Actualitat

Agenda | Notícies

Dimarts 22 d'abril del 2008. XIVè Forum d'Inversió

Organitzat per ACCIÓ / CIDEM/COPCA al Centre de Convencions Internacional de Barcelona.

Créixer en lideratge 2008

Ja podeu consultar el programa dels tallers internacionals sobre economia del coneixement organitzats per IntraSC i promoguts per la Fundació privada Centre per al Coneixement.

L'alcalde de Lisboa, Antonio Costa, visita 22@Barcelona

L'alcalde de Lisboa, Antonio Costa, ha visitat el districte 22@Barcelona per conèixer de prop els avenços d'aquest projecte urbanístic i econòmic de la ciutat de Barcelona.

Una empresa de Silicon Valley s'instal·la al 22@Barcelona

La multinacional nord-americana i europea de Silicon Valley, Elastix Corporation, és la primera empresa del Programa Landing que s'instal·la al districte 22@Barcelona.

19 abril de 2008. Jornada "Família, educació i noves tecnologies"

El taller, adreçat a les famílies dels centres d'educació primària i secundària, tractarà sobre les noves oportunitats que ens ofereix l'era digital per a la comunicació i la relació entre els nostres fills i filles.

22@Barcelona, protagonista de l'Executive Breakfast Seminar del Financial Times

Organitzat per Promoció Econòmica Internacional de l'Ajuntament de Barcelona i el Financial Times a la seu del prestigiós diari a Londres.

22@Update Breakfast del mes de març

El talent digital serà la clau per a adaptar-nos a una nova era en els mitjans.

Programa de co-acceleració empresarial

El Programa Landing impulsa un projecte de co-acceleració per fomentar la internacionalització d'empreses de Barcelona i Monterrey.

Catalonia and the link to the global innovation system

JOSEP M. PIQUÉ
JOAN BELLAVISTA
M. CARMEN ADÁN

Knowledge is born, grown and used in environments fostering adequate conditions for developing such processes. What has been interpreted during years as a compelling need for development has now become an indispensable element for the future. The focal points of economic dynamism and innovation are moving at a high speed and struggle for attracting the best global talent.

Knowledge-based economy. Talent as a key player

Knowledge has become the key factor to economic and social development. It is commonly accepted that new technologies can expand the benefits of knowledge to all segments of society and reduce the gap of life quality between its citizens. Those countries able to manage a shift towards a knowledge-based economy, taking advantage of the increasing and sustained wave of technological innovation, will have better chances of being competitive on the global markets.

Knowledge is born, grown and used in environments fostering adequate conditions for developing such processes. What has been interpreted during years as a compelling need for development has now become an indispensable element for the future. The focal points of economic dynamism and innovation are moving at a high speed and struggle for attracting the best global talent. T-Economy has territories competing to offer the best ecosystems to those looking for a place to develop their projects. Those countries and cities creating the best conditions for developing talent will be in a better position to develop the knowledge economy and society.

New technologies can expand the benefits of knowledge to all segments of society.

The development of policies acting adequately on the key points of the innovation value chain (science-technology-industry-market) and policies to attract, retain and create talent can maximise the assets of a country. Giving value to the scientific knowledge stock developed by universities and research institutions, giving support to interfaces between science and business, developing programmes addressed at people to develop talent, providing companies with resources to innovate and compete under better conditions and including sophisticated local demand as a competitive variable of the territory are some actions to be taken. In this respect, it is important to point out the need to network in collaboration between public institutions and private organisations under a rationale of creating and growing with a global mindset. At the same time, we need to place our innovation system in global networks to provide companies and organisations with global externalities facilitating development. Science, technology, talent, financing, suppliers, partners and clients become global in both their origin and destination.

Innovation systems. Developing global connectors.

There are four models especially important to the study of knowledge-based innovation systems:

- Model 2 by M. Gibbons (1994), explaining the systems to produce heterogeneous and multidisciplinary knowledge

- Models based on the innovative milieu of P. Aydalot (1986), developed by the members of GREMI, among which R. Camagni, J. Perrin and R. Ratti

- National and regional innovation systems theorised by C. Freeman (1998), A. Lundvall (1988) and R. Nelson (1993), focusing on the role of the industry and public administration and the capacity of a territory to develop an innovation system of its own

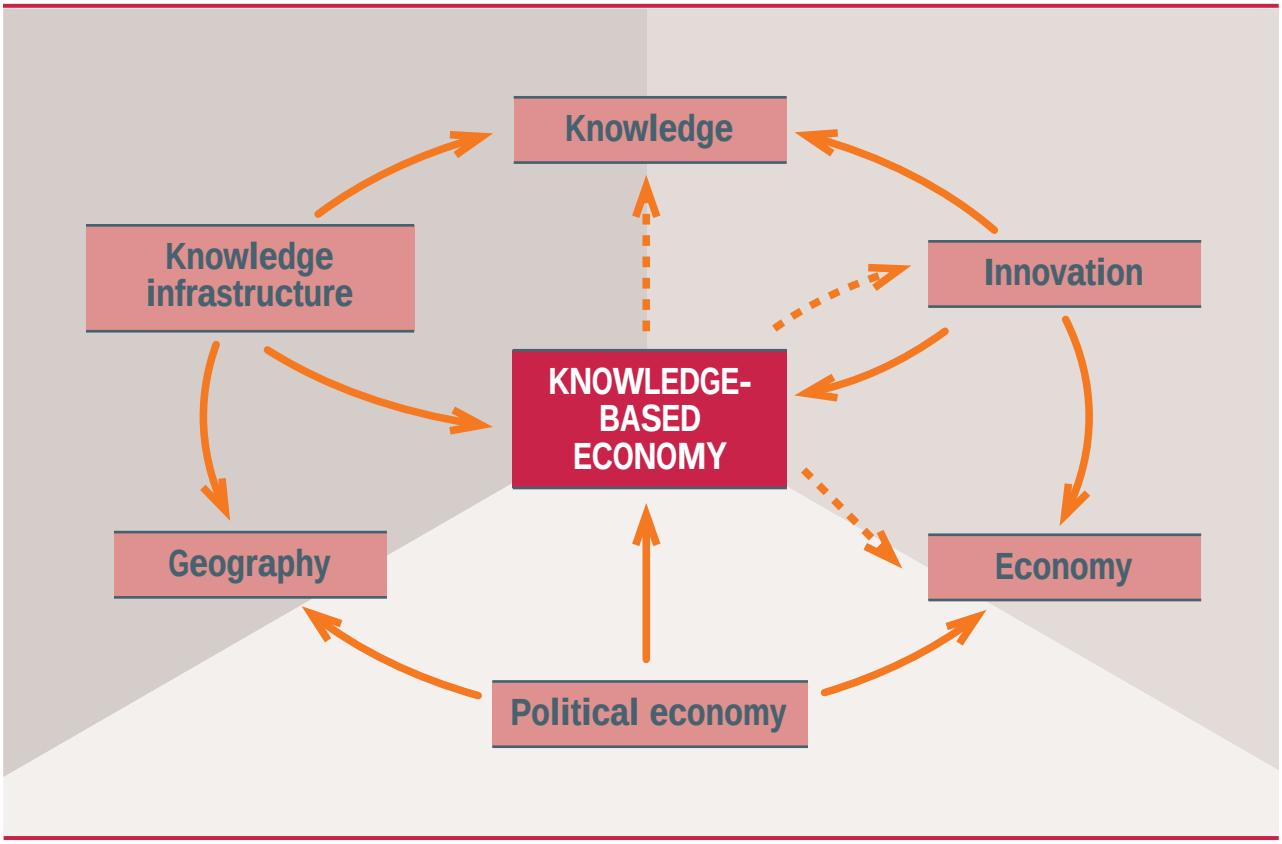
- The triple helix model, analysing and incorporating the system of relations between the different players (university, industry and government) proposed by Henry Etzkowitz and Loet Leydesdorff (2000)

These models could be completed by those related to territorial organisation such as the Italian school of industrial districts and those developed around

Porter's clusters, which despite not being originally conceived for an economic framework of technological change, cannot set aside the increasing importance of science and technology systems to explain the territorial economic element and its fitting into global value chains.

Their contributions can be summarised in the recognition of the importance of supporting spaces and the organisation of players in the territory for the competitiveness of its production system. Understanding supporting spaces as the set of formal and informal organisations contributing to the competitiveness of companies, and organisation as the set of networks or channels to spread knowledge and information linking the players participating in economic activity, we will conclude that what we are talking about is the capacity to produce externalities on behalf of the players in the territory for their use by the production system. Progress will depend on the quality of this capacity. It is not only about enlarging and improving the technological capacity of the production system or the science and technology stock and capacity of professors and researchers, but also about increasing progressively the complexity of internal relation channels and the link between all players as a whole so the production system receives all relevant knowledge to take decisions. The search for this complexity often requires the creation of

Chart 1. **Triple helix model**



Font: Leydesdorff, L.; Meyer, M. (2003). «The Triple Helix of University-Industry-Government Relations». Scientometrics, 58 (2), p. 200.

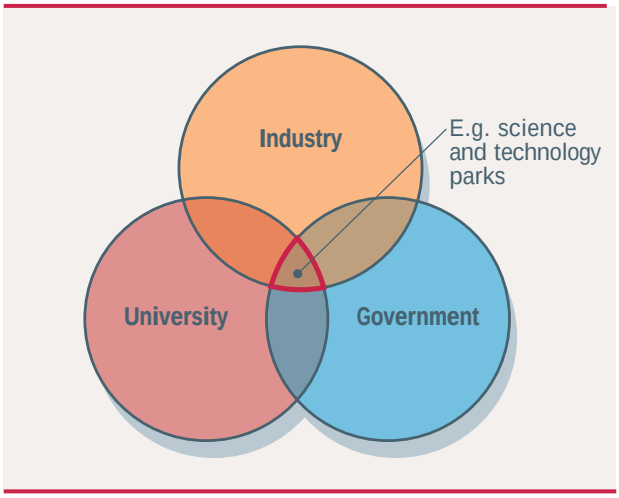
▲ According to the triple helix model, an innovation system is made of universities and research and technology institutes, public administration and of course companies.

new pieces and functions within the system. This capacity to transform characterises innovative systems.

Science, technology, industry and market can be local and global, either as a whole or individually. The challenge to the innovation system is to ensure both local and global flows.

According to the triple helix model,[1] an innovation system is made of universities and research and technology institutes, public administration (local, regional, national and international) and of course companies (big, SMEs and new ones). To complete the Triple Helix[2], the market (demand) and financing systems (both public and private) are to be added. The model helps to explain the role of new hybrid organisations resulting from the contributions of the three players, such as science and technology parks, business incubators and venture capital sources.

Chart 2. **Triple helix model**



Source: Own research based on the triple helix model

▲ The model helps to explain the role of resulting new hybrid organisations, such as science and technology parks.

This model leaves open the cross-connection between the local triple helix and the global system. In this respect, proposals such as the World Innovation Network[3] (an international network of incubators) express the need for a systemic connection between such local and remote innovation systems in order to provide global externalities to companies and organisations.

The science-technology-industry-market system: a local or global value chain?

An active science-technology-industry-market system ensures an adequate flow of the knowledge value chain. The roles of the different players in the system are thus adapted to maximise their contribution to the development of the knowledge-based and driven innovation system.

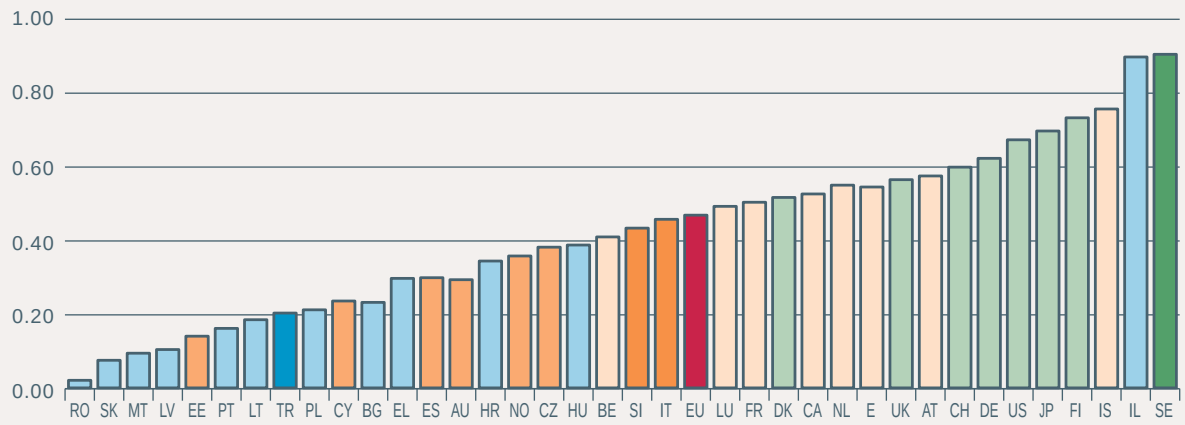
Thus, new supporting and interface units and functions appear and disappear. Science, technology, industry and market can be local and global, either as a whole or individually. The challenge to the innovation system is to ensure both local and global flows.

The most advanced economies devote large amounts of funds to R&D with the aim of sustaining and increasing the competitiveness of their production system. Science and technology capital and the innovation capacity of a territorial system cannot be improvised. The Innovation Scoreboard[4] puts together public and private R&D expenditure as well as business R&D expenditure at universities under the Knowledge Creation chapter. Although its ability to explain the functioning of the system is rather modest, it does offer quite a correct view of inputs, the effects on output from the «black box» and some mechanisms Nathan Rosenberg (1982) called Inside the Black Box.

R&D expenditure also represents an indicator for the complexity of the system. The cut between

public and private efforts is probably one of the parameters explaining best the capacity to integrate the production system and the supporting space. When business participation is modest and public one high, we interpret that companies in the production system do not probably have any

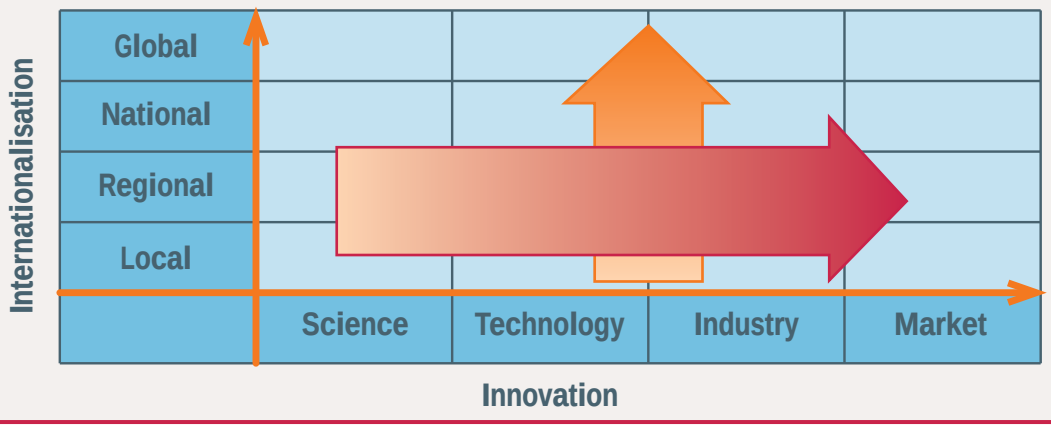
Chart 3. Knowledge creation



Source: European Innovation Scoreboard, 2007

▲ The Innovation Scoreboard puts together public and private R&D expenditure as well as business R&D expenditure at universities under the Knowledge Creation chapter.

Chart 4. Innovation and internationalisation



Source: own research

▲ A given scientific and technological knowledge generated by research centres would be absorbed more effectively by international markets. This requires mechanisms to internationalise technology.

formal R&D department or a poor capacity to absorb relevant scientific and technological knowledge, or both.

From another perspective, a given scientific and technological knowledge generated by research centres would be absorbed more effectively by international markets. This requires mechanisms to internationalise technology.

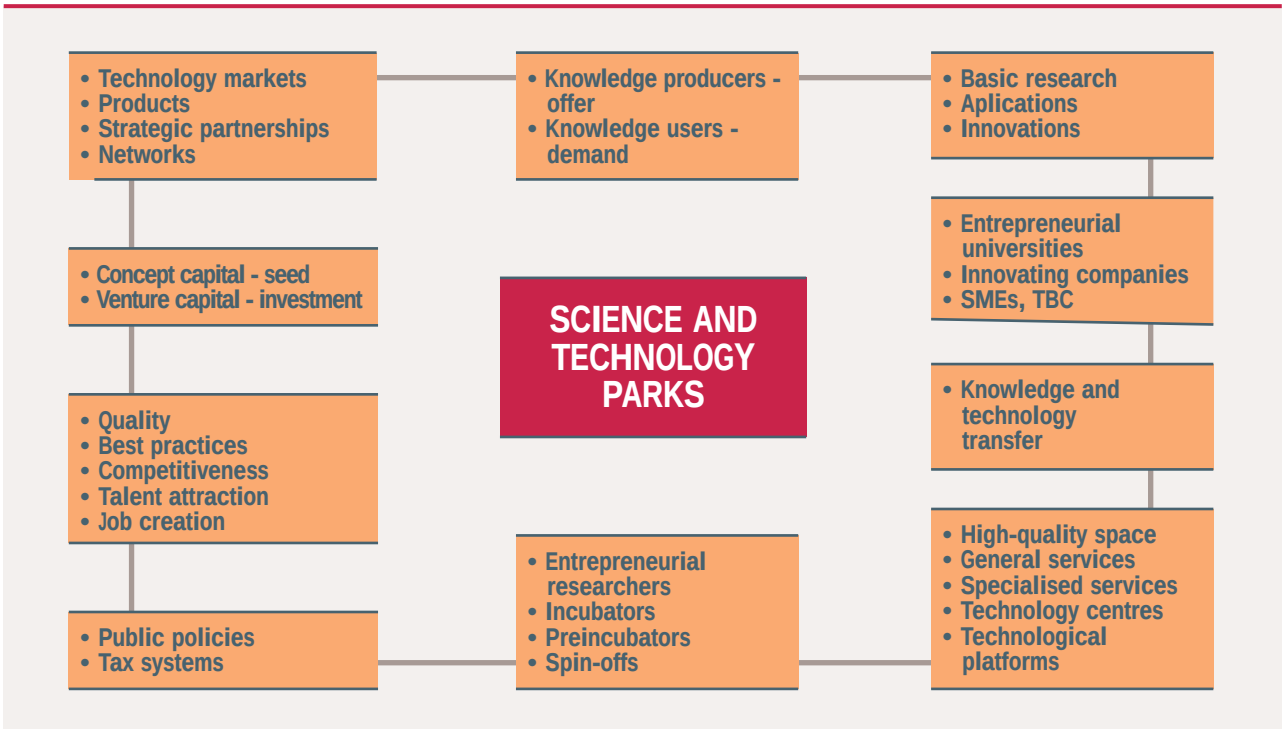
The most critical point in the value chain are precisely the transducers or mechanisms of contact between the different parts of the chain and of course the availability of players to assume this role. The development of connectors and cultural change would ensure the synapsis of the system.

Universities and science and technology parks: global network players

Modern science is global by definition. Research groups validate their contributions to the scientific community and disseminate results all over the world. This kind of knowledge is born global. Scientific communities settle in each knowledge area by means of global networks, each with its own methods and interests, not always considering their link to the production system. It is a world of papers, journals, lectures and congresses. The connection, i.e. valorisation in the widest

Chart 5. **Science and technology park networks at the heart of the innovation system**

Professional and specialised management of all elements to the system



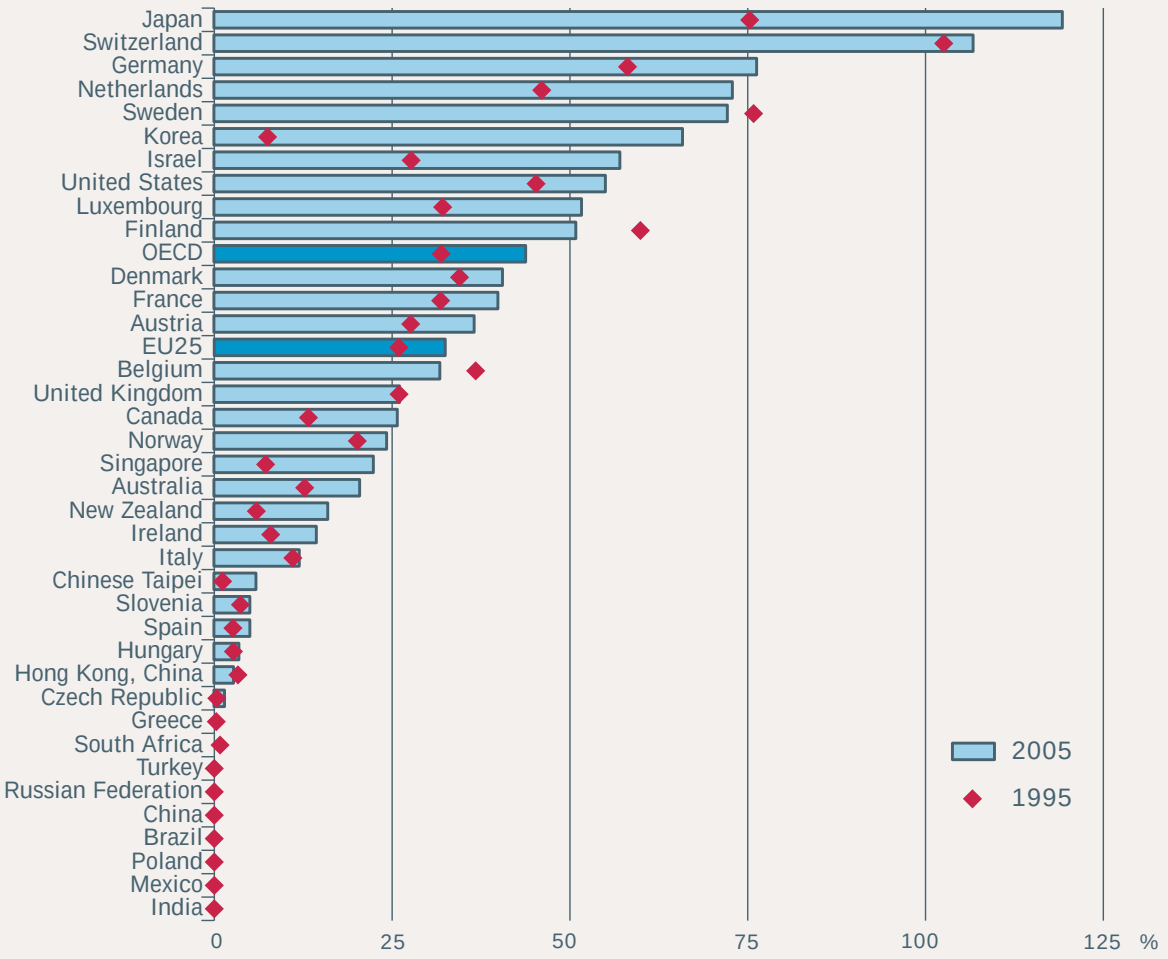
Source: Adapted from BELLAVISTA, J. *(2005). «¿Por qué debemos apoyar el desarrollo de los parques científicos y tecnológicos en España?». APTE- Tecno, 10.*

▲ Research groups validate their contributions to the scientific community and disseminate results all over the world.

sense of such research, and transfer as one of its modes, needs to be promoted and ensured through other patterns. In Spain, and Catalonia is no exception here, the inclusion of university staff into the publication and congress landscape has experienced a remarkable development, having reached 3.1% of worldwide scientific production in 2006.[5]

The OTRI have played a key role in monitoring and consolidating technology transfer from universities to the industry. However, the challenges of marketing international technology following the model of the Stanford Research Institute or the commercial use of licences according to the OTL model at Stanford leave room for increasing international activity.

Chart 6. Triadic patents per million inhabitants of population, 2005



Source: OECD Science, Technology and Industry Scoreboard, 2007

▲ A key indicator of the intention to use inventions worldwide are triadic patents (joint protection in Europe, the United States and Japan).

Also, the creation of technology-based companies coming from the university system has experienced substantial change. The CIDEM policies, developing the University Trampoline Network, have resulted in a strong increase of the number of created companies. Their potential lies in growth and the ability to take on global markets with highly competitive science and technology.

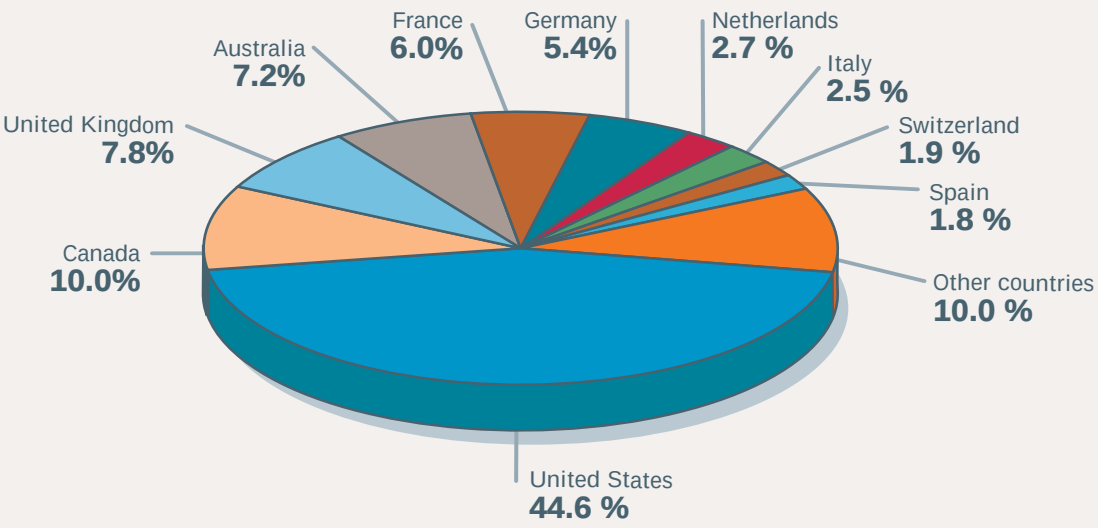
The university system has assumed its third function through science and technology parks.

The university system has assumed its third function through science and technology parks, creating them as interfaces between universities and the industry. Their challenge are external systemic relations and the link with the global innovation system. In Catalonia, parks have been created with an international relational strategy although their immediate impact is local. The different models that have appeared complete each other, working as a Catalan network of parks (XPCAT), thus having all elements required for a research and innovation system: creation and use of knowledge, infrastructures, services, institutions, capital and market.

This strategy of a local network projected on the global scene takes advantage of the links set up in the last years with the International Association of Science Parks (IASP) and its Spanish counterpart (APTE). Parks and their networks have a high capacity of conveying the strategic relevance of public R&D&I policies, of creating and growing technology-based companies and of having infrastructures and services the system needs to position itself in the knowledge economy and society. The International Conference of Science and Technology Parks held in Barcelona in 2007 proves the relevance and international attention Catalan parks have earned in the last years as well as their potential as a tool for the future.

Chart 7. International mobility of high skilled

Share of employed professional and technical migrants to OECD countries, by country of residence, 2000 or 2001



Source: OCDE Science, Technology and Industry Scoreboard, 2007

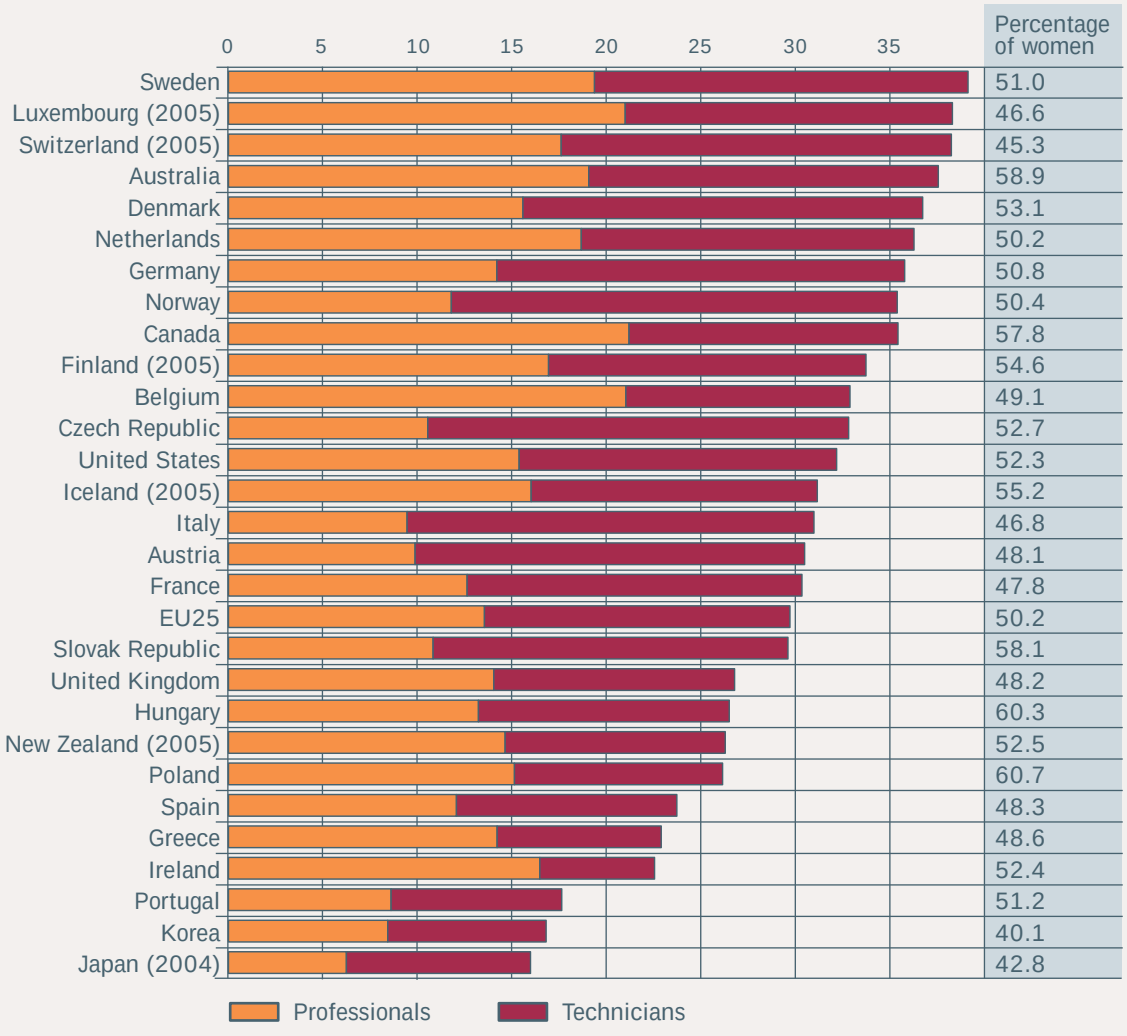
▲ International mobility is still low. We are far from countries like the United States, Canada, the United Kingdom and Australia as to attracting highly skilled workers.

The business base: clusters competing globally

Companies need to innovate and therefore develop mechanisms to manage their strategic and operative innovation. Such innovation needs to have an impact on the financial statement, either in innovation, processes, products or all of them. As valorisation of knowledge becomes systematised, a company can incorporate competitive advantages by protecting intellectual property. A key indicator of the intention to use inventions worldwide are triadic patents (joint protection in Europe, the

Chart 8. HRST occupations, 2006

As a percentage of total employment

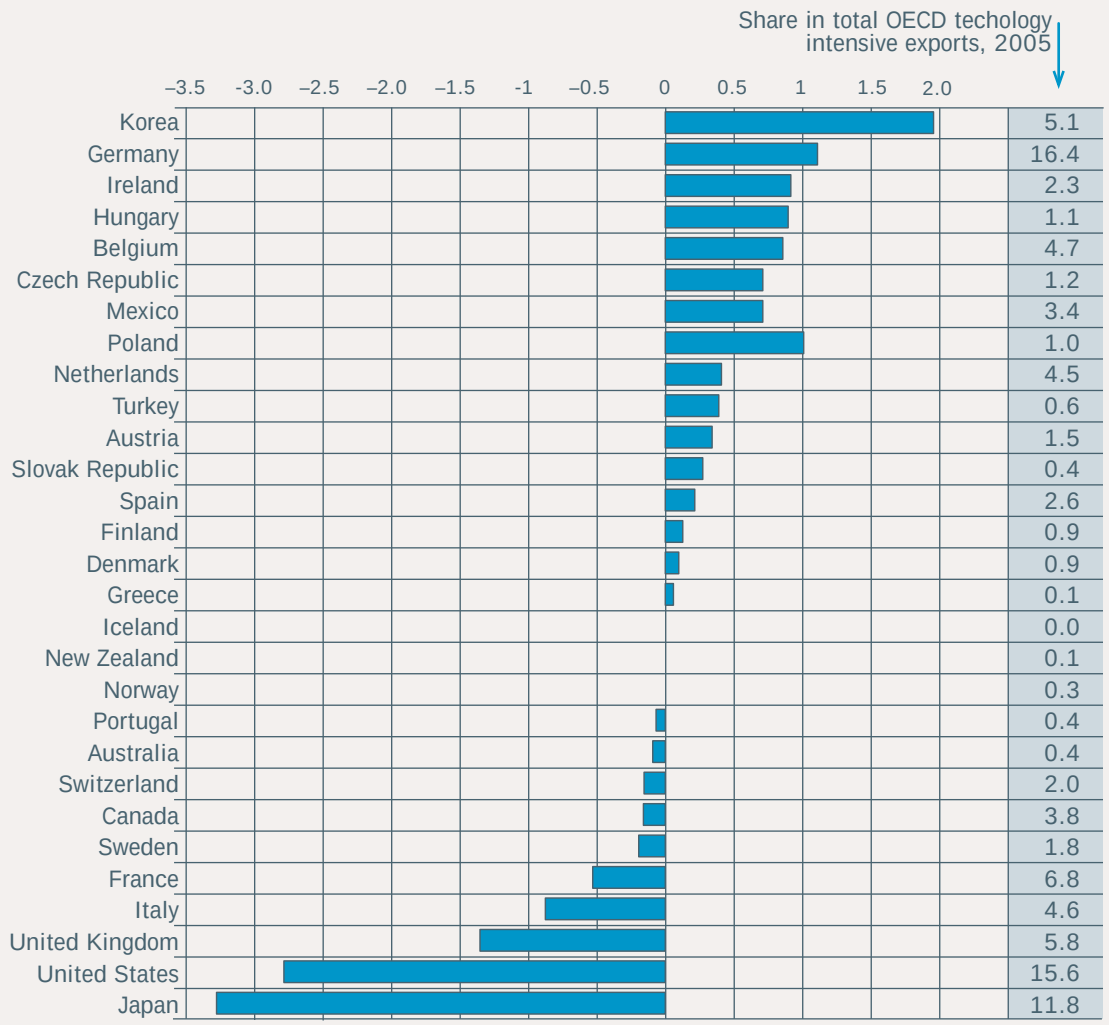


Source: OCDE Science, Technology and Industry Scoreboard, 2007

▲ A bit over 20% of overall workforce in Spain are qualified workers with a higher education degree or employed in science and technology, half the figure of countries such as Sweden and Luxembourg.

Chart 9. Share in total OECD high- and medium-high technology exports

Percentage change in shares of exports over 1996-2005



Source: OECD Science, Technology and Industry Scoreboard, 2007

▲ Big corporations, SMEs and new technology-based companies need to create conglomerates to innovate, compete and offer mutual support at a global level.

United States and Japan). Companies do their activity according to their competencies and the markets they serve. Shifts in the global economic structure increase the opportunities for internationalisation of companies (speed and efficiency of international communications and transport, increasing homogenisation of markets, rise of international financing opportunities and increase of international human capital mobility[6]). Nevertheless, international mobility is still low. We are far from countries like the United States, Canada, the United Kingdom and Australia as to attracting highly skilled workers. Only 1.8% of migrant qualified labour live in Spain. Besides, considering that

the main support for knowledge-based economies is human capital in science and technology, figures are not much better. Around 20% of overall workforce are qualified workers with a higher education degree or employed in science and technology, half the figure of countries such as Sweden, Luxembourg, Switzerland, Australia and Germany, ranging at about 40%. Despite this gap, the increase of this labour group has been the highest of all OECD countries in the last ten years at 7%, much above Germany, the United Kingdom, the United States and Korea. However, global markets and resources need to be used and R&D valorisation incorporated to contribute to exports.

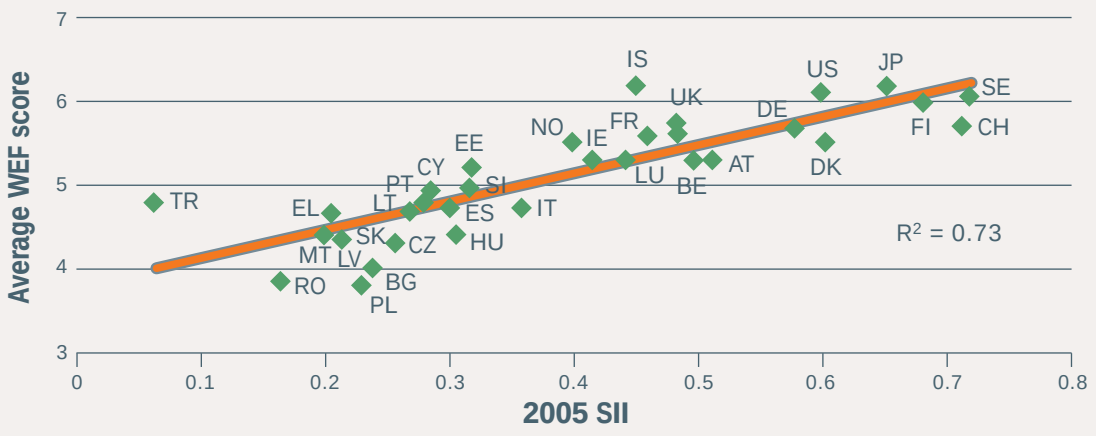
In this respect, the cluster policy developed in Catalonia over different periods expresses the capacity to join different elements of one same value chain with the aim of sharing views, serving international markets by developing a critical mass and following common marketing strategies that strengthen all members of clusters. Such clusters include universities, technology centres and specialised incubators to compete internationally.

Big corporations, SMEs and new technology-based companies need to create conglomerates to innovate, compete and offer mutual support at a global level. Big corporations need to use the SME network to include the acquisition of new technology-based companies as a mechanism of managing corporate venturing. New companies need to take advantage of those having already gone international to implement leveraging strategies in their own internationalisation process.

Markets: from local learning to global competitiveness

The market closes the value chain and justifies economic activity. According to Porter, as a market be-

Chart 10. **Correlation between the WEF indicator for sophisticated demand from local buyers and the 2005 SII**

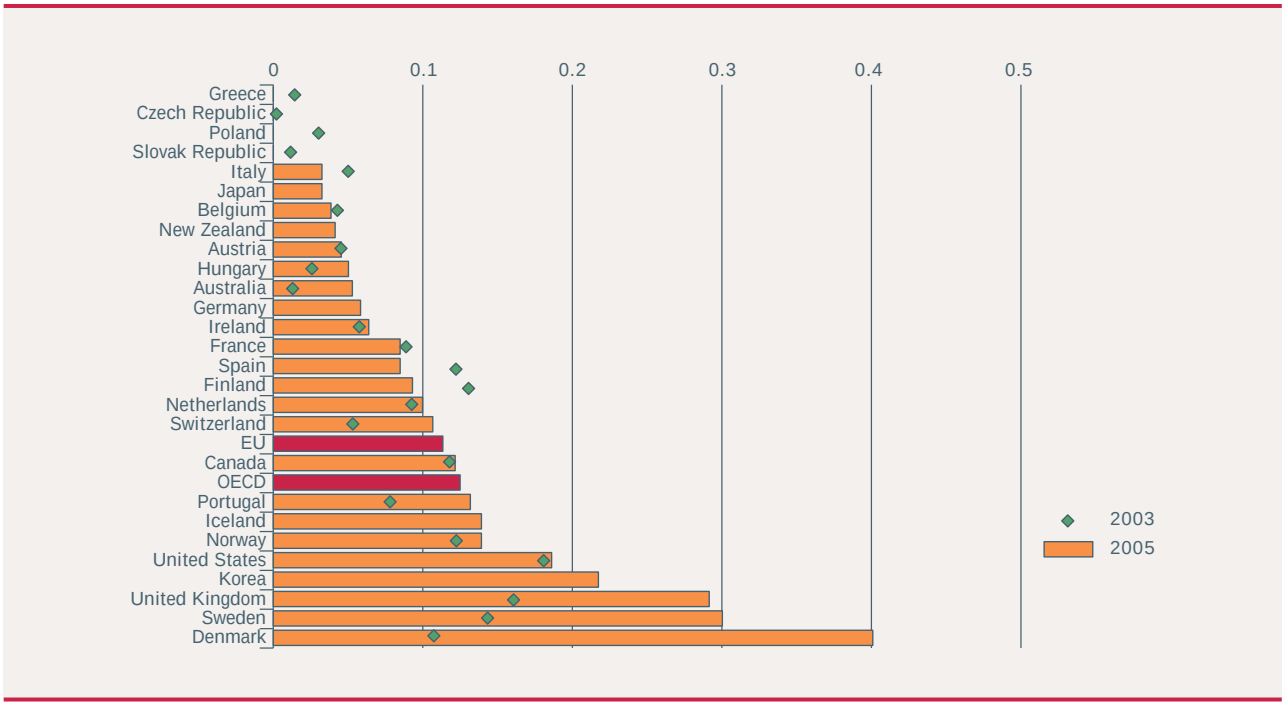


Source: 2006 Trend Chart Methodology Report. Searching the forest for the trees: «Missing» indicators of innovation

▲ The graph relates the Summary Innovation Index (SII) results of the 2005 European Innovation Scoreboard (EIS) with the data related to sophisticated demand by local buyers from the World Economic Forum (WEF) 2005 Global Competitiveness Report.

Chart 11. 2003-05 trends in venture capital investment

As a percentage of GDP



Source: OECD Science, Technology and Industry Scoreboard, 2007

▲ Private financing modes (business angels, venture capital and corporate venturing) are a sign of maturity of an ecosystem. Both models need to complete and support each other.

comes sophisticated it also becomes a competitive variable and a driver for innovation given that the local market is a learning one and a reference to the rest of markets. Fostering first experiences and golden references paves the way for implementing innovations. Local markets need to become learning markets and true innovation laboratories.

The European Innovation Scoreboard (EIS 2007) includes demand conditions as a key element to implement innovation. In this respect, sophisticated and public acquisition are two tools having a direct impact on the creation and application of new knowledge and also on the development of new business initiatives. The previous European Innovation Scoreboard (EIS 2006) already included the indicator for sophisticated demand. A graph is shown relating the Summary Innovation Index (SII) results of the 2005 EIS with the data related to sophisticated demand by local buyers from the World Economic Forum 2005 Global Competitiveness Report.

Public administration can become a sophisticated market by making use of its great acquisition capacity. Areas such as health, security, education, media, culture, housing and environment can act as drivers and clusterisers of economic activity in a country. Already existing markets must not be forgotten either. It is on them where Catalan industry will need to ensure its competitiveness by means of continuous innovation. In a globalised economy, serving global markets has to be a maxim. Global externalities such as international platforms or incubators serving the industry ensure a quick capture of economic value.

Financing: ways of growing to enter global markets

Public and private financing modes with international connections need to be found to ensure the development of business initiatives in the different stages of growth. The systemic creation of public financing models, innovation risk financing and the creation of new technology-based companies can produce a multiplying effect on the implementation of business innovations, their growth and the creation of new born global companies. Private financing modes (business angels, venture capital and corporate venturing) are a sign of maturity of an ecosystem. Both models need to complete and support each other.

Public administration: governance of the innovation system

The creation of an ecosystem encouraging innovation for the sake of economic competitiveness needs to be a main focus of public policies. Identifying and giving priority to strategic industries, reference technologies and projects bringing together all players in the innovation system is paramount.

The implementation of public policies and strategies shared with universities and companies to foster poles of reference, the clusterisation of sectors and the internationalisation of companies are some examples of such action.

Public administration can act on the knowledge value chain, from financing basic research to conversion into sophisticated demand. It can also intervene in any stage or transducer linking the different parts of the chain. Related to the triple helix, public administration also plays an active role in creating new hybrid organisations such as science and technology parks.

At local, regional, national and European level, public administration needs to act in a coordinated way to add to existing functions and ensure the consistency of current policies. Universities and the industry need an administration integrating science and technology infrastructure into the production system.[7]

Administrations, universities and companies from different territories can create stable frameworks to foster economic and academic cross-relations. The creation of internationalisation platforms links innovation systems with each other and fosters cross-relations between remote companies and universities.

Conclusions: Catalonia linked to the global innovation system

Only a global approach allows to take on the knowledge economy. It is therefore necessary to act on the different aspects of the global innovation system and develop adequate policies maximising the potentialities of the science-technology-industry-market system, all this with a good use of connectors, talent, financing, the value chain, governance and players participating and competing.

Science and technology parks play a key role in the internationalisation of innovation systems, becoming growth factories for new local companies and landing factories for global companies willing to connect with innovation systems in the park. In this respect, science and technology parks act as connectors between the local innovation system and remote ones, as show the cases of Finland, Quebec and many Asian and Southeast Asian countries. The inclusion of success stories into the Catalan park system and the focus on the strategy of connecting in local and international park networks have turned it into a crucial tool for Catalonia's position within global innovation networks.

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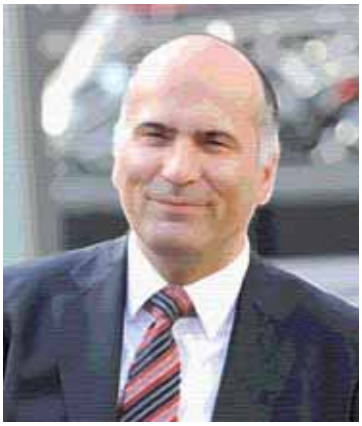
President of the Catalan Network of Science and Technology Parks and vice-president of APTE (Spanish Association of Science and Technology Parks).

His activity is focused on promoting knowledge economy and city to consolidate 22@ as a global innovation node.



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Technical assistant at XPCAT.

Notes

1. 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*, vol. 29 (2), February 2000

2. Piqué, J. M.; González, S.; Bellavista, J.; Alves, V. (2005). *Science and Technology Parks and Universities in the Incubation System of Technology-based Companies: Contribution from the Triple Helix Model*. Turin: V Triple Helix Conference.

3. Etzkowitz, H.; Solé, F.; Piqué, J. M. (2006). *Creation of Born Global Companies within the Science Cities*. Helsinki: XXIII IASP World Conference on Science and Technology Parks.

4. EU (2007). *European Innovation Scoreboard*. PRO INNO Europe: INNO-Metrics.

5. INE (2006). *Estadísticas de I+D. Indicadores de Ciencia y Tecnología*.

6. Oviatt B. M.; McDougall, P. P. (1994). «Toward a theory of international new ventures». *Journal of International Business Studies*, 25 (1).

7. Etzkowitz, H.; Webster, A.; Gebhardt, C.; Terra, B. R. C. (2000). «The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm», *Research Policy*, 29, p. 313-330.