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Development of SMEs and heterogeneity of trajectories: the case of biotechnology in France

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Abstract

Biotechnology is an emergent sector based on the creation of research-intensive Small and Medium Enterprises (SMEs). While some SMEs are growing, most of them remain small, even those set-up several years ago. What is the pattern of development of the biotech sector? What are the patterns of development of firms? Studies on the development of high-tech SMEs have focused on a business model, in which entrepreneurs rely on growth forecasts to persuade capital investors (business angels and venture capitalists) to invest in a radical innovation project. Firms aim for a world market to industrialise their innovation, and initial public offering (IPO) enables initial investors to make profits that offset risky initial investment. While this model is appealing, it is simply one of the possible models of biotechnology development. Some firms are not designed to experience exponential growth, and choose to target local markets. Moreover, not all firms have the ambition of being listed on the stock exchange. Based on an in-depth analysis of the business and development of 60 French biotech SMEs, this article identifies two business models. By defining the development trajectories of each of these models, it highlights the temporary nature of the emergent model.

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1. Introduction

Biotechnology is one of the emergent sectors whose development is largely based on the creation of research-intensive SMEs. In France, the number of new biotech SMEs is skyrocketing, from fewer than 10 new firms per year a decade ago, to more than 30 in 1998. However, while some SMEs are growing, most of them remain small, even those set-up several

years ago. What is the pattern of development of the biotech sector? What are the patterns of development of firms?

Studies on biotechnology development have focused on a business model that emerged along with the development of high-tech SMEs. Based on a radical innovation project, a group of entrepreneurs creates a firm designed to grow fast. These entrepreneurs rely on optimistic forecasts of a promising scientific breakthrough to convince capital investors (business angels and venture capitalists) to fund their technological developments. The firm targets an international market in which it can industrialise its innovations and

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generate a comfortable income. Initial public offering (IPO) enables initial investors to make profits that offset risks taken at the outset. While this model is appealing, both in its ability to link up scientific discovery and economic valorisation of science, it is only one of the possible biotechnology development models. Some firms are not designed for exponential growth and target only a local market. Moreover, not all firms have the ambition of being listed on the stock market. Even if going public depends partly on age and on timing (there are periods when the window is open, and periods during which going public is very difficult), fewer than 30% of biotechnology firms are listed in the US and fewer than 7% in Europe. Biotechnology firms, therefore, develop along the lines of several models that have to be described and understood if the evolution of the sector, relations between the actors involved and the effects of public policies are to be understood.

The main features of the biotech sector (science-based, importance of start-ups, and heterogeneity of actors involved) are helpful in understanding its dynamics. Even if they are based on the growth of firms, trajectories and development logics can differ from one company to another. A survey of 60 firms was conducted in the year 2000 to understand the development of SMEs in France. In-depth face-to-face interviews were held during the same year within each of the 60 firms. The results shed light on the diversity of SMEs, which can be described in terms of business models. A business model describes a category of firm in relation to the market it targets, its expected growth, its modes of governance, and the organisation of its activity. The diversity of business models of biotechnology SMEs is a point that is rarely considered in studies on factors promoting the development of these firms (see [Section 2](#)). This approach requires not only the differentiation of firms' activities, but also an explanation of their resulting position compared to other actors in the industry and, more generally, the institutional framework around the firm. While the factors facilitating the creation of start-ups are now known, few studies have been made of those facilitating their sometimes-fragile survival and development. The present article highlights the logic of the development of firms and shows that modes of development differ for each business model.

[Section 2](#) discusses the role of SMEs in industrial dynamics and analyses how the diversity of SMEs

has been studied in different contributions. Data and methods are presented in [Section 3](#). The size of the innovation project appears to be a key variable to split the sample of firms into two homogeneous clusters. Networks of the firms (founders, alliances, etc.) are then discussed in [Section 4](#) to describe the Sectoral Innovation System (SIS) in biotechnology.

2. Heterogeneity of SMEs

2.1. Sectoral characteristics of biotech firms

Innovation in biotech firms has common characteristics. Three main features have attracted a great deal of attention in recent years. (1) Development of the biotech sector is based on the entry of a large number of SMEs; the biotech sector is often described as a large and highly turbulent population of innovators; SMEs are a leading force in a science push context, while the role of large firms is mainly to integrate new discoveries into their products after they have been developed by SMEs. (2) Biotech is a science-intensive sector. This characteristic has two consequences ([Zucker et al., 1994; Feldman, 1999](#)). First, SMEs are located close to the source of knowledge, i.e. close to the main universities, even if they are not spin-off of universities. Second, most of the founders have a scientific background and a Ph.D. and are members of scientific networks. (3) Strategic alliances progressively appear as central features of the biotech sector. The status of alliances is changing from strategic alliances, as a means to acquire and co-ordinate resources for technological and scientific development, to a new organisational form. [Powell et al. \(1996\)](#) explain the development of SMEs by the inter-organisational collaboration between SMEs and large firms. For established firms in traditional life sciences sectors, such as pharmaceuticals, chemicals, or seeds, the introduction of biotechnology has been a competence-destroying innovation. Because of the novelty of this scientific field and the risks attached to biotechnology, established firms channel their investments in biotech research to SMEs through long-term contracts or by forming joint ventures ([Arora and Gambardella, 1990](#)). SMEs, in turn, enter into long-term contracts to obtain complementary assets, such as product testing, commercialisation, or

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