

## Sci Bytes @ SciSTIP Nr 2 (June 2018)

### How well is South African science doing?

When assessing the performance of any national science system one needs to be clear about the “performance criteria” as well as the underlying data that are being used in such an assessment.

As far as the underlying data are concerned, we use the <sup>CA</sup>Web of Science database<sup>1</sup> and confine our assessment to South Africa’s publications in two categories: ‘articles’ and ‘review articles’. This means that we exclude documents such as books, book chapters and conference proceedings in our counts.

We assess South Africa’s bibliometric performance according to three indicators: *Publication output*, *International collaboration* and *Citation visibility or impact*. We have selected these three indicators as they are conventionally used in bibliometric analyses and do capture some of the most important aspects of scientific production. However, it is also important to emphasize that they do not capture other important dimensions of scientific performance. Dimensions, such as the relevance and quality of a country’s science, the degree to which science impacts on society and the profile of the human resource base of scientific production (to name three only) are not addressed in this communication.

### SA’s publication output over the past seventeen years has increased significantly

South Africa’s publication output in the Web of Science has increased from 3 668 publications in 2000 to 15 550 in 2016 (Figure 1). This increase translates into an average annual growth rate of 2,9%. Figure 1 also shows that South Africa’s share of world output more than doubled from 0.4% in 2000 to 0.91% in 2016. Not surprisingly, these results have translated in an improved position when comparing SA with other countries. As far as country rank is concerned, South Africa has improved its ranking in the world (from position number 34 in 2000 to 28 in 2016) (Figure 2).

Sci Bytes @ SciSTIP is a new information series produced by SciSTIP. Its aim is to disseminate on a regular basis brief reports about some aspect of the science and innovation system in South Africa. The aim is to inform and share knowledge produced by SciSTIP. The “bytes” are written in a non-technical style. Every issue of Sci Bytes will be structured in the form of a main question (with some elaboration). This series also forms part of SciSTIP’s science engagement strategy. We want to invite anyone to send us any suggestions for topics/questions that you would want us to address in future issues. You can send the emails to Johann Mouton at [jm6@sun.ac.za](mailto:jm6@sun.ac.za)

<sup>1</sup> The <sup>CA</sup>Web of Science (WoS) database consists of a number of collections. In our counting we confine ourselves to the Web of Science Core Collection which consists of three Citation Databases: the Science Citation Index Expanded (SCI), the Social Sciences Citation Index (SSCI) and the Arts and Humanities Citation Index (AHCI). The current version of the WoS has two precursors: it was originally established as the ISI-database (referring the Institute for Scientific Information established by Eugene Garfield). In 2005 ISI was acquired by Thomson Reuters (TR). In 2015 Clarivate Analytics bought out the Web of Science. The correct current reference, therefore, is to refer to the database as the <sup>CA</sup>Web of Science. .

Figure 1 below shows the trend in the production of scientific papers for South Africa over the past 17 years.

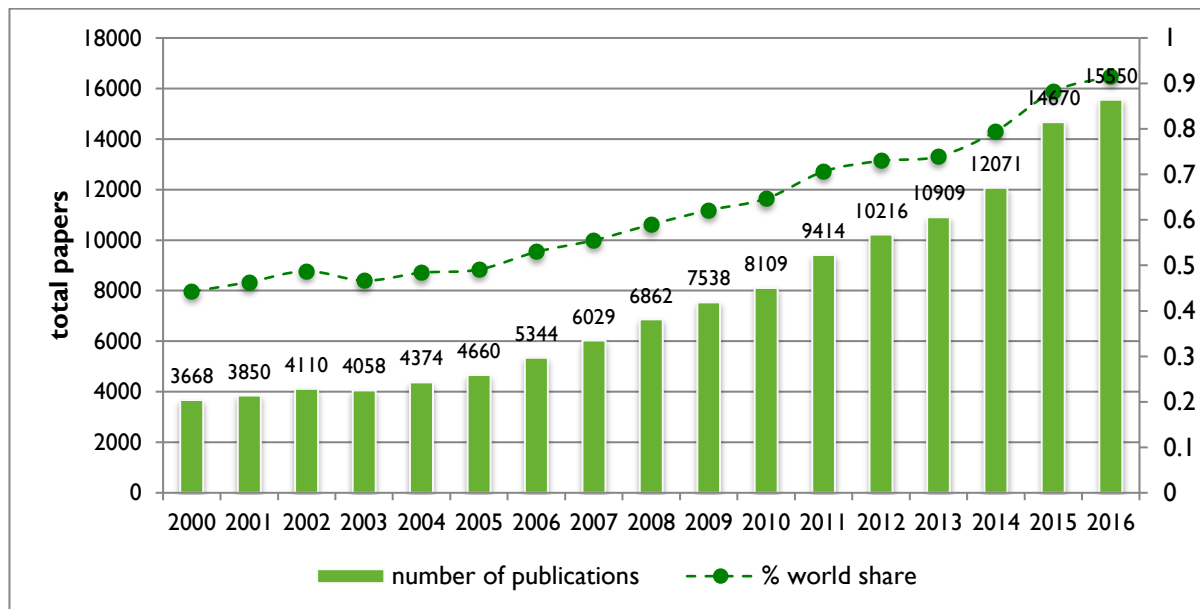


Figure 1: SA’s publication output and world share (2000 – 2016)

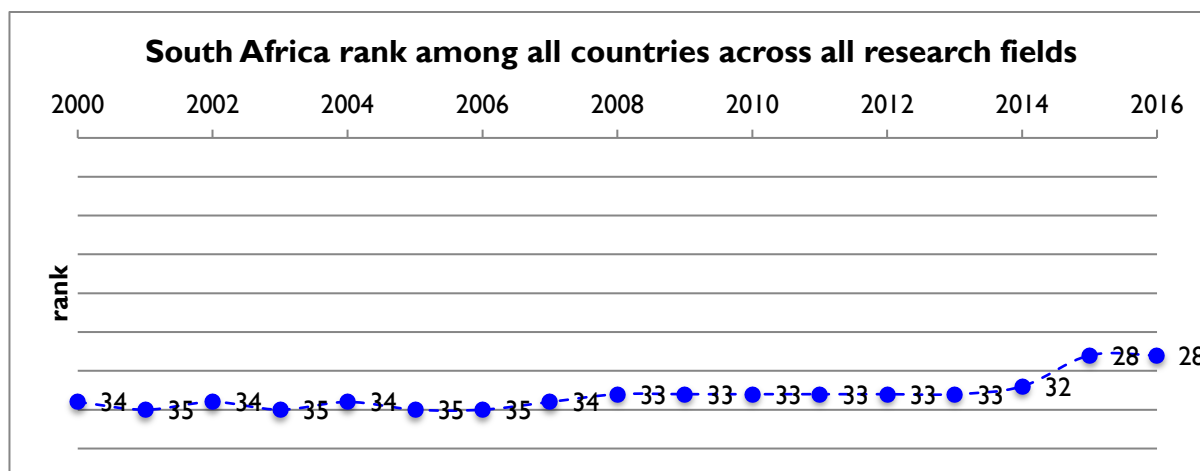


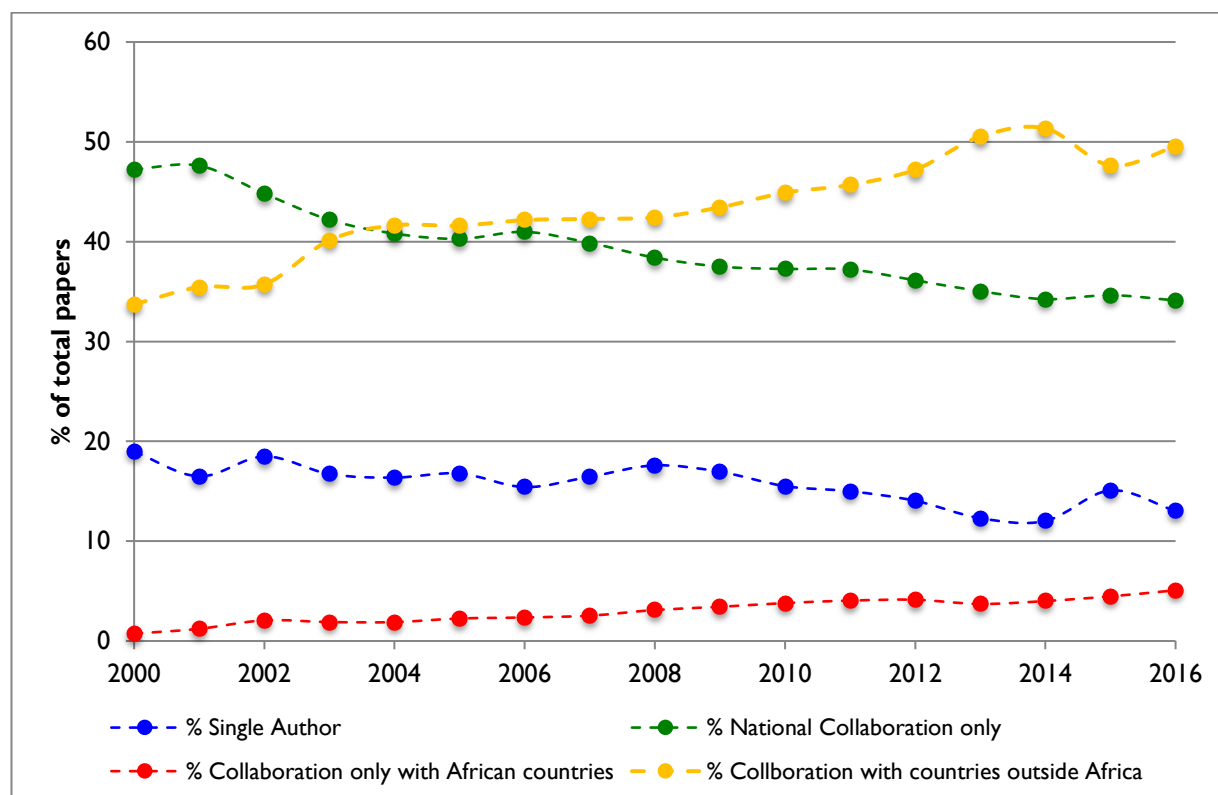
Figure 2: SA’s rank amongst all countries (2000 – 2016)

### South African scientists collaborate significantly more with scientists and scholars internationally than before

It is standard bibliometric practice to measure research collaboration by looking at patterns of co-authorship in scientific papers. We have followed the same practice here and specifically distinguished between four categories of collaboration:

- No collaboration (either single authored articles or single institution authorship)
- National collaboration (multiple authors from more than one institution in South Africa)
- International collaboration with scientists from African countries only
- International collaboration with scientists from countries outside of Africa

The results (Figure 3) show a clear trend towards more international collaboration. This in itself is a desirable development as increased international collaboration often translates in higher citation impact, increases in networks and access to more funding opportunities. In 2000, about a third of SA's papers involved co-authorship with at least one foreign author. By 2016 this proportion has increased to 50%. The increase in international collaboration has occurred at the 'expense' of national collaboration (which declined from 47% to 34% over the same period) as well as a clear decline in single-authored publications. There is a small, but steady, trend of increasing collaboration with scientists and scholars in the rest of Africa: this proportion increased from a near zero-base in 2000 to 5% in 2016.



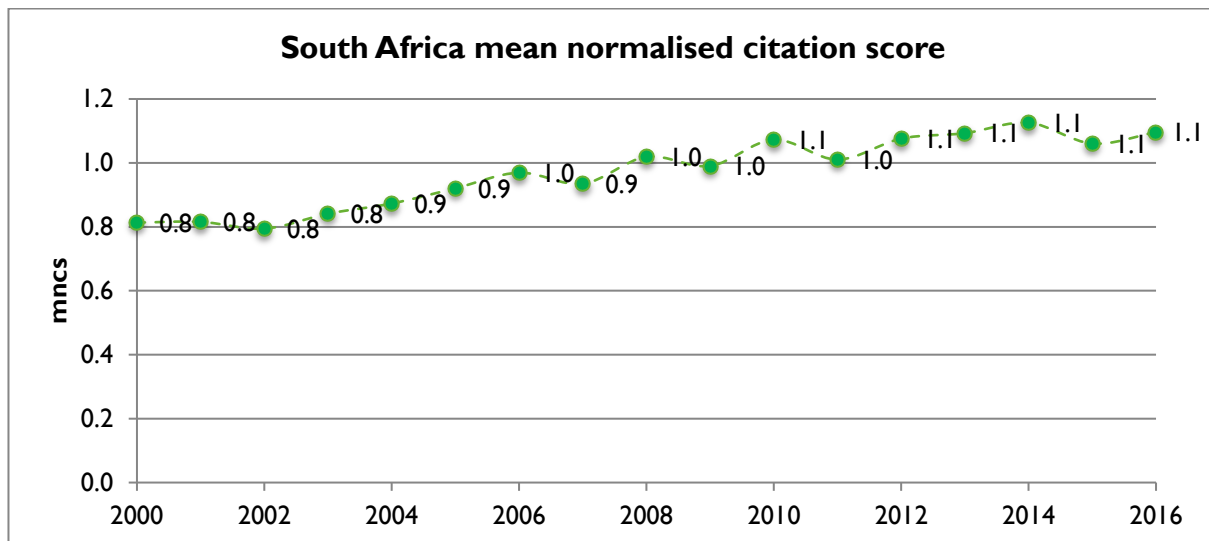
**Figure 3:** SA's collaboration profile (2000 – 2016)

The growth in South Africa's publication output has taken place at the same time as we have seen an increase in the visibility of our scientific papers

An increase in scientific output does not necessarily imply that such output is recognised by other scientists working in the same fields. So we also asked the question whether the substantial growth in SA's production of scientific papers translated in an increased visibility amongst scientists.

The visibility of science is partially captured by looking at the number of times research publications are referenced ('cited') in the publications of other researchers. But citation practices differ vastly across different scientific fields. This means that one needs to apply appropriate normalize procedures in such analyses in order to make comparative assessments. <sup>2</sup>

<sup>2</sup> In order to 'normalise' for the differences in citation practice across different scientific fields, we follow standard normalisation procedures. We first calculate the normalised citation score (*ncs*) for every publication, so called for being normalised by field and year.  $ncs = 1$  indicates that the publication has received the number of citations expected for a publication in its field and year. Since the *ncs* is comparable across (sub-)fields and years, we can take the mean of these scores for a set of publications, hence the mean normalised citation score (*mncs*).



**Figure 4:** The citation impact of SA’s publications (2000 – 2016)

The results of our citation analyses, using the mncs score, are presented in figure 4. These analyses show that the citation impact of SA’s scientific papers has increased steadily from 0,8 in 2000 to 1,1 in 2016. This is a very positive result as a score of above 1 means that SA’s papers are on average being cited slightly higher than all the papers in the fields that we publish.

### So how well is South African science doing?

The answer: Very well! South Africa’s performance in terms of publication output, international collaboration and citation impact has improved significantly over the past 17 years

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