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Academic inventions and patents in the Netherlands: A case study on business sector exploitation

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ABSTRACT

This paper describes a new methodology to identify patent applications based upon research at nine universities and three university medical centers in the Netherlands and a case study elaborating subsequent, scientifically research based, IP exploitation in several sectors. We address the identification and utilization of the intellectual property by domestic business enterprises and start ups based upon patents from university research. A sophisticated semi-automated data collection heuristic was adopted to identify all relevant university-invented patent applications that were filed between 2000 and 2010.

In total 2898 patent applications based upon scientific research at universities and related to university inventions were identified. For 952 of these university inventions patent applications were filed by the universities themselves. The total number of university based related patent applications represent 5% of the total volume of patent applications from Dutch origin.

A subsequent survey among companies exploiting university research based IP, was carried out to gather information on their actual use of their IP in terms of manpower involved in product or market development and estimated monetary value of the patents. 78 companies responded to this survey. The main findings reveal that a variety of IP exploitation strategies has been used. Overall, more than 50% of the patents still wait to be used for further development and innovations. The number of jobs created by spin offs from university research institutes is approximately 9500 jobs over a period of 10 years. Average revenues from these patents amounted to € 42,000. Several findings from our small-scale national survey on patent exploitation with regards to use and monetary values are in line with general results from the large-scale European PatVal survey and the APE-INV survey.

1. Introduction

Nowadays, university researchers at industry-oriented 'entrepreneurial' universities can draw on many modes and follow several pathways to interact and cooperate with (local) business companies (e.g. Ref. [13]). University–industry linkages and commercialization of university research may have significant impacts on industrial R&D [2] and vice versa [12]. Local, regional or national economies may benefit significantly from university knowledge transfer. Patents feature prominently as a mode of intellectual property ownership and a vehicle for technology transfer. 'University-owned' patented technologies help create university spin-off companies, or start-up companies by former academic staff where ownership of the patent is sometimes shared with co-applicants. Another group of patents representing university-generated intellectual property rights are often acquired, sold or licensed to companies for a variety of purposes and objectives. This group of 'university-research based' patents are filed in the name of or by companies and list the names of one of more university employed academics as inventors. Both types collectively are referred to as 'academic patents'. To analyze the latter mentioned group of patent applications a sophisticated methodology has been elaborated. This paper describes the methodology and the results.

Patents have proved to be a very rich source of empirical information for a vast body of empirical studies on university technology transfer, among others, university–industry R&D linkages, university inventors, science-based innovations, and the economic value of university research (e.g. Refs. [5,8,11,15,16]). The PatVal-EU Survey was a large scale comparative study on the patent inventors across Europe, both public sector and private sector inventors [6]. Two recent review articles focus specifically on the various characteristics of academic inventors and their patents [9,10], where the

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empirical data were derived from the APE-INV study, which was concluded in 2013, covering six European countries (Denmark, France, Italy, Sweden, The Netherlands, and United Kingdom).

Some universities in The Netherlands are, by European standards, very prolific in patenting. In part this is because of their scientific and technical research specialization profile, and partly because knowledge transfer and valorization of scientific knowledge were added in 2005 to the main objectives and goals of all public sector universities. This 'third mission' is specifically meant to enhance the targeted dissemination of knowledge to user communities in the Netherlands – the business sector and industry in particular. Their knowledge transfer portfolio involves dedicated resources and efforts devoted to entrepreneurship courses, industry outreach programs, intellectual property right protection, transfer of university-developed technologies, commercialization of university-IP through patent licensing and pre-seed funds to promote spin-off companies. All Dutch universities now run specialized organizational units, either a Technology Transfer Office (TTO) or a comparable unit, that engage in these activities. The APE-INV study of European patent applications, relating to the years 2002–2006, identified 600 academic inventors in the Netherlands who represented 2.75% of academic scientists employed by universities in 2005–2007 [9]. This share is relatively low compared to the other five countries; double appointments and close ties between Philips, a large electronics company, and Eindhoven University of Technology are mentioned as possible explanations [9].

This case study reports on academic patenting at nine public research-intensive universities (out of 13 universities) and three university medical centers (out of eight medical centers): Delft University of Technology; Eindhoven University of Technology; Twente University; Wageningen University and Research Center; Leiden University; Free University of Amsterdam; University of Groningen; Utrecht University and Radboud University Nijmegen. The university medical centers are those of Leiden University, Free University of Amsterdam and the University of Groningen.

The overall objective of this case study was to ascertain the regional economic impacts of university IP. These findings have been reported elsewhere in a Dutch-language report for government policy-makers in the Netherlands [17]. In this paper we focus our attention on the data collection methodology and findings with regards to IP exploitation in the business sector and their assessment of the patent's financial value. The main research questions we addressed are:

- How can one reliably identify all academic patents where university research staff was actively involved?
- Does IP exploitation of academic patents, and their financial value for the company, differ by sector and by company size?
- How valid are the findings of this small-scale country-specific case study? More specifically, how do they relate to the results of earlier academic studies, especially the APE-INV study and PatVal-EU study?

University-owned patents and university-research based patents are analyzed collectively.

The next section outlines the key features of the study's methodology. Section 3 presents the main findings. The final section summarizes the general observations and concluding remarks with an eye towards possible follow-up studies.

2. Methodology and information sources

The first input for use in patent application searches that could be based upon scientific research is by the names of university staff members. So we had to identify and enter all full names of staff, including their scientific disciplines, who were employed by a university at some point during the years between 2000 and 2010 and who were active as a researcher in the natural sciences, engineering sciences, biotech, pharma or medical sciences. These data were collected in the first half of 2011 by the Netherlands Patent Office after which the on-line *Espacenet* database and the October 2011 version of EPO's PATSTAT[1] database were executed using these names from the universities. Both sources enable large-scale automated searches for university presence in the patent documents at the level of entire countries or regions (e.g. Ref. [4]). The first selection criterion we imposed is that patent applications[2] are filed after January 1st 2000. Secondly, at least for one of the inventors indicated The Netherlands (country code 'NL') as country of residence. Inventors for which the country is not, or is not correctly listed as NL, are not included. This type of error was deemed acceptable because patent families were used at a later stage in the patent selection process and also patents usually have more than one inventor meaning that the document would be included by a match on the name of one of the other inventors. We assume that using these sets of equivalent patent publications eliminated most of these errors. This final selection includes 295,371 patent applications, thus considerably narrowing down search space for identification of university addresses and employees. Based on the lists of names of university employees as provided by the HR department of the 9 universities a search list was constructed in which prefixes and postfixes of names were omitted. These truncated names were matched (partially) with inventor names using an n-gram matching algorithm [7] specifically designed to maximize the recall/precision rates by minimizing the numbers of false positives as well as false negatives (see Appendix 1, for technical details).

For reasons of verification subsequently the sets of potentially relevant patent applications were sent to the TTOs of the participating universities and academic medical centers. The patent information pack for these manual checks included:

- title of the patent application;
- name(s) of the inventor(s) of a patent;
- name(s) of the applicant(s) for the patent;
- patent publication numbers of relevant patent applications, with the publication date for all publications belonging to a patent family;
- label to identify all patent applications that belong to a patent family
- number of patent applications, with the application date for all documents in a patent family.

University staff members, either at the TTOs or HRM departments, matched these data to information on university staff names and affiliations, extracted from the information systems.

How then is this IP pool based upon university research used and exploited in the business sector? And, more specifically, how significant are the university spin-off companies in terms of market-oriented exploitation of IPR – in terms of job creation and economic growth in regions around universities? To address these issues and questions, 230 mail questionnaires were distributed by the TTOs of Dutch universities among companies within their client portfolios. This set of firms includes university spin-offs and start-ups, as well as other small and medium sized companies located in the same region as the university, and some 30 larger

[1] The official name of the database is EPO Worldwide Patent Statistical Database (PATSTAT).

[2] We focus on patent applications as we are interested in R&D activities, and are less concerned with the legal issues of the patent granting procedures.