

A.Pisoni, A. Onetti, L.Fratocchi, M.
Talaia

Managing R&D activities in the Italian red
biotech industry. A comparison between
Italian independent firms and
multinational companies

2010/3



UNIVERSITÀ DELL'INSUBRIA
FACOLTÀ DI ECONOMIA

<http://eco.uninsubria.it>

In questi quaderni vengono pubblicati i lavori dei docenti della Facoltà di Economia dell'Università dell'Insubria. La pubblicazione di contributi di altri studiosi, che abbiano un rapporto didattico o scientifico stabile con la Facoltà, può essere proposta da un professore della Facoltà, dopo che il contributo sia stato discusso pubblicamente. Il nome del proponente è riportato in nota all'articolo. I punti di vista espressi nei quaderni della Facoltà di Economia riflettono unicamente le opinioni degli autori, e non rispecchiano necessariamente quelli della Facoltà di Economia dell'Università dell'Insubria.

These Working papers collect the work of the Faculty of Economics of the University of Insubria. The publication of work by other Authors can be proposed by a member of the Faculty, provided that the paper has been presented in public. The name of the proposer is reported in a footnote. The views expressed in the Working papers reflect the opinions of the Authors only, and not necessarily the ones of the Economics Faculty of the University of Insubria.

© Copyright A.Pisoni, A. Onetti, L.Fratocchi, M. Talaia

Printed in Italy in January 2010

Università degli Studi dell'Insubria

Via Monte Generoso, 71, 21100 Varese, Italy

All rights reserved. No part of this paper may be reproduced in any form without permission of the Author.

**MANAGING R&D ACTIVITIES IN THE ITALIAN
RED BIOTECH INDUSTRY.
A COMPARISON BETWEEN ITALIAN INDEPENDENT FIRMS
AND MULTINATIONAL COMPANIES.**

Alessia Pisoni^{}, Alberto Onetti^{**}, Luciano Fratocchi^{***}, Marco Talaia^{****}*

January, 2010

Abstract

This paper aims at analysing the main features of R&D activities carried out by the Italian biotech companies. The proposed contribution can be ascribed to the massive stream of research related to the reconfiguration of the value chain activities at the international level. Such a topic has become more and more actual because of both the markets globalisation and diffusion of networked architectures within internationalised companies (see, among others, Bartlett 1986; Bartlett and Goshal 1987, 1990; Bartlett, Doz and Hedlund 1990; Forsgren 1993; Forsgren and Holm 1993; Forsgren, Holm and Johanson 1991, 1992; Forsgren and Johanson 1992; Forsgren and Pedersen 1998; Hedlund 1979, 1980, 1986, 1994; Hedlund and Ridderstrale 1994; Hedlund and Rolander 1990; Lipparini and Fratocchi 1999). Within such a stream of research, we decided to focus the attention on the biotech industry, due to its specific features, that deeply influence both the strategic behaviour of firms and the economic environment of the countries where they operate.

^{*} Lecturer, Department of Economics – University of Insubria, Via Monte Generoso, 71 - 21100 Varese VA, Italy, e-mail: alessia.pisoni@uninsubria.it

^{**} Associate Professor, Department of Economics – University of Insubria, Via Monte Generoso, 71 - 21100 Varese VA, Italy, e-mail: alberto.onetti@uninsubria.it

^{***} Associate Professor, Department of Mechanical Thermal and Managerial Engineering – University of L'Aquila-Località Monteluco di Roio 67040 L'Aquila AQ, Italy, e-mail: Luciano.fratocchi@ing.univaq.it

^{****} PhD Candidate, Business Research Department – University of Pavia, Via San Felice, 7 - 27100 Pavia PV, Italy, e-mail: marco.talaia@uninsubria.it

Keeping in mind the different types of biotech firms operating at global level, we have decided to focus our attention to a less heterogeneous population. In so doing, we narrowed the analysis to the red biotech segment (that is health care biotech companies which develop drugs and diagnostics), because of its absolute predominance both in Italy (73% of enterprises, 94% of total revenue and 86% of investments¹) and at worldwide level (51% of EU firms and 60% of USA ones²). First of all we collected data for a sample of companies operating in the Italian red biotech industry. Particularly, we focused on R&D activities: we tried to quantify its extent, to understand where they are located (domestically or abroad) and the role played by alliances/cooperation with -in and -out the industry. More specifically, in order to reach the goals above described, attention was paid to the aptitude of the Italian country-system to attract investments from abroad. In doing so, we studied separately the Italian independent firms and MNCs. Analysing the peculiarities of how Italian independent firms and MNCs manage R&D activities, we tried to find out the existence of a different approach to R&D investments.

The paper is structured in four main sections. In the first one, the main relevant features of biotech firms are discussed and the literature background presented. The second paragraph deals with sample and methodology description. In the third section, the main results regarding the analysis of R&D activities carried out by the red Italian biotech companies are presented. The conclusions complete the paper.

Keywords: Biotech, localisation, R&D, collaborative R&D, MNCs.

THEORETICAL BACKGROUND

The proposed contribution can be ascribed to the massive stream of research related to the reconfiguration of the value chain activities at the international level. Such a topic has become more and more actual because of both the markets globalisation and diffusion of networked architectures within internationalised companies (see, among others, Bartlett 1986; Bartlett and Ghosal 1987, 1990; Bartlett, Doz and Hedlund 1990; Forsgren 1993; Forsgren and Holm 1993; Forsgren, Holm and Johanson 1991, 1992; Forsgren and Johanson 1992; Forsgren and Pedersen 1998; Hedlund 1979, 1980, 1986, 1994; Hedlund and Ridderstrale 1994; Hedlund and Rolander 1990; Lipparini and Fratocchi 1999).

Within such a stream of research, we decided to focus the attention on the biotech industry, due to its specific features, that deeply influence both the strategic behaviour of firms and the economic environment of the countries where they operate.

First of all, the investigated sector is characterized by a high content of technological innovation (being R&D expenditure generally more than 30% of total sales). With this respect, the recent study of Hopkins et al. (2007), according to which the biotech revolution would be simply a “myth”, seems to be a little exaggerated in its conclusions, since it does not consider the huge amount of research projects actually still in their development earlier stages. The high-tech nature of the investigated industry, in turn, leads to a competition essentially based on “intensive knowledge” (Pavitt 1984). Consequently, enterprises definitively benefit of particularly qualified human resources that strictly depend on a high level university system. With this respect, JunKunc (2007) had recently demonstrated that the radical increase of the importance of specialized

knowledge in such an industry dramatically impacts on the possibility to include secondary shares in biotech-related IPOs.

Moreover, (public and private) research centres and health care providers represent strategic partners as well. As a consequence, co-localisation and agglomeration in geographical clusters (such as the Cambridge area, Bio-Vallée, and Medicon Valley) typically characterize the biotech industry (see, among others, Mytelka and Farinelli 2000). With this respect, Chiaroni and Chiesa (2006) recently proposed a taxonomy of biotech clusters based on how they have emerged. More specifically, they describe three main typologies:

- spontaneous clusters, which emerge from the concentration of specific conditions (e.g., the presence of an excellent scientific base and/or of an entrepreneurial culture), such as in the case of Cambridge area;
- policy-driven clusters, which directly originate from policy makers action: with this respect, authors make a distinction among policies related to an industry/firm restructuring (such as in the case of Uppsala, in Sweden) and those specifically devoted to the biotech development (such as in the case of France or Germany). With this respect, it is worth noting that the relevance of “national systems” for the integration of technological progress with public interest is largely recognized, since, at least, Bartolomew (1997);
- hybrid clusters, such as in the case of Milan (Italy) and San Diego (USA).

Focusing on the localisation of R&D activities carried out by biotech companies a recent study of Jommi and Paruzzolo (2007) pointed out that the existing literature has not yet provided a complete analysis of all variables potentially influencing the localisation of R&D in the pharmaceutical and biotech industries and that, in particular,

so far there is no evidence on the Italian case-study. Another recent study provided, instead, evidences about the determinants of the foreign location of technological activities of MNCs (Le Bas and Sierra 2002) finding out that very often such companies locate their activities abroad in technological areas or fields where they are strong at home or seek out locations that have complementary strengths to their own. Furthermore, Singh (2008) recently analysed the impact of geographic dispersion of a firm's R&D activities on the quality of its innovative output concluding that having geographically distributed R&D per se does not improve the quality of a firm's innovations being negatively associated with average value of innovations. According to Belderbos et al. (2005) managerial decisions related to localisation of R&D activities are influenced by local markets size, by local country per capita income, by abundance of scientists and by engineers and Intellectual Property Rights regime strength. Summarizing, the above quoted study of Jommi and Paruzzolo (2007) also provides a general framework on factors influencing localisation of R&D on pharmaceutical and biotech industry. These factors were classified into the following categories: regulatory environment, institutional framework, national system of innovation, local development and specialisation.

Another characterizing element of biotech firms is the "metasectorial" nature of such business, emerging from the convergence of differentiated industries, such as pharmaceuticals, chemicals (and more specifically the combinatory one), Information and Communication Technology (as clearly showed by the so-called platform companies), human and veterinary medicine, food processing. This convergent nature implies the simultaneous presence in the sector of very differentiated economic players, coming from different competitive fields. At the same time, biotechnology platforms can be

applied in different market contexts; with this respect, it is generally accepted the idea to classify biotech firms along the following segments: “red/health care” (pharmaceutical and diagnostic business), “green” (agriculture, zootechnics and veterinary medicine), “white/grey” (industrial and environmental field) and “platform/bioinformatics”.

Due to dispersion of such various sources of knowledge and application fields all over the world, biotech firms are diffused in several territorial contexts. This because the knowledge necessary for the construction of a sustainable competitive advantage are scattered in a plethora of geographic areas (Cookson 2005), which need to be contemporarily garrisoned (the so called “meta-national” business approach quoted by Doz, Santos and Williamson 2002). Those evidences explicitly induce to adopt new theoretical frameworks to investigate such a business. With this respect, Madhok and Osegowitsch (2000) proposed the adoption of a dynamic capabilities and technology accumulation perspective for investigating the biotech industry. More recently Mathews and Zander (2007) advanced the idea of linking the internationalisation and entrepreneurial perspectives.

The biotech industry is often described as being composed of different industrial organization often labelled as “non-self sufficient” and “non-autonomous” companies under the strategic point of view (Phillips and Beckman 2001; Onetti and Zucchella 2008) that set up complex collaborative arrangements/relationships networks established with other companies (Powell and Brantley 1992) or institutions (Pisano 2006). The relational dimension in this industry is very important because value creation is mainly based on R&D activity that relies on research, financial and institutional partnerships. In fact, on the one hand, knowledge creation pass through

“networks for exploration” and on the other hand, the exploitation of generated knowledge and research products commercialization is based on commercial partnerships/agreements with, for example, big pharmaceutical companies. The last relationships described form the so called “networks for exploitation” (March 1991; Rothermael and Deeds 2004). The biotech industry is recognised as being a paradigmatic case of “distributed innovation”, since R&D activity is based on interorganizational and interpersonal partnerships (Onetti and Zucchella 2008) that, as example for the red biotech segment, involve big pharmaceutical companies, research institutions, hospitals and universities (Hagedoorn 1993; Oliver 2004; Lim, Garnsey and Gregory 2006; Powell, Koput and Smith-Doerr 1996; Owen-Smith and Powell 2004, Stuart, Ozdemirb and Ding 2007; Gilsing and Noteboom 2006).

On the basis of what previously discussed, and given the importance of research partnerships in the biotech field (Powell et al. 1996; Cunningham 2002; Audretsch 2001; Audretsch and Feldman 2003; Chiesa 2003; Pisano 2006; Miles et al. 2006), we decided to focus our attention on R&D activity carried out by Italian red biotech companies trying to quantify its extent, to understand where they are located and the role played by cooperation with -in and -out the industry.

2. DATA AND METHODOLOGY

On the basis of the theoretical framework previously described, we focused the analysis on the red biotech segment, because of its absolute predominance both in Italy (73% of enterprises, 94% of total revenue and 86% of investments) and at worldwide level (51% of EU firms and 60% of USA ones).

We referred to Blossom Associati-Assobiotec 2006 and 2007 Report for the data and the segmentation criteria of Italian biotech sector. In order to specifically investigate the

main features of R&D activities, companies performing exclusively sales activities were excluded. We thus identified 162 red biotech companies and sent them a questionnaire in order to collect both qualitative and quantitative data. The questionnaire was made up of the following sections:

General information: location(s) in Italy, eventual listing at stock markets, country of origin (only for subsidiaries)
Managed activities: research and development, clinic development, production, and sales
Collaborations with selected actors: university and other research centres, multinational firms, incubators and scientific parks, hospitals and clinics
Economic and financial data: total number of employees (at world level and in Italy for multinationals), total amount of revenue (at world level and in Italy for multinationals), percentage of people devoted to R&D; percentage of revenue arising from biotech technologies/processes; amount of investments in research and development (at world level and in Italy for multinational), percentage of such investments in biotech technologies/processes
Therapeutic areas of specialization
Number of products/projects in the different stage of the pipeline
Number of processes developed in Italy

The data collected through questionnaires were integrated with annual reports and records from Chamber of Commerce. The survey was conducted between 2006 and 2007.

We received 43 fully compiled questionnaires obtaining an answer rate of about 26.5%, which can be considered a satisfactory results if compared to figures obtained by the best international surveys (Harzing 1997). The most relevant features of the investigated sample are summarized in tables 1 and 2.

In our survey we decided to carry out, on the sample of 43 red biotech companies localised in Italy a qualitative analysis through which we get evidences about the

investigated phenomenon. In order to do that, companies were further divided accordingly to the governance structure in Italian independent firms and in multinational companies. The latter were divided in Italian MNCs and in subsidiaries of foreign MNCs. To identify the main features of the R&D activities performed by the investigated firms this paper mainly addresses the following research questions:

- How is R&D activity managed by Italian independent firms and by MNCs?
- Does company localization affect the localization of R&D activity? Is there any difference between Italian independent firms and MNCs?
- Do Italian independent firms and MNCs present a different attitude towards research partnership development?

3. RESULTS DISCUSSION

First of all, it is worth noting the main features of the respondents. In doing so, we draw our attention to the governance structure and find out that nearly 60% of the sample is composed of Italian independent firms and 40% of multinational companies (the latter are formed of 20% of Italian MNCs and 80% of subsidiaries of foreign MNCs).

Under the point of view of the corporate model adopted by the red biotech companies, our sample is composed by nearly 40% of “born biotech” and by 60% of “pharma biotech” companies (see table 1). Born biotech are companies whose core business is mainly oriented to research and development activities, while pharma biotech, also called “diversified companies”, are mainly pharmaceutical firms that diversify in the biotechnological sector or biotechnological companies deriving from the pharmaceutical industry; they are therefore companies operating along the entire value chain of the pharmaceutical sector.

Table 1. Sample description – Respondents by corporate model adopted

	Italian independent firms	MNCs			Total
		Italian MNCs	Subs of foreign MNCs	Total MNCs	
Born biotech	56.0%	20.0%	15.4%	16.7%	39.5%
Pharma biotech	44.0%	80.0%	84.6%	83.3%	60.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: own calculations on data Blossom Associati – CrESIT, 2006

According to company size, we can notice that nearly half of our sample is composed by small sized companies, 35% of large companies and the rest are medium firms (see table 2). It is worth noting that nearly 90% of all small sized companies are Italian independent firm and more than 50% of large companies are subsidiaries of foreign MNCs.

Table 2. Sample description – Respondents by firm size

	Italian independent firms	MNCs			Total
		Italian MNCs	Subs of foreign MNCs	Total MNCs	
Large	16.0%	60.0%	61.5%	61.1%	34.9%
Medium	8.0%	40.0%	23.1%	27.8%	16.3%
Small	76.0%	0.0%	15.4%	11.1%	48.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: own calculations on data Blossom Associati – CrESIT, 2006

Notes: to investigate the distribution of respondents firms according to size, we referred to the EU definitions introduced by the Recommendation 361/2003

As regards geographical distribution, one can notice that companies of the sample are generally concentrated in a selected number of clusters (see table 3). More specifically, more than 80% of red biotech companies are located only in three regions: Lombardy in the North, Tuscany and Latium in the Centre.

Lombardy is the area with the higher concentration of biotech companies (Orsenigo 2001; Chiesa 2003; OECD 2006; Blossom Associati-Assobiotech 2006, 2007; Onetti and Zucchella 2008; Pisoni 2008; Castaldi 2009). Companies are mainly concentrated in the

area of Milan where the main Italian research centres are located (IPI 2007). As expected, in this area we found the higher concentration both of born biotech and pharma biotech (with a slight prevalence of born biotech) and of Italian independent firms and MNCs (with a slight prevalence of Italian independent firms).

On the contrary, Latium is featured by a stronger presence of MNCs of large pharmaceutical companies, more oriented to manufacturing and sales activities than to R&D. In Rome and Latina, for instance, we found a high percentage of pharma biotech companies (nearly 23% of the total sample). This result may be explained by the huge presence, in such two areas, of pharmaceutical companies, especially large multinationals (we refer, among others, to Pfizer, Merck Sharp & Dohme, Bristol Myers Squibb). This presence arises from the proximity to Rome and the availability of fiscal incentives and grants in those areas, which were considered less developed until the beginning of '90s. Finally, Tuscany, where is located nearly the 16% of all MNCs of the sample, show a slight dominance of born biotech companies (23.5% of the total versus 15.4% of pharma biotech ones). In this region we find out two big multinational companies (Chiron, Grifols) that started their activities in the early nineties. In our opinion that this could have boosted in that region the trend to invest in R&D.

If we analyse data at a district level, two main clusters emerge: Milan³ (where is located 50% of all MNCs and 53% of total pharma biotech) and Rome (where is located 11% of all MNCs and 15% of total pharma biotech). In Tuscany, there is a more fragmented situation being MNCs and pharma biotech companies almost equally distributed in three local districts: Pisa, Siena, and Florence. Being them quite close each other, it may be assumed they belong to the same cluster, often referred (Blossom Associati - Assobiotec 2006) as the "Tuscan biotech cluster". Based on such assumptions, we noted that

pharma biotech companies are all large corporations, since they are mainly subsidiaries of foreign multinational companies (see tables 1 and 2).

Table 3. Sample description – Respondents by geographical distribution

Region	District	Italian independent firms	MNCs			Total
			Italian MNCs	Subs of foreign MNCs	Total MNCs	
Lombardy	Milan	40%	40.0%	53.8%	50.0%	44.2%
	Monza		20.0%		5.6%	2.3%
	Lodi	4.0%				2.3%
	Varese	4.0%				2.3%
Lazio	Rome	8.0%	20.0%	7.7%	11.1%	9.3%
	Latina			15.4%	11.1%	4.7%
Tuscany	Pisa	4.0%		7.7%	5.6%	4.7%
	Siena	8.0%		7.7%	5.6%	7.0%
	Florence	4.0%	20.0%		5.6%	4.7%
	Livorno	4.0%				2.3%
Piedmont	Torino	4.0%				2.3%
	Ivrea	4.0%				2.3%
Veneto	Venice	4.0%				2.3%
Friuli Venezia Giulia	Gorizia	4.0%				2.3%
Campania	Naples	4.0%				2.3%
Sardinia	Cagliari	4.0%		7.7%	5.6%	4.7%
Total		100%	100%	100%	100%	100%

Source: own calculations on data Blossom Associati – CrESIT, 2006

Analysing the firms' value chain, we noted that R&D activities are mainly located (51% of all R&D activities) in the same region where is also located the company's registered office (see table 4). Moreover, data show that nearly 23% of all R&D activities are performed in more than one location. Further insights show that Italian independent firms, among the others, followed by Italian MNCs are the one that select more than one location to establish R&D activities. It is worth noting that, unfortunately, about 70% of foreign MNCs do not declare the exact location of R&D activity in Italy.

Table 4. Location of R&D activities

Company location	R&D location	Italian independent firms	MNCs			Total
			Italian MNCs	Subs of foreign MNCs	Total MNCs	
Lombardy	in the same region	32.0%	40.0%		11.1%	23.3%
	in other region					
	multi location	16.0%	20.0%		5.6%	11.6%
Latium	in the same region	4.0%		7.7%	5.6%	4.7%
	in other region			7.7%	5.6%	2.3%
	multi location	4.0%	20.0%		5.6%	4.7%
Tuscany	in the same region	12.0%		7.7%	5.6%	9.3%
	in other region					
	multi location	4.0%	20.0%		5.6%	4.7%
Piedmont	in the same region	8.0%				4.7%
	in other region					
	multi location					
Veneto	in the same region	4.0%				2.3%
	in other region					
	multi location					
Friuli Venezia Giulia	in the same region					
	in other region					
	multi location	4.0%				2.3%
Campania	in the same region	4.0%				2.3%
	in other region					
	multi location					
Sardinia	in the same region	4.0%		7.7%	5.6%	4.7%
	in other region					
	multi location					
Total	in the same region	68.0%	40.0%	23.1%	27.8%	51.2%
	in other region			7.7%	5.6%	2.3%
	multi location	28.0%	60.0%		16.7%	23.3%
	ND	4.0%		69.2%	50.0%	
		100%	100%	100%	100%	100%

Source: own calculations on data Blossom Associati – CrESIT, 2006

Thus seems to confirm the idea that, due to dispersion of the various sources of knowledge and application fields all over the world, biotech firms are diffused in several territorial contexts. Moreover, data shows that R&D activities seem to be polarized in the same areas of major concentration of biotech firms. Thus seems to confirm the idea that, in order to access specific knowledge, healthcare biotech companies could take advantage of geographical proximity to clustered location (see among the others, van Geenhuizen and Reyes-Gonzalez 2007).

Considering data in table 5, regarding the percentage of employees involved in R&D (on the total number of employees), as a proxy of R&D investments we can notice how

Italian independent firms' investment efforts in R&D activity/projects seem to be higher in comparison to what arises from MNCs. In fact, nearly 60% of Italian independent firms has at least half of their employees involved in R&D activities against about 20% of MNCs.

Table 5. Employees involved in R&D activities as a percentage of total employees (average level in 2004-2006)

% employees involved in R&D	Italian independent firms	MNCs			Total
		Italian MNCs	Subs of foreign MNCs	Total MNCs	
Up to 5%			7.7%	5.6%	2.3%
From 5.1% to 10%	8.0%		38.5%	27.8%	16.3%
From 10.1% to 15%	8.0%	20.0%	7.7%	11.1%	9.3%
From 15.1 to 20%	4.0%	20.0%	7.7%	11.1%	7.0%
From 20.1 % to 25%		20.0%	7.7%	11.1%	4.7%
From 25.1% to 50%	20.0%	20.0%	7.7%	11.1%	16.3%
From 50.1% to 75%	20.0%				11.6%
More than 75%	40.0%	20.0%	7.7%	11.1%	27.9%
ND			15.4%	11.1%	4.7%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: own calculations on data Blossom Associati – CrESIT, 2006

Moreover, being MNCs of our sample mainly subsidiaries of foreign pharmaceutical companies the collected data are perfectly aligned to the one of a recent report issued by PWC (2007) that point out the low investment efforts of such companies. Thus, in our opinion, confirms the lower value added orientation of the latter type of companies, which seem to conceptualise our country more as a market opportunity than a knowledge base to be exploited. In fact, from the literature about “R&D centralization vs. delocalisation” reviewed in the first section of the paper arises, among other factors, the importance of the national system of innovation in influencing the localisation of R&D activities.

Finally our research focused on collaborations that biotech companies set up with other actors in- and outside the industry. As earlier explained, this is a widely recognized

success factor in the biotech industry (see among the others: Koput, Powell and Smith-Doerr 1996), since the high intensity of knowledge required. With this respect, a primary relation is generally realised with universities (Stuart et al. 2007; Berkovitz and Feldman 2007); as a consequence we expect such collaborations to be a widespread phenomena, with no respect to the business model (born biotech or pharma biotech, size and “origin”). Data summarized in table 6 completely confirm such an hypothesis. In fact, as the table below show, most of the firms in the sample (almost 90%) are tightly connected with universities, a lot of them with research centres (72%) and hospitals (65%) and fewer with other multinational companies (50%) and with incubators (about 30%) (see table 6).

Table 6. Collaboration performed with universities, research centres, MNCs, incubators and hospitals

Collaboration with		Italian independent firms	MNCs			Total
			Italian MNCs	Subs of foreign MNCs	Total MNCs	
Universities	Performed	92.0%	100.0%	69.2%	77.8%	86.0%
	Non Performed			23.1%	16.7%	7.0%
	ND	8.0%		7.7%	5.6%	7.0%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%
Research centres	Performed	72.0%	80.0%	69.2%	72.2%	72.1%
	Non Performed	4.0%	20.0%	23.1%	22.2%	11.6%
	ND	24.0%		7.7%	5.6%	16.3%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%
MNCs	Performed	60.0%	80.0%	15.4%	33.3%	48.8%
	Non Performed	16.0%	20.0%	69.2%	55.6%	32.6%
	ND	24.0%		15.4%	11.1%	18.6%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%
Incubators	Performed	36.0%	40.0%	15.4%	22.2%	30.2%
	Non Performed	32.0%	60.0%	69.2%	66.7%	46.5%
	ND	32.0%		15.4%	11.1%	23.3%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%
Hospitals	Performed	60.0%	80.0%	69.2%	72.2%	65.1%
	Non Performed	12.0%	20.0%	23.1%	22.2%	16.3%
	ND	28.0%		7.7%	5.6%	18.6%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: own calculations on data Blossom Associati – CrESIT, 2006

Some evidences arising from the table need to be clarified. First of all, as regards the collaboration with MNCs, it is logically expected that such relationships will take place

only for companies established in Italy, since such a type of collaboration maybe defined for foreign subsidiaries at headquarters level. Thus could explain the low percentage of subsidiaries of foreign MNCs that declare to perform it. Secondly, it is worth noting that the partnerships with incubators seem to be less important. However, such a result could have been affected by the limited presence of incubators in our country. As a consequence, these relationships are not very diffused, especially among MNCs.

In analysing all the research relationships established by the companies under study, we would like to focus on the ones that have been developed with universities because of several factors. First of all, scholars agree on their importance in establishing networks of knowledge exploration (see among the others, Stuart et al. 2007; Berkovitz and Feldman 2007; Onetti and Zucchella 2008), moreover in our sample they seem to be the most articulated and show the highest degree of response.

Table7. Number of collaborations performed by red biotech companies with universities

Collaboration with universities	Italian independent firms		MNCs						Total	
			Italian MNCs		Subs of foreign MNCs		Total MNCs			
	NR	(%)	NR	(%)	NR	(%)	NR	(%)	NR	(%)
of the same district	2	4.7%	2	22.2%	4	23.5%	6	23.1%	8	11.6%
of the same region	11	25.6%	2	22.2%	1	5.9%	3	11.5%	14	20.3%
of other Italian regions	15	34.9%	2	22.2%	10	58.8%	12	46.2%	27	39.1%
of other European countries	11	25.6%			1	5.9%	1	3.8%	12	17.4%
of Asian countries	1	2.3%					0	0.0%	1	1.4%
of US	3	7.0%	2	22.2%			2	7.7%	5	7.2%
of other countries in the world			1	11.1%	1	5.9%	2	7.7%	2	2.9%
Total	43	100.0%	9	100.0%	17	100.0%	26	100.0%	69	100.0%

Source: own calculations on data Blossom Associati – CrESIT, 2006

Table 7 provides a picture of the network of collaborations between red biotech companies and universities. From the table, clearly arises how the emerging network of R&D collaborations is largely based on relationships established at national level, i.e. 71% of all agreements are among actors within the national territory. In detail, 40% of Italian independent firms presents a strong national embeddedness (performing 57% of

all relationships established with universities) if compared to the same attitude shown by Italian MNCs (only 8.7% of the total amount) and by subsidiaries of foreign MNCs (20%). At the same time, data provides evidences of the different attitude between Italian independent firms and MNCs to establish an international network of R&D collaborations. In fact, further analyses demonstrate that the overwhelming majority of all relationships established with universities (75%) are developed by Italian independent firms that therefore show a considerable interest in linking themselves to foreign universities. Being Italian independent firms mainly small companies (see table 2) it appears not to be surprisingly that they perform the majority of the partnerships surveyed in this study. In fact, as Powell (1998) pointed out, knowledge exploitation for small biotech firms relies more than the others (medium and large ones) on the existence of collaborative partnerships.

CONCLUSIONS

The paper aims at presenting the main features of R&D activities of the Italian red biotech industry. This industry was chosen because of the high uncertainty and complex knowledge base required that raise the importance of R&D activity as unquestionable. The analysis carried out on a sample of 43 red biotech companies identifies first of all a picture of the location of R&D activities in Italy. Moreover, the survey provides further insights on R&D collaborations performed. The final purpose of the paper is to identify different attitude, if any, in managing R&D activities between Italian independent firms and MNCs, both Italian and subsidiaries of foreign companies.

First of all, it arises that red biotech companies are generally concentrated in a selected number of regional clusters, more specifically Lombardy, Tuscany and Latium. If we analyse data at a more specific level, two main clusters emerge: Milan (where is located

more than 50% of total red biotech) and Rome (14%). Similar results were obtained in analysing the location of R&D activities. As regards R&D investments efforts performed by the red biotech companies analysed, we find out a different approach between Italian independent firms and MNCs, especially foreign ones. In 2006, 60% of Italian independent companies reserve more than half of their employees to R&D activities, compared to the 11% (altogether considered) of the multinational ones. Considering such numbers it seems possible to argue that Italy seems to be considered by multinationals more as a market opportunity rather than a venue for R&D investments. In fact, being MNCs mainly subsidiary of pharma biotech companies, they are more focused on manufacturing activities since they are typically related to pharmaceutical production.

Moreover, as regards R&D activities, we also find out a certain good level of collaboration with local actors, as hospitals and universities. That is a widely recognized success factor in the biotech industry (Koput, Powell and Smith-Doerr 1996), since the high-intensity of knowledge required. In particular, we focused on relationships established by biotech companies with universities. Once again, we compare the attitude towards the establishment of R&D partnerships of Italian independent firms and MNCs. It arises the strong attitude of Italian independent firms to internationalize their research alliances network. This result is particularly relevant because of the small size of these companies that force them to build several R&D partnerships to encompass the lack of resources that characterize their business (Powell 1998).

Concluding, our results show that the Italian general framework of factors influencing R&D localisation does not seem to be able to influence the localisation of R&D activities of biotech MNCs. Therefore, under this point of view, the aptitude of the

Italian country-system to attract investments from abroad seems to be particularly weak. With respect to such aspect, it is necessary to point out the unanimous belief - of both, researchers and policy makers - how foreign direct investments (particularly the high knowledge and innovation based) deeply impact on the economic strength and development of the country of destination (Findlay 1978; Barrel and Pain 1997; Borenszeiten, De Gregorio and Lee 1998). However, it is necessary to remember the exploratory nature of this paper, as a consequence we are not yet able to provide comprehensive guidelines for decision makers. Further analysis on biotech industry will allow us to provide them in future studies.

ENDNOTES:

¹ Data source is: BLOSSOM ASSOCIATI - ASSOBIOTEC, *Biotechnology in Italy 2007. Financial and strategic analysis*; Blossom Associati – Assobiotec Report, Milan, 2007

² Data source is: Critical I, *Biotechnology in Europe: 2005 Comparative study*, BioVision, Lyon, 2005. It is worth noting that such analysis includes also support and services firms to the biotech sector – which are not considered in our paper focused at the Italian level. This could partially affect the comparison.

³ It is worthy to note that Monza is a new autonomous province but is geographically contiguous to Milan, so they may be considered a unique cluster.

REFERENCES

Audretsch, David B. (2001), "The role of Small Firms in U.S. Biotechnology Clusters", *Small Business Economics*, 17(1-2), 3-15.

Audretsch, David B. and Maryann P. Feldman (2003), "Small-Firm Strategic Research Partnerships: The Case of Biotechnology", *Technology Analysis & Strategic Management*, 15(2), 273-288.

Barrel, Ray and Nigel Pain (1997), "Foreign Direct Investment, Technological Change, and Economic Growth Within Europe", *The Economic Journal*, 107(445), 1770-1786.

Bartlett, Christopher A. (1986), "Building and Managing the Transnational: The New Organizational Challenge", in *Competition in Global Industries*, Michael E. Porter (Ed.). Boston: Harvard Business School Press, 367-404.

Bartlett, Christopher A. and Sumantra Ghoshal (1987), "Managing Across Borders. New Organizational Responses", *Sloan Management Review* 29(1), 43-53.

Bartlett, Christopher A. and Sumantra Ghoshal (1990), "Managing Innovation in the Transnational Corporation", in *Managing the Global Firm*, Christopher A. Bartlett, Yves L. Doz, and Gunnar Hedlund (Eds.). London and New York: Routledge.

Bartlett, Christopher A., Yves L. Doz, and Gunnar Hedlund Eds. (1990), *Managing the Global Firm*. London and New York: Routledge.

Bartolomew, Susan (1997), “National Systems of Biotechnology Innovation: Complex Interdependencies in the Global Systems”, *Journal of International Business Studies* 28(2), 241-266.

Belderbos Rene, Lykogianni Elissavet and Reinhilde Veugelers (2005), “Strategic R&D location by multinational firms: spillovers, technology sourcing and competition”, Paper prepared for 2005 EARIE Conference.

Bercovitz, Janet E.L. and Maryann P. Feldman (2007), “Fishing upstream: Firm innovation strategy and university research alliances”, *Research Policy*, 36, 930-948.

Blossom Associati - Assobiotec (2006). *Biotechnology in Italy 2006. Financial and strategic analysis*. Milan: Blossom Associati - Assobiotec Report.

Blossom Associati – Assobiotec (2007). *Biotechnology in Italy 2007. Financial and strategic analysis*. Milan: Blossom Associati – Assobiotec Report.

Borensztein, Eduardo, Jose De Gregorio, and Jong-Wha Lee (1998), “How does foreign direct investment affect economic growth?”, *Journal of International Economics*, 45, 115-135.

Castaldi Laura (2009), “L’industria del biotech”, in *Le imprese biotech italiane. Strategie e performance*, Mario Sorrentino (Ed.). Bologna: Il Mulino.

Chiaroni, Davide and Vittorio Chiesa (2006), “Forms of creation of industrial cluster in biotechnology”, *Technovation*, 26(9), 1064-1076.

Chiesa, Vittorio (2003), *La bioindustria. Strategie competitive e organizzazione industriale nel settore delle biotecnologie farmaceutiche*. Milano: Etas Libri.

Cookson, Catherine (2005), “MP seeks more aid for high-tech start-ups”, *Financial Times*, 22 March, 5.

Critical I (2005), *Biotechnology in Europe: 2005. Comparative study*. Lyon: BioVision.

Cunningham, Brian C. (2002), “Biotech and Pharma: State of the Relationship in the New Millennium”, *Drug Development Research*, 57, 97-102.

Doz, Yves L., Jose Santos, and Peter Williamson (2002), *From Global to Metanational: How Companies Win in the Knowledge Economy*. Boston: Harvard Business School Press.

Findlay, Ronald (1978), “Relative Backwardness, Direct Foreign Investment and the Transfer of Technology: A Simple Dynamic Model”, *Quarterly Journal of Economics*, 92, 1-16.

Forsgren, Mats (1993), "Managing International Networks - A Project Description", Paper presented at the Organisational Capabilities and Internationalisation Processes, Paris, November 3-5.

Forsgren, Mats and Ulf Holm (1993), "Internationalization of Management - Dominance and Distance", in *The Internationalization of the Firm - A Reader*, P. J. Buckley, and P. N. Ghauri (Eds.). London: Academic Press, 337-349.

Forsgren, Mats, Ulf Holm, and Jan Johanson (1991), "Internationalisering av Andra Graden (Internationalization of the Second Degree)", in *Internationalisering, Företagen och det Lokala Samhället, (Internationalization, Firms and the Local Society)*, R. Andersson, E. Ekstedt, R. Henning, and A. Malmberg (Eds.). Stockholm: SNS Förlag.

Forsgren, Mats and Jan Johanson Eds. (1992), *Managing Networks in International Business*. Philadelphia: Gordon and Breach.

Gilsing, Victor and Bart Nooteboom (2006), "Exploration and exploitation in innovation systems: the case of pharmaceutical biotechnology", *Research Policy*, 35, 1-23.

Hagedoorn, John (1993), "Understanding the Rational of Strategic Technology Partnering: Interorganizational Modes of Cooperation and Sectoral Differences", *Strategic Management Journal*, 14(5), 371-385.

Harzing, Anne-Wil (1997), "Response rates in international mail surveys: Results of a 22-country study", *International Business Review*, 6(6), 641-665.

Hedlund, Gunran (1979), "Organization as a Matter of Style", in *Recent Research on the Internationalization of Business*, L. G. Mattson and F. Wiedersheim-Paul (Eds.). Uppsala: Acta Universitatis Upsaliensis Symposia Universitatis Upsaliensis Annum Quingentesimus Celebrantis, No. 13.

Hedlund, Gunran (1980), "The Role of Foreign Subsidiary in Strategic Decision-Making in Swedish Multinational Corporation", *Strategic Management Journal*, 1(1), 23-36.

Hedlund, Gunran (1986), "The Hypermodern MNC - A Heterarchy?", *Human Resource Management*, 25(1), 9-35.

Hedlund, Gunran (1994), "A Model of Knowledge Management and the N-Form Corporation", Working Paper Institute of International Business, Stockholm School of Economics.

Hedlund, Gunran and Jonas Ridderstrale (1994), "Toward the N-Form Corporation: Exploitation and Creation in the MNC", Working Paper Institute of International Business, Stockholm School of Economics.

Hedlund, Gunran and Dag Rolander (1990), "Action in heterarchies - new approaches to managing the MNC", in *Managing the Global Firm*, Christopher A. Bartlett, Yves L. Doz, and Gunran Hedlund (Eds.). London and New York: Routledge, 15-46.

Hopkins, Michael M., Paul A. Martin, Paul Nightingale, Alison Kraft, and Surya Mahdi (2007), "The Myth of the Biotech Revolution: An Assessment of Technological, Clinical and Organisational Change", *Research Policy*, 36(4), 566-589.

IPI (2007), *Il settore delle biotecnologie in Italia. Un quadro conoscitivo degli operatori e dei programmi di sostegno*, Roma.

Jommi Claudio and Paruzzolo Silvia (2007), "Public administration and R&D localisation by pharmaceutical and biotech companies: A theoretical framework and the Italian case-study", *Health Policy*, 81(1), 117-130.

JunKunc, Marc T. (2007), "Managing Radical Innovation: The Importance of Specialized Knowledge in the Biotech Revolution", *Journal of Business Venturing*, 22(3), 388-411.

Koput, Kenneth W., Walter W. Powell and Laurel Smith-Doerr (1996), "Interorganizational Collaboration and the Locus of Innovation. Networks of Learning", *Biotechnology Administrative Science Quarterly*, 41.

Le Bas, Christian and Christophe Sierra (2002), "Location versus home country advantages in R&D activities: some further results on multinationals' locational strategies", *Research Policy*, 31, 589-609.

Lim, Lisa P.L., Elisabeth W. Garnsey, and Mike Gregory (2006), "Product and process innovation in biopharmaceuticals: a new perspective on development", *R&D Management*, 36, 27-36.

Lipparini, Andrea and Luciano Fratocchi (1999), "The Capabilities of the Transnational Firm: Accessing Knowledge and Leveraging Interfirm Relationships", *European Management Journal*, 17(6), 655-666.

Madhok, Anoop and Thomas Osegowitsch (2000), "The International Biotechnology Industry: A dynamic Capabilities Perspective", *Journal of International Business Studies*, 31(2), 325-335.

March, James G. (1991), "Exploration and Exploitation is organizational Learning", *Organization Science*, 2, 71-87.

Mathews, John A. and Ivo Zander (2007), "The International Entrepreneurial Dynamics of Accelerated Internationalization", *Journal of International Business Studies*, 38(3), 387-403.

Miles, Raymond E., Grant Miles, and Charles C. Snow (2006), “Collaborative Entrepreneurship; A Business Model for Continuous Innovation”, *Organizational Dynamics*, 35, 1-11.

Mytelka, Lynn and Fulvia Farinelli (2000), “Local Clusters, Innovation Systems and Sustained Competitiveness”, Discussion Paper Series, The United Nations University, Institute for New Technologies.

OECD (2006), *OECD biotechnology statistics 2006*, OECD online report.

Orsenigo, Luigi (2001), “The (failed) Development of a Biotechnology Cluster: The Case of Lombardy”, *Small Business Economics*, 17, 77-92.

Oliver, Amalya L. (2004), “Biotechnology, Entrepreneurial Scientists and their collaborations”, *Research Policy*, 33, pp. 583-97.

Onetti, Alberto and Antonella Zucchella (2008), *Imprenditorialità, internazionalizzazione e innovazione. I business model delle imprese biotech*. Roma: Carocci.

Owen-Smith, Jason and Walter W. Powell (2004), “Knowledge networks as channels and conduits: the effects of spillovers in the Boston biotechnology community”, *Organization Science*, 15, 5-21.

Pavitt, Keith (1984), "Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory", *Research Policy* 13(4), 343-375.

Phillips, Julia and Fiona Beckman (2001), "Good relations – PR for the biotech business", *Nature Biotechnology*, 19, BE34 - BE36.

Pisano, Gary P. (2006), *Science Business: the Promise, the Reality, and the Future of Biotech*. Boston: Harvard Business School Press.

Pisoni, Alessia (2008), Il biotech in Italia: caratteristiche delle imprese e cluster emergenti, in *Imprenditorialità, internazionalizzazione e innovazione. I business model delle imprese biotech*, Alberto Onetti and Antonella Zucchella (Eds.). Roma: Carocci.

Porter, Michael E. (1986), *Competition in Global Industries*. Boston: Harvard University Press.

Powell, Walter W. (1998), "Learning From Collaboration: knowledge networks in biotechnology and pharmaceutical industries", *California Management Review*, 40(3), 228-240.

Powell, Walter W. and Peter Brantley (1992), "Competitive cooperation in biotechnology: learning through networks?", in *Networks and organizations: structure, form and action*, N. Nohria and R. Eccles (Eds.). Boston: Harvard Business School Press.

PWC (2007), "Pharma 2020: the vision", Cited by Andrew Jack, *Pharma urged to focus spending on R&D*, FT, June 13 2007.

Rothaermel, Frank T. and David L. Deeds (2004), Exploration and Exploitation alliances in biotechnology: a system of new product development", *Strategic Management Journal*, 25, 201-221.

Singh, Jasjit (2008), "Distributed R&D, cross-regional knowledge integration and quality of innovative output", *Research Policy*, 37, 77-96.

Stuart, Toby E., Salih Zeki Ozdemir, and Wawerly W. Ding (2007), "Vertical alliance networks: The case of university-biotechnology-pharmaceutical alliance chains", *Research Policy*, 36, 477-498.

van Geenhuizen, Marina and Leonardo Reyes-Gonzalez (2007), "Does a clustered location matter for high-technology companies' performance? The case of biotechnology", *The Netherlands Technological Forecasting & Social Change*, 74, 1681-1696.