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Approach to Citation Determinants of Articles from Colombian Engineering Journals in Scopus

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Abstract

The present text offers the results of an ordinary least squares (OLS) regression model that relates the number of citations of articles published in Colombian engineering journals in the Scopus database (Dyna; Engineering and Research; Engineering and University; and Faculty of Engineering Journal) to the following variables: journal, article, authors and affiliation. The model results show that the following variables are citation determinants: number of references, publication year, publication in Dyna and use of English as publication language or not. The following variables are not significant: abstract word count, total page count, number of authors, affiliation with universities with a greater research output and affiliation with an Anglophone country.

Keywords: Bibliometrics, citation determinants, Colombian journals and engineering articles

1 Introduction

The citation of articles has become an indicator of research quality used by institutions and researchers. In general, the academic community believes that cited articles create knowledge and thus have a scientific impact [1]. However, the literature on citation determinants is in its early stages, and although some common elements have been identified, there is still no consensus on the issue [2, 3, 4].

Different empirical papers agree on four groups of particularly significant variables among citation determinants: i) the journal in which the article is published, ii) the article, iii) the author or group of authors and iv) affiliation (origin) by institution and country. Based on these variables, we can develop our understanding of why some research circles outperform others and how we can facilitate scientific publishing structures with a greater long-term impact [2, 4].

The literature also reveals differences in determinants according to field of study and the database used as a source for articles. For example, a set of texts was published in 1990 in the following journals: Management Science, Journal of the Operational Research Society, European Journal of Operational Research (EJORS), Operations Research, Decision Science and Omega. A correlation was identified between citation and journal relevance, article length, number of references, the author's university of origin's ranking in the Times Higher Education Supplement (THE) and type of text (e.g., book review, article, technical notes, letters) [5].

A Google Scholar search for EconLit texts by French professors published between 1969 and 2008 resulted in the following citation determinants: author's age, author's gender, size of the author's team and size of the author's network [6]. For finance texts, it was found that articles involving econometrics or that were published in certain journals have a greater number of citations [7]. In medicine, in addition to the number of authors and journal rankings, a global research scope and working group are determinants [8].

The literature also suggests that although issues such as citation concentration (e.g., by author, journal or country) and the relevance of a text being written in English affect citation, there are differences in the weight and significance of variables such as author collaboration (size of network, number of articles written by the same team) for articles written in the northern or southern hemisphere [9].

In Colombian engineering research between 1997 and 2009, a previous work on the web of science concludes that i) there is a concentration of articles in Dyna, Faculty of Engineering Journal, and Engineering and Research Journal; ii) the majority of articles published in Latin American journals, but not Colombian journals, are written in English; and iii) the National and Antioquia Universities stand out as article producers, but these universities do not have the highest number of citations [10].

The present text explores the citation determinants for Colombian engineering journals available on Scopus: Dyna, Engineering and Research, Engineering and University and Faculty of Engineering Journal from 2008-2017. For this purpose, a linear regression model is developed with the following explanatory variables: number of authors, number of references, abstract word count, total page count, Anglophone-country affiliation, affiliation with universities that have a greater publication output, language of article and journal of origin.

2 Methods

The model suggests that a set of variables can explain the citation of an article. For the articles in Colombian engineering journals available the Scopus database, the following explanatory variables were selected according to the literature [11, 12, 13, 4] (See Table 1):

TABLE I. Explanatory variables in the model

Variable Group	Variable	Type	Values
Journal	Journal Name	Dichotomy for each of the four journals	0: does not meet 1: meets
Article	Summary word count	Continuous	Positive
	Number of references	Continuous	Positive
	Total article pages	Continuous	Positive
	Language of the article	Dichotomy for article in English	0: does not meet 1: meets
	Publication year	Continuous	Positive between 2008 and 2017
Authors	Number of authors	Continuous	Positive
Affiliation	Affiliation with high-producing universities	Dichotomous	0: does not meet 1: meets
	Affiliation with Anglophone country	Dichotomous	0: does not meet 1: meets

3 Data

The study consists of 2,471 articles from the following journals: Dyna, Engineering and Research of the National University of Colombia, Engineering and University of the Pontifical Xaverian University and the Faculty of Engineering Journal of the University of Antioquia. The articles were published between 2008 and 20171 and appear in the Scopus database. Out of the 2,471 articles, 1,046 (42%) had obtained

[1] The dates correspond to journals available on the Scopus database; in other words, this period covers all the articles published since the journal was made available on the database.

at least one citation by the date of search. Dyna had the highest number of articles published (1186; 48%) and cited (575; 55%), and 2011 was the year of greatest production (345, 14%) and the greatest number of articles with at least one citation (172, 16%) (See Table 2).

TABLE II. General description of the study

	DYNA		**Engineering and Research**		**Engineering and University**		**Faculty of Engineering Journal**		**TOTAL**	
Year	**N. Art**	**N. art with citation**	**N. Art**	**N. art with citation**	**N. Art**	**N. art with citation**	**N. Art**	**N. art with citation**	**N. Art**	**N. art with citation**
2008	66	39			12	3	54	27	132	69
2009	105	72	59	36	19	6	77	37	260	151
2010	110	68	64	23	14	9	113	45	301	145
2011	140	76	83	50	27	10	95	36	345	172
2012	155	96	45	28	24	6	61	15	285	145
2013	120	78	35	19	24	7	65	22	244	126
2014	189	96	42	20	21	5	80	25	332	146
2015	180	42	57	18	21	3	70	18	328	81
2016	121	8	41	1	18	1	58	1	238	11
2017					6				6	
Total	1186	575	426	195	186	50	673	226	2471	1046

4 Result

The OLS model for number of citations includes the following independent and explanatory variables: number of authors, number of references, abstract word count, total page count, affiliation with an Anglophone country, written in English, affiliation with higher-producing universities, publication year and journal of origin. The model results in an overall and individual significance of 95% for number of references, publication year, published in Dyna and written in English.
The following variables contribute directly to citation: number of references, written in English and published in Dyna; publication year was inversely related. Individually, the variables with the greatest contribution, in order, are published in Dyna (0.546), written in English (0.355) and publication year (-0.229). In other words, the most cited articles come from Dyna, are written in English and are the oldest. In contrast, abstract word count, total page count, number of authors, affiliation with higher-producing universities and affiliation with an Anglophone country are not significant (See Table III).

TABLE III. Model results; author's calculations

				R2	*0.117*
				F	*28.962*
				P significance	*0.000*
Variables	***β***	***Standard error***	***β standardized***	***T***	***P significance***
(Constant)	460.953	31.890		14.455	0.000
Dyna	0.546	0.094	0.169	5.806	0.000
n_authors	0.022	0.025	0.017	0.878	0.380
n_references	0.015	0.002	0.124	6.058	0.000
p_abstract	0.001	0.001	0.030	1.499	0.134
n_pages	0.001	0.013	0.001	0.043	0.966
c_anglophone	-0.170	0.148	-0.022	-1.146	0.252
art_english	0.355	0.076	0.110	4.681	0.000
top_universi	0.012	0.069	0.004	0.180	0.857
year	-0.229	0.016	-0.342	-14.433	0.000
E&U	-0.230	0.203	-0.037	-1.137	0.255
EFJ	-0.091	0.110	-0.025	-0.833	0.405

5 Discussion

The low explanatory power of the model (R2 = 0.117) raises the possibility of exploring other possible determinants [14], areas of study and forms of modeling. For example, author reputation, article topics, the generalizability of the writing or the time between publication and the first citation might be explored as determinants. In terms of area of study, the results suggest that high-citation articles do not have the same dynamics as those with low citation rates. Moreover, there are significant differences in citation determinants according to an article's country of origin [2, 14]. It is also possible to explore modeling for stochastic processes.

Dyna is the second oldest Colombian journal in Scopus. It was created in 1933 in the School of Mines at the National University of Colombia, established in 1886 and widely recognized in Colombia. With three to six publications per year, Dyna published the most articles for the period of study. It is also the journal with the highest ranking in Scopus: Q2 in 2012, 2013 and 2015. These characteristics could explain why publication in this journal is a citation determinant.

In terms of obsolescence, citations of the articles are not yet declining (i.e., the square of publishing age is not significant), which suggests that the studied articles are still in a phase of increasing citation and that future possibilities for citation exist. This result fits well with the conventional 10-year timeline for the obsolescence of scientific research [15]. Nevertheless, this hypothesis cannot be corroborated until 2027.

The results highlight the insignificance of author networks and university of origin, which shows that authors with a history of publishing in certain journals do not

necessarily have more citations. Likewise [10], for the study population, articles by authors affiliated with the most productive universities (Universities: National, Antioquia, Valle and Industrial of Santander) do not necessarily receive more citations.
Contrary to some proposals [10] and to the belief that publishing in English and Spanish in reference journals will increase visibility and citation, it is important that an article be published in English but not in both languages. For the articles in Colombian engineering journals available on Scopus, bilingual publishing was not a citation determinant.

6 Conclusion

This descriptive analysis of 2,471 articles published in Colombian engineering journals that are available on Scopus (Dyna, Engineering and Research, Engineering & University Journal and Faculty of Engineering Journal) shows that i) the majority of published (42%) and cited (55%) articles come from Dyna; ii) articles are published in English (49%), Spanish (47%) and both Spanish and English (4%); (iii) most articles are written by groups of authors (95%); iv) university affiliation is concentrated in four universities: National, Antioquia, Valle and Industrial of Santander (35%); and v) 42% of the published articles were cited at least once.
The following variables are significant for the citation of articles published by the journals Dyna, Engineering and Research, Engineering and University and Faculty of Engineering Journal: number of references, year of publication, published in Dyna and written in English. The following variables are not significant: abstract word count, total page count, number of authors, affiliation with universities with the highest output and affiliation with an Anglophone country.

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