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► **To cite this version:**

Elisa Salvador, Ilaria Mariotti, Fabrizio Conicella. ”Science Park or Innovation Cluster?” Similarities and differences in physical and virtual firms’ agglomeration phenomena”. *International Journal of Entrepreneurial Behaviour & Research*, 2013, 19 (6). hal-02273841

**HAL Id: hal-02273841**

**<https://hal.science/hal-02273841>**

Submitted on 29 Aug 2019

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This article has been accepted for publication by the  
*International Journal of Entrepreneurial Behaviour & Research.*

It can be cited as follows:

Salvador E., Mariotti I., Conicella F. (2013) “Science Park or Innovation Cluster? Similarities and differences in physical and virtual firms’ agglomeration phenomena”, *International Journal of Entrepreneurial Behaviour & Research*, vol. 19, n. 6, pp. 656-674.

## **“Science Park or Innovation Cluster?” Similarities and differences in physical and virtual firms’ agglomeration phenomena**

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### **Structured Abstract**

#### **Purpose**

The paper focuses on the science park “physical” location and the innovation cluster “virtual” location, and aims at investigating: (i) the motivations driving firms to settle in these two agglomerations; (ii) the main problems firms, belonging to the two structures, face in their growth process; (iii) similarities and differences between a “physical” and a “virtual” location; (iv) which forms of proximity (geographical, relational, social, cognitive, organizational, and institutional) play a role within the science park and the innovation cluster.

#### **Design/Methodology/Approach**

A literature review on proximity is followed by an investigation of the Bioindustry Park and the innovation cluster BioPmed in Piedmont region in Italy, through a structured questionnaire, sent between February and March 2002, to firms co-located in the park and/or member of the cluster.

#### **Findings**

From the analysis did emerge that the physical location in the park and the virtual location in the cluster might be complements rather than substitutes.

#### **Research limitations/implications**

Shortcomings like the limited number of companies interviewed, and the absence of a sample of companies exclusively co-located in the park, are observable. Additional research might corroborate the results, which are specifically valid for the two case studies.

#### **Practical implications**

The idea of understanding differences and similarities between the science park and the innovation cluster, and of investigating which proximity typologies play a role in a “physical” and in a “virtual” location, may be useful to design future policy strategies.

**Originality/Value**

The originality of this paper is given by the analysis of a new phenomenon: physical and virtual agglomeration typologies, characterized by several forms of proximity enhancing knowledge diffusion.

**Keywords:** science park; innovation cluster; proximity; networks; knowledge diffusion.

**JEL Codes:** O3; L2 ; R12

This paper was presented at the XLIX Colloque Association de Science Régionale De Langue Française (ASRDLF), “Industrie, villes et régions dans une économie mondialisée”, Belfort, France, 9-11 July 2012 : Salvador E. won a researcher scholarship for presenting this article at the conference.

Although the paper is the result of a joint work of the three authors, the sections may be attributed as follows: sections 1 and 2 to Mariotti I.; sections 3, 5 and 6 to Salvador E.; sections 4 and 7 to the three authors (Salvador E.; Mariotti I.; Conicella F.).

## **1. Introduction**

The importance of geographical proximity in the context of Internet and ICT is questionable (Warf, 1995; Cairncross, 1997; Gaspar and Glaeser, 1998; Friedman, 2007). It is hypothesized that other forms of proximity (relational, social, cognitive, organizational, and institutional) may be of more importance (see, amongst others, Boschma, 2005; Capello, 2007).

In traditional industrial districts and innovative milieu, geographical proximity played a key role in network formation, company growth, and knowledge diffusion. However, the ICT revolution brings in to question the importance of geographical proximity for firms. New forms of “virtual” agglomeration like the “innovation cluster” are emerging as result of forward-looking public policies. An innovation cluster is based on membership to a dedicated organization with activities of a common interest, which is identified and managed by a cluster management company. Innovation clusters are frequently the most dynamic and high-tech components of larger regional communities based on sector commonalities/markets or by the use of similar technologies. Innovation clusters include companies that may be also hosted in a science park.

Within this context, the present paper focuses on agglomeration phenomena in two government settings subsidized by public policies: the science park (hereafter SP) and the innovation cluster (hereafter IC), being the former a physical location and the latter a virtual location. The effect of physical and virtual location was examined by analysis of a structured questionnaire sent to the firms settled in the Bioindustry Park Silvano Fumero and the innovation cluster BioPmed, both located in Piedmont region in the north-west of Italy.

The paper aims to investigate: (i) the pivotal motivations driving firms to locate in these two agglomerations; (ii) the main problems/obstacles firms in each structure face in their growth process; (iii) the main similarities and differences between a physical location (SP) and a virtual location (IC); (iv) which forms of proximity (Boschma, 2005; Capello, 2007) play a role in the SP and IC.

The originality of this research work is provided by the investigation on whether the “physical” location in a SP and the “virtual” location in an IC are substitutes and/or complements, considering the increasing importance of both Internet and ICT (Benghozi *et al.*, 2009), and face-to-face contacts (McCann, 2008).

The paper is structured as follows. The introduction is followed by a literature review on the role played by the proximity forms in enhancing firms’ growth, innovation, competitiveness, and knowledge diffusion within several agglomeration phenomena (from industrial districts and innovative milieu to science parks and innovation clusters). Section three is dedicated to the description of the SP and IC agglomerations, and their relationship to the proximity typologies framed in the literature. The case study of the Italian Bioindustry Park and BioPmed innovation cluster are then presented. Section four focuses on data and methodology. Section five describes the analytical outcomes of the questionnaire investigation through descriptive statistics while section six illustrates a SWOT analysis for the future development of BioPmed. Discussion, policy recommendations and conclusions follow.

## **2. Literature review**

This section provides an overview of the main issues in the longstanding debate about the importance and the role of all forms of proximity in several agglomeration forms. For several decades enterprise clustering has offered a competitive alternative to the advantages achieved through a larger production scale, and through the ensuing economies of scale (Guerrieri and Pietrobelli, 2001). The existence of clusters has frequently been identified in the literature as an important factor in regional development (i.e. Brusco, 1982; Piore and Sabel 1984; Porter 1990). Saxenian’s classic study (1985) of Silicon Valley and Route 128 revealed that this concept was relevant not only for traditional Italian industrial districts or Californian wineries, but also applied to more knowledge-based and hi-tech settings. The literature on enterprise clusters, firms’ agglomeration, and industrial districts is very wide, and a detailed description of the clusters’ typologies is beyond the scope of the present paper (for a review, see, amongst others, Markusen,

1996; Gordon and McCann, 2000; Guerrieri *et al.*, 2001). Nevertheless, it is important to understand the “genetic” conditions (Capello, 2007) that must be in place for a geographical area to host clusters, agglomerations of activities, and industrial districts. Specifically it is important to investigate whether the different forms of proximity constitute relevant underlying conditions.

The importance of proximity is addressed in a long standing and prolific literature that spans multiple disciplines: including urban and regional economics, economic geography, innovation economics, and evolutionary economic geography. Since the beginning of the 1900s, economists recognized that geographical proximity and social proximity play a key role in firms’ growth and competitiveness (Weber, 1909/1929). Specifically, geographical and social proximity have been identified as two necessary genetic conditions, though not sufficient, for an area to host an industrial district (Table 1). The other important conditions are: (i) the concentration of small firms in an area, characterized by productive flexibility and rapid adjustment to market volatility, (ii) and the industrial specialization of the area, which means that all phases of the production chain are undertaken – from the design of the product to its marketing worldwide – (Capello, 2007).

The first attempt at a formal classification of the reasons for firms’ agglomeration in an industrial district was made by Marshall (1920). Marshall proposed the following three reasons why firms would continue to be localized within the same area: (i) the development of a local pool of specialized labor, (ii) the increased local provision of non-traded input specific to an industry, and (iii) the maximum flow of information and ideas (Krugman, 1991). The Marshallian industrial district has been taken as a reference by a few Italian economists like S. Brusco, G. Becattini and G. Fuà in studying the phenomenon of the “Third Italy” of the 1970s. Becattini defined the Italian industrial district as “*a socio-territorial entity which is characterized by the active presence of both a community of people and a population of firms in one naturally and historically bounded area. In the district, unlike in other environments, such as manufacturing towns, community and firms tend to merge*” (Becattini, 1990: 38)<sup>i</sup>. The Marshallian industrial district and its Italian version have stressed the role of space as a generator of location advantages, such as lower production and

transaction costs, and a more efficient use of resources, which enable firms to achieve higher levels of productivity and profit (Capello, 2007).

However, the influence of space on economic activity does not result solely in improvements to the static efficiency of production processes (i.e. an increase in firms' revenues or a decrease in their costs), but also in the innovative and creative capacity of firms (Mouleart and Sekia, 2003). Innovation and creativity can, however, be found both in urban areas, which have always been the main sites of innovative activity, and in non-metropolitan areas (i.e. Silicon Valley in California, Route 128 in the Boston area, Baden-Wurttemberg in the South of Germany, Sophia Antipolis close to Nice). Understanding these phenomena became of particular interest in the 1980s, a period in which, under the impetus of extensive technological changes, innovation came to be considered the driving force of economic development (Capello, 2007). Specifically, the GREMI (*Groupe de Recherche Européen sur les Milieux Innovateurs*) group investigated the phenomenon of spatial concentration of small firms, and concluded that factors related to “relational proximity” (social interactions, interpersonal synergies, and collective action among actors) account for the greater innovative capacity (see amongst others, Aydalot, 1986). According to this theory, economic and social relations between local actors influence the innovative capacity and economic success of specific local areas termed “milieu innovateurs<sup>ii</sup>” (Camagni, 1991). Specifically, synergy among actors is enhanced by geographical proximity and economic and cultural homogeneity, which produce advantages for small firms because they underpin processes of collective learning and socialization of knowledge (relational proximity), (Table 1).

However, since the early 1980s the idea that technological improvement render geographical distance of little or no importance has flourished (Gaspar and Glaeser, 1998; Warf, 1995). As Christopherson *et al.* (2008) stated, in the 1990s several authors argued that globalization – in particular the revolution in ICT – marked the “end of geography” (O'Brien, 1992), the onset of the “death of distance” (Cairncross, 1997), the emergence of a “borderless world” (Ohmae, 1995), and the “vanishing of distance” (Reich, 2001). This issue has been argued, more recently, in the best-

selling book by Thomas Friedman (2007) “The World Is Flat”, which argues that the world is becoming rapidly “flatter” because of the belief that transaction costs associated with overcoming space have fallen dramatically, and the falling spatial transaction costs are a result of both technological and institutional changes (McCann, 2008). The findings of this book have been discussed in a Special Issue by the Cambridge Journal of Regions, Economy and Society in 2008, which collects several papers stemming from various disciplines. Specifically, McCann (2008) argues that while the actual transport costs of shipping goods or information may have fallen enormously (see Glaeser and Kohlhase, 2004), this is not necessarily true for transaction costs involved in making or setting up a transaction<sup>iii</sup>.

To summarize, the main cluster typologies studied since the 1900s have stressed “proximity” as a key condition for an area to host a cluster, and specifically, geographical and social proximity play a key role within the industrial district, while geographical and relational proximity are important within the milieu innovateur<sup>iv</sup> (Table 1).

*Insert Table 1 about here*

Besides, as Boschma (2005)<sup>v</sup> stated in his analysis on the impact of geographical proximity on interactive learning and innovation, the importance of geographical proximity cannot be assessed in isolation, but should always be examined in relation to other dimensions of proximity (cognitive, organizational, social, institutional – Table 2) that may provide solutions to the problem of coordination. Indeed, because of advanced ICT, networks through which learning takes place are not necessarily spatially delimited. Rallet and Torre (1999) showed that tacit knowledge may be transmitted across large distances through other forms of proximity: the need for geographical proximity is rather weak when there is a clear division of precise tasks that are coordinated by a strong central authority (organizational proximity), and the partners share the same cognitive experience (cognitive proximity), (Boschma, 2005). Nevertheless, the exchange of tacit knowledge still requires face-to-face contacts, which can take place by bringing people together through travel



now and then (McCann, 2008). In other words, it did not need geographical proximity in the meaning of permanent co-location.

*Insert Table 2 about here*

However, as Boschma (2005) stressed, a good balance of the several proximity typologies, described in Table 2, is needed. With regard to the cognitive proximity: *“a not too great cognitive distance between firms (in terms of competencies and skills) enables effective communication and, thus, learning, while a not too small cognitive distance avoids lock-in, especially when access to dissimilar bodies of knowledge is required in product innovation”* (Boschma, 2005: 63-64), and the traditional cluster (see *infra*) is a practical example.

Similarly, too much organizational proximity is accompanied by bureaucracy and lack of flexibility, while the opposite is linked to a lack of control increasing the danger of uncertainty and opportunism. Therefore, these factors need to be controlled. Too much or too little social proximity may also be detrimental to interactive learning due to “lock-in” or an underestimated risk of opportunism - again, a balance is needed.

Too much institutional proximity is unfavorable for new ideas and innovations, because institutional lock-in and inertia obstruct awareness and rising of new possibilities. Conversely, too little institutional proximity is detrimental to collective action and innovation because weak formal institutions lack social cohesion and encourage opportunism. A balanced solution can result in institutional stability, openness and flexibility, when linked to the other forms of proximity.

Finally, as concerns geographical proximity, ICT have widened the boundaries of networks through which learning takes place, and are not spatially limited. Therefore, according to Boschma (2005: 70), *“geographical proximity may play a complementary role in building and strengthening social, organizational, institutional and cognitive proximity”*.

To sum up, geographical proximity is neither a necessary nor a sufficient condition: *“it is not necessary, because other forms of proximity may function as substitutes to solve the problem of coordination. It is not sufficient, because learning processes require at least cognitive proximity”*

*besides geographical proximity*” (Boschma, 2005: 71). In the present paper we build on these assumptions trying to apply these different but complementary meanings of proximity to the Bioindustry park and BioPmed innovation cluster case-studies.

### **3. The Bioindustry Park Silvano Fumero, BioPmed innovation cluster and the role of proximity**

Recently, the importance of clusters has emerged within the framework of the “Lisbon Strategy” launched in 2000, which sees SMEs as a strategic issue (European Commission, 2007). Regional clusters are able to overcome the structural weaknesses associated with the small size of firms because of agglomeration economies; they foster firms and employment growth, and are channels of knowledge diffusion because geographical distance hampers knowledge flow (Capello, Caragliu, 2012). Knowledge “spill-over” increases the productivity of a country, or region, which is not only affected by the extent to which local firms invest in R&D activities, but also by the potential access to external R&D stocks (Coe and Helpman, 1995). While most successful clusters are market-driven and are a spontaneous phenomenon (i.e. industrial district, milieu innovateur), since the end of the 1990s an increasing number of clusters (i.e. science park, innovation cluster) have been generated as a result of public policies (Cainelli and Zoboli, 2004; Commission of the European Communities, 2008).

Within this context, the present section provides a description of two cluster typologies promoted by public policies: the science park and the innovation cluster, and investigates which role the different forms of proximity play within them. In addition to this, two case studies: the “Bioindustry Park Silvano Fumero” and the emerging innovation cluster “BioPmed” are examined in detail.

The concept of Science Park first emerged in the U.S. during the early 1950s when Stanford Research Park and the Research Triangle Park were established. In Europe, the first park was established in Edinburgh, Scotland (the Heriot-Watt Research Park) in 1965 (Haxton, 1998). According to Link and Scott (2003: 1325) and to Link and Link (2003: 81), “*the definition of a*

*research or SP differs almost as widely as the individual parks themselves*". Although several definitions of SP have been proffered in recent years, there is a common emphasis on technology transfer from universities, and on knowledge diffusion and regional economic growth. Generally speaking, the term "science park" is used to describe a property based initiative that has formal and working links with one or several universities, higher education institutions, or research centres. SPs foster and support the start-up, incubation and development of knowledge based businesses, innovation and with growth potential; it provides an environment where large and international businesses may develop networking initiatives with small and medium-sized companies and research centres (Parry, Russell, 2000; Ferguson, Olofsson, 2004).

Notwithstanding their dimension and heterogeneity, the rationale for the creation of SPs has traditionally been considered: (i) proximity to university laboratories and research centres; (ii) the presence of an incubator; (iii) the creation of networking opportunities (Soetanto, Jack, 2011; Ahmad, Ingle, 2011); (iv) the provision to tenant firms of suitable accommodation, and technical and business services (Colombo, Delmastro, 2002; Link, Scott, 2003, 2006, 2007); (v) an attractive working and living environment.

The analysis of the SP characteristics allows us to hypothesise that firms and research institutes/universities co-located in the SP may benefit from geographical, cognitive, institutional, and organisational proximities (Table 2).

Nonetheless, globalization and the ICT revolution mean that learning is not spatially delimited. In this context, a specific typology of innovation cluster (IC) has been promoted by the European regional policy. The IC is designed to stimulate innovative activity by promoting intensive interactions, sharing of facilities and exchange of knowledge and expertise, and by contributing effectively to technology transfer, networking and information dissemination (Conicella, 2010). The IC is managed by a dedicated company that can also be a science park. Since the IC is based on a membership, it can collect a larger number of organizations (i.e. firms,

universities, research centres) than the SP, and although the IC members will still require face-to-face contacts, this will not need permanent geographical proximity by co-location.

Therefore, the IC characteristics allow us to hypothesise that members of the IC may benefit from cognitive and organizational proximities.

The two cases analysed are the SP Bioindustry Park Silvano Fumero and the IC BioPmed<sup>vi</sup>. The Bioindustry Park Silvano Fumero<sup>vii</sup> (BIPCa SpA – Collettero Giacosa-Turin, Italy) is located 40 km far from Turin (Piedmont region – north west of Italy), and focuses on the promotion and development of biotechnology research. The park is a joint stock company. It aims at supporting the start-up and growth of a new sector - “life science” - in a territory mainly specialised on mechanics, electronics and ICT. It is the second most important, and the second largest biotech SP in Italy (Buchi *et al.*, 2010; AA.VV., 2010), and has been operating since 1998. *“The science park developed a quite interesting governance model based on a triple helix, private public partnership approach”* (Conicella, Baldi, 2011: 9) with a shared vision of fostering entrepreneurship development and research results transfer. The main purposes of the Park are to attract companies, create start-ups, foster technology transfer activities and act as hub for international networking. The international dimension is particularly important, and is essential in the life science sector<sup>viii</sup>, which is global in its nature. After ten years, the Bioindustry Park hosts about 35 different organisations (large companies, SMEs, start-ups, universities, and associations), employing about 500 workers; besides, four additional companies, with about 300 workers, are located within 10 kilometres of the Park. Most of the firms have relocated to the area to join the SP (Conicella and Baldi, 2012).

In order to foster the further development of the park, in 2009 the SP developed the BioPmed<sup>ix</sup> IC for the biotechnology and medtech sectors in Piedmont region. BioPmed is one of twelve ICs promoted by the Piedmont Regional Authority within the POR-ERDF 2007-2013<sup>x</sup> program, and at December 2011, it comprised 80 organizations, including large companies, SMEs, universities and research centres working in the life sciences and health care sector (Conicella,

Baldi, 2011; Conicella, Bassi, 2011). The SP, being in charge of the innovation cluster project, acts as an interface between regional authorities and the cluster members, and coordinates and promotes all the activities (BioPmed report 2009/2010).

In the next section differences and similarities between the SP and the IC, and the specific proximity forms characterising of the two clusters are investigated. Besides, the analysis investigates the pivotal motivations driving firms to locate in these two agglomerations, and the main problems/obstacles firms, belonging to the two structures, face in their growth process.

#### **4. Data and methodology**

A survey has been carried on the companies hosted by the SP Bioindustry Park Silvano Fumero and/or members of the IC BioPmed. Specifically, a questionnaire<sup>xi</sup> was sent to total of 284 companies of which 20 both hosted in the SP and member of the IC, 45 companies only member of the IC, 14 companies only hosted by the SP, and 205 companies neither hosted by the SP, nor member of the IC (counterfactual group). The answer rate was good for the sample of companies both hosted in the SP and member of the IC (13 companies, 65%), while for the firms only belonging to the IC, and for those only hosted by the SP the answer rate was about 29% (13 and 4 respondents, respectively). Only 3 firms belonging to the counterfactual group filled the questionnaire.

The response rate led us to focus on two samples: firms both hosted in the SP and members of the IC (13 companies, 65%) and firms only members of the IC (13 companies, 29%). Therefore, given the sample of company respondents, the following analysis focuses on 26 firms. Descriptive statistics from the questionnaire answers<sup>xii</sup> are illustrated in the following section, followed by a SWOT analysis focusing on the future development of BioPmed.

#### **5. Results from the survey**

The questionnaire has been divided into the following sections: sections 1 and 4 are common to all the company respondents, while sections 2 and 3 include questions for companies hosted in

the SP and/or member of the IC. The results are described according to the different questionnaire sections.

### ***5.1 Section 1: general characteristics of the company***

This section analyses the results from the questionnaire for all 26 companies, providing a comparison between the two sub-samples where appropriate.

More than 70% of the questionnaire respondents (including firms both hosted in the SP and members of the IC, and firms only members of the IC) are limited companies, and they have mainly been created in the last ten years (73% from 2002 to 2009). This result is in line with the date of creation of the Bioindustry Park (1998), and BioPmed IC (2009), and with the development of the implemented strategy for attracting companies. The majority of companies had a product-based business model (76%) and the remainder were service based (24%). All these firms work in the life science and biotech sectors, including different technological fields: biotechnology, new materials, ICT, electronics, chemistry, all dealing in different market segments such as pharmaceuticals, diagnostic, medical technologies, services, e-health, bioinformatics.

The size of the firms, in terms of number of employees, is in general very small. Turnover in many companies was very small, due to specific sector activity. Many companies did not report any turnover in 2009 and 2010 (37%), but there were a few cases of medium or very high turnover. Medium and high turnover companies are found in both groups, and are on average older compared to the others. On the other hand, companies with no turnover are frequently science based start-ups in an early phase of development that received seed and/or venture capital financing, and are pursuing precompetitive/preclinical research activities. These companies have a high economic value (that justifies the huge amount of invested money) but presently are not able to exploit their assets through revenues.

Given the global nature of life science and biotech sectors, these companies regard international, presence and collaboration as very important: the international market is clearly the most important for these companies and for the most part these markets lie in non-EU countries. It

must also be underlined that, according to the questionnaire answers, companies both hosted by the SP and members of the IC are more internationally oriented (85%) compared to companies only members of the IC (30%).

Despite the strong international attitude and product orientation, the majority of firms have no patents or very few patents. Generally, the first patent was obtained in the last ten years while the most recent patent between 2009 and 2011. This reluctance to innovate through patents might be explained by their “young” age and the existence of “tacit know-how” not still finalized in patents. Another element is the presence of patent strategies based on a few “strong patents”. According to the company’s international attitude, these patents have an extension at the international level (94%).

### ***5.2 Section 2: hospitality in a science park-incubator (Bioindustry Park)***

In this section we focus exclusively on the sample of 13 companies that are both hosted in the SP and members of the IC. We aimed to investigate the characteristics and advantages of the *physical* location by analysing the answers these firms gave about the location in the SP. Questionnaire respondents were hosted in the SP since 2000.

The main reasons for the situating businesses in the SP was the “possibility to use the resources provided by the park” as well as the “prestige and visibility motivations and guarantees of reliability” (Figure 1).

*Insert Figure 1 about here*

In line with these results, the main advantages for being hosted in the SP are: “greater visibility” and the “possibility to use the services provided by the structure”. This result is in line with the literature depicting “a favourable image” of the park as one of the success factors.

Furthermore, the answers about the main services used by on-park companies show a great adoption of all the services (meaning networking with other firms and university and research centres, use of common spaces for meetings, consultancy opportunities, maintenance services), with the only exception of tutorship.

And, according to their strong international interest, the firms have specified in an open commentary that '*international promotion activities*' (72%) is the main service to be further implemented and developed.

It can therefore be argued that the overall hospitality in the park is very good.

As concerns the main advantages related to the on-park location, the firms have stressed that the park is a suitable location for developing ideas and innovative projects, and for networking contacts; it provides good services, and it offers the advantage to become member of a group of excellence and have access to high quality human resources.

On the other side, the main disadvantage is the transport infrastructure, specifically, the lack of a good train connection to the park, and the distance from Milan and other main cities. The poor accessibility might be considered an obstacle to enhance face-to-face contacts with players in large cities like Milan and Turin, and to improve the park's visibility. However, overall questioning revealed that the distance between the park and the universities and other research centres was not important to most businesses.

### ***5.3 Section 3: innovation cluster (BioPmed)***

This section has been compiled by 26 companies, of which, 13 only members of the IC (and not hosted by the SP), and 13 both hosted in the SP and members of the IC. In order to avoid double counting, comparisons and differences between these two sub-samples are clearly provided, where needed.

On average, 50% of the respondents have been members of the IC since the year 2009, while the others joined the cluster in 2010 and 2011. The main motivations and expectations for joining the IC were related to the opportunity to: (i) establish collaborative research projects; (ii) improve innovation performance and company competencies, and collect new ideas; (iii) develop networking opportunities; (iv) undertake feasibility studies; (v) develop new products and company competitiveness; (vi) improve visibility. The reasons that were considered to be only of minor importance were those linked to internal business workings, such as company costs and time-to-



market reduction (Figure 2). The most important motivators in the two samples of companies in both the IC and SP were to: “collect new ideas and improve competencies” and “foster the creation of new products” (in line with the main advantages coming from the *physical* location in the park, see section 4.2 *supra*). Conversely the most important motivators for companies in the IC only were to “improve innovation performance” and “improve firm competitiveness”. Both groups reported similar importance of other motivations, like “establishing collaborative research projects”, “keep in touch with other member firms”, “undertake feasibility studies”, and “improve firm visibility”.

The advantages of membership in the IC was similar to the motivations for joining: company competencies improvement, networking establishment, more visibility, and the creation of collaborative agreements, while reduction of the time-to-market has not been considered a relevant advantage, as yet underlined in Figure 2 (see Figure 4). No significant differences have been observed comparing the answers provided by the two samples of companies.

*Insert Figure 2 about here*

*Insert Figure 3 about here*

*Insert Figure 4 about here*

Amongst the IC members the main risks and barriers have been: lack of time, administrative burdens and lack of collaboration, followed by communication and intellectual property rights (IPR) problems. Lack of trust among the members is considered a risk of minor importance (Figure 3). No significant differences have been observed in the answers provided by the two samples of company (both hosted by the SP and member of the IC or only members of the IC).

A last area investigated was what needs improvement in the IC. BioPmed members would like to have a faster communication channel between the BioPmed manager and public institutions as well as more information, advice and aid in responding for calls for projects. They would also like assistance in fostering networking among the cluster members through meetings and common initiatives. The exchange of tacit knowledge, still requires face-to-face contacts.

#### ***5.4 Section 4: differences between the location in the Bioindustry Park (SP) and in the innovation cluster BioPmed (IC)***

Finally, *Section 4* has focused on the difference between the *physical* location in the SP and the *virtual* location in the IC. This section has been compiled by the overall sample of 26 companies, taking into account the differences due to the “exclusively virtual” location of 13 companies (only IC) and the “both physical and virtual” location of the other 13 companies (SP and IC). About half of the companies both located in the SP and members of the IC have indicated the SP solution as a better one, while the others chose the cluster solution. The results are not so for the group of firms belonging only to the IC, indeed, 6 of them indicated the cluster as a better location, 4 opted for the park, and the last 3 did not answer.

Furthermore, another question aimed at investigating the main “similarities and differences” in the creation of agglomeration phenomena between the location in the SP or the IC membership (Figure 5).

*Insert Figure 5 about here*

Questionnaire answers showed little difference. More specifically, looking at Table 3 we can state that about 39% of the companies both hosted in the SP and members of the IC indicated no differences between the park and the cluster solutions in the creation of agglomeration phenomena, while on average the same percentage of firms indicated little difference with a subtle prevalence of importance of the cluster solution compared to the park. On the other hand, companies that were only members of BioPmed indicated little difference in the creation of agglomeration phenomena (31%) with a subtle preference for the park solution, while 23% of respondents stated that there is no difference. Therefore, it seems that the answers are influenced by the single perceptions of the respondents that highlight that the “*the grass is always greener on the other side*”, and this is stronger for the sample of firms in the cluster.

*Insert Table 3 about here*

According to the answers received, the SP provides more opportunities for networking and exchanging opinions among firms located near one another, and coordinated at central level by the park (organisational proximity) structure. On the other side, the IC membership provides increased possibilities for networking with potential clients and an higher number and variability of involved participants. Among the factors strictly linked to the location in an IC, questionnaire respondents chose collaboration opportunities as the most important benefit resulting from inclusion, followed by new product and market enlargement. By contrast, the creation of social links has been considered of minor importance, thus confirming the lack of social proximity within the cluster.

Among the factors that are strictly linked to the location in a SP, questionnaire respondents chose collaboration opportunities as the most important benefit of membership, followed by the creation of social links and new products. Finally, market enlargement was considered of minor influence. It can, therefore, be stressed that while the creation of social links has been clearly perceived by questionnaire respondents as more linked to the physical location inside a SP, the IC seems to be perceived as a useful opportunity for collecting new clients, leading to new products and therefore enlarging the market.

The analysis of the SP and the IC characteristics, as presented in section three, allowed us to hypothesise that firms and research institutes/universities co-located in the SP may benefit from geographical, cognitive, institutional, and organisational proximities, while firm members of the IC may benefit from cognitive and organizational proximities. These hypotheses have, then, been tested by the results of the survey.

## **6. A SWOT analysis for the development of BioPmed**

Starting from the questionnaire results, this section is dedicated to a SWOT analysis of the main strengths, weaknesses, opportunities and threats for the future development of the BioPmed (Table 4). Questionnaire findings highlighted a limited difference between the physical location in a SP and the virtual location in an IC. Nevertheless, they showed that companies hosted in the Bioindustry Park and members of BioPmed are more internationally oriented than companies that

were only members of the IC. Furthermore, the park is perceived more useful for the creation of social links, and face-to-face contacts with the other companies (geographical and institutional proximity), while the cluster is more important for improving the number of clients and creating new products through collaborative research projects (a form of cognitive proximity).

The different advantages of the two locations probably justify the absence of clear predominance of the SP or the IC in the creation of agglomeration phenomena between the hosted companies. The SWOT analysis in Table 4 highlights the wide range of collaboration opportunities as a main strength of BioPmed, as well as the ICT potential and the opportunity for international collaboration. There are also several weaknesses and threats. The main weaknesses result from the culture of, and attitudes to, the virtual dimension, and the perception of difficulty in creating social links. As a consequence, the main threats are identified in the lack of trust and, therefore, the difficulty of establishing a virtual community.

*Insert Table 4 about here*

## **7. Discussion and concluding remarks**

The idea of the present study has been to understand a new phenomenon: *physical* and *virtual* agglomeration forms, which are characterised by several forms of proximity enhancing knowledge diffusion. Therefore, the firms' *physical* location in the SP Bioindustry Silvano Fumero, and the firms' *virtual* location in the IC BioPmed have been investigated by means of a questionnaire interview of 26 firms (13 both hosted in the SP and members of the IC, and 13 benefiting exclusively from the virtual location in the IC), and the hypotheses about the role of proximity within the SP and IC, framed in section 3, have been tested.

However, it cannot be denied that this research work suffers from some shortcomings including the limited number of companies interviewed, and the absence of a sample of companies exclusively co-located in the SP. Nonetheless, the results of the survey allowed us to test the hypotheses framed in section 3, which are, nevertheless, specifically valid for the two case studies.

Additional research on SP and IC might allow corroborating these results, and in case, extending them to the SP and IC typologies.

The IC and the SP investigated are both specialized in life science and biotech, thus showing a more international outlook. The firms appreciate the services provided by the SP especially the visibility and prestige perception resulting from being located in the structure. Similarly, firms' members of the IC highlight the importance of improving competencies and innovation, and establishing collaborative research projects. Visibility and networking opportunities are also important.

To sum up, the overall analysis did not reveal a strong difference in motivations, perceptions and advantages coming from the location in the SP and in the IC. The agglomeration phenomena in a SP or in an IC seem to follow similar patterns, with some exceptions, e.g. the creation of *social links*, which was clearly perceived as more connected to the physical location (SP) than to the virtual location (IC). In addition to this, the SWOT analysis has showed that some cultural issues (e.g. traditional entrepreneurial culture, fear of "bad competition" inside the cluster), some policy issues (change in regional priorities, changes in cluster based policies), and some systemic issues (lack of funding for R&D, lack of risk capital) could affect the development of the IC and of all the other clusters focused on the innovative sector's development.

The survey allowed to investigate the proximity classification proposed by Boschma (2005), and to conclude that firms and research institutes/universities co-located in the SP may benefit from geographical, cognitive, institutional, and organisational proximities, while firm members of the IC may benefit from cognitive and organizational proximities. To avoid problems due to too much or too little proximity, a balance involving a mix of various forms of proximity has to be looked for. In our case-studies cognitive proximity, given by the involvement of companies working in the same sector, has to be properly balanced by the management staff of the park/cluster (organizational proximity) in order to avoid detrimental effects due to close cognitive proximity. Besides, the

correct level of organizational proximity could be controlled through annual surveys in on-park companies and cluster members.

As concerns institutional proximity, a balance is required, since too much institutional proximity is unfavorable for new ideas and innovations due to institutional lock-in and inertia, while too little institutional proximity is detrimental to collective action and innovation, because weak formal institutions lack social cohesion with emerging opportunism. Institutional proximity is, however, under the control of the managing staff in the IC and in the SP, and needs to balance openness and flexibility.

Finally, geographical proximity complements the other forms of proximity: it is mainly satisfied in the SP where companies are physically co-located, and it is advocated by the IC members when a specific request for face-to-face contacts is put forward. Although geographical proximity is somewhat overcome by the Internet and ICT, as McCann (2008) stressed, “face to face contacts are still important”.

In general, “clusters in the EU do not always have the necessary critical mass and innovation capacity to sustainably face global competition and to be world-class”, because of market fragmentation, lack of cooperation and weak university-industry relationships (Commission of the European Communities, 2008: 5). As a consequence, “there seems to be a general agreement about the need to develop and further strengthen collaboration between three key actors in the RTD domain: the public sector, the business community and higher education institutions” (Saublens, 2008: 8). Therefore, we could say that in order to achieve and maintain the right balance between the various forms of proximity for achieving benefits, management staff of the park/innovation cluster could work in partnership with business schools (Conicella, Salvador, 2012; Darabi, Clark, 2012). Entrepreneurship education programmes (Bureau *et al.*, 2012; Fogg, 2012) may have a key role to play in order to improve the potentialities of innovation clusters like BioPmed. Therefore, if it is true that the creation of “social links” is one of the most difficult aspects to develop in a virtual location like BioPmed, science parks and business schools could work in partnership in order to

schedule an educational programme to foster the emergence of specific social links in ICs. This might include short education initiatives, aimed at creating a “mind attitude” and “cultural change”, and foster the IC’s advantages, improving the potential of an initiative that, thanks to ICT, could complement the traditional physical location inside a SP. The role of proximity is clearly intended to play in the future new and renewed roles. The winning strategy lies in finding the balance between all the different aspects and the several parties involved.

It can be concluded that the strategy for the future development of BioPmed should include strong collaboration and involvement of the park: the physical location in the park and the virtual location in the cluster might be complements rather than substitutes. The results of the survey, although limited to two specific case studies, provide a deeper understanding of interactions in the virtual and physical locations, and also provide a framework for future studies in this area.

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<sup>i</sup> A well-known classification is the one proposed by Markusen (1996) who grouped several different forms of industrial organisation into three types of industrial districts: (i) the Marshallian industrial district and its Italian variant, (ii) the Hub-and-Spoke district, (iii) the satellite platform, (iv) the state-anchored industrial district.

<sup>ii</sup> The concept of “innovative milieu” is abstract: the milieu must be considered an economic and territorial archetype more than an empirical reality. The characteristics of the innovative milieu are never fully realised in real territorial systems. The innovative milieu can never be considered a precondition for innovation; it is only an element which increases the probability of an innovative outcome (Capello, 2007).

<sup>iii</sup> McCann (2008) focuses on spatial transaction costs, and disentangle them into three categories: (i) the transaction costs associated with moving goods across geographical space, that is transportation costs; (ii) the transaction costs associated with moving knowledge and information across geographical space, that is knowledge-information transmission costs; (iii) the transaction costs associated with moving across national borders, that is tariff costs (institutional costs and the tariffs associated with a particular border crossing).

<sup>iv</sup> The key role of spatial or geographical proximity has also been investigated by the Innovation economics literature, which places more emphasis on the existence of geographically bounded spillovers from knowledge sources (i.e. university research) to industrial innovation (i.e. Jaffe, 1989; Anselin *et al.*, 1997, 2000; Breschi and Lissoni, 2001a, 2001b). This literature focuses on the assumption that spatial proximity between firms and knowledge sources facilitates the interactions and face-to-face contacts necessary for the transmission of the tacit component of knowledge.

<sup>v</sup> Ron Boschma and the Utrecht School belong to evolutionary economic geography discipline. For an overview, see also the French School of Proximity Dynamics.

<sup>vi</sup> For further details about the Bioindustry Park Silvano Fumero and BioPmed, see Salvador (2012).

<sup>vii</sup> [www.bioindustrypark.eu](http://www.bioindustrypark.eu)

<sup>viii</sup> i.e. chemical, pharmaceutical, diagnostic, veterinary, agro-food, cosmetics, bioengineering and information technology.

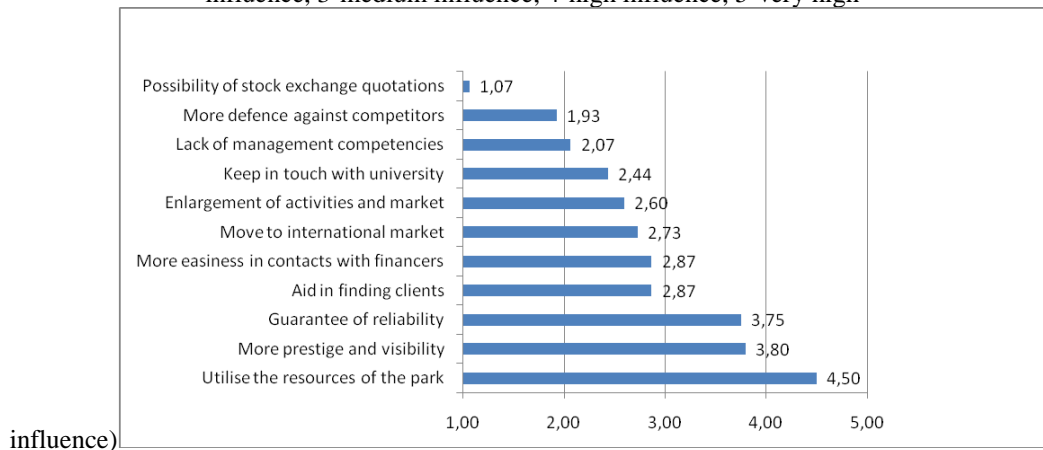
<sup>ix</sup> [www.BioPmed.eu](http://www.BioPmed.eu)

<sup>x</sup> “*The Regional Operating Programme (POR) Regional Competitiveness and employment is the planning tool of the European Fund for Regional Development (ERDF), whose financing aims to boost competitiveness of the regional system, leveraging both the capability to produce and absorb new technologies and the ability to use natural and environmental resources in a sustainable model of development*”, (BioPmed report 2009/2010: 7).

<sup>xi</sup> A questionnaire has been chosen as method of investigation because of the difficulties in collecting face to face interviews and because of the necessity to have a standard set of questions for a comprehensive investigation.

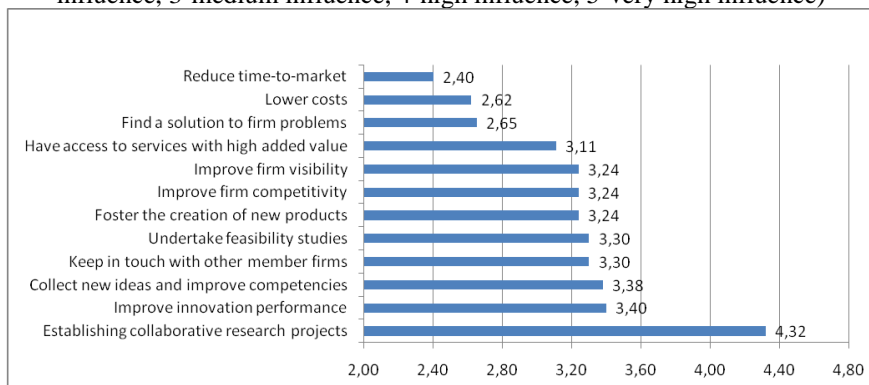
xiii The questionnaire included multiple-choice questions usually with the use of the Likert scale and some open questions for collecting ideas and suggestions from respondents. It was sent by e-mail to these companies between February and March 2012 with information about the purpose and details of the survey. An e-mail reminder was sent to the companies that did not reply to the first e-mail within a month.

Figure 1: Reasons for being hosted in a park (Likert scale, rating average between 1-no influence at all, 2-low influence, 3-medium influence, 4-high influence, 5-very high influence)



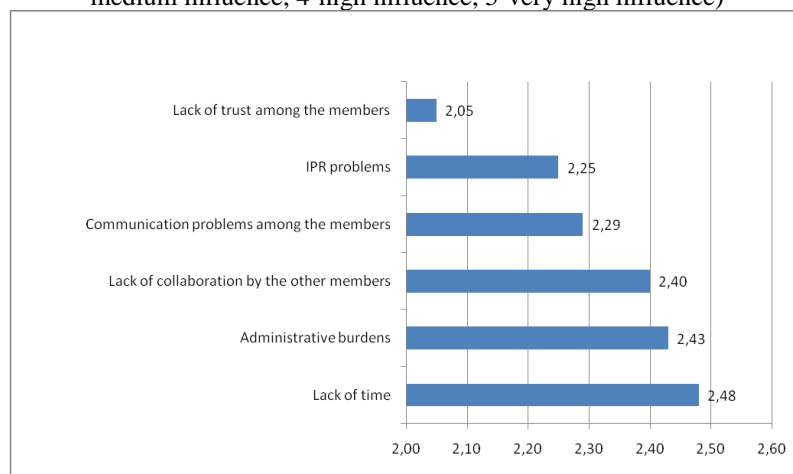
Source: authors'elaboration

Figure 2: Main motivations for joining BioPmed (Likert scale, rating average between 1-no influence at all, 2-low influence, 3-medium influence, 4-high influence, 5-very high influence)



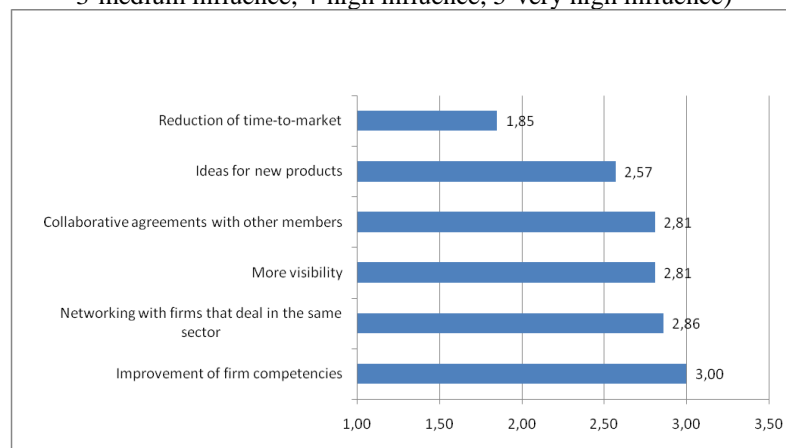
Source: authors'elaboration

Figure 3: Main risks to be afraid of (Likert scale, rating average between 1-no influence at all, 2-low influence, 3-medium influence, 4-high influence, 5-very high influence)



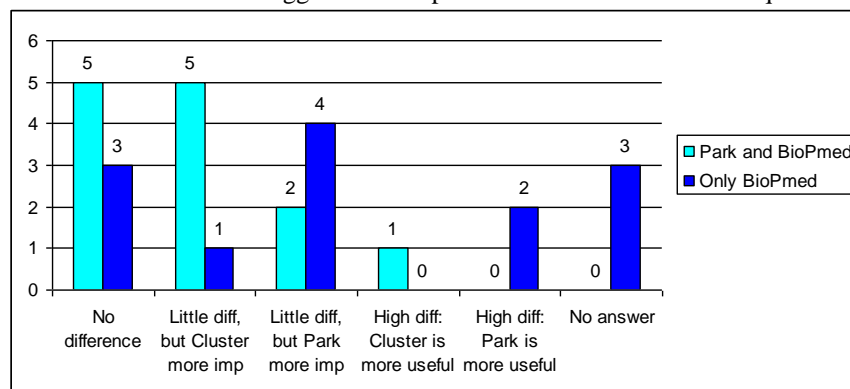
Source: authors'elaboration

Figure 4: Advantages from the membership (Likert scale, rating average between 1-no influence at all, 2-low influence, 3-medium influence, 4-high influence, 5-very high influence)



Source: authors'elaboration

Figure 5: Similarities and differences in agglomeration phenomena: orientation of the questionnaire respondents



Source: authors'elaboration

Table 1: Proximity as genetic condition for an industrial district (ID) and/or a milieu innovateur (MI)

Typologies	Definition	ID, MI
Geographical proximity	Geographical contiguity among firms, it facilitates the exchange of tacit knowledge.	ID, MI
Relational proximity	A set of norms and values that govern interactions among people, firms; the institutions where people, firms are incorporated, the relationship networks set up among various social actors and the overall cohesion of society.	MI
Social proximity	A system of institutions, codes, and rules shared by the entire community regulate the market; this system induces firms to cooperate and to resort to the local market when activities, phases or services prove too costly for them to produce internally	ID

Source: authors' elaboration on Capello (2007: 186-187 and 196-200)

Table 2: Proximity's typologies and innovation according to Boschma (2005)

Typologies	Definition
Cognitive proximity	"People sharing the same knowledge base and expertise may learn from each other" (Boschma, 2005: 63-64): effective communication is facilitated, but too much cognitive proximity may be detrimental to learning and innovation.
Organizational proximity	Refers to the extent to which relations are shared in an organizational arrangement, either within or between organizations, involving a given rate of autonomy and a degree of control.
Social proximity	Refers to strong socially embedded relations between agents at the micro-level: this involves trust based on friendship, kinship, commitment and past experience.
Institutional proximity	Includes economic actors sharing the same institutional rules of the game, as well as a set of cultural habits and values.
Geographical proximity	Refers to the spatial or physical distance between economic actors, both in its absolute and relative meaning.

Source: authors' elaboration on Boschma (2005)

Table 3: Similarities and differences in agglomeration phenomena: orientation of the questionnaire respondents

	Park and BioPmed	Only BioPmed
No difference	39%	23%
Little diff, but Cluster more imp	38%	8%
Little diff, but Park more imp	15%	31%
High diff: Cluster is more useful	8%	0%
High diff: Park is more useful	0%	15%
No answer	0%	23%
Total	100%	100%

Source: authors'elaboration

Table 4: SWOT analysis for the future development of BioPmed

<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>✓ Focus on new and emerging markets and sectors: life science and biotech</li> <li>✓ Wide range of networking and collaboration opportunities</li> <li>✓ International orientation</li> <li>✓ Collection and sharing of ideas with the other members</li> <li>✓ Smart specialisation approach</li> </ul>	<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>✓ Lack of the physical dimension</li> <li>✓ Lack of a "mind attitude" towards the advantages of a virtual community</li> <li>✓ Lack of perception of "social links" creation</li> <li>✓ Cultural issues</li> <li>✓ Systemic issues</li> </ul>
<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>✓ Collaborative projects</li> <li>✓ International synergies</li> <li>✓ Participation in European projects</li> <li>✓ Potentialities offered by the ICT revolution</li> <li>✓ Improvement of firm competencies</li> <li>✓ Open innovation</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>✓ Lack of trust in a "virtual" community</li> <li>✓ Lack of time</li> <li>✓ Lack of establishment of "agglomeration phenomena"</li> <li>✓ Policy issues</li> </ul>

Source: authors'elaboration