Research Quality Indicators for Brazilian, Portuguese and Spanish Universities

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Introduction

Bibliometric indicators are used worldwide to assess the scientific production and to measure the diffusion and use of research results produced by countries, universities, institutions and researchers (Lewison, 1998; Nicolaisen, 2002; Tijssen, van Leeuven & van Raan, 2002; Ventura & Mombrú, 2006). World rankings of universities have always a bibliometric component, normally the total count of publications or citations. In the use of these indicators, it is important to keep in mind that there are some limitations (Adler, Ewing & Taylor, 2008; Cheek, Garnham & Quan, 2006). The citation count is the most used tool to develop qualitative indicators (Hirsch, 2005; van Raan, 2006), but the interpretation of these counts must be careful, especially when they are applied across scientific fields due to the wide variation of citation cultures.
Schubert & Braun, (1986) suggested that the Relative Citation Rate would compensate this. Other proposals are recorded in the literature (Vinkler, 1986; Moed, Debruin & van Leeuwen, 1995) as variations of that paper.
In this poster, we propose a different and simpler normalization at the level of the scientific areas as defined by Thomson Reuters in the Essential Science Indicators (ESI), although this indicator can be considered as another member of the family initiated by the Relative Citation Rate. The ESI considers 22 scientific areas but we only consider the eight areas that, together, are responsible for more than 60% of the world scientific production (Agriculture Sciences, Biology & Biochemistry, Clinical Medicine, Chemistry, Mathematics, Materials Sciences, Physics, and Engineering). The documents indexed in 2004 in the Web of Science (WoS) and their citations until February 2009 were considered for this normalization for the six most productive Spanish, Portuguese and Brazilian universities. These data were used to calculate the Global Relative Impact, Q, the ratio between the actual number of citations obtained by the documents and the expected citations for the same set of documents if they were to perform as the world average. The expected citations are calculated multiplying the number of published documents by the world average number of citations per document.

$$Q = \frac{\text{Actual Citations}}{\text{Expected Citations}}$$

As the average number of citations per document varies widely across scientific areas, we may introduce the Mean Relative Impact over scientific areas,

$$^{a}Q = \frac{\text{Actual Citation}}{\text{Sum of Expected Citation Each Field}}$$

where the expected citations are calculated multiplying the number of documents published in each field by the world average number of citations per document for the same field. Figure 1 shows the effect of the application of these indicators to the scientific production indexed in the WoS in 2004 for each institution.

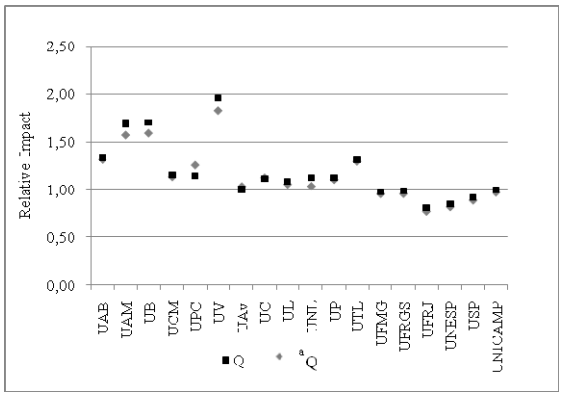

Figure 1. Relative Impact of the publications of the six major Spanish, Portuguese, and Brazilian universities.

For most universities, the Mean Relative Impact is lower than the Global Relative Impact, the exceptions being the *Universidad Politécnica de Cataluña* and *Universidade de Aveiro*. This is easily understood if we consider that the average citation count per document for each of the eight areas considered here is above the global world

mean for Biology & Biochemistry, Chemistry and Physics and below the global world mean for Agriculture Sciences, Clinical Medicine, Mathematics, Materials Sciences and Engineering. The relative large importance of Engineering for the *Universidad Politécnica de Cataluña* and of Materials Sciences for the *Universidade de Aveiro* explains the result. The *Universidad de Valencia* takes a good relative position as it produced a large number of documents in Chemistry and Physics and these documents had an impact higher than the world mean impact for the same scientific area.

The use of the number of publications or the number citations to evaluate the research productivity of an institution is unfair to smaller institutions, but size correction is not consensual among researchers. Institution size is introduced here by the number of teaching staff for which we use official national data supplemented by university published statistics.

Table 1. Number of doctorates (doctor.) and number of documents (docs.) indexed in the WoS (2004) per teaching staff (Teachers) for the ensemble of ht six most productive Brazilian, Portuguese and Spanish universities.

	Doctor./Teachers	Docs./Teachers	Docs./Doctor.
Six Spanish universities	0,20	0,80	3,98
Six Portuguese universities	0,09	0,72	8,26
Six Brazilian universities	0,29	0,75	2,58

The scientific production per member of the teaching staff has mild variations among these three university systems. The ratio of the number of documents to the number of doctorates awarded suggests that the publications from Portuguese universities may be partly due to the permanent staff while in Spain and Brazil the publications are largely mediated by doctoral students.

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