Research Policy 42 (2013) 1667–1678

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Resources and research: An empirical study of the influence of departmental research resources on individual STEM researchers involvement with industry

Beth-Anne Schuelke-Leech*

The John Glenn School of Public Affairs, The Ohio State University, 250 B Page Hall, 1810 College Road, Columbus, OH, 43210, United States

ARTICLE INFO

Article history:
Received 13 September 2011
Received in revised form 2 June 2013
Accepted 24 June 2013
Available online 30 July 2013

Keywords:
University–industry relations
Resources
Technology transfer
Organizational context
Academic disciplines
Hierarchical linear modeling

ABSTRACT

This paper investigates the influence of departmental level characteristics and resources on individual involvement with industry using a national survey of STEM faculty. An integrative model of industry involvement is developed and tested that integrates a multi-level perspective on university–industry relations. Three measures of industry involvement are tested: the amount of time a researcher spends with industry, the number of activities a researcher engages in, and the intensity of those activities. Results of the model show that the quality of human capital in a researcher's home department is a significant influence on industry involvement. Non-federal R&D expenditures and direct industry funding also positively increase the likelihood of industry involvement. Policy and managerial implications of the results are discussed.

1. Introduction

Resources are essential for the success of any research endeavor, though they cannot ensure success. In 1979, Montjoy and O'Toole pointed out that policy success was dependent on both the clarity of the mandate and the availability of resources. In recent years, universities have increasingly been forced to deal with scarcer resources (Etzkowitz, 1999) and researchers face more competition for R&D funding (Dill, 1996; Newman et al., 2004; Yusuf, 2007). Thus, there are important questions about how needed resources are acquired and the influence that they have on individual researchers.

Resources have no inherent value; they are only useful as they are valued and used by people to accomplish something (Gregori, 1987). Resources enhance capacity and capabilities (Wernerfelt, 1984). Thus, resources can be defined as the assets, capacities, knowledge, and individuals that a researcher has access to that enhances his or her ability to do research.

Resources are obtained from many different sources, including: from the individual's own abilities and knowledge, from the organization that an individual works for, and from the wider networks that an individual belongs to. Within an organization, resources are often considered part of the organizational capital. Though resources are typically assumed to be mobile and imitable, the combination and utilization of resources within a given organization is not, and thus, can be a competitive advantage (Barney, 1991). Typically, there are numerous types of resources required and the relative influence of different resources can be difficult to discern (Lee, 2009). Some resources have a positive influence on organizational and individual performance, while other resources have negative or insignificant effects. Thus, how research resources are acquired and combined can have a profound influence on the success of the research endeavor and the capital created by that organization. Capital can be considered the application or investment of resources to create some desired output (Lin, 2001); in this case, measurable research outputs, such as: publications, graduate students, patents, and spin-off companies.

Resources may be internally available, as with academic colleagues, graduate students and laboratory equipment, or they may be externally acquired, through research grants or industry contacts. If required resources are not available within the organization, a researcher must look externally for them. This may drive a researcher to be involved with industry if departmental resources are insufficient. Alternatively, if resources within the department are abundant, a researcher may be less likely to look externally for them. This paper contributes to the literature on the effects of resources by looking at the influence of different types of resources on the involvement of individuals with industry.

* Tel.: +1 614 247 8798; fax: +1 614 247 4868.
E-mail addresses: schuelke-leech.1@osu.edu, baschuelkeleech@hotmail.com

0048-7333/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.respol.2013.06.010

2. Academic disciplines

Academic researchers are influenced by their membership in an academic discipline, their home department, and their institution (Ellemers et al., 2003; Hagstrom, 1965). The department that a researcher belongs to, and the accompanying academic expectations and culture, are important in determining individual researcher performance (Allison and Long, 1990; Creswell, 1986). Professional colleagues have a pronounced influence on a faculty member's research interests and direction (Blau, 1994). Researchers that move into more prestigious departments increase their level of productivity to correspond to departmental conventions (Allison and Long, 1990). This is due, in part, to the social and physical capital – the productive use of resources – that exists within those departments. Allison and Long also found that the facilities and physical resources available at an institution affected the number of publications, while the intellectual stimulation from colleagues – the human resources within the institution – affected the quality of those publications.

Most faculty members in research universities are required to conduct and publish research in order to get tenure, build their academic reputation, and get promoted (Geisler and Rubenstein, 1989). In an environment where there is greater pressure to publish, there is expected to be a correspondingly greater pressure to collaborate since collaboration has been shown to increase academic productivity (Bakanic et al., 1987; Meadows, 1974). One study of collaboration found that researchers who worked alone or with only one collaborator published substantially fewer papers than those who worked with a large number of collaborators (Meadows, 1974). Papers with multiple authors (a common measure of collaboration), on the other hand, have a greater likelihood of getting accepted for publication (Bakanic et al., 1987). If there are sufficiently large and stimulating networks within a researcher's home department, there may be less incentive to look for these interactions elsewhere. However, collaboration with academic researchers and collaboration with industry are not the same, and in fact, collaboration with industry may actually be detrimental to academic collaborations and academic productivity (Clark, 2009, 2010). As involvement with industry is generally a voluntary activity, a researcher must assess the time and effort required to work with industrial partners and conclude that the involvement will have a net benefit for their research (Carayol, 2003; Perkmann et al., 2011). Thus, researchers must either see that industrial involvement will provide resources or knowledge that cannot be acquired otherwise. Productive and eminent researchers are concerned with how activities will impact on their publications and academic productivity (Perkmann et al., 2011). These researchers are generally located in higher-rated departments that value higher scholarly productivity (Allison and Long, 1990; Crane, 1965). Researchers in higher ranked departments will only work with industry if they see the value to their own career goals and research (Perkmann et al., 2011).

3. Industry involvement

Being involved with industry takes both a desire to be involved with industry and the ability to move beyond theoretical, curiosity-driven research. Industry is generally more interested in short-term problems and empirical research that can either assist in solving a problem or in providing the foundations for commercializable technologies and products.

Notwithstanding many university policies to promote industry involvement, technology transfer, and commercialization across the whole institution, universities are really collections of discipline-based colleges and departments with their own norms and standards for dealing with research and industry, rather than a single, homogeneous organization (Clark, 1983, 1995). The prestige of research at a university is founded on academic disciplines (Bechtel, 1986; van Knippenberg and Ellemers, 2003) and is heavily tied to individual departments and programs (Brewer et al., 2002). University departments provide the institutional rules, norms, and expectations with which individuals are expected to conform, as described by Douglass North (1990). These standards and expectations, in turn, define the resources needed to meet expectations and goals. Therefore, the standards and resources within a department are important influences on a faculty member. Rather than focusing on how industry funding and other industry resources can "pull" researcher to be involved with industry, this paper considers how resource constraints within the university can "push" individual researchers to seek these resources through industry involvement.

The main research question of this paper is how much do these departmental resources influence individual involvement with industry, particularly when accounting for the norms and standards that are established by academic disciplines? If resources are not readily available, individuals may seek to build networks and collaborations to get them. Alternatively, when internal resources are abundant, pressures to secure these resources externally may be reduced. Therefore, in departments with greater research resources, researchers may not feel the need to partner with industry or to seek these resources through affiliation with University Research Centers. Thus, the hypothesis of this paper is that: *Researchers in departments with greater human, financial, and physical capital will be less likely to be involved with industry.*

4. Data

The data used for this study are from two levels: the individual researcher and the department that the researcher resides in.

Data about the behaviors and attitudes of individual researchers comes from a survey done by the Research Value Mapping (RVM) Program, under the direction of Principal Investigator, Barry Bozeman taken between spring 2004 and spring 2005.[1] Departmental data was obtained from the NSF-IPEDS web site, Webcaspar,[2] and from data collected for the NAP Doctoral Program Study during 2005. Thus, the data is all from 2005 or for the five years preceding 2005 for composite variables.

The RVM survey was designed to get a sample from the population of academic researchers in the STEM fields (i.e., science, technology, engineering, and mathematics) from research intensive universities. Furthermore, it was designed to get responses from 200 men and 200 women in each of twelve STEM fields: Agricultural Sciences, Biological Sciences, Chemistry, Computer Science, Chemical Engineering, Civil Engineering, Earth and Atmospheric Sciences, Electrical Engineering, Materials Engineering, Mathematics, Mechanical Engineering, and Physics (Bozeman and Gaughan, 2007). The target population was identified through the departments and faculty listings at the Carnegie Doctoral/Research Universities (Research Value Mapping Program, 2005). The academic discipline that the doctorate was awarded in was identified by the researcher (Research Value Mapping Program, 2005). This was in turn coded with the NSF classification for academic fields. In addition to the specific fields, bivariate response variables were created for the aggregated categories of: (1) life scientists, (2) physical scientists, (3) engineers, (4) mathematicians and computer scientists, and (5) other. An additional bivariate response variable for

[1] The RVM project was based at the Georgia Institute of Technology in Atlanta, Georgia, and supported by the National Science Foundation and the Department of Energy. http://www.rvm.gatech.edu/aboutrvm.htm.

[2] https://webcaspar.nsf.gov/.