



ORIGINAL

How much does a citation cost? A case study based on CONICET's budget

¿Cuánto cuesta una cita? estudio de caso basado en el presupuesto de CONICET

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ABSTRACT

Introduction: CONICET has been fundamental in the training of a large number of researchers and the promotion of science in Argentine society.

Objective: describe the relative cost per published article and citation received for articles published by authors affiliated with CONICET.

Methods: a bibliometric study was carried out in which the scientific production of CONICET was analyzed in the Scopus database and the CONICET budget from 2016 to 2021.

Results: a decrease in the CONICET budget was observed, only recovering in the last year but without reaching the historical maximum studied. On the other hand, as previously mentioned, it was commented that the citations decreased despite the increase in the number of articles. Faced with this panorama, the theoretical cost of an article and that of a bibliographical citation can be presented. So, for example, for the year 2021, the cost of publishing an article was 41014,09 USD, and the cost of a citation was 9442,77 USD.

Conclusions: we cannot minimize the budgetary expenses of a government institution of thousands of workers to simple final products that are articles when in between are the expenses of salaries, awareness campaigns, building construction and its maintenance or things that have nothing to do with it. With science (or yes) how to pay the water bill of an institute; but if we can get closer to a theoretical cost of the articles and citations produced by Argentine scientists.

Keywords: Scientific Production; Bibliometrics; Production Indicators; CONICET; Argentina.

RESUMEN

Introducción: el CONICET ha sido fundamental en la formación de una gran cantidad de investigadores y en la promoción de la ciencia en la sociedad argentina.

Objetivo: describir el costo relativo por artículo publicado y por cita recibida a artículos publicados por autores afiliados al CONICET.

Métodos: se realizó un estudio bibliométrico en el que se analizó la producción científica de CONICET en la base de datos de Scopus, y el presupuesto del CONICET en el periodo de 2016 a 2021.

Resultados: se observó una disminución el presupuesto de CONICET solo recuperándose en el último año pero sin llegar al máximo histórico estudiado. Por otra parte, y ya anteriormente mencionado se comentó que a pesar de aumentar el número de artículos disminuyen las citaciones. Frente a este panorama se puede presentar el coste teórico de un artículo y el de una cita bibliográfica. Así pues, por ejemplo, para el año 2021 el coste de publicar un artículo fue de \$ 41014,09 USD y el coste de una cita \$ 9442,77 USD.

Conclusiones: no podemos minimizar los gastos presupuestarios de una institución gubernamental de miles de trabajadores a simples productos finales que son los artículos cuando de por medio están los gastos de sueldos, campañas de concientización, construcciones edilicias y su mantenimiento o cosas que nada tienen que ver con la ciencia (o sí) como pagar la factura del agua de un instituto; pero si lograr acercarnos a un

costo teórico de los artículos y citas que producen los científicos argentinos.

Palabras clave: Producción Científica; Bibliometría; Indicadores de Producción; CONICET; Argentina.

INTRODUCTION

In the academic world, scientific articles and their citations are important research productivity and impact measures. Given that an article is worth as much as the journal in which it is published, it would go without saying that researchers seek to publish in journals with a high impact factor. Publishing in these Q1 journals does not guarantee citations. Still, it is understandable that, due to their prestige and indexing, they have very high visibility and, therefore, more opportunities for an article published there to be cited.⁽¹⁾

Although the aforementioned is important to assess science's quality, this generates negative consequences. Although scientific fraud is considered an exception and not the rule among the National Council for Scientific and Technical Research scientists, scandals due to allegations of unethical conduct have shaken the engine of Argentine science.^(2,3) In the midst of a world that criticizes but lives to the rhythm imposed by the "Publish or perish" mandate, scandals of more significant proportions appear, such as the factories of "made in China" items.⁽⁴⁾

The importance given to scientific articles as a measure of the productivity of the scientist/public works and the need to publish to remain in the academic position has been taken advantage of by publishers, creating a highly lucrative publishing economy around this phenomenon. High-impact factor journals charge exorbitant fees to authors for the privilege of publishing in them. Therefore, the payment of the APC (cost per publication or editorial charge) subtracts researchers from their budget to purchase supplies and equipment.

Through the body governing Argentine science, the State grants funds (PICT: Scientific and Technological Research Projects)⁽⁵⁾ that are delivered to researchers who compete so that their projects are financed. Then these researchers become seasoned accountants who manage this money to "turn it into science." The objective of creating CONICET was to promote the country's scientific and technological development and coordinate the research activities carried out by scientific and technical institutions.⁽⁶⁾ This institution has carried out significant research in molecular biology, theoretical physics, chemistry, archeology and social sciences, among other disciplines. It has also been fundamental in training a large number of researchers and promoting science in Argentine society. However, behind these seemingly impressive achievements is a complex system that involves financial and time costs.

In this context, this question arises: How much does it cost CONICET to receive a citation in its scientific publications, and how much does it cost to publish a scientific article?

METHODS

A bibliometric study was carried out in which the scientific production of CONICET was analyzed in the Scopus database provided by the profile in SciVal. The scientific output was analyzed by identifying the number of publications and citations per year, among others.

The budgetary amounts of said institution and those that it delivers to researchers (PICT) were investigated. An attempt was made to calculate the actual dollar value awarded to researchers who win a PICT, and these theoretically cover the article's publication.

Because laboratory supplies and equipment are marketed in US dollars USD, it was necessary to investigate the historical value of the same, obtained through the information provided by the Central Bank of the Argentine Republic to establish comparisons.

The information was processed and organized with Microsoft Excel. The times selected for the analysis vary between 2016 and 2021. The applicable ethical and legal regulations for data management in research have been followed.

RESULTS

Overview of CONICET's scientific production

Table 1 shows that the total number of articles increased compared to the previous year, but the citations and the index of citations per article decreased. Another index that marks a negative course is the decrease in the impact of weighted citations by field. This indicator adjusts the number of citations a publication receives by the number of citations expected for similar publications in the same field, allowing a fairer comparison of the impact of research in different areas.

It could be affirmed that the percentages of international and academic-business collaboration remain practically unchanged in these years.

Table 1. CONICET bibliometric indicators (2016-2021)

Bibliometric indicator	2016	2017	2018	2019	2020	2021
Total number of articles	7586	8270	8802	8844	9892	10159
Citations	139865	134337	121138	95081	76955	44125
Citation impact weighted by field	1	0,98	0,97	0,9	0,89	0,89
Citation impact weighted by field (published in the top 10% of most cited journals)	8,6	7,9	7,9	7,6	7,2	6,9
Percentage of articles published in the top 10% of most cited journals.	30	29,5	28	28	26,3	24,7
Citations per article	18,4	16,2	13,8	10,8	7,8	4,3
International collaboration (%)	42	41,2	41,6	43,2	44,2	46,4
Academic-business collaboration (%)	1,5	1,2	1,3	1,6	1,3	1,6

Source: SciVal

“How much does it count to publish science?”

Table 2 shows that the budget amounts for each year have been increasing consecutively. This response to the devaluation of the Argentine peso requires larger budgets to be granted to exceed the purchasing power of the amount granted the previous year. For this reason, it is considered necessary to calculate the equivalencies to US dollars to appreciate and compare over the years.

We observe that CONICET's budget has decreased, only recovering in the last year but without reaching the historical maximum studied.

On the other hand, as previously mentioned, it was commented that the citations decreased despite the increase in the number of articles.

Faced with this panorama, the theoretical cost of an article and that of a bibliographical citation can be presented. So, for example, for the year 2021, the cost of publishing an article was 41014,09 USD, and the cost of a citation was 9442,77 USD.

Table 2. Cost per article and bibliographic citation

Indicator/Year	2016	2017	2018	2019	2020	2021
Total number of articles	7586	8270	8802	8844	9892	10159
Citations	139865	134337	121138	95081	76955	44125
CONICET Budget (\$ARS)	8818379497	11247757975	13581029087	18442177143	24507996877	41409963518
CONICET Budget (\$USD)	592433960	641629091	471154521	361292529	319718177	416662107
Cost per paper (\$ARS)	1162454,46	1360067,47	1542948,09	2085275,57	2477557,31	4076185,01
Cost per citation (\$ARS)	63049,22	83727,92	112112,05	193962,80	318471,79	938469,43
Official dollar average	14,89	17,53	28,83	51,05	76,66	99,39
Cost per document (\$USD)	78095,70	77585,14	53528,12	40851,71	32320,88	41014,09
Cost per appointment (\$USD)	4235,76	4776,26	3889,40	3799,84	4154,61	9442,77

Sources: SciVal, Banco Central de la República Argentina (BCRA)⁽⁷⁾, and CONICET official website.⁽⁸⁾

*The average cost of the official dollar was obtained by taking the figures for the first business day of said year and the first business day of the following year and averaging.

For table 3's preparation, in addition to investigating and using the average value of the official dollar (the solution used for its calculation is explained at the bottom of table 2), we present the amounts corresponding to the PICT of each year investigated. The value corresponds to those type A projects that do not request scholarships in all areas except economic sciences, social sciences and humanities. Of these mentioned areas, the amounts are even lower. It is important to clarify that this budget is not delivered over three years. Hence, the researcher receives a third of the total budget per year, and this is not adjusted for inflation, so a decrease against the dollar standard must be appreciated.

It can be seen in the table that the actual amount of the subsidies granted is less and less. The amounts delivered in pesos are not adjusted for inflation.

Table 3. Budget in dollars received by researchers financed by CONICET through the PICTs

Year	PICT Amount	Amount per year	Amount year 1	Amount year 2	Amount year 3	Final amount	Average amount
	\$ARS	\$ARS	\$USD	\$USD	\$USD	\$USD	per year
2016 ⁽⁹⁾	960000	320000	21498	18254	11101	50854	16951
2017 ⁽¹⁰⁾	1140000	380000	21677	13183	7444	42305	14102
2018 ⁽¹¹⁾	1380000	460000	15958	9012	6001	30971	10324
2019 ⁽¹²⁾	1950000	650000	12734	8480	6540	27754	9251
2020 ⁽¹³⁾	3249000	1083000	14128	10897	7366	32391	10797
2021 ^{*(14)}	3520000	880000	8854	5985	¿?	¿?	¿?

Source: National Agency for the Promotion of Research, Technological Development and Innovation.⁽¹⁵⁾

*The PICT 2021 will be delivered in four years.⁽¹⁴⁾ In addition, the future values of the dollar are unknown, so we only calculate up to the one delivered in 2022.

DISCUSSION

According to figures reported by Miguel et al.⁽¹⁶⁾, Argentina already had 8619 articles in Scopus in 2008 and 11041 by 2012. It should be mentioned that these figures correspond to all of the science in the country where a significant and dominant actor is CONICET. Still, these numbers and those presented by CONICET in the period studied do not show significant increases and a slight upward trend.

The fewer citations per year that decrease as we approach more current dates responds to the fact that these last articles have not had the time to be consulted and cited than the rest. It should be noted that the number of published articles has increased slightly and could respond to the fact that more is being published or to the increase in human capital that has a history of publication before joining CONICET.

The cost per article and publication should be mentioned that it is a theoretical value. Now, we must interpret each of these values separately. In the case of the cost of citations, as the years go by, more articles are cited, and it could be said that the citation becomes cheaper since the budget amount is the same and the citations increase. However, the number of articles per year does not change, nor does the annual budget mentioned above; therefore, this is a better indicator.

It can be seen that the “investment” of 78095 USD per document in 2016 went from 41014 USD in 2021. This decrease is not because more is published with less money. Despite having increased the number of articles, there is no doubt that the budget allocated in 2021 is not equal to that of 2016. This shows the budget cut that Argentine science has suffered.

Pitta⁽¹⁷⁾ mentions in her book that researchers enter the institution, and the investment is not proportional, so the same amounts must be distributed among more researchers. This, together with the drop in the currency's purchasing power and the fact that subsidies to science are not adjusted for inflation, means that the amounts agreed to be delivered have a lower value each year.

FINAL CONSIDERATIONS

Indeed, we cannot minimize the budgetary expenses of a government institution of thousands of workers to simple final products that are articles when in between are the costs of salaries, awareness campaigns, building construction and its maintenance or things that have nothing to do with it. See with science (or yes) how to pay the water bill of an institute, but if we can get closer to a theoretical cost of the articles and citations produced by Argentine scientists.

Under pain of being criticized, the author considers that when we write an article, we rarely notice from which quartile the citation we will use comes whenever it supports what we assert; as long as Scopus or PubMed comes, they “guarantee their quality”. Thus, what is the advantage of publishing in a Q1 over a Q4 journal when both are in the same databases? Why does CONICET pressure about publishing “hard sciences” articles in Q1 journals?

The PICTs are not the only sources of national research funding, and many researchers draw up international collaboration ties as strategies, lowering research costs. But CONICET's budget is one, and it has wanted to reflect the theoretical value of citations and publications. What is certain is that this subsidy is not enough to pay a theoretical value of an item.

We could do the exercise where we would conclude that a researcher who won a PICT in 2020 could only afford a third of the theoretical value of an article each year of work.

Finally, the author calls for a civilized dialogue and reflection on the financial costs that generate stress and emotional exhaustion in researchers swept away by the wave of “publish or perish” in the face of a sea of ethical scandals. Let us open the dialogue for the necessary support of CONICET and the science it generates.

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Conceptualization: Javier González-Argote.

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Methodology: Javier González-Argote.

Formal analysis: Javier González-Argote.

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