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Working Paper

Choosing and successfully sustaining competitive strategies in the European pharmaceutical industry

MPIfG Discussion Paper, No. 08/9

Provided in Cooperation with:

Max Planck Institute for the Study of Societies (MPIfG), Cologne

Suggested Citation: Herrmann, Andrea M. (2008) : Choosing and successfully sustaining competitive strategies in the European pharmaceutical industry, MPIfG Discussion Paper, No. 08/9, Max Planck Institute for the Study of Societies, Cologne

This Version is available at:

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MPIfG Discussion Paper 08/9

**Choosing and Successfully Sustaining Competitive
Strategies in the European Pharmaceutical Industry**

Andrea M. Herrmann



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MPIfG Discussion Paper 08/9
Max-Planck-Institut für Gesellschaftsforschung, Köln
Max Planck Institute for the Study of Societies, Cologne
September 2008

MPIfG Discussion Paper
ISSN 0944-2073 (Print)
ISSN 1864-4325 (Internet)

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Abstract

It is a central claim of the national competitiveness literature that firms exploit the comparative advantages of their environment by choosing to pursue the product market strategy that is facilitated by national financial- and labour-market institutions. Otherwise, so goes the argument, firms are punished in that strategies receiving no institutional support are less successful and therefore not sustainable in the long run. My analyses of pharmaceutical firms in Germany, Italy and the United Kingdom challenge these arguments on the choice and success of competitive strategies. Given that different measures of strategy success do not indicate that the latter is in line with national institutional advantages, I develop an alternative explanation for the strategy choices of firms. On the basis of my qualitative interviews with managers, I argue that technological opportunities to transform inventions or imitations into marketable products are a primary concern when entrepreneurs choose their firm's strategy.

Zusammenfassung

Es ist ein zentrales Argument der Literatur zur nationalen Wettbewerbsfähigkeit von Unternehmen, dass sich letztere die Wettbewerbsvorteile ihrer institutionellen Umgebung zu Nutze machen, indem sie diejenigen Produktstrategien wählen, die durch die jeweiligen nationalen Finanz- und Arbeitsmarktinstitutionen gefördert werden. Ansonsten, so ein weiteres Argument der Literatur, werden Firmen dadurch abgestraft, dass institutionell nicht gestützte Strategien langfristig weniger erfolgreich und daher nicht von Bestand sind. Die im Rahmen dieses Projekts durchgeführten Untersuchungen von Pharmazieunternehmen in Deutschland, Italien und Großbritannien lassen Zweifel an diesen Argumenten zu Wahl und Erfolg von Wettbewerbsstrategien entstehen. Da verschiedene Indikatoren von Strategieerfolg nicht darauf hindeuten, dass nationale Wettbewerbsvorteile die Strategiewahl beeinflussen, wird eine alternative Erklärung entwickelt, wie Unternehmen Wettbewerbsstrategien wählen. Auf der Grundlage von qualitativen Interviews mit Managern wird aufgezeigt, dass die technologischen Möglichkeiten eines Unternehmens, Erfindungen oder Imitationen in marktfähige Produkte zu verwandeln, von wesentlicher Bedeutung dafür sind, welche Strategie ein Unternehmer wählt.

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1 National institutions as drivers of strategy choice and sustainability?

Beginning with the trade theorem of Heckscher and Ohlin (Heckscher 1919; Ohlin 1933), the literature on national corporate competitiveness has developed in several disciplines and now embraces strands as diverse as neo-liberal theory (Sinn 2005), strategic management studies (Porter 1990), theories on national innovation systems (Lundvall 1992b; Nelson 1993; Pavitt/Patel 1999), and the literature on varieties of capitalism (Hall/Soskice 2001b; Amable 2003; Hancké et al. 2007). Despite their different foci, all these strands agree that economies are differently endowed with input factors which, in turn, are required for particular competitive strategies. Whereas the originators of this literature consider how the abundance of labour and capital influences corporate production decisions (Heckscher 1919; Ohlin 1933), its subsequent promoters distinguish between different types of production factors and illustrate how they facilitate strategies of radical product innovation, high-quality production and low-cost production, respectively. Because national corporate-governance and labour-market institutions are found to influence the availability of these crucially required factors, the four above-mentioned strands of the national competitiveness literature also concur in the claim that firms choose to exploit the comparative institutional advantages of their economy and embark on the strategy facilitated by their institutional environment.

More concretely, the institutional environment of *coordinated economies*, such as that of Germany and Sweden, is said to facilitate competition through *product quality*. Collective bargaining procedures between the social partners not only entail comparatively high and homogeneous wages; they also facilitate an education and training system that provides employees with highly specific vocational skills. The latter are at the root of extraordinary labour productivity and high-value-added strategies. Given that the corporate-governance system grants shareholders important control rights, managers cannot take major financial decisions at short notice, which is necessary to rapidly invest in, or divest from, radically innovative projects. Yet firms do have access to ‘patient’ capital, required for incrementally innovative projects, because major stakeholders – such as banks, suppliers, employees, and the founding family – also tend to be major shareholders. Cooperation-enhancing labour-market institutions and corporate governance systems thus constitute important comparative advantages that motivate firms to specialize in strategies of high-quality production.¹

The opposite applies to *liberal economies*, such as those of the United Kingdom (UK) and the United States, where the institutional setting is found to motivate competition

I wish to thank Steven Casper, Colin Crouch, Guido Möllering, David Soskice, Rikard Stankiewicz, Wolfgang Streeck, Pieter Vanhuyse, and Raymund Werle for stimulating discussions and their comments on earlier versions of this paper. I am grateful to Fabio Pammolli for granting me access to the Pharmaceutical Industry Database (PHID) and to Laura Magazzini for assisting me in sampling it.

1 Proponents of this argument are, in particular, Porter (1990: 355–382); Pavitt/Patel (1999); Hollingsworth (2000); Estévez-Abe et al. (2001); Hall/Soskice (2001a: 36–44); Vitols (2001); Amable (2003); Casper/Mataves (2003); Casper/Whitley (2004); Sinn (2005); see also Lindgaard Christensen (1992); Freeman (1992); Keck (1993).

through *radical innovation strategies*. Because collective bargaining processes are decentralized, it is difficult to put in place an education and training system in which firms collaborate to provide trainees with specific skills. On the other hand, wages are flexible. High bonuses can therefore be paid to motivate employees to relentlessly develop radically new innovations. Furthermore, deregulated financial markets give firms easy access to share capital. This capital, however, needs to be invested in radical innovation projects promising high returns in the short run, because if the profit expectations of shareholders are not fulfilled, the latter rapidly withdraw funds, as they have only reduced monitoring capabilities for tracking how their investment is used. Flexible labour markets and deregulated corporate governance systems thus seem to offer compelling comparative advantages for strategies of radical product innovation.²

Finally, firms in *low-investment economies*, such as those of Italy, Spain or Greece, are likely to specialize in the pursuit of *low-cost strategies*. Where labour-market institutions allow for comparatively low wage levels, employers are unlikely to participate in sophisticated education and training programmes, whereas employees, once they have finished compulsory schooling, often decide to start working rather than to invest in further education. Whenever low wage levels are coupled with non-transparent financial-market institutions, firms are furthermore likely to engage in low-cost production, as share capital and bank credits – required for radical and incremental innovation alike – are difficult to obtain. Firms in low-investment economies seem thus best advised to exploit the cost advantage of the economy, by choosing to specialize in low-cost strategies.³

The view of firms as ‘institution-takers’ on which this reasoning is based, makes it difficult to explain how a substantial number of firms can pursue competitive strategies that are not supported by national institutions. Therefore, the national competitiveness literature remains puzzled with the question of how radically innovative high-tech industries can develop in rigid or low-investment economies like those of Germany or Italy. And yet, a highly innovative biotech industry has, in fact, grown in both countries since the mid-1990s (Ernst & Young 2006; Pozzali 2004). Sticking to their constraining view of national institutions, competitiveness scholars argue that the attempt to engage in radical product innovation in these economies can be of a temporary nature only. In the long run, such attempts are condemned to failure. In other words, radical innovation strategies are expected to be less successful in rigid and low-investment economies like Germany or Italy than in flexible economies like the UK, and are therefore not sustainable in the long term.⁴

2 See, in particular, Porter (1990: 482–507); Pavitt/Patel (1999); Estévez-Abe et al. (2001); Hall/Soskice (2001a: 36–44); Vitols (2001); Amable (2003); Casper/Mataves (2003); Casper/Whitley (2004); see also Lindgaard Christensen (1992); Freeman (1992); Walker (1993); Hollingsworth (2000).

3 See Estévez-Abe et al. (2001: 175–176); Amable (2003: in particular 102–114, 197–213); see also Porter (1990: 421–453); Malerba (1993); Trento (2005).

4 For proponents of this argument, see Hall/Soskice (2001a: 17–21); Vitols (2001: 355–359); Hall/Gingerich (2004); Casper (2007).

This paper challenges the arguments on both *strategy choice* and *strategy success*. Beginning with analyses of the latter, I show that the success (measured in terms of both accounting performance and the sustainability of the initial legal status) with which firms pursue different strategies in the UK, Germany, and Italy is not influenced by the national institutions of these economies. Given that the decision to pursue strategies unsupported by national institutions is not punished by limited success, the question of alternative explanations for *strategy choice* arises. Systematic comparisons of entrepreneurial decision-making processes show that firms choose their strategy on the basis of technological opportunities, i.e. on the basis of inventions made by scientists and the facilities available for developing these inventions into marketable products. Depending on their innovation results, entrepreneurs thus decide to engage in radical product innovation, incremental product innovation or low-cost imitation.

I illustrate these points through quantitative and qualitative analyses of pharmaceutical firms – including biotech, traditional pharmaceutical, and generics firms – in Germany, Italy, and the UK. The reasons for this empirical focus are twofold. With regard to the choice of *industry*, it is possible to identify the competitive strategies of pharmaceutical firms in a straightforward way through the scientifically established notion of a New Chemical Entity (see section 2). With regard to the choice of *countries*, it is important to note that patent legislation, as well as pharmaceutical health and safety regulation, is strict but homogeneous throughout the EU zone following the establishment of the European Medicines Agency in 1995 (Casper/Matraves 2003: 1868; BAH, 2006; EMEA, 2006). Since this paper aims to test the hypotheses of the competitiveness literature on the impact of *national institutions* on competitive strategies, it was essential to control for *legislative factors* that influence corporate strategies. Consequently, only pharmaceutical firms in the most institutionally disparate EU member states that have been legislatively harmonized have been investigated. According to the national competitiveness literature, the economies that offer the most facilitative institutions for radical innovation, high quality, and low-cost strategies are, respectively, the UK, Germany, and Italy.

The paper is organized as follows. Section 2 first analyses whether firms in different economies specialize in the same competitive strategy. Finding this not to be the case, section 3 enquires into strategy success by analysing whether firms perform less well and are less sustainable if they choose to pursue competitive strategies that are not supported by national institutions. Given that empirical evidence does not support this idea, section 4 proposes an alternative explanation for strategy choice. By examining three sets of very different firms, the section illustrates that they all agree on one central point: entrepreneurs choose their firm's strategy on the basis of technological opportunities. Section 5 summarizes and interprets the various findings.

2 One economy, one competitive strategy?

To obtain a benchmark for strategy stability on the one hand, and strategy choice on the other, we need to understand to what extent firms in the same economy specialize in the same competitive strategy, as suggested by the national competitiveness literature. To this end, we first need to identify different strategies. In line with the literature, I understand a competitive strategy to be a process that leads to the emergence of a good which, in turn, gives the producing firm a sustainable advantage on the market.⁵ Deductive reasoning combined with insights from the national competitiveness literature teach us that a firm can obtain a sustainable advantage either from selling an *entirely new good* or from selling an *already existing product*. However, if the product is already known to the customer, it has to be *of a better quality* or *cheaper* than rival products. Hence, a sustainable advantage results from selling a *radically new*, an *incrementally new*, or a *cheaper standard good*. Accordingly, I distinguish between three competitive strategies: *Radical Product Innovation* (henceforth RPI), based on a radical technological innovation; *Diversified Quality Production* (henceforth DQP), based on an incremental technological innovation; and *Low-Cost Production* (henceforth LCP), based on technological imitation.

This conceptual distinction can be applied in a particularly straightforward way to pharmaceutical firms⁶ in order to identify their competitive strategies due to the scientific notion of a New Chemical Entity (henceforth NCE). Simply put, an NCE constitutes a chemical entity which had not yet been discovered. It is scientific practice to indicate whether active ingredients or excipients of a pharmaceutical product constitute an NCE, a modification of an already discovered chemical entity, or simply an imitation. Using the classification of pharmaceutical products according to the newness of their employed chemicals, I propose the following differentiation between competitive strategies (see Bottazzi et al. 2001: 1162–1167). Pharmaceutical firms inventing drugs based on an NCE pursue RPI strategies, whereas firms improving already discovered chemical entities engage in DQP. Finally, firms which do not engage in R&D, but focus on imitating innovations made by others, pursue LCP strategies.

5 See Porter (1980: chapter 2); see also Porter (1985: chapter 1); Hall/Soskice (2001a: 14–17); Estévez-Abe et al. (2001: 148–149); Casper (2001: 397–401); Lundvall (1992a: 10); Heckscher (1919); Ohlin (1933: 7); Sinn (2005: 18–19).

6 The generic term of a *‘pharmaceutical firm’* is commonly used in the literature for any company that is active in the pharmaceutical industry. Accordingly, the firm is assigned to the industry on the basis of the good it produces: a pharmaceutical product. The distinction between a ‘biotechnology’, a ‘traditional pharmaceutical’ and a ‘generics’ firm refers to the *technological approach* of the pharmaceutical company in question. In so far, biotechnology firms employ the most modern technology on the level of the cell and sub-cell to create industrially useful substances. Although traditional pharmaceutical firms sometimes apply methods used in biotechnology, they mostly make use of experimental and, thus, less deliberate approaches to drug design. Finally, generics firms are least technology-intense, as they do not engage in any research or clinical development activities, but instead imitate drugs as soon as their patent protection expires (see Drews, 2000; Orsenigo et al., 2001; Pammolli et al., 2002; Muffatto/Giardina, 2003; Wittner, 2003). Throughout this paper, I use these commonly accepted definitions of a pharmaceutical, a biotech, a traditional pharmaceutical and a generics firm.

The privately-owned Pharmaceutical Industry Database (PHID), which is developed and administered by a group of researchers at the University of Siena (Italy), offers the most complete empirical basis for identifying the competitive strategy of pharmaceutical firms in Germany, Italy, and the UK.⁷ Being one of the largest pharmaceutical databases worldwide, it keeps track of 16,751 pharmaceutical projects carried out by 3,522 firms and public research organizations in seven countries.⁸ The latter include Germany, Italy, and the UK, in addition to France, Japan, Switzerland, and the United States.⁹ For these countries, any firm is recorded as soon as it has been involved in at least one pharmaceutical project that has reached the stage of preclinical development since the 1980s. Therefore, firms whose pharmaceutical projects are/were not granted patent protection are also included in the database. However, firms that do not engage in R&D but imitate the pharmaceuticals of competitors are not recorded. Finally, pharmaceutical firms are considered only if their projects translated into therapeutic drugs curing or alleviating human diseases. Firms that are active in the service sector, such as platform-technology suppliers, are not considered.

Importantly, though, a new drug is often not developed by a single firm. Instead, the process leading to the launch of a new product is characterized by a remarkable division of labour (see Gambardella et al. 2001: 36–53). Whereas biotech firms tend to specialize in upstream research activities, downstream development activities are typically taken over by traditional pharmaceutical firms (see Orsenigo et al. 2001; Bottazzi et al. 2001; Owen-Smith et al. 2002; Pammolli et al. 2002). The PHID database takes this division of labour into account by distinguishing between the *developers*, *licensors*, and *licensees* of pharmaceutical products. A *developer* is a firm with a fully integrated value chain carrying out all stages on its own. A *licensor*, by contrast, initiates a project which ultimately translates into a new drug. However, focusing on upstream activities (i.e. on discovery, preclinical and early clinical development), the licensor decides at a certain point to licence its discovery to another firm, which continues the drug development process. Accordingly, a *licensee* focuses on the stages of (late) clinical development, registration, and marketing in order to translate the respective discovery into a marketable drug.

This distinction makes it possible to identify RPI, DQP, and LCP strategists as follows:

- RPI strategists are *developers*, or the *licensors* of pharmaceutical projects that translate into a drug based on an NCE. Since the discovery of an NCE is made by the licensor, the latter is *radically innovative* irrespective of the stage at which it decides to out-license the pharmaceutical project.

7 The PHID database is constantly updated. All figures reported in the following analysis refer to November 2004.

8 The PHID database identifies the nationality of a firm on the basis of the location of the firm's headquarters.

9 To be precise, the PHID database covers 67 countries. However, the number of pharmaceutical projects registered in the remaining 60 countries is too small to provide representative results.

- Following this logic, a firm pursues a DQP strategy whenever it is the *developer* or *licensor* of a pharmaceutical project which improves on a previously discovered chemical entity. In addition, a firm also pursues a DQP strategy if it *in-licences* a pharmaceutical project based on an NCE *at the stage of clinical development*. At that moment, the previously unknown chemical entity has been discovered. Accordingly, it is the task of the licensee to improve the entity in such a way that its effectiveness and dosage are optimized. In sum, both the licensees of a clinical development agreement and the developers or licensors of an improved drug pursue a DQP strategy, as they are not radically but *incrementally innovative*.
- This leaves us with a third group of firms in-licensing pharmaceutical projects with the aim of registering and marketing radically or incrementally new drugs. These firms are similar to generics firms in that they avoid expensive research and development activities. Hence, their strategy consists in producing and selling drugs at the *lowest-possible cost*.

Table 1 shows the results of this sampling strategy when applied to those British, German, and Italian pharmaceutical firms which have been involved in at least one pharmaceutical project since 1985.¹⁰ A detailed list of the firms that qualified as RPI, DQP, and LCP strategists is provided in the Appendix.¹¹

Contrary to the expectations of the national competitiveness literature, Table 1 does not provide empirical support for the idea that the majority of firms in the same political economy specialize in the same competitive strategy. While 47.5% of pharmaceutical firms pursue an RPI strategy in the UK, 39.4% of firms pursue this strategy in Germany, and 34.5% of firms do so in Italy. DQP strategies, in turn, are pursued by 51.5% of German, 37.9% of Italian, and 42.5% of British firms. Finally, the share of firms pursuing an LCP strategy is 27.6% in Italy, 10.0% in the UK, and 9.1% in Germany. In other words, the strategy patterns identified are very similar for the UK, Germany, and Italy. However, Table 1 also shows that firms in different economies show slight preferences for one of the three strategies. The share of British firms engaged in radical product innovation is 6.3 percentage points higher than the average. Similarly, the probability of pursuing a DQP strategy is 7.4 percentage points higher for a German firm than for the sample's average company. Finally, Italian firms show a preference for low-cost production, as the share of Italian firms engaged in this strategy is 12.9 percentage points higher than the average. Yet, a crosstab analysis of the strength of association between a

10 Given that it takes on average 14 years to develop a pharmaceutical product (Muffatto/Giardina 2003: 108–109), I have limited the sample to the last 20 years in order to cover a sufficiently long time span, while eliminating outdated results.

11 Each of those nine international pharmaceutical firms which were found to pursue – in two separate business units – an RPI strategy on the one hand and a DQP strategy on the other are counted as two individual cases. For a more detailed description of the sampling approach underlying the results reported in Table 1, see Herrmann 2008; Herrmann forthcoming: chapter 2.

Table 1 Summary results: RPI, DQP, and LCP strategists in the UK, Germany, and Italy

	Radical product innovators (RPI)		Diversified quality producers (DQP)		Low cost producers (LCP)		Total	
	No. firms	% firms	No. firms	% firms	No. firms	% firms	No. firms	% firms
UK	19	47.5	17	42.5	4	10.0	40	39.2
Germany	13	39.4	17	51.5	3	9.1	33	32.4
Italy	10	34.5	11	37.9	8	27.6	29	28.4
Total	42		45		15		102	100.0
Average	14	41.2	15	44.1	5	14.7	34	
Above average		6.3		7.4		12.9		

Source: PHID (November 2004).

firm's *location* and the probability with which a specific *strategy* is pursued shows that differences in specialization patterns are too weak to produce statistically significant results ($\chi^2 = 5.996$ [2 cells = 22.2% with expected count less than 5]; $p > .10$; *Cramer's V* = .171; $p > .10$). These findings run counter to the expectations of proponents of the specialization argument, as they indicate that neither the majority nor a statistically significant plurality of firms pursues the same competitive strategy within the same economy.

3 Strategy success

The results obtained are telling in two respects. First, they indicate that firms do not choose to pursue *that* competitive strategy for which national institutions provide the required input factors. British pharmaceutical firms do not specialize in RPI even though deregulated financial and labour markets offer easy access to share capital and employees with general qualifications (see footnote 2). Neither do German firms chiefly engage in DQP only because regulated financial markets provide them with patient capital and rigid labour markets motivate employees to acquire specific qualifications (see footnote 1). Moreover, Italian firms do not specialize in LCP even though wage levels are low in comparison to those of other European Monetary Union member states, and thus provide a source of 'cheap' labour, while non-transparent financial-market institutions make access to larger sums of capital difficult (see footnote 3).

Second, these findings provide empirical support for a phenomenon mentioned earlier: the fact that radically innovative biotech industries have developed in rigid and low-investment market economies like Germany and Italy. Seeking to explain this enigma from a functionalist perspective, the national competitiveness literature holds that radically innovative industries in these economies perform less well and are thus not sustainable in the long run (see footnote 4). Paying tribute to this argument, it must be said that the previous analyses only demonstrate *that* British, German, and Italian pharmaceuti-

cal firms pursued an RPI, DQP, or LCP strategy at some point between 1985 and 2004. However, this static overview says nothing about the *success* with which RPI, DQP, and LCP strategies are pursued in different institutional environments. It may be that firms choosing a non-conformist strategy are punished for their decision with failure in the long run. In other words, whenever firms neglect to exploit the advantage of pursuing the institutionally facilitated strategy, they are less competitive and sooner or later fail.

To shed light on this question, the following two subsections analyse how successful RPI, DQP, and LCP firms are in different institutional environments. In so doing, section 3 considers two different indicators of corporate success: accounting performance and change in legal status. In other words, subsection 3.1 addresses strategy success from a synchronic perspective by comparing various accounting ratios of RPI, DQP, and LCP pursuers in Germany, Italy, and the UK. Subsection 3.2 takes up a diachronic analysis of strategy success, investigating the sustainability of the initially pursued strategy. It asks the question: Are firms more likely to merge, be acquired, or go bankrupt if they pursue strategies that are not supported by national institutions?

The firm sample for these analyses is, mostly, the one I derived from the PHID database (see section 2). To obtain more representative results when assessing strategy success on the basis of the PHID sample, I increased the latter in two ways. First, I added generics firms, which are not included in the PHID database because they abstain from R&D activities. I thus included the entire population of British, German, and Italian generics producers which, in November 2004, could be identified as genuinely national firms, having their headquarters in, and concentrating their activities on, the national territory of the respective country (Wittner 2003: 51–54, 70–73, 133–134). Hence, I added six British,¹² nine German,¹³ and two Italian¹⁴ generics producers to the dataset and classified each of them as a low-cost producer. Second, I added German and Italian biotech firms, as they were underrepresented in the initial sample in comparison to their British counterparts (see tables A.1 – A.3 of the Appendix). The reason for this is that the British biotech industry began to develop in the 1980s – much earlier than its German and Italian counterparts, where most biotech firms were founded, respectively, in the mid-1990s and around the turn of the millennium. Therefore, many German and most Italian biotech firms had not yet brought a pharmaceutical project beyond the stage of preclinical development and, hence, were not yet registered in the PHID database when I sampled the latter in November 2004. To obtain a more homogeneous sample, I randomly added three German¹⁵ and eight Italian¹⁶ biotech firms, using data

12 Namely, *CP Pharmaceuticals, Generics (UK), Kent Pharmaceuticals, Sterwin Medicines, Sussex Pharmaceuticals, and Tillomed Laboratories.*

13 Namely, *Aliud Pharma, Azupharm, Betapharm Arzneimittel, CT Arzneimittel, Hexal, Lichtenstein Pharmazeutica, Merck Dura, Ratiopharm, and Stada Arzneimittel.*

14 Namely, *DOC Generici and Dorom.*

15 Namely, *DeveloGen, Ingenium Pharmaceuticals, and Sirenade.*

16 Namely, *Axxam, BioXell, Newron Pharmaceuticals, Nikem Research, Novuspharma, Primm, Shar. dna, and Siena Biotech.*

provided by Ernst & Young (2002: 15–19) and the ‘Italian Biotech Database’ of *Venture Valuation* (2006) as a sampling basis. I identified the firms’ strategy (RPI or DQP) by comparing the classification of Ernst & Young (2002: 15–19) with that of Knut Lange (2006), by consulting the firms’ web pages, and by talking to their representatives.¹⁷ With the addition of these 17 generics and 11 biotech firms, the initial sample of 102 pharmaceutical firms was increased to 130.

Synchronic analyses of strategy success

Do firms perform less well if they pursue a strategy that is not supported by national institutions (see Hall/Soskice 2001a: 17–21; Hall/Gingerich 2004)? From a synchronic perspective, one way to answer this question is to compare the accounting performance of the 130 aforementioned RPI, DQP, and LCP strategists. More precisely, I compared how these firms perform in six accounting ratios which are among the most important indicators used by analysts to evaluate the financial conditions of a firm. They include (a) *return on shareholders’ funds*, a measure of corporate profitability indicating how much profit a firm has generated with the money that shareholders have invested; (b) *return on capital employed*, a ratio that reveals the profitability of a firm’s capital investments; (c) *profit margin*, a ratio of profitability that indicates how much out of every dollar of sales a firm obtains in earnings; (d) *current ratio*, a liquidity ratio that measures a firm’s ability to pay back its short-term liabilities (debt and payables) with its short-term assets (cash, inventory, and receivables); (e) *solvency ratio*, an indicator used to measure a firm’s ability to meet long-term obligations; (f) *gearing*, an indicator that explains how a firm finances its operations either through outside lenders or through shareholders, whereby firms with a high gearing – that is, with more long-term liabilities than shareholder equity – are considered speculative. As a rule of thumb, one can say that firms perform better, the higher they score on each of these indices – with the exception of their gearing, where the opposite applies.

All ratios were obtained from the AMADEUS database, a privately-owned dataset of Bureau van Dijk, which contains financial information on nine million public and private companies in 38 European countries (Bureau van Dijk 2004). It was possible to obtain accounting ratios for 73 of the 130 pharmaceutical firms included in the overall sample. Before grouping these 73 firms according to their strategy and country, I calculated each accounting ratio for each firm as an average value of the past five years in order to correct for temporary peaks.

17 On the basis of these insights, I classified *DeveloGen*, *Ingenium Pharmaceuticals*, *Sirenade*, *BioX-ell*, *Newron Pharmaceuticals*, *Novuspharma*, *Shar.dna*, and *Siena Biotech* as RPIs, and categorized *Axxam*, *Nikem Research*, and *Primm* as DQPs.

Table 2 Performance of RPI, DQP, and LCP strategists in six accounting ratios

Group of firms	No. of cases	Return on shareholders' funds (%) ^a	Return on capital employed (%) ^b	Profit margin (%) ^c	Current ratio ^d	Solvency ratio (%) ^e	Gearing (%) ^f
RPIs UK	11	-55.10	-58.13	-4.34	3.86	53.84	74.68
DQPs UK	12	49.37	59.30	5.63	3.41	52.22	106.43
LCPs UK	7	-16.02	-84.27	-6.74	1.53	34.78	62.83
RPIs Germany	5	-34.07	-14.89	-16.72	7.89	66.77	36.01
DQPs Germany	8	28.03	24.48	12.43	3.03	46.58	88.19
LCPs Germany	3	169.49	42.22	12.95	1.31	25.29	856.68
RPIs Italy	8	-8.03	-7.30	2.36	3.19	43.34	196.84
DQPs Italy	13	20.77	18.50	10.33	1.50	40.37	78.32
LCPs Italy	6	48.39	62.35	9.06	1.28	17.47	466.02
RPIs overall	24	-35.03	-31.78	-4.92	4.48	53.03	112.07
DQPs overall	33	32.93	34.02	9.13	2.56	46.18	91.02
LCPs overall	16	42.92	-0.32	2.88	1.40	26.51	362.87
Total or average	73	12.78	5.57	4.13	2.94	44.12	159.77

a: Return on shareholders' funds = profit or loss before tax/shareholders' equity.

b: Return on capital employed = profit or loss before tax + interest paid/shareholders' equity + non-current liabilities.

c: Profit margin = profit or loss before tax/operating revenue.

d: Current ratio = current assets/current liabilities.

e: Solvency ratio = shareholders' funds/total assets.

f: Gearing = non-current liabilities + loans/shareholders' equity.

Source: AMADEUS, sampled in December 2004 (Bureau van Dijk 2004).

Table 2 presents the results. To find empirical support for the argument that the success of competitive strategies is influenced by national institutions, Table 2 should reveal that RPI strategists perform particularly well in the UK, whereas DQP pursuers perform better than average in Germany, and LCP firms outperform their peers in Italy. Interestingly, though, this is not the case. For each of the six accounting ratios, British RPI strategists, German DQP pursuers, and Italian LCP firms are usually outperformed either by firms pursuing different strategies in the same country or by firms pursuing the same strategy in different countries – or even on both accounts. Crosstab analyses confirm the findings presented in Table 2. To run these analyses, I calculated for each firm and each accounting ratio whether the respective RPI, DQP, or LCP strategist performed better or worse than the average 73 firms for which data could be obtained. Crosstab analyses of the respective *average performance indicators* with the firms' *countries* and *competitive strategies* unambiguously led to the same results. If statistically significant deviations are observable at all, they are not in line with the predictions in the national competitiveness literature.¹⁸ These results indicate that the success of competitive strategies is not influenced by the institutional environment within which firms operate.

Another noteworthy observation to be made on the basis of Table 2 is that RPI strategists perform overall rather poorly in all profitability ratios, including the return on shareholders' funds, return on capital employed, and the profit margin. This finding, in turn,

18 Detailed results of the crosstab analyses performed can be provided by the author upon request.

indicates that RPI, DQP, and LCP strategies are characterized by a distinct investment-return profile, which is particularly evident in the case of radical product innovators. Because it takes years before investment in research and development of pharmaceutical products becomes profitable, newly established RPI strategists do not usually make a profit in the first years of their existence. This seems to explain why their profitability ratios are comparatively low. However, the possibility that competitive strategies differ in their risk-return profile also indicates that comparisons of accounting ratios between firms pursuing *different* strategies might be of limited help in understanding whether national institutions influence strategy success, because part of the variations among strategies in these indicators might stem from the differences in risk-return profiles rather than from differences in the institutional environment.

It is thus useful to cross-check the findings presented in Table 2 with indicators that eliminate the possible influences of different risk-return profiles. To this end, the AMADEUS database offers additional indicators that can be taken as synchronic measures of strategy success. In the so-called peer report of the database, a firm is ranked in comparison to its ten most direct competitors according to six economic items on the one hand and six accounting ratios on the other. While the accounting ratios are the same as those described in Table 2, the six economic items are (a) the firm's *operating revenue*; (b) its *profit or loss before tax*; (c) the annual *cash flow*; (d) the firm's *total assets*; (e) its *shareholders' funds*; and (f) its *number of employees*. Depending on how well a firm performs relative to its ten most direct competitors, it is assigned a score from 1 to 11, whereby higher scores indicate better performance.

Table 3 gives an overview of the peer performance of those 73 pharmaceutical firms for which data could be obtained from the AMADEUS database. For reasons of simplification, Table 3 does not report the scores of each of the twelve peer indicators separately. Instead, a firm's average position has been calculated for the six economic items (column 3) and the six accounting ratios (column 4). These two performance indicators of RPI, DQP, and LCP strategists in Germany, Italy, and the UK are reported on the left-hand side of Table 3. The right-hand side ranks the respective groups of firms according to their overall peer performance, which, in turn, was calculated by averaging out the scores obtained in economic items and accounting ratios. In order to correct for temporary peaks, each peer performance indicator was calculated as an average value of the past five years for which data was available.

Table 3 also shows that RPI, DQP, and LCP strategists in Germany, Italy, and the UK achieve fairly similar positions on both the economic items index (column 3) and the accounting ratio measure (column 4). On a scale from 1 to 11, the average positions range from 3.65 (DQP pursuers in the UK) to 5.89 (LCP firms in Germany). In other words, all the pharmaceutical firms observed perform worse than at least three, but better than six, of their most direct competitors – irrespective of the strategy they pursue and the country within which they are located. From the perspective of an entrepreneur, this result might be reassuring to the extent that the pursuit of any strategy seems to

Table 3 Performance of RPI, DQP, and LCP strategists relative to their ten most direct competitors

Group of firms	No. of cases	Ø peer performance in economic items ^a	Ø peer performance in accounting ratios ^b	Group of firms ranked by position obtained	No. of cases	Ø peer performance in economic items and accounting ratios ^c
RPIs UK	11	5.73	5.26	DQPs UK	12	4.19
DQPs UK	12	3.65	4.73	DQPs Italy	13	4.48
LCPs UK	7	4.87	4.42	LCPs UK	7	4.64
RPIs Germany	5	4.39	4.95	RPIs Germany	5	4.67
DQPs Germany	8	4.56	5.83	RPIs Italy	8	4.74
LCPs Germany	3	5.89	4.50	LCPs Italy	6	4.86
RPIs Italy	8	4.44	5.04	DQPs Ger.	8	5.19
DQPs Italy	13	4.19	4.77	LCPs Germany	3	5.20
LCPs Italy	6	5.28	4.44	RPIs UK	11	5.50
RPIs overall	24	4.99	5.12			
DQPs overall	33	4.08	5.01			
LCPs overall	16	5.21	4.44			
Total or average	73	4.62	4.92	Total	73	4.77

a: On a scale from 1 to 11, average of firms' ranking in operating revenue, profit or loss before tax, cash flow, total assets, shareholders' funds, and number of employees.

b: On a scale from 1 to 11, average of firms' ranking in return on shareholders' funds, return on capital employed, profit margin, current ratio, solvency ratio, and gearing.

c: On a scale from 1 to 11, average of peer performance in economic items and of peer performance in accounting ratios.

Source: AMADEUS, sampled in December 2004 (Bureau van Dijk 2004).

have about the same chances of success. From the perspective of the national competitiveness literature, though, this result is troubling because it indicates that national institutions do not directly influence the success of corporate strategies. This idea is confirmed by the last three columns of Table 3, which rank the different groups of firms according to their overall peer performance. Although one should keep in mind that differences between the individual positions are minor, it is striking to find British RPI strategists, German DQP pursuers, and Italian LCP firms amongst those four groups of firms that perform least well. This finding, again, militates against the idea, commonly advanced in the literature, that pharmaceutical firms perform less well if they pursue a strategy that is not supported by national institutions (see Hall/Soskice 2001a: 17–21; Hall/Gingerich 2004).

Diachronic analyses of strategy success

It would be premature, however, to dismiss, purely on the basis of synchronic analyses, the idea that national institutions influence strategy success, as it may be that firms perform equally well at a certain point in time. Once corporate performance is considered over time, it may turn out that some strategies fail more often than others, depending on the institutional environment within which they are pursued. In this subsection, I

thus take up diachronic analyses of strategy success by enquiring into the frequency with which firms merge, are acquired, or go bankrupt. Are the initially pursued strategies more sustainable – that is, less susceptible to mergers, acquisitions, and bankruptcy – if they are supported by national institutions providing the required input factors (see Vitols 2001: 355–359; Casper 2007)? To answer this question, I first address the sustainability of competitive strategies on the basis of the previously employed PHID dataset of 130 pharmaceutical firms. I then countercheck the findings on the basis of an additional dataset comprising biotech firms only.

Does the PHID sample provide empirical support for the idea that competitive strategies are less sustainable unless firms pursue RPI strategies in the UK, DQP strategies in Germany, and LCP strategies in Italy? To answer this question, a retrospective check on each of the 130 pharmaceutical firms was carried out to see whether they have gone bankrupt, merged, been acquired, or kept their original legal status in the course of the last twenty years (i.e. between 1985 and 2006). Table 4 summarizes the results. Because mergers and acquisitions (M&As) do not necessarily constitute instances of corporate failure, whereas bankruptcy does, Table 4 makes the following distinction. Columns 2 to 5 list all instances of bankruptcy and M&As separately; these are then added up and reported in columns 6 and 7 as instances of change in legal status. Columns 8 and 9 report the remaining number and percentage of firms that did not experience a change in legal status. Taken together, all instances of status change and status stability lead to the overall number of firms surveyed, shown in columns 10 and 11.

Irrespective of whether M&As are perceived as instances of corporate success or failure, Table 4 indicates that firms go bankrupt, are acquired, or merge independent of the competitive strategy they pursue within a given institutional environment. For all instances of bankruptcy, it is particularly evident that national institutions providing required input factors do not influence the sustainability of competitive strategies. While bankruptcy is a rare event in general, the only instance observed for Germany concerns a firm that pursued a DQP strategy. In Italy, bankruptcy is – in relative terms – most widespread among LCP pursuers. Only RPI strategists in the UK show signs of strategy sustainability in line with the expectations of the national competitiveness literature.

To assess statistically whether differences in the sustainability of competitive strategies vary significantly between countries, I carried out two crosstab analyses. As might have been expected on the basis of Table 4, the association between a firm's *country*, its *strategy*, and the *stability* of this strategy (measured in terms of 'bankruptcy,' 'M&A,' and 'legal status stability' on the one hand,¹⁹ and in terms of 'legal status change' and 'legal

19 More concretely, the key indicators obtained are
 – for the UK: $\chi^2 = 2.140$ (4 cells = 44.4% with expected count less than 5), $p > .10$; *Cramer's V* = .153, $p > .10$
 – for Germany: $\chi^2 = 6.314$ (6 cells = 66.7% with expected count less than 5), $p > .10$; *Cramer's V* = .265, $p > .10$

Table 4 Changes in the legal status of RPI, DQP, and LCP strategists

Group of firms	Bankruptcies		M&As		Legal status change		Legal status stability		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
RPIs UK	1	5	6	32	7	37	12	63	19	100
DQPs UK	1	6	6	35	7	41	10	59	17	100
LCPs UK	2	20	3	30	5	50	5	50	10	100
RPIs Germany	0	0	2	13	2	13	14	87	16	100
DQPs Germany	1	6	2	12	3	18	14	82	17	100
LCPs Germany	0	0	5	42	5	42	7	58	12	100
RPIs Italy	1	7	2	13	3	20	12	80	15	100
DQPs Italy	1	7	0	0	1	7	13	93	14	100
LCPs Italy	1	10	3	30	4	40	6	60	10	100
RPIs overall	2	4	10	20	12	24	38	76	50	100

Source: PHID, sampled in November 2004; changes occurred between 1985 and 2006.

status stability' on the other²⁰) is not strong enough to produce statistically significant results. Synchronic analyses therefore cast doubt on the idea that national institutions influence strategy success, even when the latter is understood in terms of the sustainability of a firm's legal status. In other words, firms seem to fail, or to change or maintain their legal status irrespective of the country in which they pursue RPI, DQP, and LCP strategies.

Albeit only for firms pursuing RPI strategies, it was possible to countercheck these findings by means of the 'VentureXpert' database of *Thomson Financial* (2004). This database provides detailed information on a representative sample of firms in many Western economies that have received venture capital since the early 1980s (Bernard 2006). Because data can be sorted by country and industrial activity, it is possible to isolate those biotech firms that have obtained venture capital in the UK, Germany, and Italy. These firms can be assumed to pursue an RPI strategy for two reasons. First, tables A.1, A.2, and A.3 show that the majority of RPI strategists are biotech firms (see Appendix). Second, several studies illustrate that institutional share capital in general, and venture capital in particular, constitute the most important source of finance for RPI pursuers (see Bottazzi/Da Rin 2002; Gompers/Lerner 2004: chapter 12; Kanniainen/Keuschnigg 2005; Herrmann forthcoming: chapter 3). Firms that are active in the biotech industry and have received venture capital are very likely to pursue an RPI strategy.

– for Italy: $\chi^2 = 4.988$ (6 cells = 66.7% with expected count less than 5), $p > .10$; Cramer's $V = .253$, $p > .10$

20 More concretely, the key indicators obtained are

– for the UK: $\chi^2 = .468$ (1 cell = 16.7% with expected count less than 5), $p > .10$; Cramer's $V = .101$, $p > .10$

– for Germany: $\chi^2 = 3.706$ (3 cells = 50.0% with expected count less than 5), $p > .10$; Cramer's $V = .287$, $p > .10$

– for Italy: $\chi^2 = 3.866$ (3 cells = 50.0% with expected count less than 5), $p > .10$; Cramer's $V = .315$, $p > .10$

Table 5 Changes in the legal status of RPI strategists

Radical Product Innovators	UK		Germany		Italy	
	No.	%	No.	%	No.	%
In registration	1	0.8	0	0.0	0	0.0
Active investment	101	80.2	140	90.9	27	79.3
Went public	12	9.5	4	2.6	4	11.8
Acquisition	8	6.3	2	1.3	2	5.9
Merger	3	2.4	6	3.9	1	3.0
Bankruptcy	1	0.8	2	1.3	0	0.0
Σ	126	100.0	154	100.0	34	100.0
Successful RPIs ^a	114	90.5	144	93.5	31	91.1
Ambiguous RPIs ^b	11	8.7	8	5.2	3	8.9
Unsuccessful RPIs ^c	1	0.8	2	1.3	0	0.0
Σ	126	100.0	154	100.0	34	100.0
Legal status stability ^d	114	90.5	144	93.5	31	91.1
Legal status change ^e	12	9.5	10	6.5	3	8.9
Σ	126	100.0	154	100.0	34	100.0

a: Sum of biotech firms which were in the process of registration in 2004, which have remained unchanged since their establishment (active investment), or which went public between 1985 and 2004.

b: Sum of biotech firms which merged or were acquired between 1985 and 2004.

c: Biotech firms which went bankrupt between 1985 and 2004.

d: See 'a' above.

e: Sum of biotech firms which merged, were acquired or went bankrupt between 1985 and 2004.

Sources: VentureXpert, sampled on 19 October 2004: changes occurred between the mid-1980s and 2004. Italian Biotech Database, sampled on 18 June 2006: changes occurred between the mid-1990s and 2006.

While the sample obtained from VentureXpert for both Germany and the UK is representative, the one obtained for Italy must be completed. Given that the Italian biotech industry started to take off around the turn of the millennium,²¹ many firms were not yet included in the VentureXpert dataset when I sampled it in October 2004. To make up for this shortcoming, I consulted the 'Italian Biotech Database' of *Venture Valuation* (Venture Valuation 2006). This database provides the most complete list of biotech firms which have received, or constitute attractive opportunities for, venture investment. In June 2006, it contained 34 firms. Like their British and German counterparts, these firms can be expected to pursue RPI strategies for the two previously mentioned reasons: they are active in the biotech industry, and they are (potential) recipients of venture capital. Yet, unlike VentureXpert, the Italian Biotech Database does not provide systematic information on bankruptcy, M&As, and firms that have gone public. To reveal whether the firms in this database have a history of mergers or acquisitions and to discover possible additional instances of bankruptcy, I consulted experts from the Italian biotech industry, various reports (Chiesa 2004: 14–20; Fornasiero 2004; Muffatto/Giardina 2003: 119), and the companies' web pages to identify the firms that had gone bankrupt or public, that had merged, or that had been acquired.

Table 5 provides an overview of the information obtained and illustrates the extent to which British, German, and Italian RPI strategists have changed their legal status

21 The majority of today's most successful biotech firms in Italy were founded between 1999 and 2003 (see Venture Valuation 2006).

since the mid-1980s. Whereas the upper section of Table 5 (lines 2 to 7) provides more detailed insight into corporate changes, the middle section (lines 9 to 11) regroups the respective events into successful, unsuccessful, and ambiguous cases. The lower section (lines 13 and 14) gives a summary of the initial events (lines 2 to 7) by distinguishing merely between legal status stability (line 13) and legal status change (line 14). It should be noted that this sample presumably conveys an overly optimistic impression of strategy sustainability because it only includes (potential) venture-capital recipients. Having been subject to the scrutiny of venture capitalists, these firms are more likely to be engaged in promising research projects than the average biotech firm in Germany, Italy, or the UK. However, this bias towards RPI stability is symmetric, so that actual failure can be assumed to be systematically higher in all three countries to the same extent.

The figures presented are telling in that they again cast doubt on the argument advanced in the national competitiveness literature that RPI strategies are unsustainable in Germany (see Vitols 2001: 355–359; Casper 2007). Contrary to this claim, Table 5 shows that the aggregate figures of legal status sustainability are strikingly similar for British (90.5%), German (93.5%), and Italian (91.1%) RPI strategists alike. I tested the statistical robustness of this observation through several crosstab analyses. In line with the previous analyses, I tested the associational strength between the *country* of RPI strategists and their *sustainability*, whereby I measured the latter in terms of ‘strategy success,’ ‘ambiguity,’ and ‘failure’ on the one hand,²² and in terms of ‘legal status change’ and ‘legal status stability’ on the other.²³ The results obtained show that the scores are not statistically significant for either χ^2 or *Cramer’s V*, whereby *Cramer’s V* received low scores. These indicators thus lend additional statistical support to the observation that RPI strategies are about equally sustainable in Germany, Italy, and the UK.

4 Strategy choice

Given that section 2 showed that firms in different types of economies pursue RPI, DQP, and LCP strategies to the same extent, and given that the previous analyses indicate that strategies are successful even if they are pursued in institutionally hostile environments, it can be ruled out that entrepreneurs base their strategy choice on institutional considerations. But what, then, drives an entrepreneur’s choice of competitive strategy? In this section I attempt to provide an alternative explanation. To this end, it should be noted that *choice* and *change* of competitive strategies are synonymous events from an analytical point of view, as they are determined by the same cause. The use of one or the other

22 The key indicators obtained are $\chi^2 = 2.037$ (4 cells = 44.4% with expected count less than 5), $p > .10$; *Cramer’s V* = .057, $p > .10$

23 The key indicators obtained are $\chi^2 = .907$ (1 cell = 16.7% with expected count less than 5), $p > .10$; *Cramer’s V* = .054, $p > .10$

term simply depends on a firm's stage of development. When a company is set up from scratch, it must choose the strategy it wishes to pursue. An established firm, by contrast, already pursues a strategy that it may wish to change at a certain point in time. Yet the reasons why a newly founded firm chooses a particular strategy and an already established company changes its strategy are the same. In this section, I discuss instances of strategy choice and change to roughly the same extent.

Drawing on insights I gained from interviewing CEOs and managers of selected RPI, DQP, and LCP firms,²⁴ I suggest that entrepreneurs base their choice of competitive strategy on technological opportunities – that is, on the inventions made by scientists and the facilities available for developing these inventions into marketable products. To illustrate this argument, I will discuss several particularly revealing cases, presenting them in three groups. The first group consists of three firms that resemble each other in all respects but three: the institutional environments in which they are situated, the technological opportunities available to them, and the strategies they pursue. The second group comprises four firms that are prototypical examples of German and Italian biotech firms. Differing in a variety of ways, their common feature is the extent to which technological opportunities have influenced the firms' strategy choices. The third group is made up of three companies that have changed their strategy at a particular point in time. Although the direction and moment of change as well as the firms' institutional environment differ, the most important driver of strategy change is the same in all three cases: technological opportunities.²⁵

Similar firms, choice of different competitive strategies

A particularly revealing example of how the choice of competitive strategy is influenced by technological opportunities is provided by three biotech firms which, for reasons of confidentiality, shall be called *Chrome Ltd.*, *Chrome GmbH*, and *Chrome Srl*. These firms are strikingly similar in many respects. In addition to being active in the biotech industry, they are active in the same therapeutic area of vaccines against bacterial pathologies. Although they function independently in making their short- and medium-term decisions, all three firms are wholly owned by the same US corporation. Furthermore, they are similar in size, employing 750, 850 and 1,100 people, respectively. All have a fully integrated value chain which includes an R&D department, production facilities, marketing and sales structures, and administrative support functions. However, the three companies differ in two crucial aspects. First, they are situated in three different institu-

24 For reasons of confidentiality, I refer to these interviews with two or three initial letters that stand for the country in which the interview was carried out ('Ger' for Germany, 'It' for Italy, and 'UK' for the United Kingdom), combined with an abbreviation for the strategy pursued by the interviewee's firm and a figure indicating the number of the interview.

25 This section draws from interviews carried out between March 2004 and March 2006. Changes after March 2006 are not taken into consideration here.

tional environments: *Chrome Ltd.* in the UK, *Chrome GmbH* in Germany, and *Chrome Srl.* in Italy. Furthermore, they differ in the competitive strategies they pursue. Whereas the German and British firms are engaged in development-oriented DQP strategies, the Italian company specializes in research-oriented RPI (UkDQP1; ItRPI2; GerDQP2).

Because this strategic orientation runs counter to the expectations of the national competitiveness literature, I asked human resources managers from each firm about the reasons for their company's strategy choice. Interestingly, the three interviewees agreed in their answer: the choice or change of competitive strategy was motivated by the technological opportunities of each firm; namely, the extent to which pharmaceutical inventions gave rise to hopes for the development of radically or incrementally new products. When the US holding company bought the Italian affiliate in 1992, the latter had a long-standing history in pharmaceutical research, made possible through its extensive R&D facilities and its links to internationally renowned research institutes. These technological capacities had not only produced radically new pharmaceuticals but also raised hopes for further radical innovations. Accordingly, the Italian affiliate continued to pursue a research-focused RPI strategy after it was acquired (ItRPI2). The situation was different for both the German and the British affiliate. When the two firms were bought by the US holding company, their R&D facilities and their academic networks augured incremental rather than radical innovations. Therefore, the German biotech firm continued to pursue a development-focused DQP strategy (GerDQP2), whereas its British counterpart changed its strategy from RPI to DQP (UkDQP1).

Different firms, choice of similar competitive strategies

Further evidence of firms choosing their strategies on the basis of technological opportunities is provided by the emergence of the German and Italian biotech industry in general, and by two German and two Italian biotech firms in particular. To preserve their confidentiality, the German firms shall be called *Melareen AG* and *Intrapharma AG*, the Italian firms *Belle SpA* and *Neverpharma SpA*. These firms are not only examples of Germany's and Italy's most successful biotech firms in the early years of the new millennium; they are also particularly representative examples of the different circumstances under which the German and the Italian biotech industry developed.

To begin with, the incentives to set up a biotech firm in Germany and Italy were diametrically opposed. Whereas structural and financial support from the government provided positive incentives for company formation in Germany, the opposite was true for Italy, where biotech firms were often founded as a response to downsizing measures by pharmaceutical companies. Furthermore, like many German biotech firms, *Melareen* and *Intrapharma* were spin-offs from academic institutions (GerRPI1; GerRPI2), whereas *Belle* and *Neverpharma* grew out of existing pharmaceutical companies (ItRPI3; ItRPI1), as have almost all Italian biotech firms. Finally, company foundation took place

at different points in time. Like many German biotech companies, the two German firms were founded in the mid- and late 1990s; the two Italian firms, like most of their national counterparts, were set up around the turn of the millennium.

Despite these discrepancies, German and Italian biotech firms in general, and these four examples in particular, agreed in their choice of competitive strategy. Aiming at the commercial development of radical inventions made within the organization from which the firms in question emerged, all newly founded companies decided to pursue RPI strategies (GerRPI1; GerRPI2; ItRPI3; ItRPI1). This decision was not affected by the extent to which national institutions provided the necessary input factors for RPI. Instead, the search for these factors came after the decision to establish an RPI company.

Strategy change over time

Three examples of strategy change complete the anecdotal evidence presented thus far. A German LCP strategist, which I shall call *Aetherpharma GmbH*, constitutes the first example. Until 2001, *Aetherpharma* was part of a larger pharmaceutical group, within which it pursued a DQP strategy. When the increasing need for innovative performance and flexibility led to the splitting of this group, *Aetherpharma* had to reconsider its strategic orientation. Following a prolonged period of reduced R&D efforts, *Aetherpharma's* discovery record was bleak. Because its poor R&D performance dashed hopes for early inventions, *Aetherpharma* decided to change its competitive strategy from DQP to LCP (GerLCP1). This decision demonstrates how technological opportunities and, more precisely, the prospect *not* to come up with marketable innovative products, influenced the firm's decision to change its strategy.

A similar example is provided by an Italian LCP strategist which, for reasons of confidentiality, is referred to here as *Glycerine SpA*. Until the early 1990s, *Glycerine* was a typical marketing specialist in that it imitated, produced, registered, and marketed the products of other pharmaceutical firms. While pursuing these activities, *Glycerine* happened to discover a recombinant protein, which raised hopes for the development of superior products and, hence, for incremental innovation. In an attempt to exploit this technological opportunity commercially, *Glycerine* opened a small research centre and changed from an LCP to a DQP strategy. But this change in general, and pharmaceutical development in particular, was not without problems. Although the R&D activities of *Glycerine* translated into several patents and international research collaborations, the firm became aware that it lacked both the financial means and the technological expertise to develop its discovery into a marketable product. Consequently, it decided to stop its R&D efforts and closed the research centre (ItLCP1). In other words, *Glycerine* changed from a DQP back to an LCP strategy – roughly ten years after its first strategy change. Like the experience of *Aetherpharma*, the change from LCP to DQP, and vice

versa, was instigated by technological opportunities: namely, the firm's hope, then incapacity, to turn a pharmaceutical invention into a marketable product.

The final example of strategy change is again provided by an Italian firm, which I shall call *Allpharma SpA*. Unlike the two previous cases, *Allpharma* changes – and changes back – its competitive strategy from DQP to RPI. This approach is possible because the firm's R&D activities take place at two levels. Having been among the first Italian firms to open their own R&D laboratories, the national research facilities of *Allpharma* constitute the basis for the firm's usual activities in incremental product innovation. Furthermore, *Allpharma* is one of the founding members of an exclusive, private European research alliance established in 1989. Having the explicit aim of facilitating the 'joint research and development of innovative pharmaceutical products' (ItDQP1), this research network occasionally serves as a platform for the development of *Allpharma's* radical innovations. More concretely, *Allpharma* occasionally makes radical discoveries while pursuing its traditional DQP activities. Seizing these technological opportunities, the firm temporarily changes its strategy from DQP to RPI by relying extensively on its international research partners. Once the latter have helped to transform the radical invention into marketable patents, or even products, *Allpharma* changes back to incremental innovation and proceeds with product improvements (ItDQP1).

In sum, technological opportunities are a central concern of entrepreneurs when choosing their firm's strategy in two respects. First, the firms discussed here differ in all particulars but one: their strategy choice was driven by the prospect not to be inventive or, rather, to develop a radical or incremental invention into a marketable product. Second, all 'strategy changers' chose a new strategy that was technologically close to the former one. Firms switched from LCP to DQP strategies, and vice versa. They also changed back and forth from DQP to RPI strategies. However, not one firm switched from RPI to LCP, or the other way round. The decision to choose a new strategy that corresponds to the firm's former technological expertise underlines how important technological considerations are for the strategy choices of pharmaceutical firms.

5 Discussion and conclusions

What do the analyses presented in this paper teach us about the success and choice of competitive strategies pursued in the pharmaceutical industry? Contrary to the central argument of the national competitiveness literature (see footnotes 1 to 3), entrepreneurs do not seem to base their choice of competitive strategy on institutional considerations. Rather than pursue a particular strategy because it is facilitated by national institutions providing specific input factors, entrepreneurs instead decide to take up RPI, DQP, or LCP strategies irrespective of their firm's institutional environment (section 2). Interestingly and, again, contrary to the expectations of national competitiveness scholars

(see footnote 4), entrepreneurs are not punished for pursuing strategies that receive no institutional support, as neither the success nor the sustainability of competitive strategies seems to be dependent on national institutions providing the required input factors (section 3).

Although alternative explanations for strategy success go beyond the scope of this particular paper, I have sought to develop an alternative explanation for strategy choice on the basis of qualitative evidence, in that systematic comparison of interviews with CEOs and managers suggests that technological opportunities are a crucial factor when entrepreneurs decide which competitive strategy to pursue. When the prospect of inventions is limited, entrepreneurs opt for LCP strategies. When chances of developing an incremental or radical invention into a marketable product are reasonable, they instead choose to pursue RPI or DQP strategies (section 4).

These insights challenge contributions to the national competitiveness literature, which depict firms as institution-takers.²⁶ By arguing that firms choose their strategy in line with national institutions that provide the necessary types of finance and labour qualifications, the literature attributes important constraining capacities to these financial- and labour-market institutions. This idea is underlined by the reasoning that firms choosing to pursue strategies without institutional support are less successful and, thus, not sustainable over time.²⁷ The previous analyses have, however, shown that firms behave like Schumpeterian entrepreneurs rather than constrained institution-takers, which becomes apparent from the following reasoning. Schumpeter draws a crucial distinction between entrepreneurs and managers (Schumpeter 1934: 74–94; Schumpeter 1939: 103–106; Schumpeter 1947) in that

the defining characteristic [of the entrepreneur] is simply the doing of new things or the doing of things that are already being done in a new way (innovation). ... [Thereby,] the 'new thing' need not be spectacular or of historic importance. It need not be Bessemer steel or the explosion motor. It can be the Deerfoot sausage. (Schumpeter 1947: 151)

Contrary to this, a manager merely 'head[s] the administration of a going concern' (ibid.). Entrepreneurs thus possess the necessary creativity to pursue new business ideas and 'to cope with the resistances and difficulties which action always meets with outside of the ruts of established practice' (ibid.: 152). Managers lack that creative capacity.

Although I have used the notion of 'firms' throughout this paper as an umbrella term for 'managers' and 'entrepreneurs,' Schumpeter's distinction indicates that firms gain competitiveness because they are 'entrepreneurial,' not because they are 'managed' (Schumpeter 1934, 1939). We have seen that firms are competitive because entrepreneurs deliberately consider their firm's individual technological opportunities when

26 See, in particular, Porter (1990); Pavitt/Patel (1999); Hall/Soskice (2001b); Amable (2003); Hall/Gingerich (2004); Casper (2007); Hancké et al. (2007).

27 See footnote 4.

choosing its competitive strategy. In the same vein, we have seen that entrepreneurs do not let their strategy choice be driven by the institutional environment of their company. Thus, corporate competitiveness results from the independence and creativeness of entrepreneurs rather than the institution-driven implementation of strategies through managers.

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Appendix

Table A.1 RPI, DQP, and LCP in the UK

Company name	Technology focus	Firm age	Competitive strategy
Acambis	Biotech	12	RPI
Amarin	Biotech	15	RPI
Antisoma	Biotech	16	RPI
CRT (Cancer Res Tech.)	Trad. pharma	41	RPI
Celltech Group	Biotech	24	RPI
CeNeS	Biotech	7	RPI
Henderson Morley	Biotech	8	RPI
Imperial Cancer Res.	Trad. pharma	102	RPI
KS Biomedix	Biotech	n.a.	RPI
Onyvax	Biotech	7	RPI
Pharmagene	Biotech	7	RPI
PowderJect	Biotech	11	RPI
Protherics	Biotech	5	RPI
Scotia	Biotech	20	RPI
SkyePharma	Biotech	8	RPI
Xenova	Biotech	17	RPI
AstraZeneca	Trad. pharma	91	RPI & DQP
GlaxoSmithKline	Trad. pharma	174	RPI & DQP
Shire	Trad. pharma	18	RPI & DQP
Amersham Pharmacia Biotech	Trad. pharma	n.a.	DQP
Axis Genetics	Biotech	n.a.	DQP
Bioglan	Biotech	72	DQP
Britannia	Trad. pharma	23	DQP
British Biotech	Biotech	18	DQP
Cambridge Antibody Technology	Biotech	14	DQP
Crusade Laboratories	Biotech	5	DQP
DevCo	Trad. pharma	5	DQP
Galen	Trad. pharma	36	DQP
Napp	Trad. pharma	81	DQP
Nycomed Amersham	Trad. pharma	130	DQP
Oxford Glyco Sciences	Biotech	n.a.	DQP
Provalis	Biotech	7	DQP
Smith & Nephew	Trad. pharma	73	DQP
Allergy Therapeutics	Trad. Pharma	70	LCP
Biopharm (UK)	Biotech	n.a.	LCP
Cambridge Lab.s	Trad. pharma	17	LCP
Virogen	Biotech	n.a.	LCP

Source: PHID (November 2004).

Table A.2 RPI, DQP, and LCP in Germany

Company name	Technology focus	Firm age	Competitive strategy
BASF	Trad. pharma	139	RPI
Curacyte	Biotech	5	RPI
GPC Biotech	Biotech	7	RPI
Jerini Bio Tools	Biotech	10	RPI
MediGene	Biotech	10	RPI
Merz	Trad. pharma	96	RPI
MorphoSys	Biotech	12	RPI
Scil Biomedicals	Biotech	5	RPI
Wilex Biotechnology	Biotech	7	RPI
ASTA Medica	Trad. pharma	169	RPI & DQP
Bayer	Trad. pharma	141	RPI & DQP
Boehringer Ingelheim	Trad. pharma	119	RPI & DQP
Schering AG	Trad. pharma	133	RPI & DQP
Altana	Trad. Pharma	27	DQP
Degussa	Trad. pharma	5	DQP
Falk	Trad. pharma	44	DQP
GLE Medicon	Trad. pharma	n.a.	DQP
Gruenthal	Trad. pharma	58	DQP
Jenapharm	Trad. pharma	54	DQP
Madaus	Trad. pharma	85	DQP
Medac	Biotech	34	DQP
Merck KGaA	Trad. pharma	336	DQP
Merckle	Trad. pharma	59	DQP
Paion	Biotech	4	DQP
Revotar	Biotech	4	DQP
Schwarz Pharma	Trad. pharma	58	DQP
Plantorgan	Trad. pharma	30	LCP
Schwabe	Trad. pharma	138	LCP
Strathmann	Trad. pharma	30	LCP

Source: PHID (November 2004).

Table A.3 RPI, DQP, and LCP in Italy

Company name	Technology focus	Firm age	Competitive strategy
Abiogen	Biotech	7	RPI
Alfa Wassermann	Trad. pharma	56	RPI
Ausonia	n.a.	n.a.	RPI
Istituto di Ricerche Sigma Tau	Trad. pharma	19	RPI
Medioloanum	Trad. pharma	32	RPI
Poli	Trad. pharma	25	RPI
Rotta Research	Biotech	43	RPI
SPA	Trad. pharma	57	RPI
Bracco	Trad. pharma	77	RPI & DQP
Menarini	Trad. pharma	118	RPI & DQP
Fidia	Trad. pharma	58	DQP
Bruno	Trad. pharma	n.a.	DQP
Chiesi	Trad. pharma	69	DQP
Dompe	Trad. pharma	64	DQP
Eurand	Trad. pharma	35	DQP
Geymonat	Trad. pharma	76	DQP
Italpharmaco	Trad. pharma	66	DQP
Recordati	Trad. pharma	78	DQP
Zambon	Trad. pharma	98	DQP
Biotoscana	Biotech	n.a.	LCP
Formenti	Trad. pharma	50	LCP
Guidotti	Trad. pharma	90	LCP
Lusopharmaco	Trad. pharma	53	LCP
Mipharm	Trad. pharma	6	LCP
Neopharmed	Trad. pharma	n.a.	LCP
Rottapharm	Trad. pharma	43	LCP
Segix	Trad. pharma	42	LCP

Source: PHID (November 2004).

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