

PATENTS

Biotechnology patent applications in Europe

A look at the differences between French, British, and German patent application trends.

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Most existing comparative studies on patent applications focus on the relative positions of the three major industrial regions, namely Europe, the United States, and Japan. Though more convenient for international comparisons, they do not take into consideration that Europe comprises heterogeneous countries, each with distinct evolutionary trajectories in the biotechnology sector. Thus, it is difficult to access specific data on different European countries. Here, we attempt to identify specific characteristics of patent applications in three major European countries: France, Germany, and the United Kingdom.

Using the Derwent Biotechnology Abstracts database for the period from 1992–1996, we examined variables including the number of patent applications, country of origin, distribution between large and small depositors, public and private sectors, different domains of applications, and extension of patent protection to European or world level (see Table 1)¹. Finally, we drew conclusions on the strategic positioning of different countries in specific technologies. Both descriptive statistical methods (which indicate the relationships between two variables) and scientometric analysis (which indicates the relationships between a set of variables) have been applied to arrive at the results.

Our use of this database was constrained by two limitations. A patent application is associated with the country where it is first deposited. Thus, any patent application by a French, British, or German firm that is first deposited outside of any of these three countries is excluded from the analysis. Second, though a patent application is a signal of technological competence, its actual economic value depends on the capacity of the innovating firm to exploit the patent and generate revenue through licensing the patent to other companies. Given these two limitations, it is difficult to make precise predictions on either the present economic

impact or the future value of the patents of the three countries concerned.

Trends in patent applications

It is clear that France is in a distinctly weaker position than the UK and Germany in terms of the number of patent applications. Our analysis revealed a similar story with respect to scientific publications². For the given period, there are about 40% more publications issuing from organizations based in the UK or Germany than from France. However, the average publication to patents ratio varies only slightly—between 3.0 and 3.3—among the three countries (i.e., it takes about 3 publications to create a patent; see Table 1). This indicates that there is no significant difference in the efficiency with which scientific knowledge is being transformed into innovations within the three countries.

In terms of the spatial strategy for patent applications, German companies mainly tend to seek domestic protection, as only 12.8% of patents are extended to a European level and only 13.3% to a world level. On the other hand, while French and British compa-

nies also tend to deposit their patent applications initially in their own countries, they extend their patents to a world level (81% of English patents and 52% of French patents) or a European level shortly thereafter.

Looking at the depositor profile, the number of patent depositors is largest in Germany, followed by the UK and France. Germany also has a greater percentage of patent applications by individuals, mainly researchers from universities, while France and Britain tend to have greater participation by public laboratories. The UK is the most favored country for patent applications from foreign firms, stemming from its more developed venture capital market, and because the patent application fees are considerably lower in Britain than elsewhere. Also, since the documents needed for patent applications often require translation, the UK has a natural advantage, with English being the dominant international language.

The knowledge that forms the basis for a patent application can be created either through internal R&D or through external

Table 1. Patent applications in France, Germany, and the UK.

	France	Germany	UK
Evolution of patent applications			
No. of patents in 1992	111.0	186.0	153.0
No. of patents in 1993	151.0	238.0	241.0
No. of patents in 1994	162.0	293.0	261.0
No. of patents in 1995	154.0	296.0	291.0
Total no. of patent applications 1992–1995	578.0	1013.0	946.0
Average no. of patent applications/year 1992–1995	144.5	253.3	236.5
Ratio of publications to patent applications 1992–1995	3.2	3.0	3.3
Extension of patents			
% of applications in country of filing company	33.1	70.0	8.0
% of extensions to European level	11.6	12.8	5.3
% of extensions to world level	52.2	13.3	81.0
Profile of patent depositors			
No. of organizations involved	209.0	554.0	376.0
No. of small depositors excluding individuals	75.0	181.0	134.0
% of organizations that are public labs	30.1	11.9	30.6
% of organizations that are private companies	56.0	45.8	55.3
% of organizations who are individuals	13.9	42.2	14.1
Participation of the different types of patent depositors			
% of participation in patent applications by public labs	44.1	20.3	33.5
% of participation in patent applications by companies	51.7	57.5	60.7
% of participation in patent applications by individuals	4.2	22.2	5.8
% of participation in patent applications by foreign companies	3.0	5.8	26.6
% of participation of large depositors that are private companies	33.7	33.7	37.4
% of participation of large depositors that are public labs	33.9	14.2	20.6
% of co-deposited patents (as % of total patent applications)	19.0	8.4	11.5

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Table 2. Large depositors in France, Germany, and the United Kingdom.

France	No. of patents						
		Hoechst	55	Forsch. Zent. Julich	11	Astra	6
		BASF	37	Inst. Genbiol. Forsh. Berlin	10	British Biotechnology	6
Companies		Bayer	29	Fraunhofer-Inst. Appl. Res. Munich	8	Lynxvale	6
Rhône-Poulenc	106	Behringwerke	27	Res. Cent. Julich.	8	Mallinckrodt Vet.	6
Bio-Merieux	32	Boehringer Ingelheim	24	German Cancer Res. Inst.	6	Nickerson-Biocem.	6
Transgene	22	Degussa	18	Kernforsch.	6	Novartis	6
Pasteur-Merieux-Connaught	13	Merck	14	Res. Inst. Genet. Berlin	6	PPL Therapeutics	6
Elf-Acquitaine/Sanofi	11	Schering	13	Univ. Tübingen	6	Advanced Technologies	5
Rhône-Merieux	9	Biopract	10	Umwelt.-Forsch. Zent. Leipzig-Hal	5	Solvay	5
Roquette-Freres	7	Solvay	9	Hans-Knoll-Inst. Nat. Prod. Res. Jp.	5	Therexsys	5
L'Oreal	6	Buna	7	Total	175	Public	
Pierre-Fabre-Med.	6	Linde	7			Medical Research Council	64
Bertin	5	Biotest	7	UK	No. of patents	Univ. London	24
Biocem	5	Forssmann WG	6			Cancer Res. Campaign	18
Genset	5	Henkel	6	Companies		Univ. Manchester	12
L.V.M.H.	5	Heraeus	6	Zeneca	82	UK MAFF	11
OTV	5	Immuno	6	SmithKline Beecham	76	UK Min. of Defense	10
Roussel-Uclaf	5	Rohm	6	Sandoz	27	Imperial Cancer Res. Technol.	8
Total	242	Chemie-Linz	6	Merck	26	John Innes Center	7
Public		Diagen-Inst. Mol. Biol. Diagn.	5	Isis-Innovation	21	Ludwig Inst. Cancer Res.	7
Inst. Pasteur	59	FZB-Biotechnik	5	Celltech	16	Univ. Leeds	7
INSERM	58	Haarmann-Reimer	5	Danisco	15	Univ. Singapore Nat.	7
CNRS	50	Invitek	5	Fujisawa	13	Univ. Cambridge	7
INRA	41	Progen-Biotech.	5	Unilever	13	Univ. Dundee	7
CEA	10	Qiagen	5	Ciba-Geigy	12	Univ. Leicester	7
Univ. Pierre Marie Curie	10	Medigene	5	Wellcome	11	AFRC	6
Inst. Francais du Petrole	8	Total	417	British Nucl. Fuels	7	Inst. Cancer Res. London	6
Inst. Gustave Rossy	8	Public		Chiroscience	7	Univ. Wales	6
Total	244	Max-Planck	36	Glaxo	7	Public Health Lab. UK	5
Germany	No. of patents	Deut. Krebs-Forsch. Zent.	21	Karo-Bio	7	Univ. Glasgow	5
Companies		Ges. Biotechnol. Forsch.	18	Tepnel-Med.	7	Univ. Warwick	5
Boehringer Mannheim	89	Max-Delbrück	15	Cantab Pharmaceuticals	7	Total	229
		GSF-Res. Inst. Environ. Health	14				

Table 3. Key technologies and number of patent applications associated.

Nucleic acid technology	1,767
Clinical genetic techniques	634
Biocatalysis and enzymes	580
Peptides and proteins	405
Animal cell culture	386
Fermentation	268
Vaccines	257
Antibodies	223
Plant genetic engineering	218
Waste disposal	205
Biochemical engineering	187
Food	167
Environment	111
Protein purification	101
Chiral compounds	81
Polymers	73
Sensors and analysis	70
Antibodies	68
Biofuels and solvents	56
Pesticides	44
Mining and metal recovery	34
Agricultural	31
Hormones	20
Biological control	14
Plant cell culture	12
In vitro propagation	9

strategic alliances. In the latter case, the partners are likely to deposit the patent application together. The phenomenon of co-deposition is not highly prevalent in the three countries studied. Even so, in order to measure the

relative role of firms, public laboratories, and individual patentees, we must consider the total number of patent participations rather than the total number of patent applications, as patents can be deposited by more than one individual or organization. We can consider an individual, company, or research laboratory to be a participant in a patent application if it is one of depositors of the patent concerned. We can then calculate the rates of participation of the different types of patent depositors as follows:

$$\% \text{ of participation in patent applications of public labs in country } X = \frac{\text{No. of patent applications in country } X \text{ in which a public lab is a participant}}{\text{Total no. of participations in country } X}$$

Similar indices can be created for private firms and individuals. The results in Table 1 reveal that though the percentage of public laboratories in the population is almost the same in the UK and France, French laboratories are more active in patent applications. Similarly, even though the percentage of private companies in the population of patentees is almost the same in the UK and France, in terms of participation, English firms lead by almost 10%. In Germany, where private companies constitute the smallest percentage of the patentee population, they are about

7% more active than France in terms of patent applications. Again, Germany is distinctive in that there is a set of individuals very active in applying for patents. Not only are private individuals more active in Germany, but these individuals are responsible for almost a quarter of German patent applications. This is because under German regulation it is difficult for university laboratories to take out patents, while individual researchers are not subject to such constraints.

Given the high costs of depositing and defending a patent, it can be assumed that companies that have deposited only one patent are either working on an emerging technology or are small companies. These have been indicated in Table 1 as small depositors. These are most numerous in Germany. A large depositor, on the other hand, is one that has applied for five or more patents between 1992 and 1996.

Recall that the proportion of patent applications in which a private company has participated ranges from 51% to 60% among the three countries. France exhibits the lowest participation rate by private companies, and Britain the highest. This ranking is again apparent when we examine the results for large depositors. In fact, large French depositors account for only 242 patents, while their counterparts in

Germany and the UK account for 417 and 416 patent applications, respectively. However, in the UK, when we remove the patent applications of foreign companies from the large depositors the number of patent applications by English private companies drops to 281, assuming a position very close to France. Large depositors are identified in Table 2.

Patent strategies

The distribution of patent applications over various technologies is shown in Table 3. Not surprisingly, the leading technologies for which patents are being applied are nucleic acid technology for genomics and pharmaceutical applications (including cloning, vectors, transformation, mapping, sequencing, probes, etc.), followed by clinical genetic techniques, biocatalysis and its applications, peptides, and animal cell culture. Germany leads in the greatest number of technologies, followed by Britain and France.

The UK has focused its resources on such sectors as genomics, antibodies, hormones, peptides and proteins, vaccines, pharmaceuticals, and biological control. While Germany is close to the UK in key technologies such as genomics and pharmaceuticals, it is more involved than the other two countries in fer-

mentation, biochemicals, food, agriculture, biofuels, biocatalysis, enzyme isolation, waste disposal, and the environment. France, though trailing behind its neighbors, does well in sectors such as vaccines, in vitro propagation, clinical genetic techniques, and to a lesser extent in sectors such as food, polymers, and animal cell culture.

Conclusions

From this analysis, the main features of patent applications specific to the countries under study can be summarized as follows. France is characterized by strong participation of public sector laboratories in patent applications, and high degrees of concentration in patent applications among both public laboratories and private companies. The United Kingdom is characterized by the strong presence of foreign companies in patent applications, and leads in patent applications in the fields of genomics and pharmaceuticals far ahead of its neighbors. Germany is characterized by a large number and variety of organizations participating in patent applications. It has strong participation of individuals from university laboratories in patent applications, reflecting the mode of regulation of public research. And Germany leads in patent applications in a

large number of key technologies.

In conclusion, the country-specific advantage of France seems to lie in the activity of its public laboratories. Increased mobilization should create even more new biotechnology firms and energize its small-company sector. Germany is clearly no longer a latecomer, having caught up extremely well in the biotechnology sector. Continuing at its present rate, it may emerge as Europe's leader in a number of key technologies. Finally, the UK is the obvious center of attraction for foreign investment in Europe, and this may further fuel the development of financiers, research establishments, and companies situated in that country.

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1. The year 1996 was left out of the calculation of the absolute number of patents in the first section of the table. In Europe, a patent is published only 18 months after its deposit. The database was built in January 1998, and therefore was incomplete for the year 1996. However, 1996 figures were counted in the other calculations in order to estimate the most recent trends in patent applications.
2. Data on publications was extracted from the same database.