

Evolution Of Scientific Production In Engineering In Latin America

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Abstract

This paper describes the performance of 13 Latin American countries regarding scientific production in the area of engineering for the period 2010 to 2019. Through a quantitative descriptive analysis, data collected from the public databases of Scimago SJR and the World Bank are analyzed. Two groups of countries are identified, where Brazil, Mexico, Colombia, Chile, and Argentina, register 50% of the publications.

Keywords: scientific production, engineering, universities, Latin America.

I Introduction

Latin America and the Caribbean (LAC) region have shown lethargy in some indicators, such as patent production, investment in research and development, involvement of the private sector in innovative practices, availability of scientists and researchers, leadership in scientific disciplines, so the region is distant from the world map [1]. The state and progress of science in Latin America are not satisfactory, so it is necessary to explore the overview of the current state of science in the region, compare it with others, and review its potential [2].

According to data published in SJR Scimago during the period 1996 to 2019, publications in the engineering sector in the region represented 12% of the scientific production in Latin America and 0.45% worldwide [3].

However, scientific production has increased in quantity, partly thanks to the management of

academic knowledge and the challenge of improving the quality and impact of the research carried out, so it is important to direct investment policies in science and technology towards applied research, to address problems associated with the challenges of sustainable development and the transformation of society [4][5][6].

Latin American scientific production is dominated by Brazil, Argentina, Mexico, and Chile, the latter having the highest proportion of publications per capita concerning the number of inhabitants[7][8]; however, as of 2019, Latin American universities represent 8% of those positioned in the SIR Scimago world ranking [9], which deserves to be analyzed to identify opportunities for improvement.

This paper aims to explore and describe the scientific production in the area of engineering in Latin America, for this purpose, the publication of articles in this area in 13 countries from 2010 to 2019 is explored.

2 Methodology

This is a descriptive study, using quantitative data analysis. 13 Latin American countries were selected

(Table 1) and their data were compiled to the indicators described in Table 1 2.

Table 1. Latin American countries' data for the study.

Country	Country	Population	Universities
México	MEX	126190788	1176
Brazil	BRA	209469333	1369
Argentina	ARG	44494502	116
Panamá	PAN	4176873	28
Costa Rica	CRI	4999441	59
Chile	CHL	18729160	139
Colombia	COL	49648685	283
Ecuador	ECU	17084357	62
Uruguay	URY	3449299	40
Peru	PER	31989256	175
Guatemala	GTM	17247807	20
Paraguay	PRY	6956071	39
Venezuela	VEN	28870195	65

Table 2. Description of Indicators.

Label	Indicator	Description and source	Year
ArticlesIng	Number of articles in Engineering	Engineering articles published by country in journals indexed in Scopus. Source: Scimago (SJR)(2020) [3].	2010-2019
Universities	Number of Latin American Latin American Universities	Universities by country reported in the Webometrics University Web Ranking. Source: Consejo Superior de Investigaciones Científicas (CSIC)(2020) [10].	2020
Population	Total Population	La población total se basa en la definición de facto de la población, que cuenta a todos los residentes independientemente de su estatus legal o de su ciudadanía. Fuente: Banco Mundial (2018) [11]	2018

3 Results

During the period from 2010 to 2019, Brazil holds the leadership in publications of articles in Engineering with 50% of them, followed mainly by Mexico (21%), Colombia (10%), Chile (8%), and Argentina (7%) (Fig. 1). The chronology of publications for these countries is shown in Figure 2 and Figure 3, where the annual increases of Brazil in

the first figure, and Peru and Ecuador in the second figure stand out. However, in relative and absolute percentage terms, these performances are shown in Figure 4. Table 2 presents the data calculated for each country concerning the total number of publications during the period, the percentage of representation, the increases observed in the period 2010 to 2019, and finally the documents published

and universities per million inhabitants to make the comparison regardless of the size of the country.

Table 2. Engineering scientific production data for the period 2010 to 2019.

Country	Total papers 2010 al 2018	%	Difference 2010 - 2019	% Increase	Documents per Million population	Universities per Millon population
Argentina	10671	6,4%	57	6%	240	3
Brazil	83113	49,6%	4586	75%	397	7
Chile	12815	7,6%	1113	131%	684	7
Colombia	16052	9,6%	1516	175%	323	6
Costa Rica	735	0,4%	91	364%	147	12
Ecuador	3592	2,1%	884	3048%	210	4
Guatemala	83	0,0%	15	500%	5	1
Mexico	33919	20,2%	1232	43%	269	9
Panama	362	0,2%	99	825%	87	7
Peru	2557	1,5%	697	801%	80	5
Paraguay	245	0,1%	57	1425%	35	6
Uruguay	1227	0,7%	69	74%	356	12
Venezuela	2182	1,3%	-159	-55%	76	2
	167553	100%				

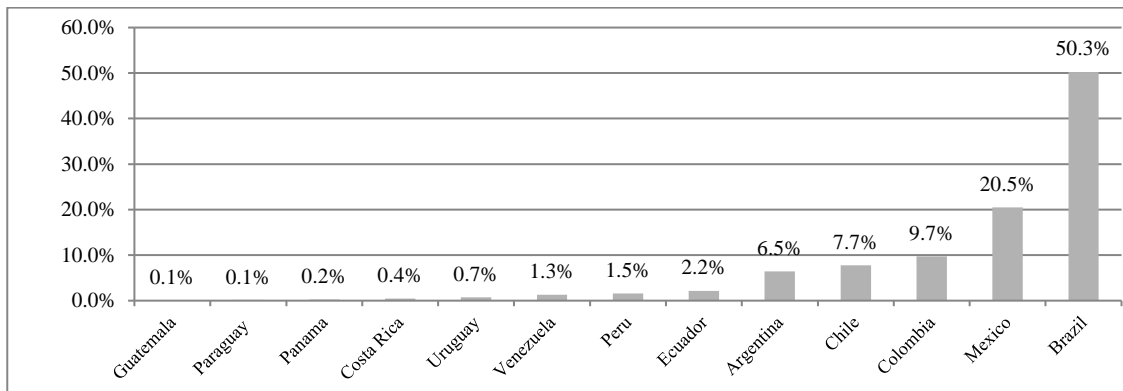


Figure 1. Total number of articles published in Engineering from 2010 to 2019 in Latin American countries.

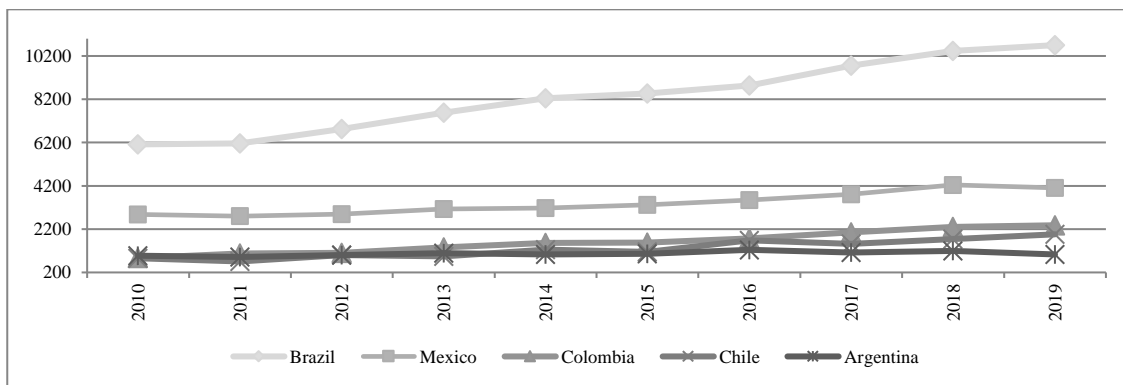


Figure 2. By year, during the period 2010-2019, articles published in Engineering in Brazil, Mexico, Colombia, Colombia, Chile, and Argentina.

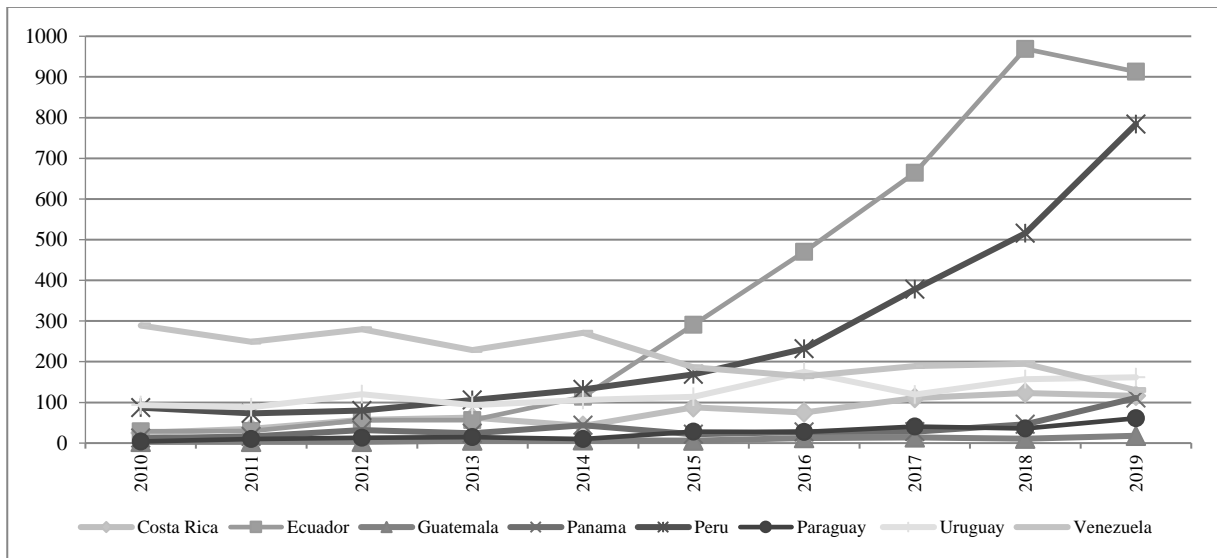


Figure 3. By year, during the period 2010-2019, articles published in Engineering in Costa Rica, Ecuador, Guatemala, Panama, Peru, Paraguay, Uruguay, and Venezuela.

Figure 4 shows that in percentage terms, Ecuador shows an extraordinary increase of 3000% with 884 articles, followed by Paraguay (1425%, 57 articles), Panama (825%, 88 articles), and Peru (801%, articles). In absolute numbers, Brazil ranks first with 4586 additional papers, representing a 75% increase, followed by Colombia (1516 articles, 175%), Mexico (1232 articles, 43%), and Chile (1113 articles, 131%).

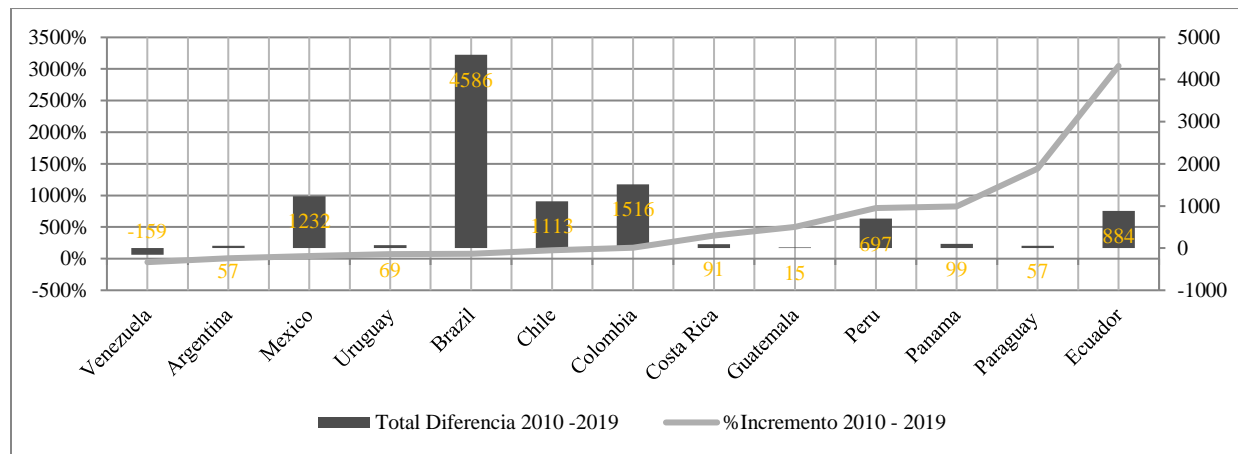


Figure 4. Percentage and absolute increase in the number of articles published in the area of engineering from 2010 to 2019, by country.

Finally, it is worth noting the change in the behavior of the indicators when measured per million inhabitants, to normalize them and make fair comparisons between countries with large volumes of published documents and others with lower scientific production (Figure 5).

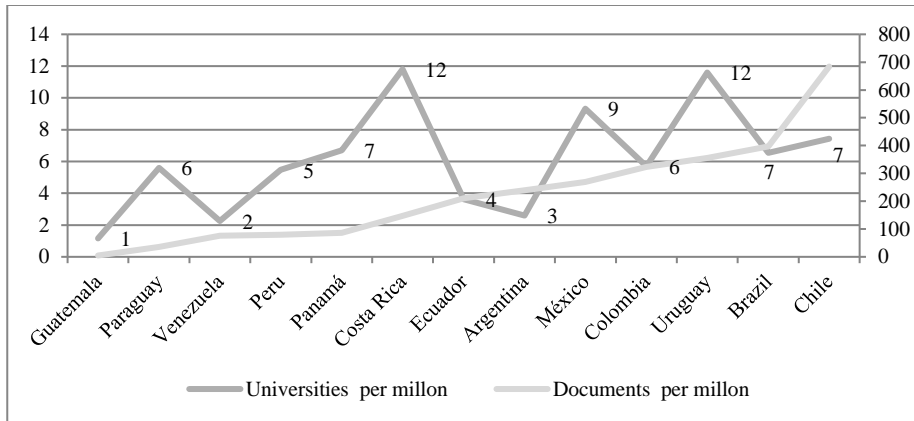


Figure 5. Ratio of universities to published papers per million inhabitants.

4 Conclusions

Engineering publications represent 12.33% of the publications in Latin America during the period 1996 - 2019. This paper explores and describes the performance of the countries regarding the evolution of their scientific production in this sector during the period from 2010 to 2019. Two groups of countries are observed, the first one formed by Brazil, Mexico, Colombia, Chile, and Argentina, where Brazil registers 50% of the publications. The second group is made up of Guatemala, Paraguay, Panama, Costa Rica, Uruguay, Venezuela, Peru, and Ecuador, which together contribute 7% of the publications in the engineering sector.

The indicators reviewed, when calculated per million inhabitants, allow comparisons to be made independently of the size of the country, finding that Chile, Brazil, Uruguay, and Colombia have the best performance regarding their scientific production in engineering.

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