

Collaboration, innovation and growth : The evolution of the UK Biotechnology sector

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The biotechnology sector has a considerable fascination for academics and policy makers. It is a young, emergent, high-tech sector in which there is a wide range of actors, from very small companies to some of the world's largest players. It is a sector where technological and market risks are high, where entry and, often, exit are rapid. It's activities are close to the science base, with a wide variety of forms of collaborative agreements, including those involving universities and private sector companies. The success of biotechnology firms is intimately linked to the acquisition of intellectual property rights – which, itself, has been extremely controversial. Last, but not least, the biotechnology sector raises fundamental welfare issues that capture the public's imagination. The main focus of the present paper is to track the evolution of the biotechnology sector in the UK using a variety of intellectual property statistics, combined with other sources of data. A secondary aim of the paper is to interest researchers in using a much broader range of IP statistics, moving away somewhat from the over-reliance on patent data. Thus, while the present paper draws extensively on patenting and patent citation information, it also reports IP information on plant and seed varieties and microorganisms. The investigation of these new statistics form on-going research, for which the authors have been building new data sets.

The study begins by outlining the number of enterprises located in the biotechnology sector in the UK over the period from 1980. It demonstrates the enormous growth of the industry and the wide variety of actors at work in the sector. In doing so, it highlights the problems posed by the different lines of business in which some of the larger companies are involved – an issue that carries over to the patenting activities of the companies, which often span a wide range of IPCs. The results include information about the trends in collaborative activity in the sector, showing the total numbers of collaborative agreements, the average numbers of collaborations *per* company and changes in the nature of the collaborative agreements over time (i.e. technological *versus* market; joint ventures, equity participations, etc.). The likely reasons for the various trends in collaborative activities are discussed. The central part of the paper explores the evolution of the sector using IP data. Data have been collected about the patenting activity of over 200 companies in the sector (both within and outside of the biotechnology IPCs), as well as the citation activity (by company and IPC) of the companies in the sample. On-going work is looking at a sample of second round citations – the citations made by the cited patents, again broken down in the same way. There are a variety of uses of such data, but the present study focuses on the changing IPCs of patents taken out early in the sample period and those taken out late on in the sample period to explore how the technology of the sector is changing. In addition, it examines the IPCs of the first and second round citations to throw further light on this issue (i.e. to establish what parts of the science and technology base the sector evolved from).