# Science and technology parks. Creating new environments favourable to innovation

PERE CONDOM VILÀ
JOSEP LLACH PAGÈS

A science park has two main objectives. The first is to act as a catalyst for regional economic development, while the second relates to facilitating the creation and development of new technology-based companies and knowledge transfer from universities to companies.

# Parks as a concept

## Historical development

Science parks are an evolution of industrial concentrations started in Britain in the wake of industrial revolution. An example of such concentrations is Trafford Park Industrial Estate in Manchester, connected with the sea through a canal during years. This area was the largest industrial area of the world in the early 20th century and its activity reached its peak during World War II. Its relevance only declined during the industrial crisis of the 1970s, although it seems to come to new life now.

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On the other side of the Atlantic, the concept of industrial concentration was quickly taken over. The first industrial park or district in the United States was the Central Manufacturing District in Chicago, created in 1905. The idea of concentrating companies in one single area became increasingly important there in the mid-20th century, during World War II. Shortly after, American companies, aware that science had made a vital contribution to victory (atomic energy, radar, aeronautical developments etc.), approached universities. This is how the first science parks came about around Stanford University in California – Menlo Park and Stanford Science Park, both created towards 1950. New proposals soon came up all over the United States.

In Europe this phenomenon took long to grip – to be precise, almost twenty years. In the late 1960s, some universities in the United Kingdom, such as Cranfield and Cambridge, took action along these lines. In the first years, the growth and impact of parks was weak. Nevertheless, in the 1980s, the British government asked universities to be more geared and close to the industry. This pressure led to a second wave of parks. Growth continued during the 1990s and by then, more than half the universities already had some kind of agreement or collaboration with science parks. In France, the most significant is Sofia-Antipolis, created around 1970. The first parks in Italy and Germany started in the early 1980s, concretely the Area Science Park in Trieste and the Technologiepark in Heidelberg.

In Spain, the concept did not arrive until the second half of the 1980s. The first initiative was the Bilbao Technology Park, created in 1985. By 1992 eight technology parks had come up in Spain, among which the Vallès Technology Park. Differently from other European countries, the first parks in Spain were not created out of universities. It was not until the 1990s that academic institutions showed a clear interest for this matter, with a wave of initiatives coming after 1996, when the Barcelona Science Park was created. In 2006, the Association of Spanish Science and Technology Parks (APTE) included 24 registered parks that encompassed about 2600 companies, with a turnover of 9 billion euros and 79,000 employees, of which 12,000 did R&D tasks. The number of projects soared in the current decade.[1]

## Park models

Park models are as diverse as individual initiatives carried out. In any case, they all have a general reference framework provided by the different park associations: the International Association of Science Parks (IASP), the Spanish Association of Science and Technology Parks (APTE) and the Catalan Network of Science and Technology Parks (XPCAT). According to the IASP, «a Science Park is an organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institu-

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tions. To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities.»

We distinguish between Science Parks and Research Parks. While the former denomination is the most common in Europe, the latter is widely used in the United States and Canada. Further, science parks in Europe coexist with technology parks. There are not great differences between both concepts. The main ones probably refer to the size or the possible admission of productive activity. While a science park is of reduced size, with strong links to university and little emphasis on manufacturing activities, a technology park is medium-sized or big and allows for productive activities. From a geographical point of view, science parks are mainly located in the United Kingdom («British model»), while technology parks refer to the «Mediterranean model», typical of countries like France, Spain, Italy and Portugal.


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Apart from these two better known models, there are other similar concepts like Technopole, Business Park, Innovation Centre, Science City and Innovation Business Park.

## Main goal of parks

A science park has two main objectives. The first is to act as a catalyst for regional economic development, while the second relates to facilitating the creation and development of new technology-based companies and knowledge transfer from universities to companies. According to some authors, a science park is commonly defined as a tool aimed at promoting industrial growth in terms of employment and production. Nevertheless, they consider that this definition must not conceal the fact that a park is a high-tech business area deliberately set up by governmental initiative or related with universities. It can therefore be said that the immediate goal of a park is to facilitate business development with the final aim of promoting regional development. However, a science park should obviously not be the only player in a regional innovation strategy.

Other perspectives point out that a park is promoted on a given territory because of three reasons. Firstly, a region may look for reindustrialisation and try to replace jobs in declining traditional industries by jobs in new hi-tech sectors. The second reason is involving the region itself in these new, fast growing industries. Such is the case of ICT and biotechnology, which are meant to improve the economic status of a region. Finally, a region may want to use a science park as a strategy to create synergies between different players.

## Main factors providing for the success of parks

There is a problem in trying to measure the success of a science or technology park: there is no clear consensus on the definition of such success. Some authors use financial criteria (investment, turnover etc.) while others take indicators related to innovation patterns (number of start-ups, patents, new products launched by incubated companies etc.).

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Further, each player directly involved in initiatives has developed a definition of their own. Besides, several errors may be made when measuring the effectiveness of a park. For instance, apart from not considering the viewpoint of each player, there is usually the belief that physical closeness between players is enough to reach the goals set for the initiative. Besides, the difference in park types is not considered either. American park managers measure their success with a set of factors including the generation of benefits (which is especially important for those parks following a real estate pattern), the contribution to local and regional economy and interaction with universities. All these factors are related to two specific

indicators: the number of settled companies and their headcount.

Although regional development is the ultimate goal of science parks, their contribution is in some cases unclear. For instance, there are assertions according to which direct contribution of European science parks to employment has been rather modest.[2] It is considered that scientific studies have tended towards focusing on success stories and set aside less successful cases.

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Nevertheless, each park has a different impact. The success of an initiative of this kind is hardly applicable to other cases. The economic structure of the region, the internal organisation of the park and the relations with local organisations, including local, regional and national government, universities and other research institutions are also to be taken into consideration.

In the United Kingdom, the UK Science Park Association (UKSPA) identifies six success factors: (1) accuracy and strict control over activities of park tenants, (2) accuracy in the design of buildings, use of soil and density, (3) professional and effective management, (4) participation of a university with a solid research base, (5) availability of supporting and financial services and (6) availability of incubation spaces.

Other sources also point out the importance of attracting driving, i.e. innovating and dynamic companies that drag other firms around them. A clear example is that of Hewlett Packard in Stanford Research Park. When it settled there in 1955, the park had five companies. By 1970 this number had grown to seventy and to over ninety by 1980. This process turned Stanford Research Park into now famous and much worshipped Silicon Valley.

## The role and challenges of science and technology parks in the Catalan innovation system

Generally speaking,[3] Catalan science and technology parks are very recent players in the innovation system. They are a powerful network built up in two waves distant in time (coincident with same trends in all Spain). In the first one, in the late 1980s, the idea of technology parks became consolidated in Spain. As a result of this, we have the Vallès Technology Park in Catalonia, created in 1987.

The second wave took place ten years later and led to the opening of science parks, a model closer to universities. The Barcelona Science Park, created in 1996, is its main landmark. After a two-year spell (2002-2003) without any new initiatives, several new projects are arising now.


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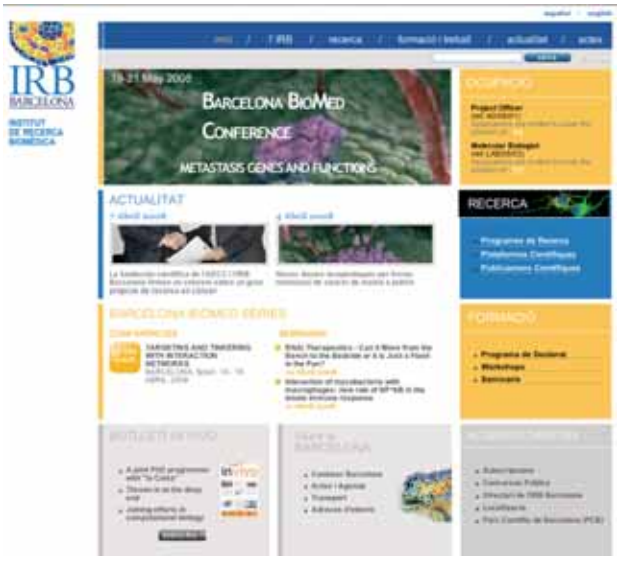
They are a reaction to the needs of promoting agents but also to the strong move by the Spanish Ministry of Education and Science for annual calls for R&D projects within this field.

The final result of this twenty-plus-year process are seventeen science and technology parks joined in the Catalan Network of Science and Technology Parks (XPCAT), which hosts and represents all of them, creating an orderly structure. This is a high figure, which suggests that our country is very active in using this sort of incentive for innovation and economic development. In the following we will summarise conceptually the role parks play in innovation systems and their main future challenges. The results are obviously also applicable to the role of Catalan parks in our innovation system.

▸ *A medium facilitating innovation.* Parks are catalytic agents. They form a medium facilitating innovation and the dissemination of knowledge thanks to their proximity. They are thus based on present players related to R&D and innovation (universities, research institutions and companies), high-quality infrastructures and advanced services, offering value and competitive advantages for their users in globalised markets. From this perspective, parks play a central role in the Catalan innovation system, pushing a new knowledge-based economy and improving the relation between all elements in the system.




▲ The final result of this process are seventeen science and technology parks.

## Parks are catalytic agents. They form a medium facilitating innovation and the dissemination of knowledge.

▸ *A set of simultaneous actions.* However, parks are the result of one action amidst many taken within a given environment – in this case, Catalonia – to compete in the knowledge economy. Concepts such as science cities and knowledge regions are clearly associated to parks. Their goal is to consolidate areas competing based on paradigms related to the new economy. All agents in this geographical area need to act in a coordinated way and with a wide range of simultaneous actions.

▸ *Interactivity.* Following this idea, the network model, the concept of «knowledge environment», is making its way through science and technology parks. It means the expansion of traditional science and technology parks towards a wider environment than their own borders, a very appropriate idea for regions wishing to change their competitiveness model. Interaction between all players leads to creative and innovative activity that clearly benefits the region.

▸ *Differentiation.* Each park needs to identify and specify its personality and strategy. In other settings, sectorial specialisation is a way of embodying this personality, of differentiation. Such a focus is not the general trend at our parks here in Catalonia. In any case, specialisation of parks is always based on heavily funded universities and research institutions, which has to do with R&D funding, a matter that is currently under discussion in Catalonia. Along the same lines, a park

needs to state if its main priority is the creation of a scientific climate intending to link up with the productive industry, if it is a centre mainly devoted to creating new knowledge-based companies, if it is giving priority to a wider concept such as innovation, etc. A park may of course decide to combine several of these concepts and follow them simultaneously, but the focus needs to be fully justified.

▸ *A park in an adequate industrial environment.* Technology transfer occurs mainly in industries and companies whose competitiveness is determined by innovation, more precisely in those where innovation is based on R&D. Given that a science park has by definition the mission of promoting technology transfer, it needs to attract companies able to relate to research institutions present in the park. Therefore, a park cannot include just any kind of company but it needs to be selective and demanding.

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▸ *Creating new companies vs. serving existing ones.* The promoters and managers of a park need to know what its goal and priority is. Has the park been created for regenerating the industrial environment or is it to serve current industrial structures by creating synergies among the players in the system? The park type and its action will differ considerably according to the focus. It seems advisable for a park located in an environment consisting of industries with a poor technology drive to focus on changing this environment, to build a new one competing in the new economy, in other words, to create new knowledge-based companies.

▸ *Space is not the key element.* Although a necessary variable, space must not be the key criterion for a science or technology park. This phenomenon has been termed by some authors as dematerialization: bricks and mortar lose their value. In this respect, parks will thus give ever less importance to physical space and more to synergies, the diversity of centres and value-added services instead. The latter issue, namely that of servces, is a key matter for Catalonia as it is an area in our innovation system that has not been very developed yet.


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▸ *Parks and services related to R&D, innovation and technology.* The managing bodies of parks do not necessarily need to take direct control of these value-added services. According to the networking model, it is not about replicating services but identifying, selecting and linking service suppliers with players in the park and assessing their contribution. At the same time, park managers need to identify uncovered needs. For instance, it is not easy to find specialised consultants in Catalonia for evaluating technologies, biotechnology patents or international technology business. From this perspective, Catalan parks need to contribute, through own creation or attraction, to developing this weak part of the Catalan innovation system, namely that of suppliers of services related to R&D, innovation and technology.

- *Brand.* Catalan parks, both individually and through XPCAT, need to push the «science park» brand to position it adequately on the market and make that all potential clients become aware of the opportunities parks offer for their business. In this respect, the value provided by parks for their tenants needs to be quantified. This would be the best tool for selling the brand.

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- *Intangibles.* The role of universities and the incubation function in the parks is to be strengthened. All this happens within a global context in the wake of ICT and a stronger presence of private initiative.

- *Involvement of the real estate sector.* The fact that space is of low interest as a competitive and differentiating variable for parks as well as the apparent need for financing actions justifies the involvement of private real estate business in developing initiatives. In other environments, parks leave the construction of buildings in private hands, but so do they also with real estate business related to offices and labs.

- *Park management.* Certain initiatives and literature suggest different factors that may hamper the development of a park in its initial stages, e.g. lack of professional management. In the same way the need for professionalisation and the creation of R&D management schools has been suggested for research management and technology transfer, authorities in charge of defining innovation policies should think about providing specific training for science park managers.

- *Participating in innovation policies.* In fact, parks in general need to assert their role in regional development and state this vision before authorities in charge of defining innovation and economic promotion policies.

**PERE CONDOM VILÀ**
Director of the Science and Technology Park of the University of Girona. A doctor in Industrial Engineering, he has taken part in several projects on innovation policies, technology transfer, science and technology parks and business creation.

**JOSEP LLACH PAGÈS**
Professor at the University of Girona.

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## Notes

1. Association of Spanish Science and Technology Parks (APTE).
2. STOREY; TETHER, 1998.
3. With the exception of the Vallès Technology Park.