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J. Eng. Technol. Manage. 22 (2005) 9–30
Journal of ENGINEERING AND TECHNOLOGY MANAGEMENT JET-M
www.elsevier.com/locate/jengtecman

The citation impact of research collaborations: the case of European biotechnology and applied microbiology (1988–2002)

Koen Frenken[a,*], Werner Hölzl[b], Friso de Vor[a]

[a]*Section of Economic Geography, Urban and Regional Research Centre Utrecht (URU), Faculty of Geosciences, Utrecht University, P.O. Box 80115, NL3508TC Utrecht, The Netherlands*
[b]*Department of Economics, Vienna University of Economics and Business Administration, Vienna, Austria*

Available online 26 January 2005

Abstract

Research collaboration is generally motivated by quality enhancement. The networks underlying collaborative knowledge production also serve as vehicles of knowledge diffusion. Both aspects are expected to contribute to the citation impact of publications. We analyse knowledge production in European biotechnology for the period 1988–2002 focusing on the role of research collaboration. Different aspects of research collaboration are taken into account simultaneously to assess their relative importance. We distinguish between the number of contributing authors and addresses as to differentiate between the effect of the collaboration between individuals and between organizations. We further distinguish between different spatial scales of collaboration (national, European, international) and between different institutional types of collaboration (between academia, outside academia, and hybrid). We find evidence that the diffusion of scientific knowledge, as measured by citation rate, is dependent on both intra- and inter-organisational characteristics. An important finding has also been that the further differences in citation impact can be related to the geographical scale of collaboration with the European scale being most successful. Furthermore, country-fixed effects suggest that the European Union, though successful as a geographical scale of collaboration, still harbours many national varieties of knowledge production.

JEL classification: L65; O32; O33

Keywords: Citation impact; Knowledge networks; Diffusion; Institutional collaboration

* Corresponding author.
E-mail address: k.frenken@geog.uu.nl (K. Frenken)
URL: http://econ.geog.uu.nl/frenken/frenken.html.

0923-4748/$ – see front matter
doi:10.1016/j.jengtecman.2004.11.002

1. Introduction

The role of research collaboration in modern scientific knowledge production is complex and multifaceted. Generally speaking, research collaboration enhances the quality of research, which leads papers with more authors to be cited more often (Katz and Martin, 1997). Recent research showed that the networks underlying collaborative knowledge production also serve as vehicles of knowledge diffusion, which would account for some part of their relative higher citation impact (Breschi and Lissoni, 2002; Singh, 2004). Thus, collaboration networks not only contribute to quality of knowledge, but also to its diffusion, which only reifies its importance from a science policy perspective.

Though high-quality empirical data on research collaboration are widely available, the analysis of the impact of research collaboration is by no means straightforward. There are multiple scales at which researchers collaborate, which challenge us to disentangle all relevant aspects in an empirical research design. There are at least three relevant levels of analysis at which collaboration can be studied, and which are, for theoretical reasons, not expected to be independent from one another nor to be fully overlapping either. First, one can distinguish between intra-organisational and inter-organisational collaboration. Second, one can distinguish between intra-regional and inter-regional collaboration (which obviously depends on the definition of regions applied). Third, one can distinguish between intra-disciplinary and inter-disciplinary collaboration (again, depending on the definition of disciplines applied). The three dimensions can be regarded as being orthogonal in that all possible combinations occur in reality.

In this contribution, we deal only with the organizational and geographical dimensions, as we focus on one particular discipline, biotechnology and applied microbiology, which we do not differentiate further into sub-disciplines. Our main interest is to disentangle the geographical and organizational aspects of scientific knowledge production. In particular, we test a number of hypotheses relating the citation impact of scientific articles published between 1988 and 2002 to the size and characteristics of the underlying collaboration network.

2. Research collaboration

Research collaboration has been a proliferating phenomenon in science. The most convenient indicator to describe this process is to count the number of co-authored scientific papers that are published. A recent study found that at the beginning of the twentieth century co-authorships accounted for less than 10 percent of all publications, while at the end of the twentieth century, this percentage had gone up to account for over 50 percent of all publications (Wagner-Doebler, 2001). There is little doubt that this percentage will further increase given that the trend has not levelled off.

The tendency for knowledge production to become increasingly collaborative can be understood as a consequence of increased division of labour among scientists. Science develops into an ever-increasing number of fields and sub-fields. Consequently, research requires some sort of integration between different knowledge bases, and, more often than not, between the knowledge of different people. In particular, though not exclusively, research collaboration has become the dominant form in problem-oriented and applied