

CITY-REGION NETWORK: THE HEALTH CLUSTER IN THE METROPOLISES OF LISBON AND PORTO

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Summary

The Health Cluster Portugal (HCP) is a formal institution that aims to increase competitiveness in the research, design, development, manufacture and trade of innovative products and services in the health sector. The set up of this interface was the result of a bottom-up initiative, within the framework of the *Norte 2015* debate on policies designed to foster competitiveness based on innovation. It was inspired in the *triple helix model* with the aim of engaging university, industrial and state players, in an attempt to strengthen coordination and interaction within and among these groups of players. Since it focuses primarily on innovation in the health sector with both a horizontal approach (between competing players) and a vertical one (from research to commercialization), the knowledge base involved is not limited to the analytical, but includes also strong input of synthetic knowledge. In this sense, the HCP must foster an ecology that will stimulate, at the same time, the *STI* and *DUI* modes of innovation. The HCP's ecology of innovation is not restricted to the players directly involved in the *local buzz* and in *face-to-face* learning, but considers also an increasingly more global network of *pipelines*.

All in all, this paper aims to explore the origin, the form, the internal organization and the external networks of the HCP, hoping to generalize its potential in promoting innovation, in a knowledge-intensive and globally competitive sector, as is the case of the *life science industries*.

Keywords: Health Cluster Portugal (HCP), Knowledge Base, Innovation, Triple Helix Model, Territorial Networks.

1 – Introduction

The identification of a significant and diversified array of players related to *life science industries*, led to a strong belief in the potential of this sector in promoting a cluster of innovation, competitiveness and development in Portugal. The recent formal establishment of the HCP is based on the assumption that the establishment of interface platforms bolsters innovation, by increasing and enhancing the creation of interactive knowledge networks among the different players in the health sector. The platforms can be fostered by political initiatives

inspired in the *triple helix model*, thus stimulating stronger interactions both within and among the fields of university, industry and the State.

With such a diversified range of players involved in the process, the knowledge base thus covered is different, depending on the characteristics of each of these players. On the one hand, the development of activities more closely related to scientific research is based mainly on analytical knowledge; on the other hand, the activities directly related to medical devices and pharmaceuticals are based mostly on synthetic knowledge.

This vast range of players is only a part of the HCP's ecology of innovation. Innovation can emerge from the *DUI* and *STI* modes of interaction among the HCP members, or between these and an increasingly more global knowledge network. Consequently, the HCP should simultaneously boost the creation of internal networks among its members, as well as the creation and expansion of global networks to access, use and produce the said knowledge.

In this paper, we will attempt to shed some light on a number of issues. What were the reasons underlying the set up of the HCP? On what model was the HCP, as an organization, inspired? What sort of knowledge is directly involved in this cluster? Will it enhance the *STI* and *DUI* modes of learning and innovation? Will it become a local node of a growing global knowledge network? What advantages are there for the promotion of innovation within the *life science industries*?

Thus, in the following two chapters we will discuss the concepts related to knowledge base, to the complex processes that can lead to innovation, and to the institutional forms and territorial dimension of knowledge and innovation networks. The fourth chapter presents a brief account of the history and process leading to the formal set up of the HCP, in an effort to identify and understand the key-players and the institutional structure embodied by this interface. The fifth chapter analyzes the characteristics of the HCP players, as well as the networks formed by these players, based on the geo-referencing of its networks, its branches and the agreements signed among them, as we are *anxious* to unveil the territorial behaviour of the networks of synthetic and analytical knowledge, formed by the HCP players. On a closing note, we will present an overview of the main conclusions.

2 – From knowledge... (to innovation)

The concept of “learning economy” (Lundvall and Johnson, 1994) is anchored in the conviction that economic activities do not depend solely on a more intense use of knowledge, but rather on the idea that knowledge is characterized by increasing volatility and, therefore, becomes obsolete more rapidly (Lundvall, 2006). In this setting, the capacity to develop new skills is of utmost importance for the economic success of companies, regions and countries (Nielsen and

Lundvall, 2003). In a global and dynamic environment, characterized by changes and progressing uncertainties, the principle of the survival of the strongest is based on the capacity to learn, in which the selective element is the capacity to innovate.

In the *learning economy*, knowledge is revealed as the essence of the “interactive learning” process (Lundvall, 1992) which leads to innovation. The bipolar perception of knowledge, in its codified and tacit forms, is often seen as the way in which to understand the characteristics of knowledge, its production process and territorial behaviour (Asheim and Coenen, 2006). However, “in our view, these two types of knowledge are not totally separated but are mutually complementary entities” (Nonaka *et al.*, 1996:205). Companies depend on their specific knowledge for their innovation process (Asheim and Coenen, 2006), consequently we suggest an alternative perspective formed by three types of knowledge bases: analytical, synthetic and symbolic (Asheim, 2007). “These types indicate different mixes of tacit and codified knowledge, codification possibilities and limits, qualifications and skills, required organizations and institutions involved, as well as specific innovation challenges and pressures from the globalizing economy” (Asheim and Coenen, 2006:165).

The production of analytical knowledge aims to understand and explain the natural systems through the discovery and implementation of scientific laws (Moodysson *et al.*, 2006), by resorting to deductive methods (Asheim, 2007). It underlies the business activities for which scientific knowledge is extremely important, and in which the creation of knowledge is grounded on formal models, based on rational and cognitive processes, as in, for example, the biotechnology companies (Asheim and Coenen, 2006). To construct and access this type of knowledge, the companies develop their R&D departments, and connections to universities and other research institutions, so the networks established between companies and universities are frequent (Asheim, 2007). It is rooted in and gives rise to an essentially codified type of knowledge, and thus “know-why” (Lundvall, 2006) proves to be essential to the entire process. “The Knowledge itself is often the outcome of the Knowledge-creation process” (Moodysson *et al.*, 2008: 1045), and as such its transfer is done by means of scientific articles, reports, electronic files or descriptions of patents (Asheim and Coenen, 2006). As mentioned previously, the tacit dimension is nevertheless relevant; scientific knowledge is very much influenced by the tacit personal dimension of the researcher or of the group of researchers developing it, and this transforms the tacit dimension of knowledge into a ubiquitous element, whatever the type of knowledge may be. Since it is a highly codified knowledge, its dissemination is done successfully via “global pipelines” (Bathelt *et al.*, 2004). The dynamics of knowledge within the social networks of “epistemic communities” can, therefore, involve interaction at a distance (Coenen, *et al.*,

2005). However, the importance of the “buzz” and of “face-to-face” must not be underestimated, as the latter plays a crucial role in the construction of relations of trust, and the former can contribute towards the assertiveness and acknowledgement of researchers within the scientific community (Asheim *et al.*, 2007). Thus the “know-who” (Lundvall, 2006) is equally important in the construction process of analytical knowledge. Analytical knowledge is directed at developing radical innovations, due to the emergence of new products and processes, which may, in turn, give rise to new enterprises and spin-off companies (Asheim and Coenen, 2006).

Synthetic knowledge is at the foundation of those companies in which the process of innovation takes place through the implementation of existing knowledge, or through the re-composition of that same knowledge (Asheim and Coenen, 2006). This is the case of, for instance, machinery industries and production systems (Asheim, 2007). Knowledge is constructed through inductive processes via simulation, experimentation and testing. Therefore, R&D and the connections between companies and universities, if they do exist, will take the shape of applied research related to the development of products and processes (Asheim, 2007). Knowledge is embedded in the respective technical solution, therefore it is only partially codified, and the tacit dimension is extremely relevant, since knowledge often derives from the experience built as a result of interaction at the workplace, with clients and suppliers (Asheim and Coenen, 2006). “Know-how” (Lundvall, 2006) is essential to the production of such knowledge, and can be developed through both interaction at the workplace and in vocational and polytechnic institutions (Asheim and Coenen, 2006). For that reason, the “communities of practice” play a critical role in the production of this type of knowledge (Coenen *et al.*, 2005). For these reasons too, “face-to-face” communication is most relevant to companies based on synthetic knowledge (Asheim *et al.*, 2007). This is a development process of knowledge steered at incremental innovations, aiming to introduce constant improvements to the processes or to the existing products.

Symbolic knowledge represents the foundation of cultural industries, publicity, fashion and design. These activities are actively engaged in innovation and design, centred on the creation of new concepts, new images, new meanings and new ideas, and is not so concerned with the physical process of production itself (Asheim, 2007). Its baseline is formed by aesthetic aspects rather than cognitive ones, and therefore the transfer of knowledge is done via symbols, signs, artefacts, sounds, narratives and images (Asheim, 2007). It is eminently tacit, as the communication capacity of this type of knowledge depends on a thorough understanding of the rules, and of the day-to-day customs, mores and culture of specific social groups (Asheim, 2007). It requires special comprehension skills, creativity and imagination, and therefore the “know-who” (Lundvall, 2006)

becomes particularly relevant in the formation of teams involved in provisional projects that develop the creation of this type of knowledge. These teams can be interpreted as “arenas of productive tensions and creative conflicts that trigger innovation” (Asheim, 2007: 226). The “buzz” plays a key role in symbolic knowledge, as it is an effective way of finding out who knows what, in other words, to identify the people who are relevant for a specific project (Asheim *et al.*, 2007). “Face-to-face” communication is likewise important for the exchange of information, negotiations and consensus within the project teams.

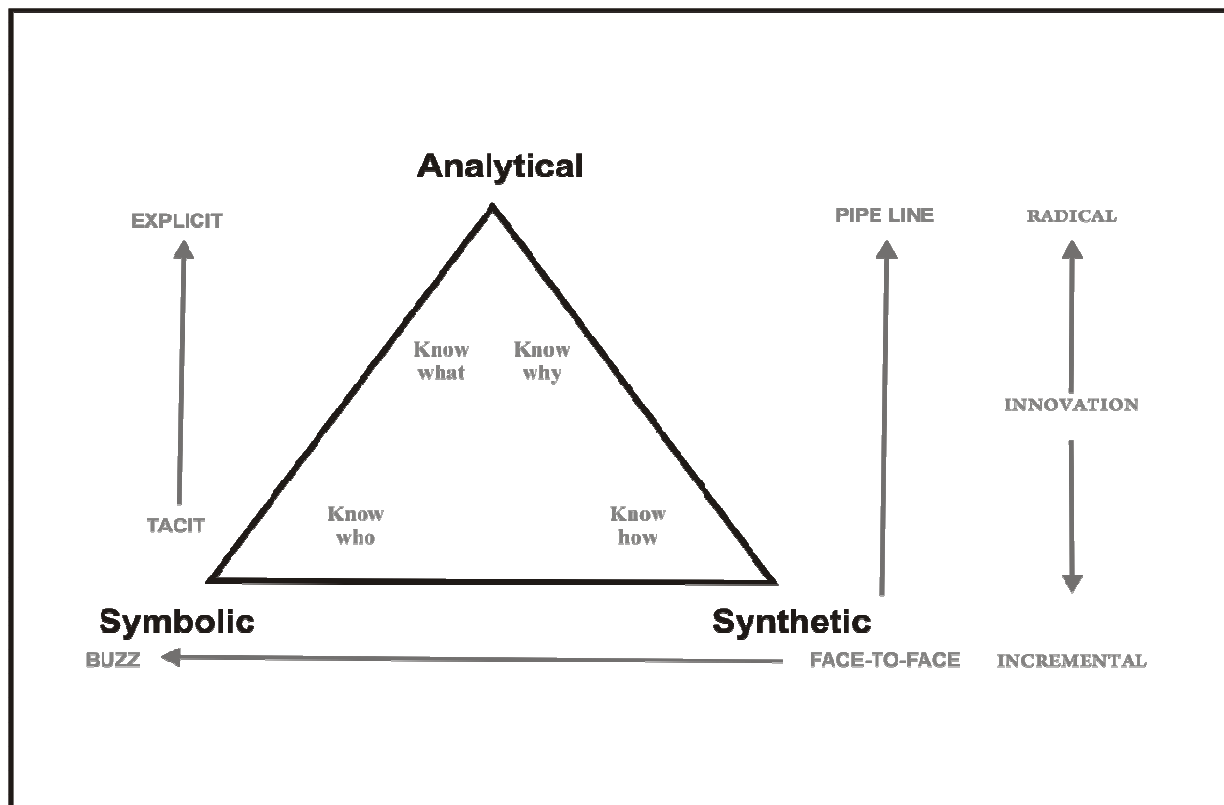


Figure 1 – Knowledge base.

The analytical, synthetic and symbolic knowledge bases are ideal forms of knowledge, and this is the reason why most companies develop activities based on the three types of knowledge (Asheim *et al.*, 2007). However, the higher or lower degree to which each of these types of knowledge is put to use varies from company to company, according to the activity developed by the company and, consequently, so does the degree of the type of knowledge it produces.

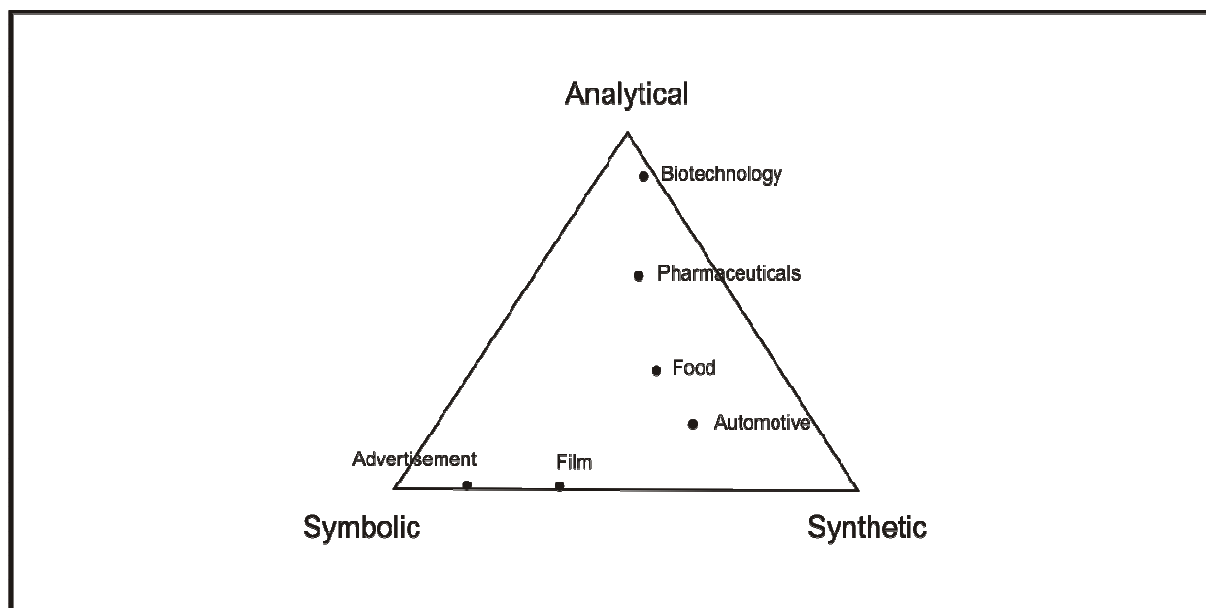


Figure 2 – Knowledge bases and industries: an illumination

Fonte: Asheim, 2007:227

3 – (From knowledge...) to innovation

The existence of a wide variety of sources of knowledge has transformed innovation into a complex process (Asheim, 2007). The concept of *learning economy* breaks totally with the linear perception of innovation, highlighting its systemic nature and claiming for a “multi-channel interactive learning model” (Caraça *et al.*, 2008). The perspective of innovation as an isolated act, at both the level of the individual and of the company, has been replaced by a complex perspective that includes economic, social, cultural, institutional and territorial aspects. It has become an ever-increasing interactive and socially organized activity (Gerteler, 2005), and thus geographical clustering makes the “learning-by-interacting” much easier (Lundvall, 1992). Nowadays, innovation means more than just a new invention or a breakthrough (radical innovation); it is also about a process and an activity of continuous improvement (incremental innovation). It is an economic activity, yet social, cultural and political too, which is centred on the learning capacity. This is a complex interactive process involving multiple players, individual and collective, formal and informal, with variable configurations, internal and external to the organizations, intended for the production, use, transformation and exchange of knowledge.

To summarize, there are two ideal ways through which companies, as “knowledge-creating companies” (Nonaka *et al.*, 1996), can foster learning and innovation. On the one hand, by implementing formal and intentional R&D processes, companies can produce scientific and technical knowledge that will turn out to be an innovation (normally a radical one): “The Science, Technology and Innovation (STI) mode” (Jensen *et al.*, 2007:680). This is the sphere of

production of analytical knowledge. Furthermore, companies should become “Learning organizations” (Lundvall, 2006), favouring processes such as “Learning by doing” (Arrow, 1962), “learning by using” (Rosenberg, 1982), and especially “learning by interacting” (Lundvall, 1992), aiming to set up the requirements for a continuous innovation process (essentially incremental), anchored in an “experienced-based mode of learning based on Doing, Using and Interacting (DUI-mode)” (Jensen *et al.*, 2007: 680). This is the realm of production of synthetic and symbolic knowledge.

Although two ideal modes of promoting knowledge and innovation, this does not mean that they are opposed. They coexist and can be complementary (Jensen *et al.*, 2007). In companies, even though one of the modes can become prevalent, we must always bear in mind the utility of the *STI* mode to foster ways of knowledge that are basically codified (analytical knowledge), and the role of informal communication and of communities of practice, developed by the *DUI* mode, to solve real problems and promote learning (Jensen *et al.*, 2007), thus strengthening the development of synthetic and analytical knowledge. At the level of the overall economy, this implies a focus both on the role played by the R&D process (stimulating the production of analytical knowledge), and on the informal processes of interaction within and among organizations (Jensen *et al.*, 2007), enhancing the creation of synthetic and symbolic knowledge. Consequently, in political terms, and in addition to the incentives given to R&D activities, the same focus should be on the enhancement of the interaction relations with other sources of knowledge (Jensen *et al.*, 2007), namely the synthetic and symbolic.

In addition to the companies, there is a multitude of external players involved in the innovation process. On the one hand, there is the “macro-environment” (Caraça *et al.*, 2008) formed by the Universities, the technological schools, the learning and training systems and capital risk. (Nielsen and Lundvall, 2003). On the other, we have the “micro-environment” (Caraça *et al.* 2008) formed by the suppliers, partner advisors, distributors, clients and competitors. The way they organize themselves varies according to the sector: this is normally dealt with by literature as a sectoral innovation system (Malerba, 2005); the region, pictured as a regional innovation system (Cooke *et al.*, 1997); or the nation, normally described as the national innovation system (Lundvall, 1992). Overall, they form the “innovation ecology, *i.e.* a complex multi-layered selection environment exerting shifting pressures on innovation processes at the enterprise level” (Caraça *et al.*, 2008:4).

As a result of this complex innovation ecology, interaction emerges as a way of promoting learning, enhancing the role of the creation of relational networks (internal and external), that enable overcoming the simple exchange of information and promote learning based on the experience of the various actors.

Even the innovation process centred on research, based on analytical knowledge, and centred on the “STI-mode”, emerges as the extension of the development process, causing a “strong and continuous engagement of science with production: R as D” (Caraça *et al.*, 2008:6). The creation of these interfaces that endow the company with channels for identifying, selecting and absorbing new ideas from its surrounding environment, namely from other players and other knowledge reservoirs, is central to the enhancement of the interaction of companies with other external players (Caraça *et al.*, 2008).

The need for interaction designed to create knowledge and innovation is one of the reasons used to justify the benefits of the geographical cluster. Many concepts, for instance, “regional innovation system” (Cooke *et al.*, 1997; Doloreux, 2002); “industrial district” (Becattini, 2002), “innovative milieu” (Maillat, 2006; Coppin, 2002), “industrial cluster” (Porter, 1990) and “learning region” (Florida, 1995; Morgan, 1997) highlight this characteristic. On the one hand, the geographical cluster facilitates access to markets, to suppliers, to labour in quality and quantity, to specialized support services and to informal networks (Doloreux, 2004). Furthermore, it also enables the sharing of a socio-institutional network formed by the economic, organizational, relational, social and cultural context, which is essential to generate relations of trust (Doloreux, 2002). These are some of the conditions that must exist so that collective and interactive learning can take place.

However, a growing number of studies have drawn attention to the fact that, in addition to the local networks, greater openness at other more global scales can be an important contribution to innovation. “When this locally embedded knowledge is combined in novel ways with codified and accessible external knowledge, new value can be created” (Bathelt *et al.*, 2004: 32). The regional level is normally not enough for companies to remain innovative and competitive since the learning process is more and more located in innovative networks and systems of various forms and scales (Asheim, 2007). The articulation of local and global networks is needed for successful cooperation projects, particularly when we need to combine, simultaneously, local and non-local skills and competences to achieve innovation success (Asheim and Coenen, 2006). By studying the *SMEs* in the metropolitan region of Ottawa (Doloreux, 2004), Doloreux concluded that the companies find support in both the networks that are external to the region and those that are part of it, and external resources are considerably more important than other potential sources of new ideas for the innovation process within companies. In the case of the *SMEs* in the *Aberdeen oil complex*, what surfaced was that the extra-local relations were not confined to mere contacts between clients and suppliers, but involved also the circulation of information and knowledge, which support innovation (Cumbers *et al.*, 2003). Gertler and Levitte (2005) suggest that the

Canadian biotechnological companies should look to the exterior in order to achieve success, particularly in terms of hiring staff from outside Canada. They also highlight the importance of global relations for the commercialization of the knowledge produced. Indeed, Lars *et al.*, (2005) alerted to the fact that “Epistemic communities”, namely within the pharmaceutical industry, enable an extra-local circulation of knowledge thanks to social integration based on professional affinity and on scientific practices. In short, we can consider that innovation consists of different phases and different dominant modes of creating knowledge. The creation of analytical knowledge can occur among close or distant partners, whereas the creation of synthetic knowledge is more limited to local collaboration (Moodysson *et al.*, 2006). Consequently, the companies that normally navigate within analytical knowledge find it easier to create global networks of knowledge than those that navigate within synthetic and symbolic knowledge.

The interfaces, as interaction platforms, take on a preponderant role in the creation of knowledge and innovation. It can be said that they work for the companies in the same way as the senses work for a living entity. They establish the link with the external world, and enable interaction with its environment at a more local or more global scale. Ever since the “chain-linked model” (Kline and Rosenberg, 1986) appeared, centring the innovation process in companies, literature has generally steered the studies produced in this direction. However, “in general, innovations take place at interfaces” (Leydesdorff and Meyer, 2003:194). Policy aimed at creating platforms to bolster interaction, cooperation and partnerships can be one way of promoting innovation. These platforms can take the form of “local nodes in global networks” (Gertler and Levitte, 2005). “Policy can contribute to this search of partners by setting arenas and organizations that facilitate local as well as global networking. This points to the increased importance of triple-helix initiatives and collaboration on the regional level in the governance of the attempts to construct regional advantage of clusters” (Moodysson *et al.*, 2006:1055).

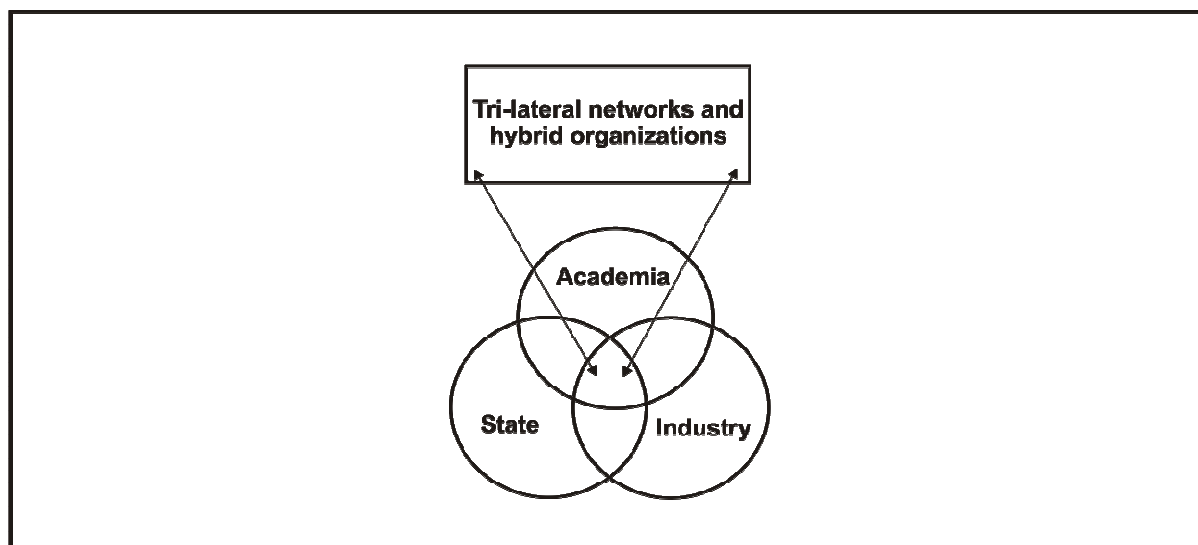


Figure 3 – The Triple Helix Model of University-Industry-Government Relations

Fonte: Etzkowitz and Leydesdorff, 2000:111

As an analytical model, the triple helix model attempts to justify the new configuration of institutions that are just beginning to emerge with the aim of promoting innovation (Marques *et al.*, 2006). It proves that there is a spiral of connections and interactions between the three institutional spheres: the University, the State and Industry. These spheres take on the shape of a triple helix on account of the increasingly blurred borders between public and private, between science and technology, the university and industry, each taking on the role that traditionally belonged to the sphere of other sectors (Leydesdorff, 2000). In this way, a “knowledge infrastructure in terms of overlapping institutional sphere, with each hybrid organization emerging at the interfaces” is being generated (Etzkowitz and Leydesdorff, 2000:111). It is a hybrid platform, constituted as a non-profit private entity with the aim of facilitating the R&D, as well as transferring knowledge and technology (Marques *et al.*, 2006). By assembling institutions that navigate within the analytical, synthetic and symbolic knowledge, these interfaces form, likewise, a platform able to enhance these three types of knowledge.

They are also stages which facilitate the “buzz” and the “face-to-face” as they create a platform that strengthens interaction. “The sources of innovation in a Triple Helix configuration are no longer synchronized a priori. They do not fit together in a pre-given order, but they generate puzzles for participants, analysts, and policymakers to solve. This network of relations generates a reflexive subdynamics of intentions, strategies, and projects that adds surplus value by reorganizing and harmonizing continuously the underlying infrastructure in order to archive at least an approximation of the goals” (Etzkowitz and Leydesdorff, 2000:112-113).

At a first glance, these platforms seem to be more targeted at fostering the *STI* mode of innovation. However, by favouring the interactions between the sphere of the university, the industry and the government, and by strengthening and diversifying interactions within each of these spheres, they can likewise promote innovation through the *DUI* mode. “The Triple Helix in which each strand may relate to the other two can be expected to develop an emerging overlay of communications, networks, and organizations among the helices” (Etzkowitz e Leydesdorff, 2000: 112). The aim is to generate an innovative environment that will lead to the emergence of spin-off companies, of strategic alliances among companies from various sectors, levels of technology and sizes. Basically, it aspires to promote trilateral initiatives that will foster economic development based on knowledge (Etzkowitz e Leydesdorff, 2000). As Etzkowitz e Leydesdorff (2000:112) mention, “These arrangements are often encouraged, but not controlled, by government, whether through new ‘rules of the game,’ direct or indirect financial assistance, or through the Bayh-Dole Act in the USA or new actors such as the abovementioned foundations to promote innovation in Sweden”.

In Portugal, the process leading to the institutionalization of the “Health Cluster Portugal” (HCP), as well as its mode of operation, leads us to believe that it was inspired precisely on the triple helix model. This article will focus on the analysis of the platform formed by the HCP.

4 – Health Cluster Portugal: the origins.

The Health Cluster Portugal – Associação do Pólo de Competitividade da Saúde (HCP) [Association for the Health Competitive Cluster] is a public law entity established on 4th April 2008, therefore in operation for just over a year. Nevertheless, the work leading to the establishment of the HCP started long before that.

Between January 2005 and September 2006, the North Regional Coordination and Development Commission (Comissão de Coordenação e Desenvolvimento Regional do Norte - CCDRN) and the Regional Council decided to foster a public bottom-up type initiative called “*Norte 2015*”. The main goal was to prepare the strategy for the regional development of the North of Portugal for the period 2007/2013, providing contributions to the elaboration of the National Strategic Reference Framework - NSRF (Quadro de Referência Estratégica Nacional - QREN), and to the new period dedicated to programming financial policies at European scale.

The initial idea of the HCP came to light within the framework of the prospective debates and of the regional coordination, which were open to public and private players. The construction of a strategic view of the development of Northern Portugal, in accordance with the “Lisbon Strategy”, is anchored on

biotechnology, in general, and on health, medical devices and pharmaceuticals, in particular (CCDRN, 2006). The diagnosis prepared under the framework of *Norte 2015* identified three specific sectors within the health sector, where production and scientific and technological competence can be found in the North Region: health care and services, medical devices and pharmaceuticals (CCDRN, 2006).

Health care and services are highly dependent on public initiative, although there is a growing tendency towards the setting up public-private partnerships. There are also some private initiatives in hospital management, for instance, the Trofa Saúde Group, the Hospitais Privados de Portugal SGPS S.A. and the Espírito Santo Saúde SGPS S.A. Similarly, there is a vast private experience in the complementary means of diagnosis and therapeutics and likewise in the provision of continuous health care, thermalism and well-being (CCDRN, 2006).

The group of medical devices is formed by three sets of companies. One is dedicated to the production and trade of bloodlines for haemodialysis, serum systems, smocks and other protective materials and kits used in treatments, highly clustered in the North region, yet operational in the entire national market, and gradually progressing internationally-wise. Another encompassing group of small-sized companies focuses on the manufacture of wheel-chairs, orthopaedic footwear, prosthetics, orthotic products and first-aid kits. Lastly, a significantly large, multi-sector group (moulds, plastic, glass, metalworks, etc.) is formed by sub-contractor component companies that manufacture medical devices (CCDRN, 2006).

The third major area is related to the pharmaceutical industry. As this is a globalized industry, there are both large multinational companies operating simultaneously in Portugal (Pfizer, GlaxoSmithKline, etc.) and national companies (Bial, Hovione, etc.). These industries invest in R&D processes and, therefore, the investment made in innovation is normally substantial.

Furthermore, the presence and quality of a group of institutions is confirmed, which are highly active in research (IBMC, IPATIMUP, CNC, ...), in training (Universities of Minho, Porto, Coimbra, Lisbon, ...) and also a significant number of qualified human resources (graduates, post-graduates and PhDs) in the field of biotechnology, health sciences, ICTs, materials engineering, among others (CCDRN, 2006).

Based on these key points, and as the health sector is expected to grow considerably, it was generally considered that the time was right to form a cluster in the health sector that could enhance this emerging business in the country, and particularly in the North Region. The idea of the potential shown by the health sector was quite explicit during the interview held with the HCP Chairman of the Board, Luís Portela, who is also the President of Bial's Board

of Directors: *“Health in Portugal exports more than Port wine. I have said this elsewhere and people simply look at me in disbelief! The fact is that Port wine exports just over 300 million euros and we export 400 million! So, as you can see, if size is what is at stake here, there is something here for sure; with a bit of luck, and if we do it properly, something good is bound to come out of it”*.

The State is currently implementing legislation on the institutionalization of this type of business clusters, which denoted a further boost to the set-up of the HCP.

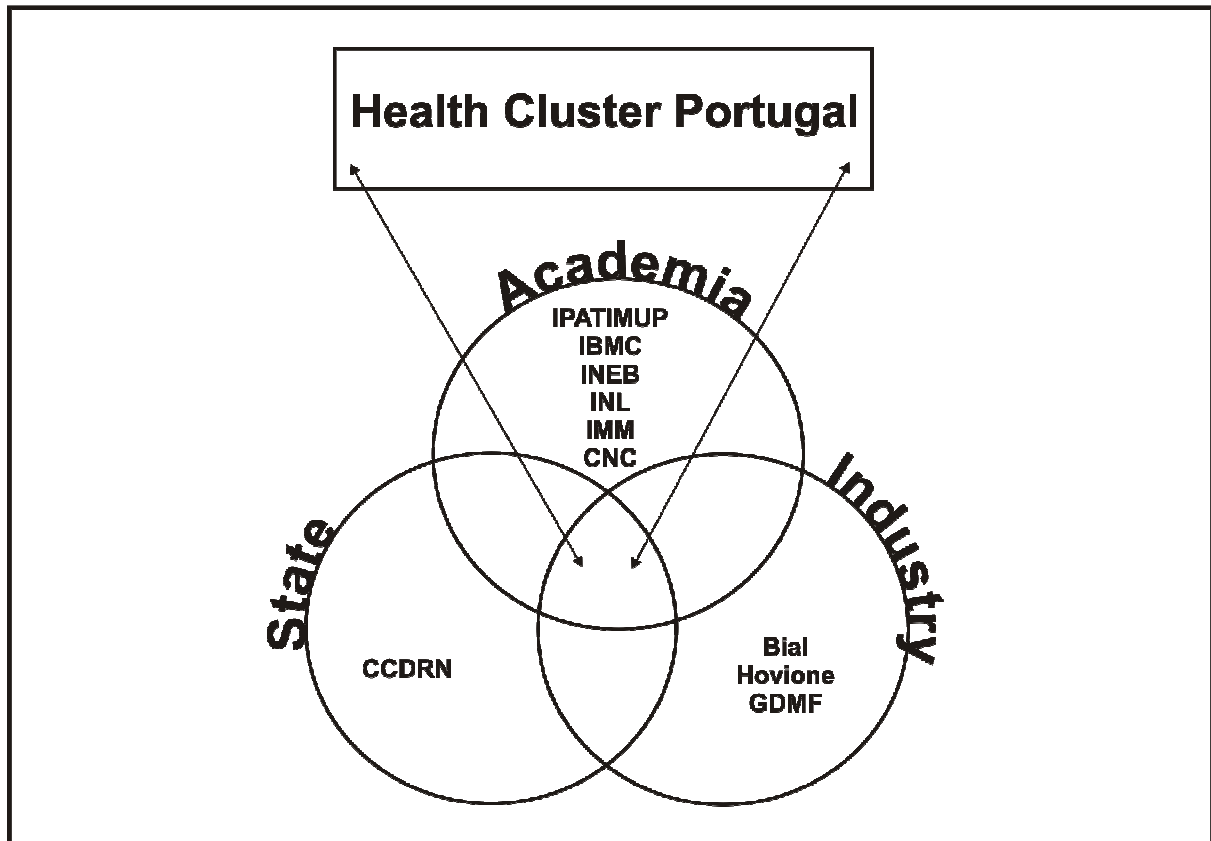


Figura 4 – Founding Group of Health Cluster Portugal.

Therefore, a work platform called the “*founding group*” (figure 4) was set up in 2007, formed by different entities from distinct areas: for the Government, by the North Regional Coordination and Development Commission (Comissão de Coordenação e Desenvolvimento da Região Norte – CCDRN), for the University, by the Institute of Pathology and Molecular Immunology of the University of Porto (Instituto de Patologia e Imunologia Molecular da Universidade do Porto – IPATIMUP), the Institute of Molecular and Cellular Biology (Instituto de Biologia Molecular e Celular – IBMC), the Institute of Biomedical Engineering (Instituto de Engenharia Biomédica – INEB), the International Iberian Nanotechnology Institute (Laboratório Ibérico Internacional de Nanotecnologia – INL), the Institute of Molecular Medicine (Instituto de Medicina Molecular – IMM) and by the Centre for Neuroscience

and Cell Biology (Centro de Neurociências e Biologia Celular – CNC), and for the industries, by Bial, Hovione and the Medical Device and Pharmaceutical Group (Grupo do Dispositivo Médico e da Farmacêutica – GDMF).

These players were invited to be part of the *founding group* as they were considered to be key-players. On the one hand, the CCDRN as a decentralized government force in the region represents the strategic commitment of public agencies to the project, further strengthened by the fact that it triggered the health cluster idea during the *Norte 2015* debate. On the other hand, the fact that Bial and Hovione are also involved in the project has heightened the trust of companies and the usefulness of this platform: they are the largest Portuguese pharmaceutical companies, highly experienced in research projects within international networks, and present in international markets. The GDMF, an association of companies, implements cooperation and interaction practices within the group of associates, and operates as a privileged route for the industries related to the medical devices. Lastly, pertaining to the university, the IPATIMUP, IBMC, INEB, INL, IMM, and CNC are regarded as be state-of-the-art research centres, highly reputed internationally, and which have helped some of the industries in the development of R&D processes. Some of these research centres are managed by renowned researchers in the national and international scientific community, and are highly respected and reliable individuals. All in all, the founding group is reputed and credible, and it provides a sense of reliability and interest to new members from the health sector in joining in the HCP.

Over a period of one year, the *founding group* conducted its mission of structuring and forming the HCP. The Public Deed, defining the Statutes, was signed on 4 April 2008.

The aim of the HCP is explicit in the Statutes “to promote and conduct initiatives and activities that will create a national competitive cluster, to provide innovation and technology targeted at international markets, respecting quality requirements and professionalism at all times, to promote and foster the cooperation among companies, organizations, universities and public entities, aiming to increase business turnover, exports and qualified employment, in the economic areas relating to the health sector, and to improve health care provision”. (HCP, 2008). The mission is clear: to contribute to the increase of competition in research, design, development, manufacture and sales of ground-breaking products and services in the health sector. The President of the HCP was quite clear on its purpose: “*We hope the companies will design innovative projects together with the research institutions and with other companies, which will enable them to improve their products and services, or even create new and competitive ones. Research institutions must seek to apply their knowledge in a practical way. They must contact the companies and let them know that they are*

conducting research in this area, which may be of interest to them, and that they can establish contacts. This is what we have been fostering. And how did we do that? By convening meetings between the parties, introducing them and taking them on field trips to visit the research institutions, by taking the research institutions to the companies, setting up meetings according to sectors and to topics. This is what we have been doing for some time now. We have been involved in this even before the cluster was set up formally. Some of these activities were already under way". He then added that, *"as a company, Bial would reap the benefits of being more competitive in a health-friendly environment than in being on a deserted island, alone"*, highlighting the importance of setting up a favourable environment that stimulates innovation.

What stands out in the statutes and in the interview with the HCP President is the intention to make the HCP a facilitator of interaction. It seeks to bring the government, companies and universities together and foster interaction within and between each of these entities, aiming to create a constellation of trust, links and common interests that will lead to the strengthening and creation of new cooperation networks which, in turn, will generate innovation.

The HCP is formed by a group of 10 institutions, which are part of the *founding group*, totalling 90 members (figure 5), split between the *public sector agencies* (1); *education research and training institutions* (21); *financial institutions and investors* (3); *business firms* (36); *other providers and services* (7); *science and business parks* (9); and *health services and insurance providers* (13).

Although the idea stemmed from the North Region, the HCP is open to national and international players (with branches in Portugal), as a means to gaining critical mass. In the words of the HCP President, *"a regional cluster would not have made sense. Ours is a fairly small country and although there are important institutions to the North of the country, we can also find them in Lisbon and Coimbra; therefore, we felt that we were rather few in Portugal, so splitting us up did not make any sense"*.

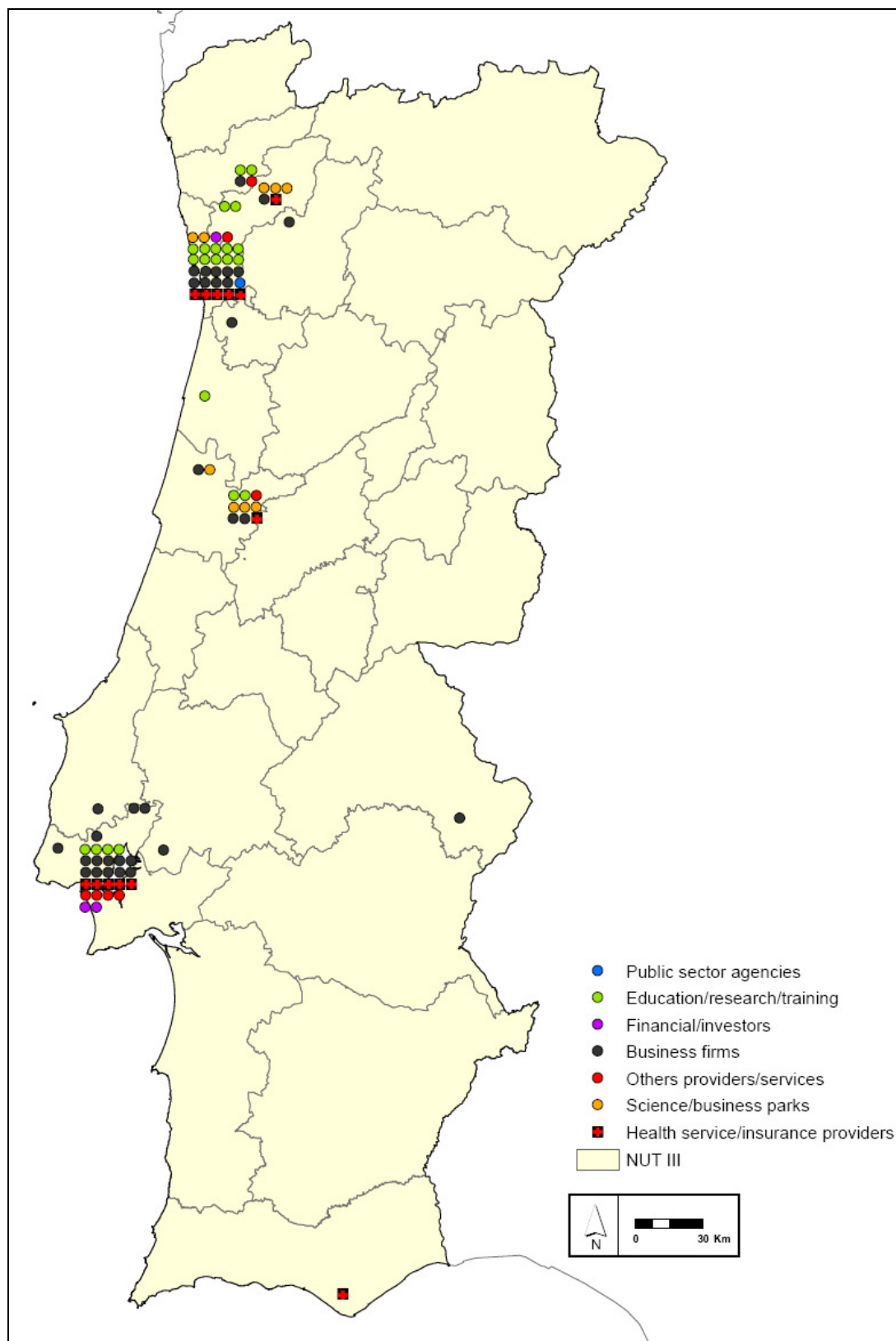


Figura 5 – Territorial distribution of the HCP associates sorted by groups of players

Nevertheless, there is a strong concentration around the expanded metropolitan areas of Porto and Lisbon, justified by the presence of the largest universities in the country, offering training and research institutions related to life sciences as (Minho, Porto, Coimbra and Lisbon), and the importance of the *demand-side*, namely hospitals, which are obviously located in these two most densely populated regions. In the Porto city-region, a wide range of players espoused the project, with a predominance of education and research institutions, as well as a considerably high number of companies. In the Lisbon city-region, we again find a diversity of groups of players and, in this case, the companies predominate. On the other hand, around Coimbra, there is a small concentration of players who have espoused the HCP, in particular the Science and Technology Parks, closely related to the University.

To summarize the idea, one of the most important factors was to identify, in terms of both quantity and quality, the players involved in the health sector; yet, this was not enough to create the health cluster. To foster the setting up of interaction networks, the need to develop a triple helix platform was recognized, which would facilitate interaction within and among the government, industrial and university spheres. The government played a decisive role in boosting the start-up of this initiative (preparing the legal framework supporting this type of platform). After the HCP was established, responsibility was passed to the industries and academia, and the government then assumed a more discreet role.

5 - Health Cluster Portugal: the rising of a knowledge and innovation network?

Today, the HCP is formed by 90 players, from several institutions and companies, whose common element is that they are in some way related to the health sector. This constellation of players ranges from analytical knowledge, as is the case of the research institutions and the pharmaceutical industries, to synthetic knowledge, such as the medical device industries (Figure 6). It can be said that the HCP is a platform that stages the interaction of players focused basically on the use and production of analytical and synthetic knowledge, where some privilege analytical and some synthetic knowledge, depending on the main activity that they develop.

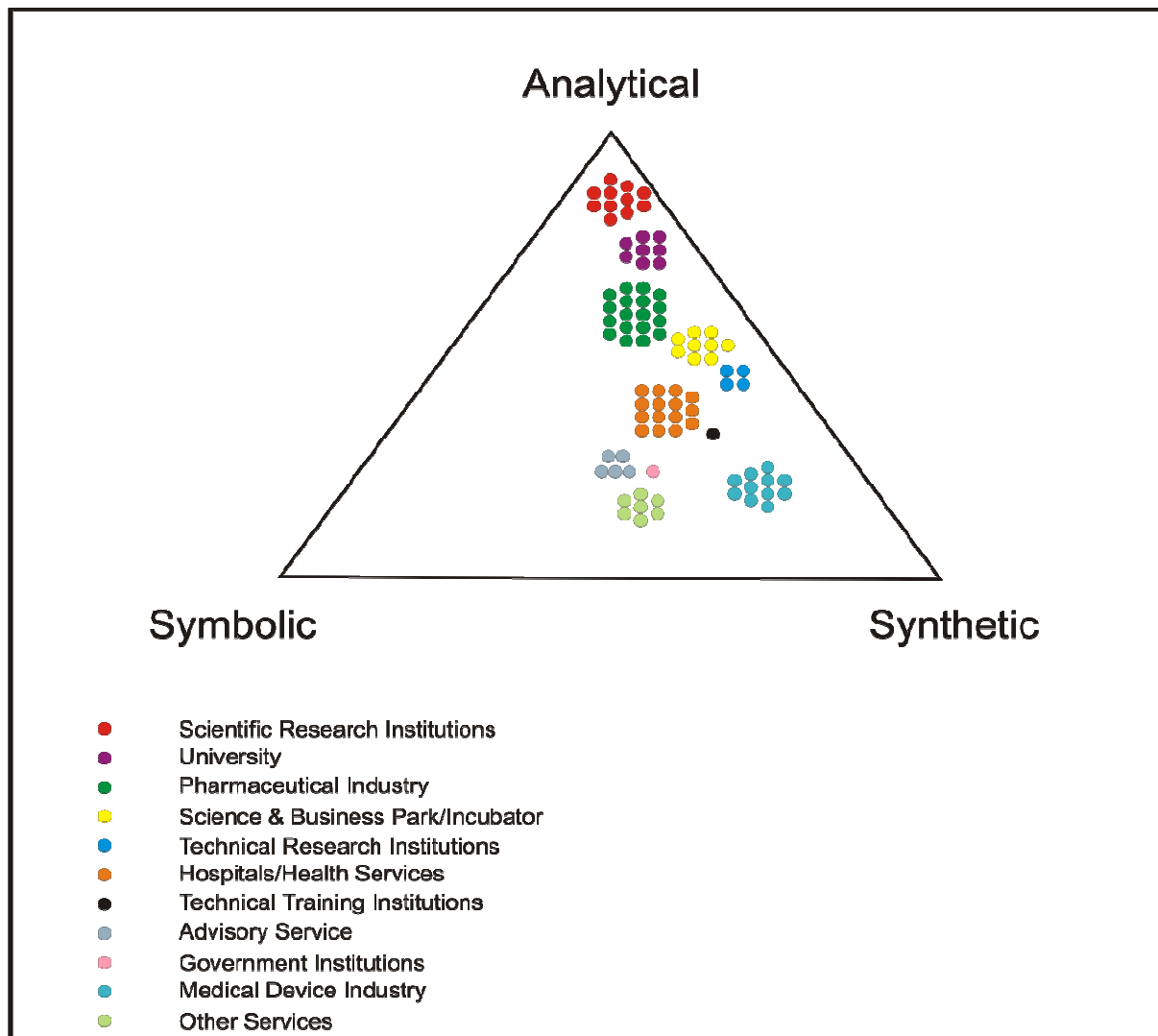


Figure 6 – Knowledge base and the players in the Health Cluster Portugal

The predominant groups of players in the HCP are the *business firms* (41%), followed by the *research, education and training institutions* group (23%), as shown in Figure 7. There is, therefore, a marked presence of the Industry and University spheres, and a small participation of the State (a mere 1%). Bearing in mind the availability of risk capital, particularly for the innovation processes, based on long and uncertain cycles, for example in the case of the R&D processes, the rather small presence (3%) of the *financial and investors institutions* is seen as a positive sign. Lastly, we must also highlight the presence of the *demand-side* players (14%), in addition to the *supply-side* players (86%), which can enhance not only interaction among companies, but also interaction between these companies and suppliers, and likewise with clients.

On the one hand, by integrating universities and research institutions, the HCP is fostering the creation of interaction networks with the industries that need scientific knowledge, thus stimulating the use and production of analytical

knowledge. Despite the fact that the dissemination of this type of knowledge is done successfully via *pipelines*, the creation of relations of trust as well as *know-who* can both be stimulated by *face-to-face* interaction and by the *buzz* generated within the HCP.

Furthermore, by stimulating the relations that universities and technical institutions have with the companies most actively engaged in the field of synthetic knowledge, it can likewise foster an interaction centred on research applied to the development of products and processes, increasing the production of synthetic knowledge. Indeed, the presence of a large variety of players, some related to the demand-side (14% of the players present in the HCP) and others on the supply-side (86%), can foster the *know-how* arising out of *face-to-face* interactions within and among companies, as well as the market, enhancing the appropriation, use and production of synthetic knowledge.

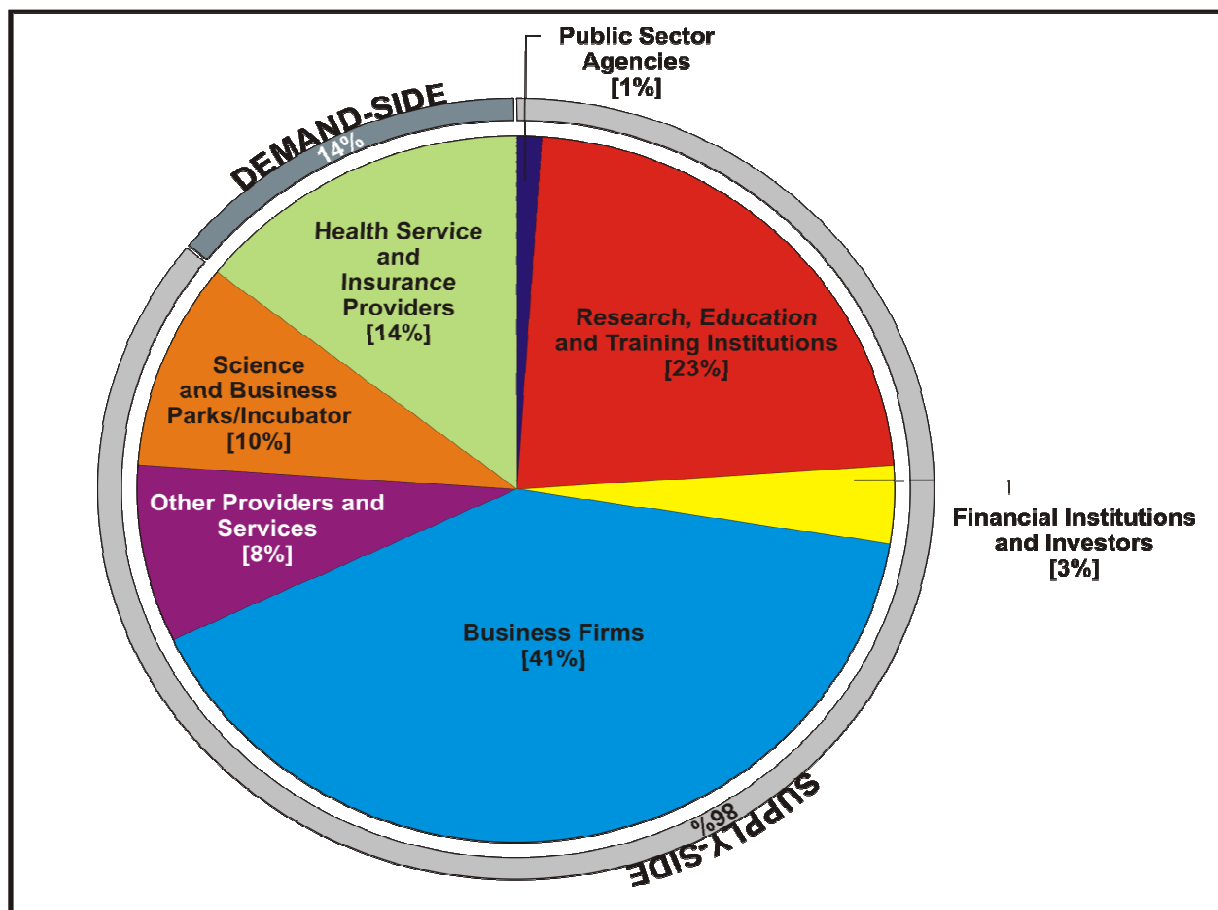


Figure 7 – Groups of players in the Health Cluster Portugal

The HCP aims to organize the innovation process by creating an ecology that includes companies that use and produce analytical and synthetic knowledge, and a constellation of players outside these companies, to strengthen the formation of relational networks. It, therefore, seeks to promote innovation

using the *STI* mode, related to the production of analytical knowledge, and using the *DUI* mode, which is related to the production of synthetic knowledge. In fact, in addition to including players from the supply-side, who play the role of suppliers and/or producers, the HCP also includes those that are on the demand-side, for instance, hospitals. By fostering the set up of these networks, which favour the interaction of knowledge between suppliers, producers and customers, it opens up opportunities for radical innovations, that may surface from, for example, the interaction between research institutions and pharmaceutical companies; however, it also opens up an opportunity for increasing innovations that may emerge from, for example, the interaction between medical device industries and hospitals or other health services. Although present, the *demand-side* represents just 14% of the total number of players that are currently part of the HCP. This is a good sign, but insufficient, as there is not one single representative player, for example, of organizations of health service end-users that represent the users/end-customers. As an interaction platform, the HCP gathers a number of the required conditions to become a local node of knowledge within the health sector.

In addition to HCP's internal relations, there is a need to identify whether there are more global networks, and how the HCP can foster access to and the creation of new ones. With this in mind, a survey was prepared on the international branch offices of the current HCP members, and on their international partnerships, some examples of which are found below.

Taking into consideration the theoretical assumption that the companies that venture into analytical knowledge benefit more easily from the *pipeline* effect, whereas those into synthetic knowledge are more dependent on *face-to-face* and the *local buzz*, the HCP networks may represent different ways of accessing knowledge.

Having analyzed the network formed by the total number of international branch offices of Portuguese companies pertaining to the HCP, the first conclusion that stands out is that its international dimension is rather small (Figure 8). The main focus is on Europe, although some occasional ventures can be seen in all five continents. The density of the global networks built, grounded on the set up of international branch offices, is low; furthermore, of all the players currently involved in the HCP, the number of those that dared beyond the national borders is rather small (only 15%).

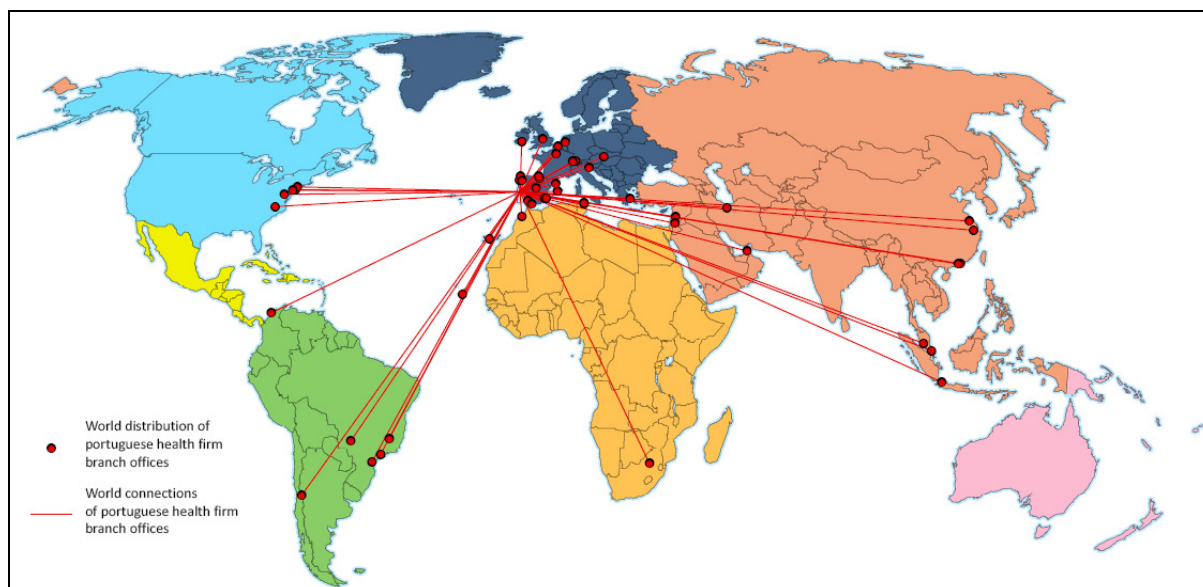


Figure 8 – International network of Portuguese branch offices of HCP members

Nevertheless, when we look into the network of branch offices of international companies, whose Portuguese branch office joined the HCP, we are soon aware that they represent a highly significant network. The companies of foreign origin, bearing the characteristics of multinationals, can represent an opportunity for the expansion of the global HCP network, as we can see, for example, in the case of Pfizer (Figure 9). Pfizer is the sole company to have a global network of branch offices much more extensive than the sum of all the branch offices of Portuguese players pertaining to the HCP. By becoming part of the HCP, these multinational companies bring with them an extensive network they have built and a wealth of experience and knowledge that no other Portuguese company holds. Membership of this type of companies is strategic for the HCP as it provides it with a fast-increasing potential to access the global networks of knowledge.

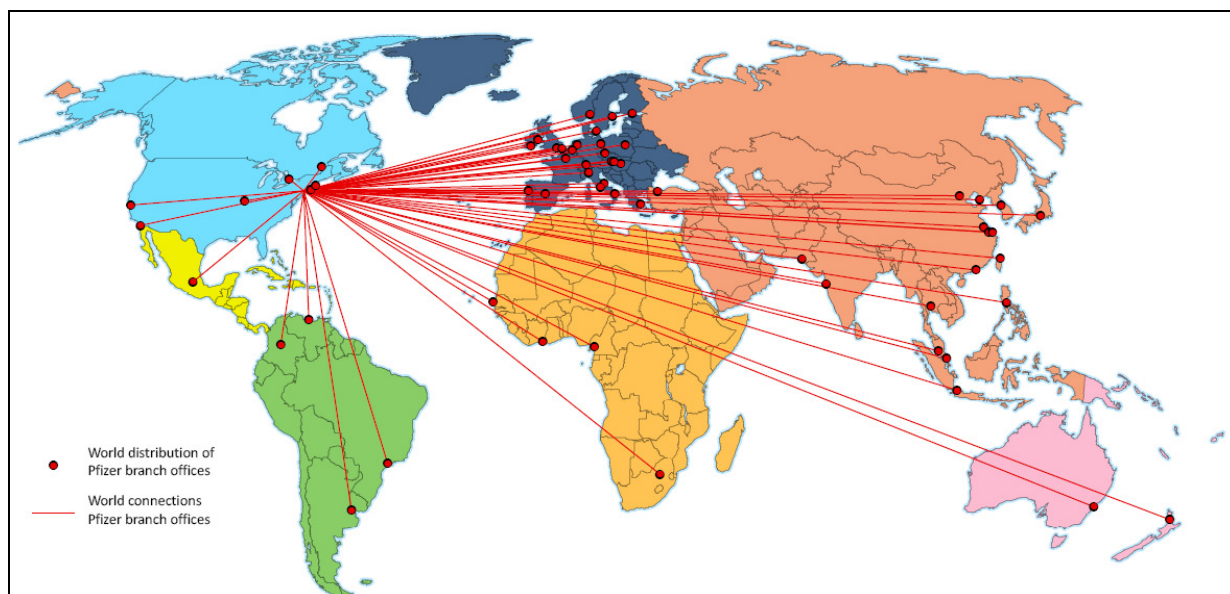


Figure 9 – Pfizer branch office network

When we analyze the network formed by head-offices and branch offices of HCP Portuguese companies, according to the type of knowledge that they produce, we see that, although in general it is small, it seems to be more extensive for those players related to synthetic knowledge (Figure 10). We are inclined to believe that this means that access to synthetic knowledge implies a *face-to-face* relation; therefore, the process of expansion into international markets implies also the opening of a branch office to effectively be present near the market, thus benefiting from the *local buzz* and *face-to-face communication*. This could be one way of accessing existing knowledge in other markets, at a more global scale, which will later be shared by the internal channels of the company, through the interaction of the head-office with its multiple branch offices. Access to knowledge, and the way it can be transferred within the company, will imply a greater physical proximity and a direct contact, first with the market, and later among the company collaborators.

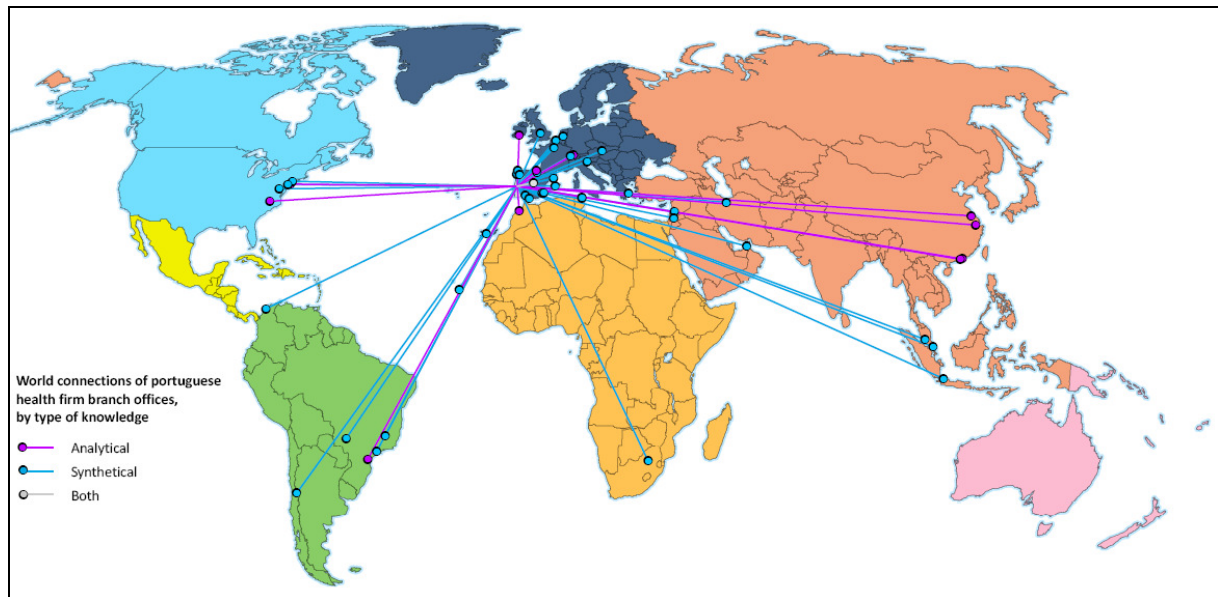


Figure 10 – International network of Portuguese players in the HCP, by knowledge base.

However, and taking the example of Bial (Figure 11), despite its rather small branch office network (only one in Spain), it has an extensive network of cooperation agreements to allow access to the knowledge needed to develop innovation. In terms of the network formed by cooperation agreements with research institutions, the companies that venture into analytical knowledge tend to have an extensive international network. The *pipeline* effect that favours the exchange of analytical knowledge, where distance does not cause too great a friction, entropy or noise, seems to be the reason behind this success. Despite the advantages offered by the *pipeline* effect, by participating in the HCP these companies may likewise benefit from the *buzz* and *face-to-face* hence generated. As the president of Bial highlighted in an interview we conducted: “*it will be much better for Bial, as a company, to be more competitive in an environment that favours the health area than to be on an island alone, isolated*”, thus enhancing the role played by the HCP in creating a favourable environment, a means to stimulate innovation.

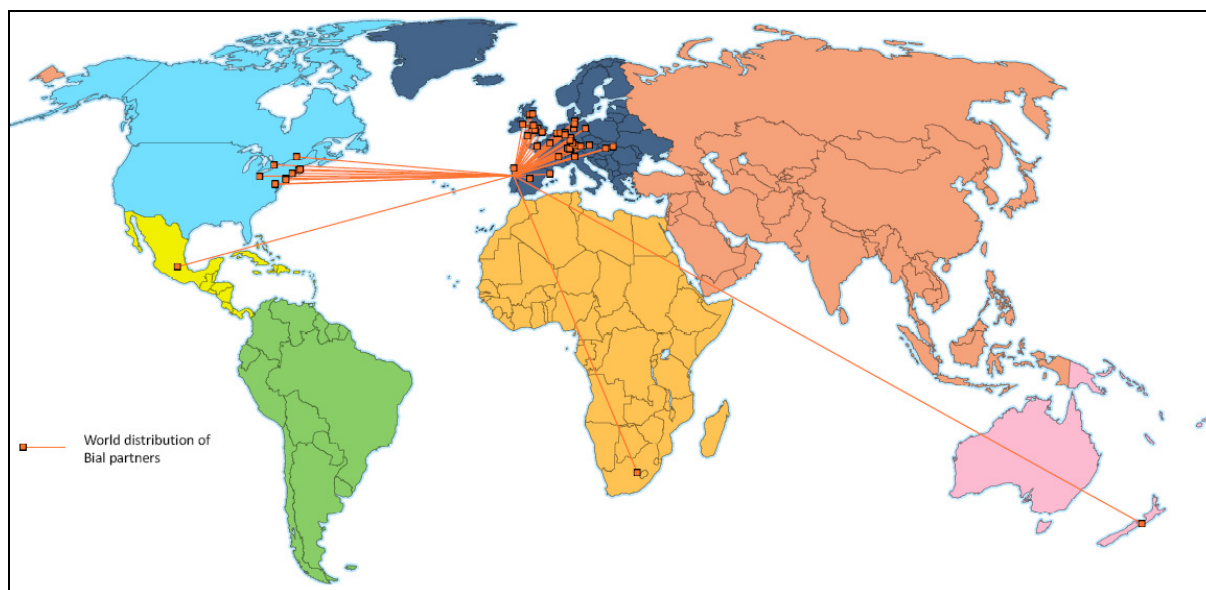


Figure 11 – Network of laboratories with agreements with Bial

There are several signs that lead us to believe that the strategies to access the global knowledge networks vary according to the knowledge base involved.

When dealing with a synthetic knowledge base, access to global networks seems to imply an effective territorial proximity as a way of internalizing knowledge; as such, the strategy involved means that it is practically mandatory to set up a new branch office in that new market. The aim of this step is to enhance the creation of a specific network, with the purpose of accessing the existing knowledge in that specific local context.

As for analytical knowledge base, it can be accessed at long distance through the *pipeline* effect, without the need of actually being there. This is why signing occasional agreements with research institutions at a global scale, according to the needs of the company, seems to be an efficient solution, as shown in the case of Bial (Figure 11). However, the large multinationals that are essentially based on analytical knowledge also seek to be effectively present in the global network, through a branch office. In theory, they choose this strategy to benefit not only from access to codified knowledge, but also so that they can benefit from the localized knowledge circulating within the informal networks through the *local buzz* and *face-to-face* learning, as shown in the Pfizer global branch office network (Figure 9). This makes us believe that the creation of analytical knowledge takes place simultaneously between close and distant partners, at multiple scales that go from the local to global.

The galaxy of knowledge is structured along a network of networks, in which the head office of the company embodies a network of branch offices, which, in turn, embody a network at a more local scale.

The ability to access simultaneously local knowledge and the network of global knowledge, formed by the total amount of specific knowledge within each

significant place at world level, seems to be one of the core concerns of companies which aim to be at the forefront of the innovation process. By becoming a local node embodying a group of local and global networks, the HCP-type platforms can represent an effective solution to creating, accessing and expanding a network of networks, particularly the small and medium sized companies – which are the majority in the current HCP -, as each player can contribute with its own network to the construction of a shared network, with the consequent and mutual benefits.

6 – Conclusion

The HCP is a platform formed by a constellation of players on the demand and supply side, the activities of which are based on the use and production of knowledge, particularly analytical and synthetic knowledge. The presence of a wide variety of players is enriching to the process of innovation, in that by creating an ecology that embodies companies that use and produce analytical and synthetic knowledge, and a constellation of external players, it increases the possibility of combining the *STI* and *DUI* modes leading to the incubation of radical and incremental innovations.

However, to simply acknowledge the existence of a variety of players related to the health sector is insufficient to promote innovation. It is not enough to just have institutions, although they are a starting point. The need to stimulate, over time, the creation of a growing flow of communication and interaction among these players is crucial. Public policies can play a decisive role in this field, by providing the requirements to set up non-profit organizations, which, like the HCP, will work as the governance structure of the different players within the university, industry and State spheres. These triple helix initiatives boost the creation of interactive networks, thus contributing to strengthening the regional advantages of the cluster.

If the creation of a consistent internal network of players in the cluster fosters innovation, by stimulating the local *buzz* and *face-to-face* learning, it is no less true that the development of a global network of *pipelines* can further enhance the processes of creating knowledge and innovation. There are signs that lead us to believe that the strategies used to access global networks of knowledge vary according to the type of knowledge base involved. If we are dealing with a synthetic knowledge base, access to global networks seems to imply an effective territorial proximity as a way of internalizing knowledge; as such, the strategy involved implies setting up a branch office in that new market. The aim of this step is to enhance the creation of a specific network, with the purpose of accessing the existing knowledge in that specific local context. As for the analytical knowledge base, it can be accessed at long distance through the *pipeline* effect, without the need of actually being there. This is why signing

occasional agreements with research institutions at a global scale that meet the companies' requirements seems to be an efficient solution. However, the large multinationals that are essentially based on analytical knowledge also seek to be effectively present in the global network, through a branch office. In this way, they can benefit not only from the access to codified knowledge, but also from the localized knowledge circulating within the informal networks through the *local buzz* and *face-to-face* learning

The galaxy of knowledge is structured along a network of networks. If in the case of companies that venture into synthetic knowledge the access is done solely by actually being present in the local contexts, those that venture into the analytical knowledge, in addition to this possibility, often also benefit from the *pipeline* effect through the construction of a network of occasional cooperation partnerships. By becoming a local node embodying a group of local and global networks, the HCP-type platforms can represent an effective solution to creating, accessing and expanding a network of networks.

Bibliography

Asheim, B. T. (2007) Differentiated Knowledge Bases and Varieties of Regional Innovation Systems, *Innovation: The European Journal of Social Science Research*, 20 (3), pp. 223-241.

Asheim, B. T.; Coenen, L. (2006) Contextualizing Regional Innovation Systems in a Global Learning Economy: On Knowledge Bases and Industrial Frameworks, *Journal of Technology Transfer*, 31, pp. 163-173.

Asheim, B. T.; Coenen, L.; Vang, J. (2007) Face-to-face, buzz and knowledge bases: sociospatial implications for learning, innovation, and innovation policy, *Environment and Planning C: Government and Policy*, 25, pp. 655-670.

Arrow, K. (1962) The Economic Implications of Learning by Doing, *The Review of Economic Studies*, 29(3), pp. 155-173.

Bathelt, H.; Malmberg, A.; Maskell, P. (2004) Cluster and knowledge: local buzz, global pipelines and the process of knowledge creation, *Progress in Human Geography*, 28 (1), pp. 31-56.

Becattini, G. (2002) Del distrito industrial marshaliano a la «teoría del distrito» contemporánea. Una breve reconstrucción crítica, *Investigaciones Regionales*, 1, pp. 9-32.

Caraça, J.; Lundvall, B-A.; Mendonça, S. (2008) The changing role of science in the innovation process: From Queen to Cinderella?, *Technological Forecasting & Social Change*, doi:10.1016/j.techfore.2008.08.003.

CCDRN e MAOTDR (2006) *NORTE 2015: Competitividade e Desenvolvimento – uma Visão Estratégica*, <http://www.ccr-norte.pt/downloads/diagnorte2015.zip> (access in Janeiro 2009)

- Coenen, L.; Moodysson, J.; Ryan, C.; Asheim, B.; Phillips, P. (2005) Knowledge Bases and Spatial Pattern of Collaboration: Comparing the Pharma and Agro-Food Bioregions Scania and Saskatoon, *CIRCLE Electronic Working Paper Series*, n° 12.
- Cooke, P.; Uranga, M. G.; Etxebarria, G. (1997) Regional innovation systems: Institutional and organizational dimensions, *Research Policy*, 26, pp. 475-491.
- Coppin, O. (2002) Le milieu innovateur: une approche par le système, *Innovations*, 16 (2), pp. 29-50.
- Cumbers, A.; Mackinnon, D.; Chapman, K. (2003) Innovation, collaboration, and learning in regional clusters: a study of SMEs in the Aberdeen oil complex, *Environment and Planning A*, 35, pp. 1689-1706.
- Doloreux, D. (2004) Regional networks of small and medium sized enterprises: evidences from Metropolitan Areas of Ottawa in Canada, *European Planning Studies*, 12(2), pp. 173-189.
- Doloreux, D. (2002) What we should know about regional systems of innovation, *Technology in Society*, 24, pp. 243-263.
- Etzkowitz, H.; Leydesdorff, L. (2000) The dynamics of innovation: from National Systems and “Mode 2” to a Triple Helix of university-industry-government relations, *Research Policy*, 29, pp. 109-123.
- Florida, R. (1995) Toward the Learning Region, *Futures*, 5, pp. 527-536.
- Gertler, M. S.; Levitte, Y. M. (2005) Local Nodes in Global Networks: The Geography of Knowledge Flows in Biotechnology Innovation, *Industry and Innovation*, 12 (4), pp. 487-507.
- HCP (2008) Estatutos do Health Cluster Portugal – Associação do Pólo de Competitividade da Saúde. <http://healthportugal.com/Quem%20somos/Estatutos> (access in Janeiro 2009)
- Jensen, M. B.; Johnson, B.; Lorenz, E.; Lundvall, B-A. (2007) Forms of Knowledge and modes of innovation, *Research Policy*, 36, pp. 680-693.
- Kline, S.J.; Rosenberg, N. (1986) An overview of innovation, in: R. Landau & N. Rosenberg (Eds) *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, Washington: National Academy Press, pp. 275-305.
- Lars, C.; Moodysson, J.; Ryan, C.; Asheim, B.; Phillips, P.; (2005) Knowledge Bases and Spatial Patterns of Collaboration: Comparing the Pharma and Agro-Food Bioregions Scania and Saskatoon, *CIRCLE Electronic Working Papers Series*, 12.
- Leidesdorff, L.; Meyer, M. (2003) The triple Helix of university-industry-government relations, *Scientometrics*, 58 (2), pp. 191-203.
- Leidesdorff, L. (2000) The triple helix: an evolutionary model of innovations, *Research Policy*, 29, pp. 243-255.
- Lundvall, B-A. (2006) Knowledge Management in the Learning Economy, *DRUID Working Paper*, n°6.

- Lundvall, B-A. (1992) *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter Publishers.
- Lundvall, B-A.; Johnson, B. (1994) The Learning Economy, *Journal of Industry Studies*, 1 (2), pp. 23-42.
- Maillat, D. (2006) *Comportements spatiaux et milieux innovateurs* in Milieux Innovateurs Théorie et politiques (texts réunis par) Camagni, R.; Maillat, D., Economica, Anthropos, Paris, pp. 65-73.
- Malerba, F. (2005) Sectoral systems of innovation: a framework for linking innovation to the knowledge base, structure and dynamics of sectors, *Economics of Innovation and New Technology*, 14 (1), pp. 63-82.
- Marques, J. C.; Caraça, J.; Diz, H. (2006) How can university-industry-government interactions change the innovation scenario in Portugal? – the case of the University of Coimbra, *Technovation*, 26, pp. 534-542.
- Moodysson, J.; Coenen, L.; Asheim, B. (2006) Explaining spatial patterns of innovation: analytic and synthetic modes of knowledge creation in the Medicon Valley life-science cluster, *Environment and Planning A*, 40, pp. 1040-1056.
- Morgan, K. (1997) The Learning Region: Institutions, Innovation and Regional Renewal, *Regional Studies*, 31(5), pp. 491-503.
- Nielsen, P.; Lundvall, B-A (2003) Innovation, Learning Organizations and Industrial Relations, DRUID Working Paper n°7.
- Nonaka, I.; Umemoto, K.; Senoo, D. (1996) From Information Processing to Knowledge Creation: A Paradigm Shift in Business Management, *Technology in Society*, 18 (2), pp. 203-218.
- Porter, M. (1990) *The Competitive Advantage of Nations*, London: Macmillan.
- Rosenberg, N. (1982) *Inside the Black Box: Technology and Economics*, New York: Cambridge University Press.