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Description	一般論文

2A20 Comparative Study on the Emergence of the Biotechnology Industry in Germany and Japan

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Introduction

The awareness of importance of this rapidly upcoming industry has been increasingly recognized by the academic management literature in the last few years. Of particular interest are small, innovative bioventures which are breaking new technological ground in the most advanced branches of the life sciences. Many studies on new entrepreneurial entrants in biotechnology are mainly addressed to the situation in the United States.

Certain elements such as the role of technology transfer between universities and industry as well as the existence of venture capital play an important part in the formation and establishment of these small businesses. Thus, it seems to be fruitful to investigate in more detail the emergence of the biotechnology industry in different countries against the background of their national settings. The present paper concentrates on two latecomers into the business of biotechnology namely Japan and Germany which both are highly industrialized countries.

In this article, we pursue two purposes: First, we provide a comprehensive picture of the evolution and the current developments of biotechnology in Japan and Germany. Second, we compare the influence of certain environmental factors on the emergence of the biotechnology industry in Germany and Japan.

In doing so, we develop an institutional framework for the emergence of the biotechnology industry in which certain environmental factors are integrated (see figure 1).

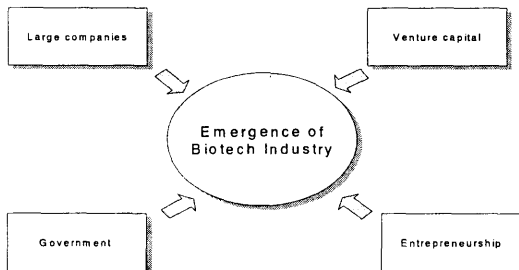


Figure 1: Institutional framework for the emergence of biotechnology.

Overview of the evolution and development of biotechnology in Germany

According to the latest European Biotech report published by the consulting company Schitag, Ernst & Young (Schitag, Ernst & Young, 2001), Germany could take the lead in biotechnology in Europe in terms of number of companies. Using a very narrowly defined understanding of biotech companies, Germany has currently 333 biotech companies compared to 271 companies in the UK and 240 in France. Five years ago, there existed only a handful bioventures in Germany and there was no sign of change on the horizon at that time.

Basically, strong negative public attitude towards biotechnology and especially genetic engineering, which prompted politicians from the

federal as well as the local governments to establish strict regulations for biotechnology-related research, characterized the situation in the early 90s.

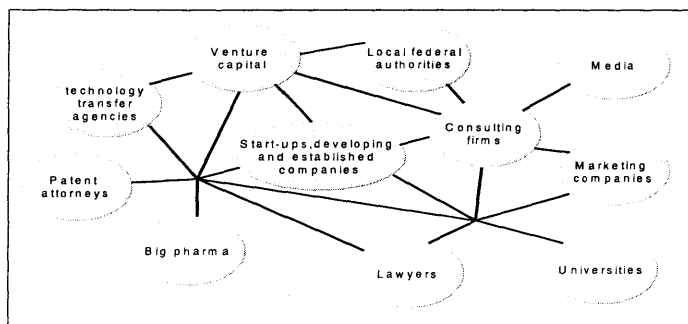


Figure 2: Clusters of innovation in biotechnology.

Current situation of the biotechnology sector in Germany

Although the swift increase of number of biotech companies in Germany is impressive, the German biotech industry is still in its infancy. This immaturity of the biotechnology sector in Germany compared to the United States as well as to its European counterpart United Kingdom can be clearly exemplified by the following indicators:

- only approximately 5% of the biotech companies in Germany generate more than Euro 50 Mio. annual sales.
- In 2000, there were in total 6 drug candidates in the pipeline (preclinical to clinical phase III) from publicly-traded German biotech companies compared to 128 of British companies.
- 17 German biotech companies were listed on the “Neuer Markt” in 2000 compared to over 400 at the NASDAQ.

Therefore, bioventures have to develop quickly a critical mass. Some German biotech companies have recognized that integration of activities along the value chain is crucial for sustainable growth. As more and more pharmaceutical companies outsource certain parts of their research and development efforts, specialized (biotech) companies have to offer a set of integrated platform technologies (one-stop-shopping). Responding to these challenges, German companies acquired other European (Evotec’s (located in Hamburg) acquisition of Oxford Asymmetry International, UK) and in particular US-American biotech companies (e.g. GPC Biotech (Munich) acquired Mitotix, USA; Lion Bioscience (Heidelberg) acquired Trega Bioscience and Medigene (Munich) acquired NeuroVir Therapeutics).

In contrast to the situation in the US and the UK, platform technology-based companies are the prevailing business models in the German biotechnology industry. These business models have compared to product-based ones the advantage of being less risky since the so-called enabling technologies can be used for a wide range of applications.

Although investments in product-based companies are more risky, they promise higher returns in the long run. Thus, an increasing number of investors prefer these business models in the hope to have an equity stake in a company with potential blockbusters in its R&D pipeline. Therefore, some German biotech companies will be under pressure to change their business models in the future.

Recently, company growth is hampered in Germany by the lack of specialists in bioinformatics as well as experienced senior managers for business development assignments. Some universities push bioinformatics in their curriculums and sponsor chairs for bioinformatics, however, because of the rather long-term character it does not avoid the shortage of skilled employees in the short-term.

Overview of the evolution and development of biotechnology in Japan

The commercialization of biotechnology in Japan has undertaken a roller-coaster ride within its short history. In the early 1980s, many Japanese companies recognized the potential of modern biotechnology. In contrast to the developments in the United States, these companies were already established companies or part of a industrial group (Keiretsu). Interestingly, not only traditional pharmaceutical, chemical and food processing companies stepped into the modern biotechnology but also many companies with totally unrelated core businesses such as steel manufacturers and even construction companies. Because of the oil crisis and diminishing profits in their core businesses, these companies conceived biotechnology as an opportunity to diversify their business.

In the 1990s, however, the biotechnology upswing ended. Several Japanese large corporations stopped or reduced their research efforts in biotechnology, since they doubted on the commercial possibilities of modern biotechnology. Therefore, only food and beverage enterprises, pharmaceutical and chemical companies invested significantly in the modern biotechnology in Japan during the 90s.

Current situation of the biotechnology sector in Japan

Recently, we can witness the establishment of several new biotechnology companies in Japan. According to the Japan Bioindustry Association (JBA), there exists currently 247 companies in biotechnology and main of these were founded in the last two years as shown in figure 3.

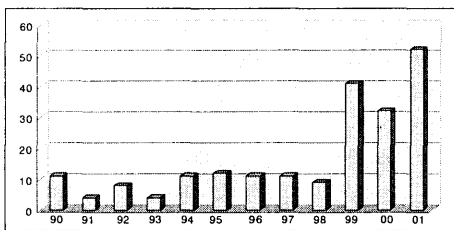


Figure 3: Number of New Start-up companies in Japan from 1990 to 2001 according to Japan Bioindustry Association.

One third of the biotechnology companies was approximately established by university researchers, one third represents spin-offs of large and medium-sized enterprises and the remaining were established by others (Japan Bioindustry Association).

These companies focus on different fields of biotechnology (figure 4). Two promising fields of biotechnology are bioinformatics and biochips in which 20 (e.g. Yokogawa Analytical Inc.) and 10 (e.g. PharmaDesign) Japanese bioventures are involved.

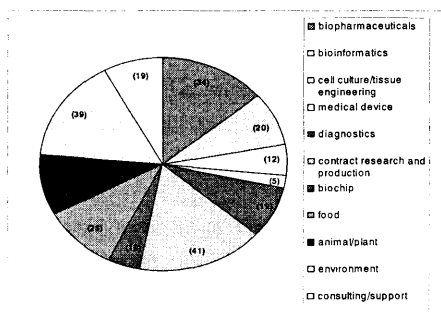


Figure 4: Focus of Japanese biotechnology companies according to Japan Bioindustry Association (number of companies in parenthesis)

Japan considered its strength in manufacturing. This can be seen in some applications of biotechnology where production skills matter, for instance, Japan possesses a strong competitive position in the production of amino acids.

In the post-genome era, it is hoped that the Japanese biotechnology industry can make use of these production skills in the long run. For instance, if the biochip technology shows its potential impact on diagnostics, mass production will be the result. The biochip technology opens up many applications in different fields, e.g. it allows to automate analysis work in medical laboratories, which is previously done manually, and it can be used for patient stratification in order to develop customized drugs with less side-effects. However, in many applications of biotechnology competitive advantages are solely based on product innovation instead of process innovation at present.

Conclusions

In contrast to Germany, large companies play an active role for the formation of biotechnology companies. As already mentioned, one third of all new biotech companies is based on spin-off activities of incumbent companies and in addition, these companies are also involved as research sponsors, investors or co-founders in many other start-ups, which were established by university researchers.

The initiatives of the German government, in particular the BioRegio-competition, were clearly one cornerstone for the development of the biotechnology sector. Since then, this strong initial influence is gradually diminished due to the maturing of the whole sector. In Japan, government plays a pacemaker role and has brought into effect many projects and laws for promoting entrepreneurship and technology transfer in high-technology sectors. Particularly, the budget for Life Sciences has increased steadily in the last few years.

Factor	Germany	Japan
Large companies	-	++
Government	++/+	++
venture capital	++	-
entrepreneurship	++	-

Table 1: Impact of certain institutional factors on the development of the biotechnology industry in Germany and Japan (-: weak influence; + minor influence; ++: strong influence).

The emergence of venture capital in Germany has significantly contributed to the biotech-boom in Germany. National as well as international venture capitalists became increasingly aware of the growth potential of the biotechnology industry in Germany. In contrast, venture capital has been nearly absent in Japan until recently. However, more and more venture capital funds have been raised in the last few years and some of them invest solely in biotechnology companies.