

Indicators to describe higher education institutions: the Spanish methodology as a sample of microanalysis

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Background

Due to the central role of universities in the education and research system, both policy makers and society are interested in the results of the evaluation processes of universities. National and international rankings of universities (SJTU: 2005; THES: 2007), based on prestige indicators, as well as on different structural, input and output indicators have emerged during the past years, creating competition among universities to be on the top.

In spite of the great interest that these indices have aroused, then present several limitations due to the use of one-dimensional prestige indicators and not considering other characteristics, as the thematic orientation of the universities (Van Raan: 2008). Also the difficulty of access to the data of institutions of higher education in many countries, the lack of normalization and criteria for their collection and updating limit the international comparison.

In order to surpass these limitations, in the last years some studies at the European level have been developed to produce a significant advance in the obtention of results. Amongst them AQUAMETH1, collected data on Higher Education in six countries in a systematic way by applying broad common definitions of data categories across countries and collecting information already available at national level. The same approach has been reproduced with minor modifications in the CHINC2 project on a sample of more than 100 institutions.

These projects have been essential to define very valuable aspects as the necessary methodology for data collection. In this sense, as Bonaccorsi and others (2007) explain, the quality and coherency of data vary according to their sources. Also, the European universities studies show the necessity to contextualise the data of the institutions considering the specific characteristics of each context. In this sense, as data show, at least in federal countries, the institutional context can be heterogeneous even at national level as the Swiss and Spanish cases demonstrates (Lepori: 2007; Gómez and others: 2009). Therefore it is more important to analyze the institutions considering some indicators of context. The differentiation between public and private universities is important because their orientations are different, and so it turns out essential to develop separate analyses. The age and the structure of the universities are another outstanding point since, as Bonaccorsi and Daraio (2007) and Gómez et al (2009) detected, most recent institutions usually show a higher specialization.

In spite of the advances produced, the obtention of data at institutional level continues being a challenge. The limitations mentioned related with the access to the sources, normalization and comparability of data show the need to develop new strategies for data collection and new exhaustive methodologies to obtain comparable results between higher education institutions.

From this premise, in the present work we propose to use the methodology followed in the study of the Spanish universities as a sample of microanalysis that can be applied in other countries. The methodology and main results obtained in a project carried out by the IEDCyT3 are shown. In this study the profile of activity of the universities -including thematic and multi-factor analyses- is presented.

¹ AQUAMETH, Advanced Quantitative Methods for the Evaluation of the Performance of Public Sector Research, a project within the PRIME Network of Excellence.

² CHINC, Changes in University Incomes: Their Impact on University-Based Research and Innovation, funded by the Institute of Perspective Technological Studies of the European Commission .

³ IEDCyT: Institute of Documental Studies on Science and Technology. Spanish Research Council (CSIC)

Methodology

To describe and analyse the scientific activities of Spanish universities, the following selection of structural, input and output indicators are obtained:

a) Structural and organizational indicators (obtained from the Spanish Institute of Statistics)

-Age: number of years since the creation of the university

-Regional GDP (NUTS-2) relative to EU-25 average, as an indicator of regional development which may influence the activity of university

-Administrative type: public or private

-Professors qualification: number of professors with and without PhD

-Number of students (non doctorate students)

-Input specialisation: thematic distribution of PhD professors over 9 thematic areas (according to WoS classification). The concentration of professors by areas was analysed through the Pratt index (Pratt: 1977).

-PhD thesis awarded

b) Scientific output. Scientific publication of the Spanish universities in international databases (WoS, produced by Thomson Scientific) and Spanish databases: ICYT (publications in Science and Technology) and ISOC (Social Sciences and Humanities) produced by the Spanish Research Council

-Activity: number of publications

-International orientation: percentage of WoS publications compared with the total of publications

-Impact: analysed by means of the number of citations per document, and percentage of non-cited documents

-Output specialization: thematic distribution of WoS publications over the 9 thematic areas was analysed. Thematic profiles of universities were identified (Pratt Index)

-Collaboration practices: national and international collaboration of each university related to the average of whole country

-Collaboration with the private sector, as an indicator of the involvement of the university in solving societal needs.

Different techniques of multivariate statistical analysis were used to group universities with a similar thematic profile (k-means clustering) and to explore the relationship between structural, input and output variables (factor analysis) with SPSS.

Results

The study of the Spanish universities includes 67 institutions: 49 public (91% of students) and 18 private (9% of the students). Public universities are more numerous, as well as older and larger than private ones. They are also more generalist universities.

Considering output, a positive correlation between university size and absolute number of WoS publications and thesis is observed. The higher productivity is associated with a high international orientation and high impact. The positive effect of international collaboration on impact is observed, in coincidence with previous results (Narin et al: 1991).

According to the profile of the professor's specialisation, two groups of specialised universities are identified: technical universities and those specialised in Social Sciences & Humanities. A cluster of generalist universities includes all the centuries-old universities and some more recent ones. Two other clusters are very slightly specialised in Agriculture-Environment and Biomedicine on the one hand, and on Engineering-Social Sciences-Humanities on the other. The highest productivity in WoS and PhD thesis per professor corresponded to the generalist cluster, data that support the deep involvement in research of these old universities.

Considering third mission, the Spanish results show that as national collaboration increases, the collaboration with companies also tends to rise, and that it is more frequent in young specialised universities located in rich regions.

The Spanish micro-analysis provides a general overview of the behaviour and characteristics of higher education institutions showing differences between public/private and generalist/specialised universities. Relationships between structural, input and output indicators and the importance of the thematic profile of the universities are put forward. These thematic differences are essential –as demonstrated Cheng & Liu: 2006- to describe the profile of activity of the universities and to analyze the interaction between structural, functional and contextual variables. In this line, a previous study shows that the specialization is positive in areas as Chemistry associated to the publication in journals of high impact factor and where the citation increased with the international orientation of publications. In the case of Engineering the prestige of journal trends to increase with the age of the universities but not with the specialization (Technical Schools). In Social Sciences young universities are more specialized with higher international orientation and collaboration but the impact tends to increase with the number of WoS documents (Bordons et al: 2009).

In the future the inclusion of other scientific outputs, using university databases, can be an important indicator to analyse the scientific activity as a whole, as demonstrate the data obtained by the UNIPUB project (Reale and others: 2009). Patent indicators are also important to obtain technological orientation of higher education as shows a Spanish report (Bordons et al: 2008).

Finally, to develop this type of analysis we consider the need to continue experiences as AQUAMETH and CHINC projects which would allow maintaining and developing a database with higher education indicators from a long term perspective as proposed by Barré (2006). In this sense collaboration with national statistics office and regional observatories is very important to obtain all information.

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