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Parc Científic de Barcelona: a central research infrastructure for life sciences incubation

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Parc Científic de Barcelona: a central research infrastructure for life sciences incubation

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Executive summary

This article describes and analyses the strategy followed by the *Parc Científic de Barcelona* (Barcelona Science Park, PCB), which has converted the science park into a central research infrastructure for life sciences entrepreneurship. Together with other initiatives, this central infrastructure has established a strong biotechnology cluster in the region. Today, this regional cluster comprises 871 companies and 95 research organisations, with a yearly turnover of €15.956 billion (7.1% of the Catalan GDP) and 42,133 employees. Catalonia produces 3.15% of all European scientific production in the health and life sciences arena while constituting just 1.44% of Europe's population.

This article describes the public policies deployed in Catalonia over twenty years that have achieved in this status quo and the lessons learnt, as well as proposals to foster the creation of new knowledge- and technology-based companies in the future.

Introduction

The biomedical industry has historically been important to Catalonia's economy. Catalonia is the home to some of the oldest pharmaceutical companies in Europe, such as Uriach (1838), Cusí (1902), Esteve (1929), Reig Jofré (1929), Grífols (1940), Almirall (1943), Lacer (1949), Salvat (1955) and Ferrer (1959). However, the relative importance of these historic companies has significantly decreased over the last forty or thirty years for two reasons. The first reason is that in the 1970s, the Kingdom of Spain started to sign international trade treaties for the first time. These treaties opened the local market to international corporations, which were able to introduce new pharmaceutical products in Spain. However, Spanish pharmaceutical companies could not compete in the global market because their main business streams were revenues obtained through the production and commercialization of products in the local market that were patented by international companies that were not respected in Spain by Franco's regime. Through the signing of international trade treaties, the Spanish companies were allowed to continue with business in Spain, but they were not allowed to export to other areas without the permission of the patent owner. The second reason for this decrease was international corporation mega-mergers. During the seventies and the eighties, multiple pharmaceutical megamergers took place worldwide. The results of these megamergers were the big pharmaceutical corporations now dominant in the global market. However, Spanish pharmaceutical companies were excluded from such operations[i] because they had nothing valuable to add to the multinational corporations, as their main focus had been the production and commercialization of internationally-patented products in Spain without complying with international intellectual property laws.

In this panorama, Catalonia came into the 21st Century with a powerful historical memory, but no apparent ability to catch up with new biotechnological trends and genomic explosion. Nonetheless, today Catalonia is again a world leader in biotechnological and pharmaceutical research, with almost 900 companies in the field, 140 research institutions and 18 university hospitals, some of them international leaders in their specialties. Therefore, Catalonia is again an international reference at the same level as other European leaders such as Copenhagen – Lund (Medicon Valley),

Switzerland, Paris, London or Bavaria. In this article, we present the way in which local R&D policies were developed by the regional government, the *Generalitat de Catalunya*.. The Barcelona Science Park (PCB) has been a central element in these policies with the shift from no apparent future to the current situation. The process also an interesting case study for other international regions.

The beginnings

As explained, Catalonia had a strong history in science and chemistry that allowed local pharmaceutical companies to "copy" internationally-protected products for their subsequent sale in the local market. In fact, Catalonia is host to two chemistry schools of historic worldwide renown, the University of Barcelona and the *Institut Químic de Sarrià* (IQS), reflecting Catalonia's strong background in chemistry. Historically, the University of Barcelona was well-known for its strength in organic chemistry, one of the pillars of pharmaceutical research. IQS was known for its strength in chemical engineering , a fundamental element in pharmaceutical manufacturing. These two academic institutions gave the country a good level of talented and trained professionals in the two fields of organic chemistry and chemical engineering . This established a good basis by which enact successful scientific policies for the re-development of the local biotechnological and pharmaceutical sector.

It was in this context that Prof. Andreu Mas-Colell (1944) was appointed Minister of Science, Universities, and Information Society to the *Generalitat de Catalunya*. Prof. Mas-Colell arrived from Harvard and Berkeley (USA) with specific ideas about which public policies were best to place Catalonia in the international life sciences arena again. Prof. Mas-Colell instituted four high-impact public initiatives that fostered the sector:

The first initiative was to create a new university that focused on life sciences, amongst other areas, *Universitat Pompeu Fabra*. This move increased competition in the academic sector, and at the beginning of the 21st century, four Catalonian universities – three public and one private (IQS) - were top performers in teaching in life sciences. Hence, in the medium-term, Prof. Mas-Colell's initiative created a strong body of biologists to complement the pre-existing group of chemists. In fact, the three public universities, the University of Barcelona, the Autonomous University of Barcelona and Pompeu Fabra University, created their scientific parks with a focus on biotechnological and pharmaceutical research. The Barcelona Science Park belongs to the University of Barcelona, the *Parc de Recerca de la UAB* (PRUAB), Research Park UAB, belongs to the Autonomous University of Barcelona, and the *Parc de Recerca Biomèdica de Barcelona* (PRBB), Biomedicine Research Park of Barcelona, belongs to the Pompeu Fabra University.

The second initiative was to start creating research institutes with the best professors from local universities independently from the universities. This policy significantly increased research productivity, since top-professors were excluded from teaching. These independent research centres were created with stable, long-term governmental funding. Later on, in 2010, the CERCA institution was created. CERCA is the public body that comprises all 45 current autonomous research centres. Therefore, the *Generalitat de Catalunya* can now execute public policies on autonomous research centres in a centralised way through CERCA.

Prof. Mas-Colell's third initiative was to create ICREA (*Institució Catalana de Recerca i Estudis Avançats*, Catalan Institution for Research and Advanced Studies) in 2000. ICREA is an organisation that identifies international talent to complement local talent and brings it to Catalonia; their mission is to build an ecosystem of excellence. ICREA has an annual budget of €29.5 million (2017) and has mobilised €581 million to date in to attract talent, identify top-performing researchers internationally, and pay them competitive wages, as well as to give to them stable funds for their own research in Catalonia. ICREA does not provide physical space, so the researchers hired by ICREA have to look for a Catalan institution to host them, either a university or an autonomous CERCA research centre.

Last, Prof. Mas-Colell started a national agency for research in 2001, AGAUR (*Agència de Gestió d'Ajuts Universitaris i de Recerca*, Agency for the Management of Research and University Grants). The agency's aim is to manage public funds for research; if the funds budgeted annually by the

Generalitat de Catalunya are not spent, they remain in the agency and can be spent the next year. In addition, by establishing the agency, Prof. Mas-Colell created an instrument that would manage and fund Catalan research independently of political shifts in the regional government, the *Generalitat de Catalunya*.

Infrastructure

Once universities were training top-performing professionals in life science research, autonomous public research centres were created, international talent was attracted to complement local talent, and the agency for research and development was created, the *Generalitat de Catalunya* decided to invest in research infrastructure for research in life sciences in conjunction with the Spanish government.

First, three singular research infrastructures were created: Synchrotron ALBA was started in 2003 and finished in 2010. The Barcelona Supercomputing Center was created in 2005 with a clear focus on life sciences; it contains one of the most powerful supercomputers in the world, Marenostrum. In 2009, the CNAG (*Centro Nacional de Análisis Genómico*, National Centre for Genomic Analysis) was established. Each of these three research infrastructures are still international leaders in their specialties. They provided a solid foundation for the public research system to be able to deliver top science.

The second policy put into place by the *Generalitat of Catalunya* together with the Spanish government was the creation of a network of scientific and technological parks[ii]. Sixteen science and technological parks were created between 1997 and 2007 in Catalonia. The mission of the scientific and technological parks is to bring public research and private research closer together. Therefore, companies were given an incentive to move their R&D facilities into the science and technological parks where many of the autonomous research centres were already located.

Local authorities ratified two policies to develop this strong network of parks. The aim of the first policy was to give each park a specific economic focus. For instance, the PCB, the PRUAB and the PRBB are focussed on biotechnology; the *Parc Científic i Tècnològic Agroalimentari de Lleida* (Scientific and Technological Agroalimentation Park of Lleida) is focussed on nutrition and agrotechnology; the Polytechnical University of Catalonia research park is focussed on aerospace technologies; etc. The purpose of specialising the parks is to allow them to pointedly focus their investments and efforts on their field. For instance, the Barcelona Science Park, which specialises in biotechnology, has implemented thirty different biotech services, such as toxicology, animal experimentation, synthetic chemistry, proteomics, etc., to serve and to attract companies in the field.

The second policy designed the parks in such a way that they are self-sustaining. Park construction was mainly financed with debt. Therefore, after a multi-year deferment period, the companies managing the parks had to start paying back the loans they were given by the Spanish government and other entities. In fact, to finance the development of the entire Spanish network of scientific and technological parks –not just the Catalan network-, the Spanish government launched a public call for loans, commonly known as "*Parquetazos*". This credit line was calculated at €2 billion for the whole of Spain.

All of these initiatives, including research infrastructure and the scientific and technological parks, reach a total estimated public investment of around €3 billion over twenty years.

Scaling-up and closing the circle

Once the framework, and infrastructure for public research, development and innovation were created by Prof. Mas-Colell, the system had started to produce considerable top-level scientific production and human talent, which had to be absorbed by the local industry in order to re-develop the country and to close the knowledge economy circle. In other words (1) basic research is (2) converted into corporate innovation that (3) obtain revenues and (4) pay taxes, which are placed

back into the public system for reinvestment in (1) basic science. In this context, the *Generalitat de Catalunya* decided to foster the life sciences private sector.

To achieve this goal, the *Generalitat de Catalunya* authorised four initiatives. The first policy was invested in and secured annual funds for the seven existing technological centres in Catalonia. Most technological centres in Catalonia are private groups of "traditional" companies that merge to gain competitiveness and synergy in innovation. Therefore, innovation by corporate groups comprising the technological centre is independently achieved collaboratively at the technological centre if the parent companies are direct competitors in the local or global market. By securing funds for innovation at the technological centres, the local government incentives the formation of associations in the industry so as to gain critical mass, and fostering the translation of basic science from research centres and universities into local industry. Years later, in 2015, the *Generalitat de Catalunya* forced the seven technological centres to merge, resulting in two big competing technological centres: Eurecat and Leitat.

The second scheme created Biocat (*Fundació BioRegió de Catalunya*) in 2006. Biocat is a *Generalitat de Catalunya* agency whose mission is twofold: to cluster all regional agents with interest in the life sciences field and to promote that cluster internationally. Therefore, BioCat has instituted multiple grants and initiatives to display the potency of the Catalan life sciences cluster in international forums and to attract international investment to the region.

The third action taken was the creation of ACCIÓ (*Agència per la Competitivitat de l'Empresa*, Agency for the Competitivity of the Companies) in 2008. One of ACCIÓ's missions was to offer R&D and innovation grants for companies, with the main goals of fostering innovation in private companies and creating a local market for science from academia to industry.

Finally, the forth initiative put multiple grants and incentives in place for companies to hire talented researchers from academia. AGAUR, ICREA and ACCIÓ offered companies multiple types of incentives to encourage the incorporation of diverse types of researchers in companies. These grants include Beatriu de Pinòs, TEM-B and ICREA Júnior Empresa grants as well as industrial doctorates, among others.

As a result of this initial push by the local government for the biomedical industry, Catalonia is again home to one of the world's leading clusters in biotechnology. Today, the Catalan biotechnology cluster comprises 871 companies, with a yearly turnover of €15.956 billion, 42,133 employees, and a large number of new entrepreneurial initiatives every year. Catalonia currently produces 3.15% of all European scientific production in the health and life sciences arena while constituting just 1.44% of Europe's population.

The Barcelona Science Park, a central element in the cluster

The PCB was the first science park built in Catalonia and in Spain, and, therefore, the park has been used as a model for the rest of the Catalan system. As stated, the PCB is focussed on biotech, and loans given to the institution came to €150 million. With this investment, seven buildings were erected, three mostly containing laboratories and four mainly office buildings. The total built surface area of the park is of 101,000 m^2. Approximately €50 million of the €150 million were allocated to high-tech equipment in life sciences research, including microscopes, high-performance liquid chromatography, nuclear magnetic resonance, cellular culture rooms, ultracentrifuges, etc. The park's mission is not only to provide laboratories and offices for biotechnological companies, but also to provide equipment that would otherwise would be very difficult for start-ups to acquire.

In total, the PCB has implemented twenty-six different services for the companies located in the park. Some are self-services, such as microscopy, ultracentrifugation and cell cultures; Others are guided services, such as radiation infrastructure or other special services. Other turnkey services are provided on four technological platforms: toxicology, animal experimentation, synthetic chemistry and proteomics. The main difference between the self-services and the services provided by the technological platforms is that self-services are operated by the clients while the services provided on the platforms are operated by technicians hired by the PCB.

The PCB does not only host companies, but also public research institutes, as well as units from the University of Barcelona. Hence, in addition to the services offered by the PCB, public research

institutes and the university also offer multiple research services focussed on life sciences, bringing the total number of scientific services offered to the community to more than fifty. All of these services have been designed to be self-sustainable and profitable. With the profit earned, the PCB can replace obsolete equipment and acquire new technologies.

With this vast and high-performing infrastructure, the public administration –in collaboration with the University of Barcelona- has been facilitating the creation and scale-up of biotechnological companies that may not have otherwise had that opportunity due to the enormous investments in equipment faced by new companies operating in the biotechnological sector . Equipment for biology and chemistry, such as microscopes, high-performance liquid chromatography, nuclear magnetic resonance, cellular culture rooms, ultracentrifuges, are too expensive for new start-ups that are just starting to raise money to develop their ideas. A rough estimation of the investment in equipment that a regular biotech start-up needs easily reaches €1 million. In addition, while all this equipment is necessary, it is not intensively used. Return on investment is very long-term and uncertain. These factors often discourage the creation of new entrepreneurial initiatives in life sciences. In contrast, they encourage companies, research and academic centres to cluster in an attempt to increase synergy and gain critical mass.

In addition to the infrastructure, buildings and services, which can be seen as "hardware", the PCB also instituted several programmes, the "software", to attract companies to the centre. The PCB launched two of their most important initiatives during two time periods, 2002-2006 and 2007-2014, when the cluster was still not mature yet, and incubation initiatives were extremely necessary: two bio-incubators. We define a bio-incubator as a physical place where companies who are established in the area have access to all scientific services offered by the park at a discount rate. To bridge the gap between the price charged to the bio-incubated companies and the real price, two agreements were signed with two different institutions, respectively.

The bio-incubated companies had to have been established fewer than 2 years prior. Entrepreneur projects were not allowed if the company had not previously been established. Companies were prioritised by a steering committee according to their focus and how they fit and would use park services.

The first agreement for the 2002-2006 bio-incubator was signed with the *Generalitat de Catalunya*. Five companies were involved during this period: Oryzon Genomics, a company that is now publicly listed; CrystaX Pharmaceuticals, sold to Oryzon Genomics for more than €50 million; Era Biotech, a company acquired by BioNaturis, which is also publicly listed; Enantia, a leader in synthetic chemistry with more than 80 employees; and Oleoyl-Estrone Developments OED, which went into bankruptcy and no longer exists.

For the second bio-incubator period, an agreement was signed with a private sponsor, Banco de Santander, benefitting 25 companies, including: StatDx, recently sold for €154 million; Intelligent Pharma, recently sold for several million euros; SOM Biotech, which has raised approximately €15 million in public and private funding; and Bionure, a world leader in multiple sclerosis treatment. In 2011, the total combined revenue of the companies during the second bio-incubator was €4.7 million. €6.7 million was invested in R&D by 25 companies and 124 people were employed, 40% of whom held a PhD.

With the impulse from the two bio-incubators, the life sciences cluster started to grow, including more and more companies. Today the PCB and its facilities comprise 75 companies, 6 research centres and 2,700 people. The PCB acts as a core for private and public research in the life science cluster. No bio-incubation programme is currently being run by the PCB, but instead an acceleration programme specifically designed for medical device start-ups, as their field needs an impulse in the region.

In conclusion, the PCB has been built and developed as a central research infrastructure that acts as a central core for Catalan life sciences. The emergence of an internationally-recognised cluster would have been very difficult without an infrastructure like the PCB.

Conclusions and lessons learned

In this article, we have summarised the public policies implemented by the regional government to re-build a historically strong cluster which was going to disappear due to globalisation. Thanks to these public policies, the cluster comprises now 871 companies with a yearly turnover of €15.956 billion, employing 42,133 people, with a large number of entrepreneurial initiatives emerging every year; this is one of the world's leading life sciences clusters.

One key elements of these public policies was the creation of a science park that specialised in life sciences where many public and private initiatives in the field could cluster and be hosted. This self-sustainable central research infrastructure has contributed to the creation of one of the biggest biotechnological clusters of Europe by 1) offering shared scientific services; 2) bringing public research and centres closer to entrepreneurs; and 3) incubating entrepreneurial initiatives.

The ten main lessons learned are:

1. A park's efficiency and profitability is maximised if the park specialises. By specialising in life sciences, the park can focus all of its efforts and economic and human resource on acquiring the specialised equipment needed by companies and research centres, as well as on creating the services required by clients. For instance, the research focus for many clients at the park is the Drosophila melanogaster. Therefore, the park provides these clients with daily feeding services for the flies with a standardised cooking process. The park also provides periodic laboratory coat cleaning and disinfection of.
2. All individual services must be inherently self-sustainable by design. Only by achieving individual sustainability are services able to renew their equipment and keep it updated. If a service is not sustainable, the management normally does not prioritise the equipment renewal. Machinery soon becomes obsolete and the service produces a loss.
3. The biggest facilities of the park have to be operated via alliances or in consortium with other external entities. For instance, at the PCB, we operate a large animal facility with more than 20,000 mice. An alliance has been established with another local science park with similarly-sized animal facilities, so the synergy developed between the two entities is considerable. The same applies to our proteomic facilities, which are operate in conjunction with the proteomic facilities of a nearby hospital.
4. The implementation of new services required by clients or their removal when no longer of interest to clients by park management must be agile. In the past, the PCB had many service platforms which were closed when the market lost interests, for instance, the nanotechnology platform or drug discovery platform. However, new platforms have been created, such as the medical device services being put into place.
5. Multiple services can be operated either directly or in collaboration with clients. In line with this idea, the PCB provides 26 scientific services to its staff, but, in total, more than 50 services in life sciences are provided by the PCB community.
6. Service competition with local companies must be avoided. Local or national companies may start providing services already provided by the park. In such cases, the services provided by the park have to be shut down, especially if they are not self-sustainable. The public initiative perform equal to the private offering. While they may be a bit better or a bit worse, they must cover gaps that the private offering is not providing.
7. The services operated by the park have to be focussed on scientific services, and not on other kind of services that may be also needed by the community and the clients, such as restaurants, cleaning, security, shops or parking. These services should be outsourced to specialised companies that can operate such services better than the park staff can.
8. One form of intangible added value of a science park is community management and community dynamisation. We organise hundreds of networking events every year, provide multiple networking areas, and work on putting companies that may be interested on contacting other institutions located at the science park in contact. In this sense, the park works to attract multiple local and national events to the science park. The clients feel that the park is the centre of the cluster because the majority of the local events related to life sciences happen at the facilities.
9. The park has hosted local stakeholders in life sciences, including national and European agencies and company and research centre unions. This fact contributes to the perception of the park as the centre of the local cluster.
10. The general public must be aware of the importance of the science park, not just companies and institutions in the field. For this reason, our science park has included a

strong communications department that works for clients for free, meaning it is included in the rent for clients who wish to communicate significant news or significant scientific achievements to the mass media.

[i] There were two notable, but late, exceptions to this exclusion. One is the Cusi-Alcon merger in 1995, which created the Alcon-Cusí corporation, which was later acquired by Novartis. The second is the merger between Almirall and Prodesfarma in 1997.

[ii] Of the sixteen scientific and technological parks built in Catalonia, three are exclusively focused on biotechnology. Of the rest, five are partially-oriented to life sciences.