

**"PATENTS AND THE EUROPEAN
BIOTECHNOLOGY LAG: A STUDY OF LARGE
EUROPEAN PHARMACEUTICAL FIRMS"**

by
Reinhard ANGELMAR*
Christoph LIEBSCHER**

N° 87 / 18

* Reinhard ANGELMAR, INSEAD, Fontainebleau, France

** Christoph LIEBSCHER, Doctor at Law, Liebscher and Partners, Salzburg

Director of Publication :

Charles WYPLOSZ, Associate Dean
for Research and Development

Printed at INSEAD,
Fontainebleau, France

PATENTS AND THE EUROPEAN BIOTECHNOLOGY LAG:

A STUDY OF LARGE EUROPEAN PHARMACEUTICAL FIRMS

Reinhard Angelmar*
Christoph Liebscher**

June 1987

ABSTRACT

The European patent environment is held to offer less effective protection for biotechnological inventions in comparison to the Japanese and U.S. patent systems. This paper addresses itself to the question of whether the European patent environment is a cause of the European lag in the industrial application of modern biotechnology. The question is examined in the context of the pharmaceutical industry, where patents are particularly important for innovation, and where most of the applications of modern biotechnology have been targeted until now.

We conducted an exploratory study among eight large pharmaceutical firms reported to be among the firms with the most important biotechnology research programs in Germany, Switzerland, and France. It was found that only one of these firms had carried out a formal evaluation of the patent situation before starting biotechnology research. Similarly, there was little formal patent evaluation prior to selecting specific product targets. We conclude that, judging from these firms, the European patent environment is not a cause of the European biotechnology lag, mainly because patent judgments have had little influence on biotechnology decisions. Indications are that patent judgments will play a more important role in future biotechnology decisions. In that case, the European patent environment could yet become a cause of the European biotechnology lag.

* Associate Professor of Marketing INSEAD

** Research Associate INSEAD, Doctor at Law, Liebscher and Partners, Salzburg

Prof. Reinhard Angelmar, INSEAD, Boulevard de Constance,
F-77305 Fontainebleau

Tel. (1)-60-72-4000

INTRODUCTION

Modern biotechnology (from now on, "biotechnology" will refer only to modern biotechnology), which comprises techniques such as recombinant DNA and cell fusion, is an emerging technology with great potential for the pharmaceutical industry (Office of Technology Assessment, 1984). Like other emerging technologies, it has been posing serious problems for the patent system (Straus, 1985). Strong patent protection is not always necessary for innovation (Scherer, 1980), but past research has shown that patent protection is essential for innovation in the pharmaceutical industry (Levin et al., 1984; Mansfield, forthcoming; Mansfield et al., 1981; Taylor and Silberston, 1973). Consistent with these findings, industry groups (e.g., International Chamber of Commerce position papers) and an OECD-sponsored report (Beier et al., 1985) have argued that industry prefers to concentrate investments for biotechnology research in countries offering the best patent protection.

Recent surveys of patent protection for biotechnology have concluded that the European patent environment offers less effective protection than either the Japanese or the U.S. patent systems (Beier et al., 1985; Office of Technology Assessment, 1984). It has also been suggested that Europe lags behind in the industrial application of biotechnology (Bylinski, 1986; Office of Technology Assessment, 1984). Europe's less favorable patent environment could well be one cause of its biotechnology lag (Wald, 1986). Although the larger European firms usually seek patent protection in all geographic areas, the large share of their European home base

in their sales and profits means that a strong patent protection in Europe is vital for them.

A weak patent situation can impair innovation through two types of mechanisms. First, if imitation is easy, as is alleged to be the case for pharmaceutical products (Schwartzman, 1976), fast followers will reduce the pioneer's profits and, as a consequence, the resources available to him for investments in future innovation will decrease. In view of the small number of biotechnology therapeutical products launched until now, this mechanism cannot be invoked as an explanation for the European biotechnology lag. A second type of mechanism operates not through actual market dynamics but via firms' expectations. Most economic models of innovation assume that firms make their decisions on the basis of the expected value of future returns from innovation (Kamien and Schwartz, 1982). Grabowski and Vernon (1986) have shown the great sensitivity of return on investment expectations for pharmaceutical research and development (R&D) projects to different patent assumptions. Weaker biotechnology patent protection in Europe would mean lower profitability expectations for European firms, and less biotechnology investment in comparison to Japanese and U.S. firms. For this expectations-based mechanism to operate, firms must make assessments of the patent situation and integrate these assessments into their resource allocation decisions.

At present, no empirical evidence exists on firms' assessment of the patent situation for biotechnology, nor about the role of these assessments in their resource allocation decisions. Thus, it is impossible to evaluate the

actual impact of the patent environment on the European biotechnology lag.

To improve understanding of this critical issue for European international competitiveness in this important technology, we conducted a study in mid-1986 among eight large, research-intensive pharmaceutical manufacturers based in Germany (4), Switzerland (3), and France (1). These firms were among the ones reported to have the most important biotechnology research programs in their respective countries (Chopplet, 1985; Office of Technology Assessment, 1984).

The study was designed to answer the following two questions: 1. How do these firms assess the European biotechnology patent environment? 2. What role have patent judgments played in their biotechnology decisions?

The insufficient prior knowledge base about these issues ruled out a structured questionnaire approach. The study, therefore, proceeded via unstructured personal interviews. In each firm, we conducted lengthy interviews with the patent specialist in charge of biotechnology for pharmaceuticals. In some of the firms, we also interviewed the head of the patent department, and/or research and marketing managers. In total, 15 persons were interviewed; some of them were interviewed more than once.

In what follows, we present and discuss the answers to the two main questions which we addressed to the firms. Subsequently, we use this evidence to evaluate whether the European patent environment is a cause of the European biotechnology lag.

PERCEPTIONS OF THE EUROPEAN BIOTECHNOLOGY PATENT ENVIRONMENT

The economic literature implies that firms are primarily concerned with two features of the patent environment: first, the inherent patentability, i.e., whether or not patent protection exists in principle and, second, the duration of patent protection (patent life) (e.g., DeBrock, 1985; Eisman and Wardell, 1981). Our interviews suggest a more differentiated perception of the patent environment on the part of the firms. The main patent judgments concern five parameters:

1. Inherent patentability. This is primarily relevant prior to the decision to start research in a broadly defined area of research. For example, before starting research on genetic plant alterations, companies might wonder whether plants are patentable.

2. Patentability of specific expected research outcomes. In case the answer to the first question is positive, the next question is whether a specific research project is likely to lead to patentable outcomes. This depends in general on the patent positions of competitors.

3. Patentability of a specific invention. When researchers come up with an invention, the question "Is this invention patentable?" arises.

4. Infringement of others' patents. As a project moves through various development stages, it is examined for potential infringement of other companies' patent rights.

5. Potential for keeping competitors out. This question assesses the extent to which patent protection allows to

maintain a monopoly position.

We will now examine the issues involved in arriving at judgments about these parameters in the European patent environment for biotechnology.

1. Inherent Patentability

At the start of industrial biotechnology, a critical question was whether biotechnological inventions were capable of being patented. Legislation in some European countries had explicitly excluded products of nature from patent protection. The legal position has evolved considerably over the past years. Japan was among the first countries to explicitly extend patent protection to biotechnological inventions, followed by the U.S., with Europe lagging behind (Beier et al., 1985; Straus, 1985). At the time of our survey, inherent patentability under European patent law for pharmaceutical biotechnological inventions was taken for granted in all companies studied.

2. Patentability of specific expected research outcomes

In economic models of patent "races" competitors are assumed to aim at a well-defined research target (Kamien and Schwartz, 1982; Reinganum, 1984). Patentability predictions for the expected research outcomes are unproblematic: all firms know the criteria by which the patent office will declare the winner. It is also assumed that competitors know instantaneously when one of the firms succeeds in making the targeted invention.

Similar to patent race models, industrial biotechnology research also has clearly defined targets (e.g., interleukin-2, tumor necrosis factor, tissue plasminogen activator, ...). But in sharp contrast to these models, patentability predictions are highly problematic. The patent specialists in our study companies felt highly uncertain about European patent offices' criteria for making patent grants. This is due mainly to three features of the European patent environment: the smaller number of past decisions compared to Japan and the US, the disclosure lag, and the uncertain patent scope.

Smaller number of patent decisions. The predictability of patent office decisions depends mainly on the number and consistency of past patent decisions. In support of this argument patent experts asserted that they could make accurate patent grant predictions for chemistry-based inventions, an area with extensive patent history. But in biotechnology, the European experience basis is low in comparison to Japan and the U.S. According to one study, the number of pharmaceutical biotechnology patents issued between January 1977 and June 1980 was 509 in Japan, 124 in the U.S., and 50 in the EEC and Switzerland (Marstrand, 1981; Wheale and McNally, 1986).

Disclosure lag. In the U.S., Canada, and Japan, disclosure of an invention, e.g. via a presentation at a conference or a publication in a scientific journal, does not destroy patentability, provided the patent application is filed within one year, two years, and six months respectively, the so-called "grace period". Disclosure provides a signal to

competitors that a potential target for inventive activity has already been preempted.

In Europe, disclosure before patent application destroys patentability. Moreover, the European Patent Convention allows companies to delay publication of their patent application until eighteen months after the date of priority application. The consequence of these restrictions on disclosure is that European firms are informed about competitors' preemptive inventions only with a considerable delay. We were told of several projects that were started in the belief that no one else was working on the same product, because no published information existed at the start of the project. Subsequent publication of a competitors' patent application then came as a bad surprise. The disclosure lag in the European patent system is not specific to biotechnology. But the large number of firms with biotechnology research programs combined with the small number of attractive projects in this area increases the uncertainty about the patentability of expected research outcomes.

Uncertain patent scope. Biotechnological products and processes are complex and allow many variations that can lead to equivalent results. The breadth of scope of patent claims determines the possibility for "inventing around" prior inventions. The uncertainty regarding European patent office practice regarding breadth of scope was very high among the firms studied. Many respondents expressed the opinion that the initial decisions had granted patents with too broad a scope, and that future decisions would become more

restrictive.

3. Patentability of a specific invention

Economic models of the patent system assume that the patent grant decision occurs as soon as the fastest firm makes the targeted invention, and that the decision is completely predictable by everyone from the facts of the case and the patent system rules. In our study, the patent specialists perceived considerable uncertainty in predicting whether it would be possible to obtain a patent for various biotechnological inventions submitted to them by the researchers. All of the factors cited in the previous section are responsible for this, still including the possibility that priority claims by faster competitors are hidden by the disclosure lag.

4. Infringement of others' patents

During the development of biotechnology products, the question arises whether or not the project infringes on anyone's patents. The patent specialists found this question very difficult to answer, and the reasons given were many: 1. the technology is very complex, and many different aspects can be covered by patents; discovering all potentially relevant patents requires extensive search; 2. the uncertain scope of the patent claims makes it difficult to predict whether or not a specific feature in a project constitutes an infringement; 3. relevant patent applications may be hidden by the disclosure lag; 4. many of the potentially relevant patent applications are still in the patent process and might

not be granted, or be declared invalid after opposition or after a nullity claim before national courts.

5. Potential for keeping competitors out via patents

Patents are only a means to the end of keeping competitors from imitating. Therefore, from an economic point of view the most important judgment concerns the extent to which the patent situation for a product will allow a firm to maintain a temporary monopoly. Only a few of the firms studied asked this question directly. But patent specialists raised a number of concerns that are related to the exclusionary power of European biotechnology patents.

First, unlike Japan and the U.S., a number of European countries allow no product patents. This makes competition at the product level more likely. Second, in some European countries, the patent holder bears the burden of proof for infringement. Many biotechnology inventions are process-related and defy easy detection of infringement. Moreover, infringement suits in Europe have to be made country by country. Countries have different legal provisions for coping with infringement. In general, none practice infringement penalties that are as severe and deterring as those which the U.S. Court of Appeals tends to impose (Perry, 1986). Furthermore, the smaller number of patents issued compared to Japan and U.S. also means that there have been fewer cases brought to courts and fought out until the final decision.

Our study among patent specialists has revealed two main

issues in regard to the European patent environment for biotechnology. First, there was the perception that the protection is weaker than that afforded by the U.S. and Japanese systems. This is in agreement with results from a comparative study which was based primarily on governmental sources (Beier et al., 1985). Second, all patent judgments, except for the inherent patentability of pharmaceutical biotechnological inventions, were seen as involving high uncertainty. This is probably due to the fact that Europe has accumulated less experience about all stages of the patent process compared to the U.S. and Japan.

An interesting question for future research is the extent to which the perceived uncertainty is entirely inherent in the patent environment, or whether it is, at least in part, due to the company patent specialists. Almost all of them were chemists with no university training in biotechnology. Their biotechnology knowledge had been acquired through short courses and personal reading. Most of them felt ill-equipped to write biotechnology patent applications, which required significantly more time and interaction with the researchers than applications for chemistry-based inventions.

THE ROLE OF PATENT JUDGMENTS IN BIOTECHNOLOGY DECISION-MAKING

The main decisions pharmaceutical firms had to make in regard to biotechnology were: 1. Should biotechnology research be started? If so, 2. What specific targets should be pursued through internal research? 3. Should know-how be bought in from the outside? 4. Should ongoing biotechnology projects be continued, or should they be abandoned? The second objective of the company survey was to find out what role patent judgments have played in these types of decisions.

1. The decision to start biotechnology research

The past research which showed the importance of patent protection for pharmaceutical innovation led us to expect that firms would engage in a formal patent situation evaluation before starting biotechnology research. Except for one company, where a formal patent evaluation was requested prior to a major step-up of biotechnology investments, we found no evidence that formal patent evaluations preceded the decisions to commit significant resources for biotechnology research. The patent specialists were almost never consulted prior to the biotechnology entry decision.

Moreover, we were told that strategic decisions to enter new areas of research were usually taken without a formal analysis of the patent situation, because inherent patentability of inventions is taken for granted. The assumption of inherent patentability holds generally true for chemistry-based invention. But at the time when our sample

firms started biotechnology research, the inherent patentability of biotechnological inventions was still doubtful in a number of European countries.

2. The decision to start a specific research project in-house

We expected again that firms would conduct formal patent situation evaluations before starting in-house research on a project, for two reasons. First, biotechnology research projects require significant resource commitments from the very beginning. They are considerably more expensive than chemistry-based projects, because they necessitate a team composed of several scientific specialists, high-security laboratories, and expensive capital equipment. Second, since they have well-defined product targets, they allow a focused patent situation analysis.

Similar to what we observed for the entry decision, we were told that specific biotechnology projects were usually started without the benefit of a formal patent situation evaluation. Typically, the first point in time when patent specialists became aware of specific projects was when researchers asked them to write patent applications. By that time, significant resources had already been committed to these projects.

We offer four explanations for the observed lack of formal patent situation evaluation before the start of biotechnology projects. First, intense perceived competitive pressure often suggested the need for action with no delay due to patent evaluation. Second, in some cases governmental pressure

combined with project subsidization reduced the need for a thorough project evaluation. Third, some projects were started despite an unfavorable competitive situation, because these projects were regarded as "learning projects". Fourth, companies tacitly transferred decision systems from chemistry-based research to biotechnology. In chemistry-based research, researchers typically conduct a thorough literature search and informally consult with patent specialists before embarking on a project, the initial phases of which are generally inexpensive. Requiring a formal patent evaluation by patent specialists only at an advanced stage of the research project makes sense under these circumstances. Biotechnology research, however, is expensive from the very beginning, and biotechnology researchers are not as "patent-minded" as chemists. According to the patent specialists which we interviewed, industrial biotechnology researchers, fresh out of university, lack understanding of the patent system. Unlike chemistry research groups, industrial biotechnology research groups comprise no senior researchers and managers with a strong patent culture who could socialize the new recruits.

3. The decision to buy in know-how

Many industrial biotechnology projects involve outside sources of know-how, under various types of arrangements: research grants, contracts, licensing-in, etc. The cost of know-how purchases often is high, especially when the suppliers are among the leading specialized biotechnology firms. A thorough analysis of the patent situation would

appear to be essential for estimating the economic value of the knowledge which the supplier already has or is likely to achieve.

Company practices in regard to the formal evaluation of the patent situation before contracting with outside know-how suppliers varied. In a few cases, formal evaluations were carried out in sufficient advance of contracting decisions. In the majority of cases, the patent specialists were consulted only at an advanced stage of negotiation. Sometimes, they were informed after the contracts had been signed.

4. The decision to continue a specific research project

Pharmaceutical innovation proceeds by stages: basic research, preclinical research, scale-up, phase I, phase II, phase III, and introduction. As a project advances from one stage to the next, the investment per period increases significantly (Hansen, 1979). Major areas for decision-making concern whether to continue a project at a given stage, and whether to promote it to the next stage.

Past research suggests that patents have primarily a negative screening function in the innovation process: they are not sufficient by themselves to call forth future investments, but unless they are present, investments may stop. Accordingly, we were most interested in how firms dealt with situations where patent protection was doubtful. If patent protection were as essential to pharmaceutical innovation as past research suggests, firms should stop investing when it becomes clear that they will not be able to

enjoy such protection.

It will not come as a surprise at this point to observe that the firms seldom faced clearly negative patent situations. In the preceding part which dealt with patent judgments we have argued that the firms' patent specialists perceived significant uncertainty in the patent environment. They were neither sure that their firm would obtain patent protection, nor were they sure of the opposite outcome. Because of this uncertainty, the patent situation failed to serve as a negative screening criterion. Faced with an uncertain patent environment, decisions on project continuation and promotion to the next stage essentially resulted from organizational processes, the outcome of which depended on managers' attitudes toward risk, individual mobility, entrepreneurship, and escalation of commitment.

In one extreme case, a company resolutely went ahead despite a rather unfavorable patent situation. Its managers had a clear appreciation of the uncertainty and the risk of facing an infringement suit, which the company was ready to take. At the other extreme, another company hesitated for several years about whether to move to the next stage. In a third company, a project was abandoned after vigorous opposition by a newly appointed marketing manager. On balance, in most cases there was considerable pressure by researchers to continue projects despite the uncertain, and sometimes rather unfavorable patent judgments by patent specialists. The three major arguments for continuing were: 1. the project was necessary for learning, even if it never got to market introduction; 2. there was always a chance that

the leader's patent would not be valid; 3. there was a chance that a significant improvement on existing patent applications or patents could be made.

PATENTS AND THE EUROPEAN BIOTECHNOLOGY LAG

We have seen that, with the exception of one company, none of the firms in our study carried out a formal patent assessment before entry into biotechnology, and that internal projects were started without prior formal patent evaluations. Because the European patent environment was not analyzed, it could not have influenced these decisions. Externally contracted projects were subject to prior patent scrutiny, but the influence of these assessments appeared to be weak. On balance, we conclude that the European patent environment had little influence on biotechnology entry and project starting decisions.

As regards continued investments for ongoing projects, in all firms but one there was no connection between patent parameters and the analysis of expected returns from biotechnology innovation projects. This disconnection seemed to be due primarily to the lack of interaction between the specialists responsible for making economic analyses, who were usually located in central product management and had little understanding of patent issues, and the patent specialists. Only one company included a patent specialist as a regular member in its product development teams.

We have noted previously that the biotechnology patent judgments involved significant uncertainty. Although not investigated in formal models of innovation, which assume patent judgments made under certainty, and risk neutrality, one might hypothesize that patent uncertainty reduces

investments for risk-averse firms. Observation of firms which did not invest or which stopped investments when faced with uncertain patent prospects would constitute evidence for this mechanism.

Again, because in the firms of our study internal biotechnology research was generally started without a formal patent evaluation, this mechanism cannot explain lags in project start-up. We did, however, observe that some ongoing projects were slowed down or stopped when the patent situation became highly uncertain. However, in all of these cases, the companies were far behind the leaders in the race, and it is this lag which explained the uncertain patent situation, rather than the patent situation being responsible for the lag. We did not observe a single case where a firm which was among the leaders in a product race refrained from investing because of patent considerations.

We conclude that, for the firms of our study, the European patent situation has not contributed to a biotechnology lag. Whatever lag there is must be attributed to other factors. Because the firms of this study were not a random sample of all European firms, and much less of all European firms potentially concerned by biotechnology, the extension of this result to a broader and different universe of European firms remains open to doubt. But the present study offers the first empirical evidence on the role of patents in the biotechnology decisions of an important subset of European firms.

CONCLUSIONS

Here, we want to comment on the three main findings of our study: 1. The high uncertainty associated with biotechnology patent judgments. 2. The surprisingly minor role which formal patent evaluations have played in firms' biotechnology decisions. 3. The conclusion that the European patent environment for biotechnology, judged by the evidence from this study, cannot account for the European biotechnology lag.

The high perceived uncertainty associated with patent judgments is bad, because it leads to wasteful duplication of resources. We have observed many cases where firms started projects and continued to invest although these projects were significantly lagging behind the leaders. Some of these projects were genuine learning projects, but for many others the uncertain patent situation of the leader provided grounds for illusions and wishful thinking. Projects were pursued because firms assumed that the leader's patents might not hold up or that a license might be obtained. It is likely that the majority of these projects will never reach the market. Whatever positive spillover effects to future projects exist are probably exceeded by the negative effects of project abandonment. Project abandonment often damages the careers of the researchers and managers involved, demoralizes them, creates broader questions about the organization's capacity to succeed with this new technology, and weakens support for further efforts.

A patent system that provided clear, unambiguous signals

about the validity and scope of the leader's patent applications would force companies to drop imitative projects and to focus their resources on projects with a good chance for leadership. The earlier one can predict the ultimate outcome of the patent process, the earlier the lagging firms can abandon or redirect their projects. But patent uncertainty cannot be reduced by official decree. Rather, it will be reduced mainly through the selfish efforts of individual firms, as expressed in patent applications, oppositions, and litigations. This will clarify the decision rules applied by the patent offices and the courts.

We have argued that the smaller cumulative experience of the European patent environment produces lower predictability in comparison to the Japanese and U.S. systems. Looking towards the future, we expect that as more biotechnology patents enter the litigation process, the diversity of the European political and legal environment will further slow down the process of uncertainty reduction relative to Japan and the U.S.. Ultimately, the value of a patent is proven by whether it holds up in court. But whereas a single court decision in the U.S. provides significant future guidance throughout the United States, a court decision in one European country has little predictive value for a court decision in another European country.

Contrary to our expectations, formal patent evaluations have played only a minor role in the biotechnology decisions of the large European companies which we have studied. Could this be because managers believe that other strong barriers to imitation make patents unnecessary? This was not the case.

Most of our respondents believed that the easy imitability, the traditional reason why patents are so important for patents in the pharmaceutical industry, would also hold for biotechnological innovations. The main explanations for the neglect of patent considerations appear to be organizational: the unquestioned transfer of traditional assumptions and systems; the lack of interaction between product management and patent specialists; the lack of a "patent culture" on the part of biotechnology researchers; the low status of patent specialists as compared to biotechnology researchers; the patent specialists' lack of biotechnology knowledge, as well as the high uncertainty associated with their judgments; last not least, the commitment of biotechnology researchers to their projects, and their frequent disregard of competitive and economic signals.

We recommend that companies conduct formal evaluations of the patent situation before starting a project, monitor the evolving patent situation, and connect patent judgments to economic expectations. Even if patent applications, in the present European patent environment for biotechnology, do not yet allow accurate patent protection predictions, they still are an important indicator of a company's position relative to competitors and could be used by management as a justification for stopping projects.

Finally, judging by the firms of this study, we concluded that the patent environment was not responsible for the European biotechnology lag until now. However, this may change in the future. The biotechnology euphoria of the early 1980s is giving way to more modest expectations. This will

lead to a reassessment of company strategies toward biotechnology. Some of the firms of our study already went through this process. One of its outcomes is an explicit emphasis on strong patent protection as a prerequisite for investment in biotechnology projects. If many European firms were to adopt this attitude, the European patent environment could yet become a cause of the European biotechnology lag.

The authors would like to thank the company patent specialists, the research and marketing managers as well as Dr. N. Brundl and Mr. J. Warcoin for their cooperation during data collection.

The authors also thank Dr. S. Goulden, Dr. W. Arnold and Professors C. Fornell and L. Gabel for their comments on a previous version of the paper.

Financial support for the project from INSEAD is gratefully acknowledged.

REFERENCES

- F.K. Beier, R.S. Crespi, and J. Straus, Biotechnology and Patent Protection: An International Review (OECD, Paris, 1985)
- G. Bylinsky, "Where the U.S. Stands," Fortune (October 13, 1986) 20-29
- M. Chopplet, ed., Les Biotechnologies dans le Monde (Cesta, Paris, 1985)
- L.M. DeBrock, "Market Structure, Innovation, and Optimal Patent Life", J. of Law & Economics (April 1985) 223-244
- M.M. Eisman, and W.M. Wardell, "The Decline in Effective Patent Life of New Drugs," Research Management (January 1981) 18-21
- H. Grabowski, and J. Vernon, "Longer Patents for Lower Imitation Barriers: The 1984 Drug Act," American Economic Review (May 1986) 195-198
- R.W. Hansen, "The Pharmaceutical Development Process: Estimates of Development Costs and Times and the Effects of Proposed Regulatory Changes," in R.I. Chien, ed. Issues in Pharmaceutical Economics (Lexington, Mass., 1979) 151-187
- M.I. Kamien, and N.L. Schwartz, Market Structure and Innovation (Cambridge University Press) 1982
- R.C. Levin, "A New Look at the Patent System," American Economic Review (May 1986) 199-202
- R.C. Levin, A.K. Klevorick, R.R. Nelson, and S.G. Winter, "Survey Research on R and D Appropriability and Technological Opportunity: Part I," Working Paper (Yale University, July 1984)

E. Mansfield, "Patents and Innovation: An Empirical Study," Management Science (forthcoming)

E. Mansfield, M. Schwartz, and S. Wagner, "Imitation Costs and Patents: An Empirical Study", Economic Journal, 91 (December 1981) 907-918

P.K. Marstrand, "Patterns of Change in Biotechnology," SPRU Occasional Paper Series, No. 15 (Sussex, UK, SPRU 1981)

Office of Technology Assessment, Commercial Biotechnology: An International Analysis (US Congress, Washington, D.C. 1984)

N.J. Perry, "The Surprising New Power of Patents," Fortune, (June 23, 1986) 73-81

J.F. Reinganum, "Practical Implications of Game Theoretic Models of R&D", American Economic Review (May 1984) 61-66

F.M. Scherer, Industrial Market Structure and Economic Performance, 2nd ed.(Rand McNally 1980)

D. Schwartzman, Innovation in the Pharmaceutical Industry (The John Hopkins University Press, Baltimore and London, 1976)

J. Straus, "Industrial Property Protection of Biotechnological Inventions" (Paper prepared for the World Intellectual Property Organization, Geneva) July 1985

C.T. Taylor and Z.A. Silberston, The Economic Impact of the Patent System (Cambridge University Press, 1973)

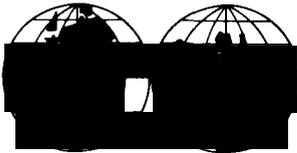
S. Wald, "Biotechnology and patent protection," in D. Davies, ed. Industrial Biotechnology in Europe: Issues for Public Policy (Francis Pinter, London, 1986) 149-156

P.R. Wheale and R.M. McNally, "Patent Trend Analysis: The Case of Microgenetic Engineering," Futures (October 1986) 638-657

1984			85/04	Philippe A. NAERT and Marcel WEVERBERGH	"Market share specification, estimation and validation: towards reconciling seemingly divergent views" .
84/01	Arnoud DE MEYER	"A technological life-cycle to the organisational factors determining gatekeeper activities" , November 1983.	85/05	Ahmet AYKAC, Marcel CORSTJENS, David GAUTSCHI and Ira HOROWITZ	"Estimation uncertainty and optimal advertising decisions", Second draft, April 1985.
84/02	Jeffrey SACHS and Charles A. WYPLOSZ	"La politique budgétaire et le taux de change réel", November 1983.	85/06	Kasra FERDOWS	"The shifting paradigms of manufacturing: inventory, quality and now versatility", March 1985.
84/03	Jeffrey SACHS and Charles A. WYPLOSZ	"Real exchange rate effects of fiscal policy", December 1983.	85/07	Kasra FERDOWS, Jeffrey G. MILLER, Jinchiro NAKANE and Thomas E. VOLLMANN.	"Evolving manufacturing strategies in Europe, Japan and North-America"
84/04	Gabriel A. HAWAWINI	"European equity markets: a review of the evidence on price behavior and efficiency", February 1984.	85/08	Spyros MAKRIDAKIS and Robert CARBONE	"Forecasting when pattern changes occur beyond the historical data" , April 1985.
84/05	Charles A. WYPLOSZ	"Capital controls and balance of payments crises", February 1984.	85/09	Spyros MAKRIDAKIS and Robert CARBONE	"Sampling distribution of post-sample forecasting errors" , February 1985.
84/06	Gabriel A. HAWAWINI	"An uncertainty model of the professional partnership", November 1983.	85/10	Jean DERMINE	"Portfolio optimization by financial intermediaries in an asset pricing model".
84/07	Gabriel A. HAWAWINI	"The geometry of risk aversion", October 1983.	85/11	Antonio M. BORGES and Alfredo M. PEREIRA	"Energy demand in Portuguese manufacturing: a two-stage model".
84/08	Gabriel A. HAWAWINI, Pierre MICHEL and Claude J. VIALLET	"Risk, Return and equilibrium of the NYSE: update, robustness of results and extensions" December 1983.	85/12	Arnoud DE MEYER	"Defining a manufacturing strategy - a survey of European manufacturers".
84/09	Gabriel A. HAWAWINI, Claude J. VIALLET and Ashok VORA	"Industry influence on firm's investment in working capital: theory and evidence", January 1984.	85/13	Arnoud DE MEYER	"Large European manufacturers and the management of R & D".
84/10	Gabriel A. HAWAWINI and Pierre A. MICHEL	"Impact of the Belgian Financial Reporting Act of 1976 on the systematic risk of common stocks", January 1984.	85/14	Ahmet AYKAC, Marcel CORSTJENS, David GAUTSCHI and Douglas L. MacLACHLAN	"The advertising-sales relationship in the U.S. cigarette industry: a comparison of correlational and causality testing approaches".
84/11	Jean DERMINE	"On the measurement of the market value of a bank", April 1984.	85/15	Arnoud DE MEYER and Roland VAN DIERDONCK	"Organizing a technology jump or overcoming the technological hurdle".
84/12	Antonio M. BORGES	"Tax reform in Portugal: a general equilibrium analysis of the introduction of a value added tax", December 1984.	85/16	Herwig M. LANGOHR and Antony M. SANTOMERO	"Commercial bank refinancing and economic stability: an analysis of European features".
84/13	Arnoud DE MEYER and Kasra FERDOWS	"Integration of information systems in manufacturing", December 1984.	85/17	Manfred F.R. KETS DE VRIES and Danny MILLER	"Personality, culture and organization".
1985			85/18	Manfred F.R. KETS DE VRIES	"The darker side of entrepreneurship".
85/01	Jean DERMINE	"The measurement of interest rate risk by financial intermediaries", December 1983, Revised December 1984.	85/19	Manfred F.R. KETS DE VRIES and Dany MILLER	"Narcissism and leadership: an object relations perspective".
85/02	Philippe A. NAERT and Els GIJSBRECHTS	"Diffusion model for new product introduction in existing markets" .	85/20	Manfred F.R. KETS DE VRIES and Dany MILLER	"Interpreting organizational texts".
85/03	Philippe A. NAERT and Els GIJSBRECHTS	"Towards a decision support system for hierarchically allocating marketing resources across and within product groups" .			

- 85/21 Herwig M. LANGOHR and Claude J. VIALLET "Nationalization, compensation and wealth transfers: France 1981-1982" 1, Final version July 1985.
- 85/22 Herwig M. LANGOHR and B. Espen ECKBO "Takeover premiums, disclosure regulations, and the market for corporate control. A comparative analysis of public tender offers, controlling-block trades and minority buyout in France", July 1985.
- 85/23 Manfred F.R. KETS DE VRIES and Dany MILLER "Barriers to adaptation: personal, cultural and organizational perspectives".
- 85/24 Spyros MAKRIDAKIS "The art and science of forecasting: an assessment and future directions".
- 85/25 Gabriel HAWAWINI "Financial innovation and recent developments in the French capital markets", October 1985.
- 85/26 Karel O. COOL and Dan E. SCHENDEL "Patterns of competition, strategic group formation and the performance case of the US pharmaceutical industry, 1963-1982", October 1985.
- 85/27 Arnoud DE MEYER "European manufacturing: a comparative study (1985)".
- 1986
- 86/01 Arnoud DE MEYER "The R & D/Production interface".
- 86/02 Philippe A. NAERT, Marcel WEVERBERGH and Guido VERSWIJVEL "Subjective estimation in integrating communication budget and allocation decisions: a case study", January 1986.
- 86/03 Michael BRIMM "Sponsorship and the diffusion of organizational innovation: a preliminary view".
- 86/04 Spyros MAKRIDAKIS and Michèle HIBON "Confidence intervals: an empirical investigation for the series in the M-Competition".
- 86/05 Charles A. WYPLOSZ "A note on the reduction of the workweek", July 1985.
- 86/06 Francesco GIAVAZZI, Jeff R. SHEEN and Charles A. WYPLOSZ "The real exchange rate and the fiscal aspects of a natural resource discovery", Revised version: February 1986.
- 86/07 Douglas L. MacLACHLAN and Spyros MAKRIDAKIS "Judgmental biases in sales forecasting", February 1986.
- 86/08 José de la TORRE and David H. NECKAR "Forecasting political risks for international operations", Second Draft: March 3, 1986.
- 86/09 Philippe C. HASPELAGH "Conceptualizing the strategic process in diversified firms: the role and nature of the corporate influence process", February 1986.
- 86/10 R. MOENART, Arnoud DE MEYER, J. BARBE and D. DESCHOOLMEESTER. "Analysing the issues concerning technological de-maturity".
- 86/11 Philippe A. NAERT and Alain BULTEZ "From "Lydiametry" to "Pinkhamization": misspecifying advertising dynamics rarely affects profitability".
- 86/12 Roger BETANCOURT and David GAUTSCHI "The economics of retail firms", Revised April 1986.
- 86/13 S.P. ANDERSON and Damien J. NEVEN "Spatial competition à la Cournot".
- 86/14 Charles WALDMAN "Comparaison internationale des marges brutes du commerce", June 1985.
- 86/15 Mihkel TOMBAK and Arnoud DE MEYER "How the managerial attitudes of firms with FMS differ from other manufacturing firms: survey results", June 1986.
- 86/16 B. Espen ECKBO and Herwig M. LANGOHR "Les primes des offres publiques, la note d'information et le marché des transferts de contrôle des sociétés".
- 86/17 David B. JEMISON "Strategic capability transfer in acquisition integration", May 1986.
- 86/18 James TEBOUL and V. MALLERET "Towards an operational definition of services", 1986.
- 86/19 Rob R. WEITZ "Nostradamus: a knowledge-based forecasting advisor".
- 86/20 Albert CORHAY, Gabriel HAWAWINI and Pierre A. MICHEL "The pricing of equity on the London stock exchange: seasonality and size premium", June 1986.
- 86/21 Albert CORHAY, Gabriel A. HAWAWINI and Pierre A. MICHEL "Risk-premia seasonality in U.S. and European equity markets", February 1986.
- 86/22 Albert CORHAY, Gabriel A. HAWAWINI and Pierre A. MICHEL "Seasonality in the risk-return relationships: some international evidence", July 1986.
- 86/23 Arnoud DE MEYER "An exploratory study on the integration of information systems in manufacturing", July 1986.
- 86/24 David GAUTSCHI and Vithala R. RAO "A methodology for specification and aggregation in product concept testing", July 1986.
- 86/25 H. Peter GRAY and Ingo WALTER "Protection", August 1986.
- 86/26 Barry EICHENGREEN and Charles WYPLOSZ "The economic consequences of the Franc Poincare", September 1986.

1987			86/27	Karel COOL and Ingemar DIERICKX	"Negative risk-return relationships in business strategy: paradox or truism?", October 1986.
87/01	Manfred KETS DE VRIES	"Prisoners of leadership".	86/28	Manfred KETS DE VRIES and Danny MILLER	"Interpreting organizational texts.
87/02	Claude VIALLET	"An empirical investigation of international asset pricing", November 1986.	86/29	Manfred KETS DE VRIES	"Why follow the leader?".
87/03	David GAUTSCHI and Vithala RAO	"A methodology for specification and aggregation in product concept testing", Revised Version: January 1987.	86/30	Manfred KETS DE VRIES	"The succession game: the real story.
87/04	Sumantra GHOSHAL and Christopher BARTLETT	"Organizing for innovations: case of the multinational corporation", February 1987.	86/31	Arnoud DE MEYER	"Flexibility: the next competitive battle".
87/05	Arnoud DE MEYER and Kasra FERDOWS	"Managerial focal points in manufacturing strategy", February 1987.	86/32	Karel COOL and Dan SCHENDEL	Performance differences among strategic group members", October 1986.
87/06	Arun K. JAIN, Christian PINSON and Naresh K. MALHOTRA	"Customer loyalty as a construct in the marketing of banking services", July 1986.	86/33	Ernst BALTENSPERGER and Jean DERMINE	"The role of public policy in insuring financial stability: a cross-country, comparative perspective", August 1986, Revised November 1986.
87/07	Rolf BANZ and Gabriel HAWAWINI	"Equity pricing and stock market anomalies", February 1987.	86/34	Philippe HASPELAGH and David JEMISON	"Acquisitions: myths and reality", July 1986.
87/08	Manfred KETS DE VRIES	"Leaders who can't manage", February 1987.	86/35	Jean DERMINE	"Measuring the market value of a bank, a primer", November 1986.
87/09	Lister VICKERY, Mark PILKINGTON and Paul READ	"Entrepreneurial activities of European MBAs", March 1987.	86/36	Albert CORHAY and Gabriel HAWAWINI	"Seasonality in the risk-return relationship: some international evidence", July 1986.
87/10	André LAURENT	"A cultural view of organizational change", March 1987	86/37	David GAUTSCHI and Roger BETANCOURT	"The evolution of retailing: a suggested economic interpretation".
87/11	Robert FILDES and Spyros MAKRIDAKIS	"Forecasting and loss functions", March 1987.	86/38	Gabriel HAWAWINI	"Financial innovation and recent developments in the French capital markets", Updated: September 1986.
87/12	Fernando BARTOLOME and André LAURENT	"The Janus Head: learning from the superior and subordinate faces of the manager's job", April 1987.	86/39	Gabriel HAWAWINI Pierre MICHEL and Albert CORHAY	"The pricing of common stocks on the Brussels stock exchange: a re-examination of the evidence", November 1986.
87/13	Sumantra GHOSHAL and Nitin NOHRIA	"Multinational corporations as differentiated networks", April 1987.	86/40	Charles WYPLOSZ	"Capital flows liberalization and the EMS, a French perspective", December 1986.
87/14	Landis GABEL	"Product Standards and Competitive Strategy: An Analysis of the Principles", May 1987.	86/41	Kasra FERDOWS and Wickham SKINNER	"Manufacturing in a new perspective", July 1986.
87/15	Spyros MAKRIDAKIS	"METAFORCASTING: Ways of improving Forecasting. Accuracy and Usefulness", May 1987.	86/42	Kasra FERDOWS and Per LINDBERG	"FMS as indicator of manufacturing strategy", December 1986.
87/16	Susan SCHNEIDER and Roger DUNBAR	"Takeover attempts: what does the language tell us?", June 1987.	86/43	Damien NEVEN	"On the existence of equilibrium in hotelling's model", November 1986.
87/17	André LAURENT and Fernando BARTOLOME	"Managers' cognitive maps for upward and downward relationships", June 1987.	86/44	Ingemar DIERICKX Carmen MATUTES and Damien NEVEN	"Value added tax and competition", December 1986.



EURO-ASIA CENTRE

CAMPUS INSEAD

Boulevard de Constance
77309 Fontainebleau Cedex, France
Telephone (1) 60 72 40 40
Telecopy (1) 60 72 40 49
Telex 690389

EAC RESEARCH PAPERS

EAC RESEARCH PAPERS

(Academic papers based on the research of EAC Faculty and research staff)

1. LASSERRE Philippe (Research Paper n° 1)
A contribution to the study of entrepreneurship development in Indonesia. 1980.
2. BOISOT Max and LASSERRE Philippe (Research Paper n° 2)
The transfer of technology from European to ASEAN enterprises: strategies and practices in the chemical and pharmaceutical sectors. 1980.
3. AMAKO Tetsuo (Research Paper n° 3)
Possibilité d'un transfert à l'étranger des techniques japonaises de gestion du personnel: le cas français. 1982.
4. SCHUTTE Hellmut (Research Paper n° 8)
Wirtschaftliche Kooperation zwischen den ASEAN - Ländern und Nordrhein-Westfalen - Hemmungsfaktoren und Chancen für die deutsche Wirtschaft. 1983.
5. ISHIYAMA Yoshihide (Research Paper n° 14)
The political economy of liberalisation of the financial system in Japan. 1984.
6. LASSERRE Philippe (Research Paper n° 17)
Singapour comme centre régional. L'expérience d'entreprises françaises. 1985.
7. Von KIRCHBACH Friedrich (Research Paper n° 18)
Patterns of export channels to developing Asia. 1984.
8. MITTER Rajan (Research Paper n° 19)
A survey of European business in India. 1984.
9. CHAPON Marie-Claude (Research Paper n° 22)
Stratégies des entreprises japonaises en Afrique. 1985.