# Strategic alliances as a mechanism for wealth creation in the biopharmaceutical industry: An empirical analysis of the Spanish case

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## Abstract

The paper studies strategic alliances signed between traditional pharmaceutical companies (TPCs) and new biotechnology firms (NBFs) in Spain, on the initial basis that a firm's rate of new product development is a positive function of the number of strategic alliances that it has entered into. Nevertheless, we believe, as do others, that although strategic alliances may initially have positive effects on that rate, this relationship may exhibit diminishing returns. We suggest that the relationship between the number of alliances and the rate of new product development may be an inverted U-shape in the Spanish biopharmaceutical industry. Our regression model provides evidence to support such a relationship. However, the results suggest that only when the firm enters into too many alliances does diminishing return and ultimately negative return set in. The main strategic conclusion for the biopharmaceutical industry is that alliances represent a viable way for biopharmaceutical companies to gain access to the complementary assets required to increase their rate of new product development. A major contribution to this investigation is the empirical assessment for the Spanish biopharmaceutical industry.

## INTRODUCTION

The emergence of biotechnology in the late 1970s led to the appearance of the so-called new biotechnology firms (NBFs). These firms, which have innovative ideas and products but often lack the financial resources needed to complete their economic cycle, are ideal candidates for collaborative arrangements with incumbent pharmaceutical companies. NBFs bring a unique set of competencies to the competitive arena. At the same time, NBFs face a unique set of challenges. From a financial perspective they often fall between the cracks of traditional funding sources and from a management perspective they often lack managerial expertise. These firms are usually focused on technological rather than business concerns.

Strategic alliances between companies have long occurred. However, in recent years the rate at which firms formally collaborate has increased significantly, partially because of rapid technological change as well as the shifting patterns of international trade and competition. Entrepreneurial companies in technologically intensive industries such as NBFs have been significant users of this kind of collaboration. Schumpeter asserts that technological breakthrough often generates a perennial gale of creative destruction in which new entrants rise to dominance at the same time that incumbent firms fail. Radical

technological changes frequently lead to the replacement of incumbents by new entrants.[1,2] Nevertheless, there are certain circumstances and industries in which radical innovations do not lead to a Schumpeterian process of 'creative destruction'. In this sense, the case of biopharmaceutical sector is worth noting.[3] The emergence of biotechnology in the 1970s could be understood as a technological breakthrough in the way medicines are discovered, developed and manufactured. While incumbents used the chemical-based pharmaceutical framework, new entrants used the new biotechnological techniques. The traditional pharmaceutical companies (TPCs) have adapted to biotechnology through strategic alliances with NBFs.

If we define strategic alliances as collaborative arrangements between independent firms by which companies bring together specific resources and skills in order to achieve common and strategic firm goals, the two fundamental benefits generated for the companies involved, TPCs and NBFs, are quite clear. First of all, access is gained to complementary assets[4,5] and, second, clear signals about a company's status are sent by aligning with 'renowned actors'.[6] Incumbents (TPCs) with complementary assets, in particular when they specialise in the commercialisation of innovations, with competencies in manufacturing or marketing, are well positioned to benefit from radical technological changes in biotechnology. From a financial perspective, NBFs often fall between the cracks of traditional funding sources and from a management perspective they often lack managerial expertise. Those firms are usually focused on technological rather than business concerns.

Following the Miles and Snow model,[5] NBFs could be labelled as 'prospectors' in the sense that they desire to be 'first to the market' with a new innovative product by using their abilities and capabilities to develop innovative technologies and products. However, to reach this goal, these kinds of companies must confront two types of risk: the liabilities of their youth of their small size.[7] The first increases their vulnerability to mortality because of the lack of broad bases of influence and endorsement, stable relationships with important and external constituents, the lack of experience and insufficient resources. The second one also increases the risk of failure because they have to face problems such as raising capital or recruiting and training specialists. In this sense, NBFs used strategic alliances to access capital to carry out costly RTD investments and to commercialise their innovations.[8]

Therefore, the emergence of biotechnology does not lead to a Schumpeterian process of 'creative destruction'. On the contrary, it looks more like a symbiotic coexistence[9] between TPCs and NBFs. The described phenomenon of extensive cooperation[10] between incumbents and new entrants is called 'creative cooperation'[9] as opposed to the Schumpeterian process of 'creative destruction'. There is a consolidation process instead of a substitution process as a consequence of the biotechnology revolution.[11] This phenomenon of a symbiosis between TPCs and NBFs has been explained from several points of view.[12] However, we deeply believe that the control of complementary assets is the key to mastering adaptation.

**Fundamental benefits**

Four main theoretical perspectives have been developed to explain patterns of strategic alliance formation:

- Studies focused on the motives of firms to enter into alliances.
- Studies focused on alliance outcomes, benefits and types.
- Studies focused on alliance management.
- Studies focused on learning processes that take place in strategic alliances.

The study carried out can be classified as the second type of research, analysing

**Strategic alliances create value**

the alliance performance in terms of its contribution to the development of new products. The paper is based on the previous work of Deeds and Hill,[13] Rothaermel[14–16] and Rothaermel and Deeds.[17] These authors have analysed the biopharmaceutical industry in the USA. Deed and Hill consider that one of the keys to success in high-tech industries is the rate at which the firm is able to develop new products. In this sense, the faster a firm develops new products and brings them to market, the more likely it is to capture first-mover advantages.[13]

It is suggested that strategic alliances are an effective and quick mechanism to integrate all the complementary assets needed to develop a new product. The latter suggests that strategic alliance is the mechanism for the 'symbiotic coexistence' between TPCs and NBFs because of their positive contribution to the rate of new product development. Both studies test the hypothesis of a positive relationship between the rate of new products and strategic alliances among incumbents and new entrants. However, Deeds and Hill, going one step further, test and find support for the hypothesis that the relationship could be positive initially but at some point may exhibit diminishing returns or even negative returns. The object of our work is to ascertain whether the Spanish biopharmaceutical industry follows the same pattern as the one in the USA and its essential contribution lies in that it is the first research project of this kind in the Spanish biopharmaceutical sector.

The paper is structured in the following sections: the next section analyses the development of the proposed hypotheses. Then an explanation is given of the methodological approach defining the research setting, data and sample, the econometric model and the different dependent and independent variables utilised to test the hypotheses developed. The main results obtained are presented and the final section sets up the main conclusions of the paper.

## HYPOTHESIS DEVELOPMENT

There is no doubt that the extensive use of the mechanism of strategic alliances in the biopharmaceutical industry is due, among other factors, to the fact that incumbents and new entrants can 'win' with it. Moreover we would say that strategic alliances create value in terms of their potential positive contribution to the rate of new product developments.

Our hypotheses are built on the groundwork of the previous research of Deeds and Hill,[13] Rothaermel[14–16] and Rothaermel and Deeds.[17] All these studies test how the North American biopharmaceutical start-ups have survived entering strategic alliances with incumbents, in order to develop new products more quickly and to gain first-mover advantage. Thus there should b a positive relationship between TPC and NBF. However, as already stated, Deeds and Hill[13] have found that although initially the relationship could be positive, at some point it may result in diminishing returns or even negative returns. Two main reasons support such a hypothesis:

- Not all alliances make an equal contribution to the rate of new product development.
- The access to complementary assets through strategic alliances is not without risk. In this sense alliance partners are at risk of poor management or of opportunistic behaviour.

We define the *basic hypothesis* in the following terms: the relationship between the number of strategic alliances a biopharmaceutical company enters into with other biopharmaceutical companies and its rate of new product development is an inverted U-shape.

## METHODOLOGY

### Research setting

The research setting is the Spanish biopharmaceutical industry. The term

describes the industry composed of traditional pharmaceutical companies that use biotechnology in their processes and/or products as well as the small biotechnology companies focused on the discovery of new drugs.

## Data and sample

The starting point of the empirical study is the operative conclusions reached in the international project from OECD no. DSTI/STP/TIP (2002) and the results obtained in a first stage of the research which has been recently published in the proceedings of the International ProAct Conference.[18]

**Methodology**

We have constructed a sample on the basis of the database of 'The Biotechnology Directory'[19] and the ASEBIO database.[20] Initially, the designed economic questionnaire was sent to the sample during the month of February 2003 and the deadline for return ended on 30th May, 2003. It contained 35 closed questions codified to process the results with the statistic software SPSS. However, in this second stage of the research the deadline for returning the questionnaire was extended in order to get more responses. The rate was increased up to 40 per cent.

## Variables

### *New product development*

Given that the research setting is the biopharmaceutical industry, the dependent variable could be the subject of an intense debate about the best way to be measured. In order to test the basic hypothesis, we will define the rate of new product development in a threefold way:

- As total number of products that the company has in the market as well as the total number of products that the company has in any phase of development, excluding products in preclinical phase.
- As total number of patents.
- As total number of products launched to the market.

### *Number of strategic alliances*

The main independent variable is the number of strategic alliances a biopharmaceutical company enters into in the biopharmaceutical industry. This variable has been defined in a broad and exhaustive way in order to have a widespread term to examine the complete categorisation of collaborative arrangements that companies can enter, including licensing agreement, equity investment, marketing alliances or R&D agreements. Following authors such as Varadarajan and Cunningham,[21] Sakakibara,[22] Das and Teng[23] and Bucar,[24] we define a strategic alliance as the combination of specific and strategic resources and capabilities between firms in order to reach certain common objectives such as the access to new markets, a broader line of products, knowledge of new capabilities, co-financing of R&D investment, production expenses and/or marketing expenses, and with the final aim of creating more value than the partner can reach in isolation.

In the model specification, to avoid possible specification errors, additional variables are introduced. Among all the variables that we have analysed, we have selected the variables that are significant in most of the cases: age and type of company.

### *Company age*

Company age is a quantitative variable measured by the number of years since the foundation of the firm.

### *Type of company*

Type of company is a dummy variable taking the value zero when the company stands in any stock market and one otherwise.

## Econometric model

The hypotheses are tested using a regression model. The form of this particular model[25] is:

$$Nw\_pr_i = \beta_0 + \beta_1 All_i + \beta_2 All_i^2 + \beta_3 Age_i + \beta 4\, TyC_i + u_i$$

where *Nw_pr* refers to the total number of new products, *All* represents the number of strategic alliances that the firm entered, *Age* measure the company age and *TyC* is the variable that represents the type of company.

We estimated the regression model by weighted least squares (WLS); an efficient estimator in presence of heteroscedasticity.[26] In that case, the OLS estimates of regression coefficients are not efficient (there is no minimum variance).

## RESULTS

**Regression results**

The regression results can be found in Table 1. We find support for the basic hypothesis. There is a quadratic relationship between the number of strategic alliances and the rate of new product development, defining it as the total number of products in the market plus total number of products under development and excluding the total number of products in the preclinical phase. Moreover, the relationship between both variables is like an inverted U-shape. As is shown in Table 1, the coefficient for *All* is positive ($\beta_1 = 3.495$), whereas the coefficient for $All^2$ is negative ($\beta_2 = -0.024$) and both coefficients are statistically significant at the 5 per cent level of significance. $R^2$ (0.710) and adjusted $R^2$ (0.581) suggest a good fit of the model. The two control variables introduced in the model show a negative relationship with the rate of new product development.

We do not find support for the hypothesis when we define the dependent variable as total number of patents. The result is not surprising. There is no doubt that although patents rise as one of the instruments more commonly used as indicator of innovation activities, its use is not without problems. Its main disadvantage is that patents allude directly to inventions and not to innovations.

We find support for the hypothesis when we define the dependent variable as number of products launched to the market. As shown in Table 1, the coefficient for *All* is positive ($\beta_1 = 3.392$), whereas the coefficient for $All^2$ is negative ($\beta_2 = -0.024$) and both coefficients are statistically significant at the 5 per cent level of significance. $R^2$ (0.699) and adjusted $R^2$ (0.579) suggest a good fit of the model.

The evidence of the existence of a quadratic inverted U-shape between the number of alliances and the rate of new

**Table 1:** Results of analysis

| Regression results | New product development[1,2] | Patents[1,3] | Commercialised products[1,4] |
|---|---|---|---|
| $\beta_0$ constant | 84.916 (27.436) | 41.910 (36.852) | 71.577 (23.193) |
| $\beta_1$ (*All*) | 3.495 (1.476) | 1.270 (2.185) | 3.392 (1.339) |
| $\beta_2$ ($All^2$) | −0.024 (0.010) | −0.013 (0.014) | −0.024 (0.009) |
| Age | −0.691 (0.273) | 0.873 (0.367) | −0.571 (0.229) |
| Type of company | −41.719 (20.342) | −98.376 (25.590) | −37.591 (17.573) |
| $R^2$ | 0.710 | 0.912 | 0.699 |
| Adjusted $R^2$ | 0.581 | 0.861 | 0.579 |
| $F$[5] | 5.513 | 18.087 | 5.816 |
| $F$ ($\alpha = 0.05$)[6] | 3.63 | 4.12 | 3.48 |

[1]Standard deviation in brackets.
[2]NPD defined as total number of product on the market + total number of product under development – products on preclinical phase.
[3]NPD defined as total number of patents applied.
[4]NPD defined as total number of products launched into the market.
[5]The *F*-statistic reported is from a test of the hypothesis that of the slope coefficients (excluding the constant) in the regression are zero.
[6]Critical value at 5 per cent of significance level from *F*-distribution.

product development in biopharmaceutical companies allows us to point out that not all alliances make an equal contribution towards increasing the rate of new products because the more alliances a firm engages in, the more likely that its marginal contribution in terms of complementary assets is relatively minor. Gaining access to complementary assets through alliances is risky; companies that engage in strategic alliances must face the risk of management and the risk of opportunistic behaviour in the alliance partner.

## CONCLUSION AND DISCUSSION

The emergence of biotechnology has changed the nature of the research and development of new medicines, but, once a new active substance is developed there is a need of competence and skill to transform it into a new and effective medicine, which only the big PTCs hold. Therefore the radical technological change that has taken place with the emergence of biotechnology has created new opportunities for incumbents in the areas of commercial development, marketing and distribution. A mutual dependency has taken place between them: a 'symbiotic coexistence' has been generated.

**New opportunities created by the emergence of biotechnology**

It is clear that the emergence of biotechnology (radical breakthrough) has not led to the Schumpeterian process of destruction of the incumbent companies owing to the generalisation of extensive inter-firm cooperation between TPCs and NBFs.[27] On the contrary, TPCs have engaged in strategic alliances with NBFs with the general aim of accessing new technology and NBFs have engaged in alliances with TPCs with the objective of increasing their possibilities for survival and growth. There is a mutual dependency between both types of companies.

It must be said, however, that following such a strategy is not without risk, a circumstance that is highlighted by the high rate of failures. In this sense, the most important costs that partners must face are, on one hand, the opportunistic behaviour (relational risk) and the risk of performance, and, on the other, all the environmental risks such as technological, political and cultural risks. An important implication for managerial practice flows directly from our results: although collaborative arrangements can help companies in their product development efforts, alliances can have both positive and negative effects, and managers must be aware of the possibility that the greater the number of alliances they enter, the more likely it is that the negative effects could outweigh the positive ones.

*Disclaimer: The views expressed in this study do not necessarily reflect those of the European Commission.*

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