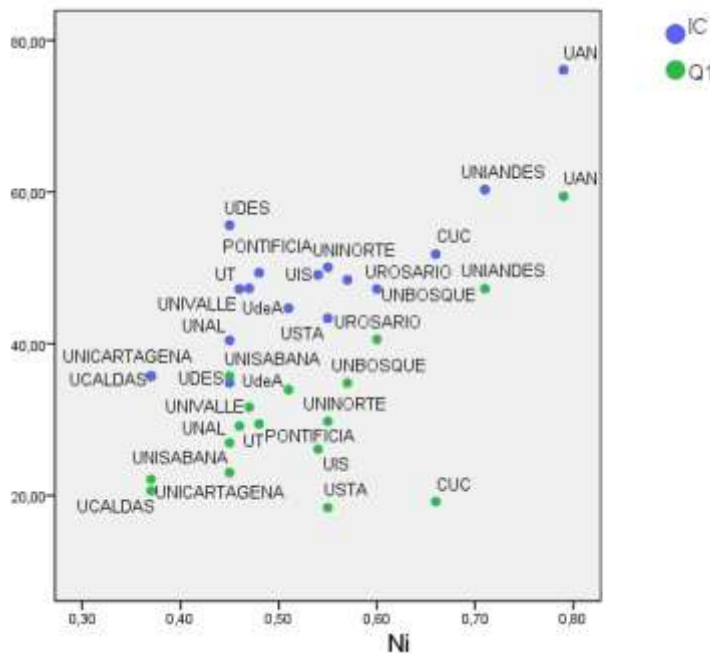Figure 1. Correlation between indicators

Figure 4. Relation of Indicators: Neither with CI, Q1 for the universities in the study.

4   Conclusions

A descriptive study of the performance of Colombian universities positioned in the Top 15 of the Scimago Institutions Rank (SIR), for scientific production, and four (4) scientometric indicators collected from the SIRiber 2020 report that reports the evaluation of institutions in the five years from 2014 to 2018, based on the publications indexed in Scopus®. The scientometric indicators for the study are total publications (Output), (IC) International Collaboration, (Q1) High-Quality Publications, and (NI) Normalized Impact of citations. Universidad Nacional de Colombia, Universidad de Antioquia, Universidad de Los Andes,

Pontificia Universidad Javeriana group between them 63% of the scientific production. A high correlation is found between International Collaboration (IC), Normalized Impact (NI), and High-Quality Publications (Q1).

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