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Fabio Arfaioli – Fabrizio Conicella

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BIOINDUSTRY PARK SILVANO FUMERO S.p.A. • Bi.P.Ca. S.p.A.

• 10010 Colleretto Giacosa TO • Via Ribes 5 • Tel +39 0125 561311 • Fax +39 0125 538350

www.bioindustrypark.eu • e-mail: bipca@bioindustrypark.it • Capitale Sociale i.v. Euro 12.581.663, al 31/12/2009 Euro 12.581.663

Registro imprese Torino n. 799923 • Codice Fiscale, Partita IVA e CCIAA To 06608260011

bioPmed innovation cluster – www.biopmed.eu - info@biopmed.eu

Intellectual capital management in third generation science parks: from physical concentration to cluster level business incubation

Fabio Arfaioli – Fabrizio Conicella[1]

Abstract

Purpose:The main purpose of this study is to analyse the role of intellectual capital management in the development of third stage science park. Assuming intellectual capital as the main resources in R&D activities the paper tries to deconstruct concept of incubation in order to reshape the boundaries of science park activities in a cluster perspective.

Design/methodology/approach: The first part of is based upon an interdisciplinary literary review and wants to clarify the theoretical model and operative hypothesis. The second analyse the case of Bioindustry Park Silvano Fumero and its IC service platform as an example of innovative business model for business incubation.

Findings: Working at IC level permits to develop service platform based on systemic needs and offer the opportunity to develop shared added value services performance. It also obliges science parks to work more out of their boundaries because of the need for knowledge heterogeneity and network. In particular incubation doesn't end in promoting start-up, but goes beyond physical boundaries of the park and involves the construction of intangible infrastructure in order to generate opportunity at cluster level.

Keywords: Intellectual Capital, cluster, science park, innovation, integrate reporting, intangible assets, management, shared services, inter-firm collaboration.

1. Theoretical framework

Literature on intellectual capital and intangible assets implies a theoretical approach based on the resource based view of firm (RBV) (Penrose, 1958). The RBV describes firms through its internal resources and its capabilities, these parameters are used to explain the variations in performance and ability to generate value among different firms. These differences results are due to the ability of companies to process resources not available to others and conferring an advantageous position. Therefore the process of accumulation and exploitation of these heterogeneously distributed resources among companies causes situations of competitive advantage or disadvantage. In this framework, the profit depends on difference between costs of resources accumulation and the value of rent accessible through their use. It is possible to identify two main implications of RBV: the first concerns the nature of the resources needed to create value in today's business environment, the second concerns the ways in which generate them and store it. These two issues are intrinsically linked to one another because different competitive assets correspond to heterogeneous mechanisms of value generation and accumulation.

Dumay and Garanina (2013) identify three different stages of intellectual capital studies. The first wave saw the birth of the first general intellectual capital (IC) theories, with which authors have tried to introduce the concept in scientific debate: they provided first classifications and first standard seeking to raise awareness about IC salience. This first wave is well represented by the pioneering work of Edvinson on its Skandia Navigator (1997) or by the Balanced Scorecard proposed by Kaplan and Norton (1992). In spite of the gradual penetration of the concept, empirical

[1] conicella@bioindustrypark.it.

support has not been suitably tested, leaving causal links about the impact of allocation of intellectual capital on the competitive advantage without a scientific validation. The second stage of IC research has definitely shifted the focus on measurement and evaluation issues stressing the topic of integrated reporting and monetary value of intangible assets. In this second phase were born dozens of different models for detection, classification and evaluation of intellectual capital. The guiding principle of all these studies aims to develop metrics for the measurement of intangible assets in order to communicate the hidden value not represented by simple budgetary data and ensure greater profitability by reducing the cost of capital (Dumay, 2012). In some cases has been used market to book methods, in others technical scorecard. The main criticism of this second strand concerns what Dumay and Garanina, citing Olson et al. (2001), define "evaluatory trap": the incremental development of frameworks and models for classification and economic exploitation of intellectual capital inspired by top-down logic and not based on previews empirical observation, became a sterile intellectual effort that end in itself. Such practice is unable neither to overcome the problems of spurious correlation between performance and intangible assets nor to consolidate a generalizable and consensual approach. Among the few elements of agreement on these two early stages of reflection on the intellectual capital we find the now commonly accepted distinction between: 1) Human capital, resulting in the knowledge embedded in people; 2) Organizational capital, the knowledge embedded in the enterprise; 3) Relational capital, the knowledge embedded in the relationship with customers, suppliers and stakeholders (Guthrie et al., 2012). The third stage of IC research adopts these standard analytical dimensions, but proposes a renewed *performative* approach as opposed to the *ostensive* one followed in the first two stages (Mouritsen, 2006). In this new perspective IC framework, rather than formulate objective metrics of the value of firms' intangible assets, it should be used as a strategic tool for management activities in order not to describe but to shape processes and organizational models. According Dumay and Garanina, The IC reporting practices become, or should become part of management of each company, providing firm-specific IC strategies able to highlight and sustain IC generation and exploitation.

Performative approach overcomes *evaluatory trap* by shifting the focus on the dynamic aspects of intellectual capital: its generation and its use. It is therefore necessary on the one hand to start a multidisciplinary dialogue (Edvinson , 2013), on the other hand to reconsider the boundaries of research on Intellectual Capital, shifting the focus from the intra-firm level to the innovation systems in which firms are engaged, moving the analysis from intra-firm IC stock to the functional interdependencies among firms. In other words, the studies of IC must broaden the concept of resources including those external to the company but internal to the system of relationships in which it operate. it is therefore possible to provide an exhaustive picture of the ways in which the knowledge assets become innovation and contribute to the generation of value. Idea that companies generate value through the integration of internal and external resources is rooted in classical economics and in particular in the work of Marshall (1890), who subdivided the competitive factors of enterprises according to a dichotomous classification: internal economies and external economies. Internal economies are those related to the resources of each company due to the quality of the workforce, the organizational forms, and the firm size and so on. External economies represent all those competitive advantages a company can have because is located in a place characterized by the presence of a large number of other specialized companies in the same branch of activity. Without entering into the debate on the marshallian districts, it is here important to highlight how the intuition of Marshall, according to which the ability to innovate and create value also depends on the resources available locally and exchanged out of market mechanisms, is still valid today. So the study of intellectual capital as a tool for analysis and management of innovative processes must take account of external factors that can foster firms' innovation performance.

In knowledge economy, innovation processes are developed far beyond the borders of the individual enterprise through formal and informal relationships between technologically heterogeneous firm, their suppliers, their customers and external R&D institution (Hagedoorn, 2002) (Colecchia and Schreyer, 2002). Integration between internal resources and external resources, especially in areas with high added value and high level of knowledge, has become the typical way to reach good results in R&D projects: first, because firms need to share the costs of risky initiatives and second, because the vertical specialization of companies on their specific technological field has facilitated the development of organizational models based on inter-firm networks through which facilitate the exchange and the integration of complementary knowledge (Edvinson, 2013) (Gomes - Casseres et al., 2006). From a RBV of the firm, access to external knowledge allows the company to react quickly to market needs, take advantage of the different skills of a system of actors - other companies, universities and research centers, government and institutional facilitators - focusing on those parts of the value chain that better reflect its competitive advantage and improving learning ability of the company (Miotti & Sachwald, 2003). In this horizontal disintegration framework of innovative processes, proximity becomes a key variable for understanding industrial development phenomena. Despite impact of globalization and despite introduction of information and communication technologies within the enterprise, these processes didn't drive to a marginalization of the effects of spatial dimension neither to a progressive loss of the significance of the spatial variables in innovation studies. On the contrary, as noted by Florida (2005), there are strong empirical evidences about incremental agglomeration of innovative activities in few places scattered around the globe. This is because spatial proximity improves technology transfer and dissemination of new knowledge in two ways: by means of spill-over effects not mediated by the market, the knowledge externalities, or facilitating the knowledge exchange on the market at prices lower than equilibrium price, the pecuniary externalities (Antonelli & Barbiellini Amidei , 2011). Boschma (2005) on the other hand highlights two critical issues related to proximity: First, proximity is not only a spatial variable but can involve cognitive, organizational and even social proximity. A poor geographic proximity, for example, can be supplied with a greater cognitive proximity. Second, there is a threshold effect such that even the massive spatial concentration, as well as the massive cognitive uniformity, has negative effects on ability of firms to generate innovation. Both Noteboom (2007) and Antonelli et al. (2011), showed an inverted U-shaped configuration of proximity effects on the firm performances: cognitive in the first case and the spatial in the second.

Observed through this analytical framework, science parks should be interpreted as the result of industrial policies built around the concept of proximity. It represents a perfect application field for a *performative* approach to intellectual capital research. Science Park, as well as physical infrastructure, is in fact a place of agglomeration of knowledge, in which firms use, exchange and enhance their intellectual capital. The companies settled benefit from dedicated infrastructure - plants, laboratories, facilities, etc. – from specialized services offered by the managing company and from the favourable environment guaranteed by the presence of a local specific and shared culture. The park is in fact a collective actor with its own specific intellectual capital, characterized by multiple complementarities among the different actors that are part of it. IC analytical tools allows to enter into these complementarities, to bring out interdependencies and knowledge flows within the park, thus providing empirical basis for explicit strategies for the generation and exploitation of new human, relational and organizational capital. Consequently the park managing company acts as a system integrator mobilizing, coordinating and integrating knowledge resources available in the system. The use of intellectual capital as a key concept to innovative processes inherent in a science park also allows to problematize the spatial dimension of the park. That is why it is possible to introduce the concept of third-generation science parks, which after having

established themselves as key players in technological development (first generation) and reached maturity (second generation) are now set to change the function, passing from a system defined by physical boundaries, being the center of a cluster or a science park environment (Allen, 2007). In the cluster concept as proposed by Porter (2000) the spatial proximity lost concreteness (Martin & Sunley, 2003) and is dependent on other forms of proximity: the physical boundaries of the park are less sharp as boundaries of the community constituting the technology cluster become more important. Similarly intellectual capital of a scientific park could be considered a *local collective competition goods* (Crouch et al., 2004) accessible not only to organizations settled inside or near the park: in this new scenario accessibility also extends to organizations that are not geographically closed but are strongly integrated from a technological, organizational or cultural point of view.

The cluster concept, in such perspective, has been used, together with the science park concept (AA.VV, 2007), as key element of integration of R&D and innovation into regional and sectorial development. As elements of the process of growth and generation of innovations science Parks have to be elements of larger communities that provide all the elements that are necessary. The presence of an enlarged *innovative ecosystems* is particularly important for the development of local clusters in high tech sectors and particularly in health care and biotechnology sectors (Booth, 2009) (Conicella & Bassi, 2011) and the role of Science Parks in such context is more to facilitate the links and relations inside the local systems to be an "entry door" for actors out of the system than to "simply" host physical actors. They are not only able to boost the transformation process of scientific results in innovation but constitute also the element for socio-economic growth of the territory. The Innovative ecosystem concept is basing its development on the capability to nurture collaborations between scientists, companies, investors and the society. The physical concentrations of actors, as stated before, loose importance. The key element became the capability to animate the community in order to stimulate R&D activities and innovation across categories of actors, sectors and technological domains. If from one side such approach is one of the elements of the so-called "smart specialization strategies" of territorial development (Foray et al., 2009, 2011) from a different perspective is driving to a new paradigm in interpreting the role of a science park in the development of a community. Another time the focus is passing from a science park that, such as in a laboratory, works with a limited number of organizations (the lessees) to a science park "without physical boundaries" that is able to manage multiple relations with actors "embedded" in the local innovative ecosystem and not "simply" physically concentrated. Start-ups, established firms, universities, public administrations and socio-economic stakeholders are part of a community and the park, as stated before has to offer the possibility to access their intellectual capital to all those actors in order to respect the role that new challenges have proposed and to stimulate innovation, serendipity and creativity (Kacco et al, 2009).

Studying intellectual capital of a high-tech industrial agglomeration requires a systemic approach able to take into account intra-firm IC and firm absorptive capacity (Cohen & Levinthal, 1990) but also IC availability outside the firm in the form of formalized knowledge, qualified human capital and networks. In this way it is possible to offer an in depth explanation of innovation performance of each company. From the point of view of a scientific park, to read its services through the lens of intellectual capital allows to assess their effectiveness and, above all, provides underpinnings for understand the evolution of local system of innovation and accordingly redefine their development strategies.

2. The case of Bioindustry Park and bioPmed regional cluster

Bioindustry Park Silvano Fumero[2] is a specialized science park created in the middle of '90s. The first mission of the Park was to stimulate the growth of a "new" industrial sector (Life sciences) in Piemonte region (N-W of Italy) and particularly in a sub territory ("Canavese") affected by a strong economic crisis (Conicella, 2010). As a science park, initially the focus was on the attraction of already established organizations and companies in order to create a positive environment for the growth of start-ups. Shared facilities, customization of buildings and financial support for adaptation of laboratories was the initial services offered by the park. Such first phase of activity was followed around 2005 by a strong focus on company creation and incubation. The "discovery" initiative was focused in the development of a start-up incubator, on the creation of a coaching system and on the support to the growth of local risk capital/seed capital provider solutions. In such period the park stimulated the creation of own service platform composed both of scientific services and *added value managerial* support services. The focus was only on companies physically located inside the park and "external organizations" was simply considered as service providers. But being the overall goal of Bioindustry Park to guarantee an environment which is favorable to the entrepreneurial development and to the transfer of research results to the productive world in order to develop life science sector a third phase was started. From one side the park has focused better their activities concentrating know-how and services on health care problem only. Such activity has been performed following a converging technology and smart specialization approach. From a different side the Park (Conicella & Baldi, 2012) started to work as hub and central element of a local community linked through communalities (e.g. the interest in health care innovations) in the context of different regional initiatives on innovation cluster growth (www.bioPmed.eu). In parallel, working in a global sector, the Park increased the internationalization efforts in and out Europe. The basic idea was to overcome dimensional limit of the Park alone with a strategic and inclusive action focused on the development of an innovative ecosystem not only for life sciences but more in general for health care companies. Converging technology, multidisciplinary, internationalization, focus on results instead than on technologies, management of complex and multiple relations at local and international level: those are some of the key drivers of such phase that is still ongoing. To work at this level, the Park through the bioPmed initiative started to work following a "concentric circles" approach. Core members are the more central group of stakeholders together with companies physically located inside the park but bioPmed has at the same time relations with more than 350 local companies that are not full members and with more of 3500 scientist (the so called "bioPmed extended community"). Such approach has been assessed not only at regional level but also at national level (Polics, 2012) and European level[3]. bioPmed is acting as a service platform focused on the company development and is working through activities that are targeting some of the key variables in company development: project building, partnering, idea assessment, business development, internationalization, technology update, etc. such area of actions are also important from an intellectual capital development point of view.

3. BioPmed IC managing tools and their impacts on firms

Starting from all the elements discussed previously and particularly on the conclusion that in a third generation science park and in a cluster environment the concept of "user" and "incubated

[2] www.bioindustrypark.eu

[3] bioPmed has been awarded with the ESCA, European Secretariat for Cluster Analysis "Bronze label" http://www.cluster-analysis.org/.

company" has to be interpreted without simply considering the geographical location but also analysing the community involvement in a done ecosystem (Salvador & Conicella, 2012). In reality from this perspective, analysis realized in Bioindustry Park and bioPmed revealed that aggregation phenomena in a science park or a cluster follow similar patterns.

Particularly for start-ups, it seems that such aspects are influencing the service platform that has been created to support the company growth. The presence in the cluster of different incubators, mainly university based, and the specific characteristics of life science companies in their first stage of development (linkage with original university department, outsourcing policies, etc.) affected the development path of such companies. More and more R&D activities are realized in University or private labs under the umbrella of outsourcing contracts and physical headquarters are dedicated to management and administration activities. This approach seems to make less interesting the traditional focus on physical incubations and permits the development of service platforms that could be accessed also from companies that have no physical presence inside a specific incubator. This is a direct consequence of a third generation science park approach. Considering the specificity of human health sector and its strong science-based characterization, transition from a traditional conception of science park towards a third-generation science park requires to reshape the concept of entrepreneurship and business incubation: entrepreneurship is the creation of new organization (Gartner, 1988) but also the discovery and exploitation of entrepreneurial opportunities (Shane, 2000) inside mature firms, incubation doesn't end in promoting start-up, but goes beyond physical boundaries of the park and involves the construction of intangible infrastructure in order to generate opportunity at cluster level. Bioindustry park through bioPmed tried to interpret such trend developing a quite complex service platform dedicated both to companies located inside the science park but also companies located in the cluster environment. The shared services platform promoted by the park and addressed to all the subjects included in the cluster becomes the main instrument through which stimulate the production of intellectual capital in enterprises and facilitate the aggregation of several subjects on r&d projects. The services are designed to positively impact the different dimensions of intellectual capital of firms in the cluster. Starting from a preliminary study of intellectual capital of bioPmed cluster (Arfaioli, 2010), it was possible to make an initial assessment of intangible assets highlighting the systemic strengths and weaknesses. Looking at strengths, intellectual capital reporting on bioPmed firms showed: 1) Young, well-educated and deeply specialized on technological areas relevant to the cluster human capital; 2) High density of relations with universities and private research center – e.g., R&D collaboration and human capital mobility – strong links with public sector, especially in the form of project financing, and favorable orientation toward inter-firm collaborations. 3) Firms' business models were characterized by a high r&d intensity; 4) A significant stock of intellectual capital property.

As for critical aspects of intellectual capital stock, intellectual capital reporting highlighted the following concern: First, the technical and scientific specialization of employees resulted in a lack of other complementary expertise, in particular managerial and commercial expertise. Second, it highlighted difficulty in activating financial channels low propensity to formalize partnerships. Third, the small average size of firms was a critical feature in matter of internationalization of the supply chain and global commercialization. On this basis, bioPmed managing company designed his own IC management platform through which promotes the development of local innovation system gravitating around the Park. Such service platform has a dedicated focus on SMEs and start-ups and is based on few key policies:

1. Focus on health care: not focus on a particular technology but on the capability to develop solutions that could be marketed. In such perspective multidisciplinary and multi-technological solutions are of great interest

2. Focus on development of the company and of the entrepreneurship inside the company
3. International approach and focus on development out of local territory
4. Open innovation Project building tools
5. Technology and business idea evaluation tools
6. Creation of links with a wide network of investors (also out of the sector and out of the territory)
7. Coaching for managerial activities on demand and based on specific support plans
8. Network of preferred providers of specific services (E.g. competitive intelligence or scientific services)
9. Offer of shared services in order to optimize the cost/benefit ratio (Salvador, Conicella, 2013)

Activities are partially free of charge and partially based on fees (following both on a package approach and on a demand approach). The concept under such approach is that the perceived value of support is also linked to the cost for the access to a specific service.

This IC platform should impact the dimensions of intellectual capital considered strategic for competitive advantage of firms and for business ecosystem development: on the one hand platform provides direct support through direct advice, on the other hand it favours the networking between different actors. IC tools proposed by the science park as managing company of the cluster IC is based upon concept of *complementarity*:

1. Complementarity between the skills of the park, those of firms and those of other organizations in the cluster. The manager provides and integrates the technical and scientific skills already present in the cluster with managerial skills by supporting the activities of project building, business planning and competitive intelligence.
2. Complementarity between the system of relationships of the park and those of its stakeholders. It is in this case the integration of relational capital through internationalization services and networking activities with public and private financing institutions.
3. Complementarity between institutional goals and competences and of cluster participants. The activities of the park in this case focuses on community building, promoting aggregation through open innovation, inter-firm partnership and shared services.

Results from periodic customer satisfaction surveys show a general positive evaluation of bioPmed IC platform (Salvador & Conicella, 2012). However firms' preferences highlight a predominant need for tools that can nurture and develop relational capital: in a context where innovation generally results from collaboration and multidisciplinary (Hagedoorn, 2002), relational capital becomes the key variable so that other IC dimension can be fully exploited and renewed over time and bioPmed IC platform seems to have intercepted this dynamics that underlie the entrepreneurial phenomena in science-based sector. It should also be pointed out the strong performative effects of proposed IC strategies: focus on the dynamics of human and relational capital of firms makes them more inclined to think in terms of knowledge investment and multi-partner collaboration. Growth of both cluster member – from 60 in 2009 to 79 in 2012 – and organizations involved in r&d inter-firm projects (Conicella, et al., 2012) (Conicella & Novaria, 2013) – from 36 in 2009 to 99[4] in 2013 – provides a robust indicator of how a development strategy built on IC management impacts positively on firm competitiveness and consolidate a local innovation system.

[4] This number include extra-cluster organization

4. Conclusion

It is easy to conclude that activities realized at science park and cluster level are both from an indirect and direct point of view correlate to intellectual capital dimensions. All such dimensions are at the basis of competitiveness of companies, particularly SMEs and start-ups and are targeted through a service platform that aims to offer practical solutions. Assessments at cluster level are realized in order to try to evaluate the impact and the perception. The overall system is conceived as a tool for the development both at company and at cluster level with a strong focus on the international dimension. Such approach has to be interpreted only as a first step towards a full understanding of the role of IC in developing support tools. A more systematic service platform that goes beyond activities that are on-going and approach the company dimension from an holistic point of view has to be developed. Better benchmarking tools with similar clusters have to be implemented. Better tools that could be used by the companies have to be realized and launched. Sustainability is still an issue and in perspective a real "marketing" approach have to be used in order to outline the real (economic) value of service offered. But also with such limits some conclusions are quite clear. First, working at IC level permits to develop service platform based on systemic needs and offer the opportunity to develop shared added value services. IC is a really important element of competitiveness. It is not a problem of "quantity" but a problem of use of IC elements as tools for company development. Second, It is not enough to launch IC tools: it is necessary both to identify sustainability path (in order to go out of the "fire and forget" paradox typical of financed projects and companies based on projects (De Filippi & Arthur, 1998)) and to assess in a periodic way specific Key Performance indicators in order to develop benchmarking activities with other actors/clusters. IC tools impact at company leave takes time, in some sectors also more than 5-8 years. This is the case of health care. Tools, sustainability and monitoring have to take in account such fact. Third, the science park dimension is probably only the starting point. More and more the ecosystems/cluster phenomenon is presenting challenges. The third generation science park paradigm in such perspective obliges science parks to work more and more out of their boundaries. As consequence the concept of "lesseses" and of "incubated company" is changing. The physical proximity is still a positive element, boosting relations and interactions and stimulating spillover but, modern technologies, new business models, the outsourcing process, the need of scientific international networks and the need to build strongest value creation networks oblige to reconsider such element. Ecosystems are no more simply physical concentrations. They are communities with links out of the specific territory. They have internal dynamics and changes. They simply require a different approach based more on the capability to create links inside and outside the ecosystems than on the capability to have a physical concentration of actors.

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