The Role of Sub-Specialities in the Assessment of Research Teams

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Introduction and objectives

An important characteristic of current science is the increasing role of collaboration and team work. Among the underlying factors promoting collaboration we can mention economic (costs of equipments), geographical (proximity), scientific (synergies), and political factors (Beaver, 2001). Collaboration is fostered by governments due to its positive effects in the creation of new knowledge and in the advance of science. In this context, the performance of research teams, which are the basic unit in the research process, is a topic of great concern. Different studies have dealt with the study of teams from a bibliometric perspective (see for example: Seglen & Aksnes, 2000; Börner et al., 2005; Calero et al., 2006). The identification of groups of excellence or the study of structural and dynamical features that are key factors for succeeding in science are some of the objectives more frequently pursued. However, the heterogeneity of areas, in which different sub-specialities very often coexist, is an important obstacle that can hinder inter-team comparisons.

The aim of this work is to analyse the structure and dynamics of teams in different aspects (activity, impact, collaboration) taking into account their specialisation profile. The study focuses on the area of Biotechnology, which is a multidisciplinary area whose applications span over a wide range of disciplines.

Materials and methods

The scientific production of one Spanish region (Madrid) in Biotechnology journals (WoS categories) during 2003-06 is downloaded from the Web of Science database. Main research teams are identified through co-authorship analysis (see Bordons et al., 1995), after normalization of authors and institutions names. The most productive author within each group is considered the leader, and the output of the leaders in other categories different from Biotechnology is collected to gain a more complete insight into team performance.

The structure and research performance of the teams are analysed according to their subject specialisation. Main aspects studied include: *a) Team structure*. Size of the team (number of members considering the co-author frequency) and cohesion of the team are analysed. *b) Team performance*. To be studied through the number of documents, productivity index (ratio between output and size of the team), impact indicators (number of citations, average citations/document, % of documents in high impact factor journals) and collaboration pattern (authors and institutions per document, national and international collaboration rates). *c) Team specialisation*. The usefulness of different indicators to characterise the specialisation profile of teams is explored: main discipline of publication, % of documents in Biotechnology and interdisciplinary index (scattering of publications over disciplines is measured through the Pratt index).

Results and conclusions

Spanish production in Biotechnology stands for 2,686 documents during 2003-06 and Madrid is the most productive region (711 documents, 27%). Main institutional sectors involved are Spanish National Research Council (CSIC, 42%) and Universities (33%). Main publication disciplines are: Biotechnology, Biochemistry, Microbiology and Food Science. The interdisciplinary character of Biotechnology is apparent because of the spread of publications over a high number of different disciplines.

A total of 55 teams are detected in Madrid by co-authorship analysis. Including all publications of the leaders, irrespective of their field of publication, the output of Madrid teams increases to 1,398 documents (a two-fold increase). The size of the teams ranges from 2 to 43 members and the output ranges from 4 to 103 documents per team. Collaboration among teams and with foreign researchers is analysed in terms of intensity as well as variety of relations. The position of the teams in the regional network is studied: there are some isolated teams whilst others with high centrality play an important role connecting groups.

According to the specialisation indicators, three typologies of teams are identified: a) core Biotechnology teams; b) basic Biotechnology-related fields (high activity in Biochemistry, Biomedicine and other basic fields); and c) applied related ones (high activity in Food, Science & Technology, Agriculture and other applied fields). By means of nonparametric statistical Kruskal Wallis test for independent samples, significant differences among the performance of these three types of groups are found with regard to output,

average number of authors and institutions and average number of citations. Field size, collaboration patterns, basic/applied level of research and citation density may differ from one to another sub-speciality within a given area. The need of identifying and assessing separately the different sub-specialities is put forward.

Table 1. Kruskal Wallis Test (a)

	Output	Average citations	Average authors	Average institutions	% Biotechnology
Chi-Square	12.038	17.106	6.730	8.305	30.176
Asymp. Sig.	.002	.000	.035	.016	.000

(a) Three typologies considered

Acknowledgments

This study was partly financed by the Madrid research project PIPCYT 2004-2008. We also would like to thank our colleagues of the ACUTE team for their useful help with the analyses of data.

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