



# A farewell to the MNCS and like size-independent indicators



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## ARTICLE INFO

### Article history:

Available online 25 April 2016

### Keywords:

Research evaluation  
Productivity  
Bibliometrics  
FSS  
University rankings

## ABSTRACT

The arguments presented demonstrate that the Mean Normalized Citation Score (MNCS) and other size-independent indicators based on the ratio to publications are not indicators of research performance. The article provides examples of the distortions when rankings by MNCS are compared to those based on indicators of productivity. The authors propose recommendations for the scientometric community to switch to ranking by research efficiency, instead of MNCS and other size-independent indicators.

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## 1. Introduction

While it may be debatable whether it was Albert Einstein or William Cameron that coined the saying, ‘*Not everything that can be counted counts, and not everything that counts can be counted*’, no one doubts its pertinence and extraordinary popularity in the field of scientometrics. Our contention is that all size-independent indicators based on the ratio to publications, such as the Mean Normalized Citation Score (MNCS) and the rankings derived at any levels, in fact barely ‘count’. Or what is worse, they may indeed count—but in the negative sense of leading to wrong decisions and policy.

The continuing drive for evidence-based decisions and policy-making in research systems has brought about a fervid search for what are justifiably hoped to be more precise, robust and reliable performance indicators and evaluation methods. Thus in recent years we have seen a proliferation of new indicators and variants or extensions of already famous ones, in particular the *h*-index (Hirsch, 2005). Bibliometricians are now running out of alphabet and subscript characters to name all the new indicators/variants. The drawbacks of the *h*-index have been discussed extensively in the literature, and there have been numerous attempts to overcome them through *h*-variants (Alonso, Cabrerizo, Herrera-Viedma, & Herrera, 2009; Egghe, 2010; Norris & Oppenheim, 2010). Instead, very little attention has been devoted to the validity of the CPP/FCSm or “old” crown indicator proposed by Leiden’s CWTS (Moed, De Bruin, & Van Leeuwen, 1995; Van Raan, 2005), the MNCS or “new” crown indicator (Waltman, Van Eck, Van Leeuwen, Visser, & Van Raan, 2011), and all other size-independent indicators based on the ratio to publications. Apart from our own works (Abramo & D'Angelo, 2014, 2013), we find only one other study in the literature (Danell, 2013) expressing doubts about the validity of the MNCS and highly-cited articles out of total

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publications as indicators of performance. In this paper we focus on the MNCS and other like indicators, based on the ratio to publications. Its aim is to make it conclusively clear that these indicators are not at all indicators of research performance, and are not worthy of further use or attention.

## 2. The fallacy of the MNCS as indicator of performance

Several years ago in this same journal, we witnessed the tit for tat argument on the statistical normalization of the crown indicator between Opthof and Leydesdorff (2010) (Leydesdorff & Opthof, 2011) and the bibliometricians from the CWTS group (Van Raan, Van Leeuwen, Visser, Van Eck, & Waltman, 2010; Waltman et al., 2011). Other scholars joined the debate (Larivière & Gingras, 2011; Moed, 2010; Vinkler, 2012), and the argument ultimately led to a new definition of the crown indicator, the MNCS (Waltman et al., 2011).<sup>1</sup> Several more scientometricians have assumed the validity of size-independent indicators based on the ratio to publications in their works: Aksnes, Rørstad, Piro, and Sivertsen (2013), Bornmann, De Moya Anegón, and Leydesdorff (2012), Fairclough and Thelwall (2015), Glänzel et al. (2014), Ruiz-Castillo and Waltman (2015), Zitt, Ramanana-Rahary, and Bassecoulard (2005), just to cite a few. However, common sense demonstrates that the MNCS and all other size-independent indicators based on the ratio to publications, whatever the technical details of their calculation, are invalid indicators of research performance. Thus, all of the many analyses based on these indicators should be revisited. The time and resources currently dedicated to improving them or employing them in research works could be more effectively devoted to the improvement of efficiency indicators. Ranking individuals or institutions by these indicators is at best of no value, and in fact presents serious dangers where they are used as the basis for decisions and policies.

The MNCS is claimed as an indicator of research performance, measuring the average number of citations of the publications of an individual or institution, normalized for subject category and publication year. Similarly, the share of individual or institutional publications belonging to the top 1% (10%, etc.) of 'highly cited articles' (HCAs), compared with other publications in the same field and year, is considered another indicator of research performance. For years we have seen the publication of international performance rankings by such size-independent indicators, based on the ratio to publications. Our contention is that research performance and relative rankings must if anything be drawn up by average field-normalized impact per euro spent on research or per researcher (preferably normalized by capital) and not per publication (Abramo & D'Angelo, 2014); or by HCAs per euro spent/researcher (Abramo & D'Angelo, 2015), and not HCAs out of publications.

Given two universities of the same size, resources and research fields, which one performs better: the one with 100 articles each earning 10 citations, or the one with 200 articles, of which 100 with 10 citations and the other 100 with five citations? A university with 10 HCAs out of 100 publications, or the one with 15 HCAs out of 200 publications? In both examples, by MNCS or proportion of HCAs, the second university performs worse than the first one (25% lower). But clearly, using common sense, the second is in both cases the better performer, as it shows higher returns on research investment (50% better). This is also the conclusion using our own proxy indicator of productivity: Fractional Scientific Strength (FSS), which embeds both quantity and impact.<sup>2</sup> Basic economic reasoning confirms that the better performer under parity of resources is the actor who produces more; or under parity of output, the better is the one who uses fewer resources. Indeed the MNCS, the proportion of HCAs, and all other size-independent indicators based on the ratio to publications are invalid indicators of performance, because they violate an axiom of production theory: as output increases under equal inputs, performance cannot be considered to diminish. Indeed an organization (or individual) will find itself in the paradoxical situation of a worsened MNCS ranking if it produces an additional article, whose normalized impact is even slightly below the previous MNCS value.

To give an idea of the distortions embedded in the MNCS-based rankings we provide a few examples, extracted from our regular analysis of performance in the Italian academic system.

First, for the period 2008–2012, we compare the performance ranking of over 36,000 professors in the sciences based on FSS to their ranking based on MNCS. Table 1 presents the results of the comparison for the top quartile of professors. On average, 42.7% of faculty that are 'top' by FSS would fail to reach this status when ranked by MNCS, with the share ranging from 32.1% in Civil Engineering to 48.5% in Earth Sciences.

Next, within these broad shifts, we show three extreme cases of differences in performance by MNCS and FSS at the individual, field, and discipline levels. Table 2 shows that Professor John Doe performs very poorly by MNCS, while colleague Jane Doe is at the top (100th percentile) of all scientists in her chosen field. But their relative positions are totally inverted in ranking by FSS. Also, in Table 3, we see that University A is the best in the nation by MNCS in the field of Diagnostic Imaging and Radiotherapy, but ranks at the bottom by FSS. Conversely, University B ranks last in Environmental and Applied Botany by MNCS, but leaps to second by FSS. Finally Table 4 shows that University A ranks second out of 49 in the discipline of Industrial and Information Engineering when considered by MNCS, but only 47th by FSS. The opposite extremes occur for University B, whose percentile rank by MNCS in Physics is 33.3, but 97.6 by FSS.

<sup>1</sup> It was in fact Lundberg (2007) who first questioned the old crown indicator and proposed a new one, which the CWTS group then labeled as the MNCS.

<sup>2</sup> For a number of years we have used this indicator to rank the performance of Italian universities and individuals (Abramo & D'Angelo, 2011; Abramo, D'Angelo, & Solazzi, 2010). The definition and operationalization of the measure of FSS at individual and aggregate levels, may be found in Abramo and D'Angelo (2014).

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