

# SCIENCE PARKS AND BUSINESS INCUBATORS: THE PORTUGUESE CASE

**Tiago Ratinho, M.Sc. Student**  
Technical Superior Institute, Technical University of Lisbon  
(tiagoratinho@ist.utl.pt)

**Elsa Henriques, Auxiliary Professor, PhD**  
Technical Superior Institute, Technical University of Lisbon  
(elsa.h@ist.utl.pt)

**Luís Maltez, President of TECPARQUES – Portuguese Association of Science  
Parks, Associate Professor, MSc, PhD**  
Technical Superior Institute, Technical University of Lisbon  
(lmaltez@ist.utl.pt)

## EXECUTIVE SUMMARY

Science Parks (SP) and Business Incubators (BI) have been established all over the industrialised and developing world as a pledge for economic development. Although in economic theory, location of R&D is not a critical variable for its diffusion and technology adoption, it is widely accepted that the daily eye-to-eye contact is crucial for the establishment of networks and partnerships.

The present paper is based on a survey of all Portuguese SPs and BIs. Despite being rather similar in their basic characteristics, it is still possible to distil some lessons and critical variables for the success of each infrastructure: *quality of management* and *effectiveness of university links* are seemingly the most important features to distinguish SPs and BIs and compare their performance.

Finally, we transform the distilled lessons in assessment criteria and propose a tentative typology to better describe and sort the SPs and BIs in Portugal.

## KEYWORDS

Science Parks, Business Incubators, Innovation Management, University-Industry Cooperation, Technology Transfer, Regional Development.

## ACKNOWLEDGEMENTS

This topic of research was triggered by an internship in the European Investment Bank (EIB), Luxembourg, to which the first author was invited to. We would like to thank all the people in the EIB that made my collaboration possible and also all the Science Parks', Business Incubators' and Tenant Companies' managers for their time and availability for data disclosure.

## INTRODUCTION

Science Parks (SP) and Business Incubators (BI) have been established all over the industrialised and developing world as a pledge for economic development. In pure economic theory, the location of R&D is not important for its diffusion and technology adoption. Yet daily share of space and eye-to-eye contact are definitely crucial for the establishment of networks and partnerships.

Much has been said about the effectiveness of such infrastructures in promoting innovation by facilitating networks of important actors of the system of innovation, e.g., universities and other institutions of R&D, companies, venture capital institutions, etc., typically present in the SP and BI (physically or as a partner) (see e.g. Fagerberg, 2005; Edquist, 2005). On the one hand, the combination of such institutions has a potential role in promoting innovation; on the other, the mechanisms that could enhance such promotion remain unclear.

Although normally property-based, definitions of both SPs and BIs focus more on services offered to tenants and other intangibles like visibility or promotion of an entrepreneurial milieu. SPs particularly have become an umbrella for several types of parks with rather different features, e.g., research parks, technology parks, industrial parks and technopoles (see Box 1). Nonetheless, the ultimate objective of any of these infrastructures remains intact: the promotion of technology transfer from centres of knowledge to companies and markets adding value to local, regional and national economies.

### **Box 1. Definitions of several types of Science Parks (adapted from Vanhoudt, 2006; Zhang, 2005; AURP, [www](http://www.aurp.be))**

**Research Parks** Property-based venture in which tenants are mostly engaged in private/public fundamental and/or applied research. The main goals are helping technology transfer and promote create links between business and companies

**Technology Parks** With low or non-existent academic involvement, tenants are mostly engaged in technological development and commercial application of research

**Industrial Parks** Clearly oriented towards production, service and distribution of traditional, tenants commercialise and manufacture technology-based products not necessarily engaging in R&D activities

**Technopoles, Technopôles, Technopolis** Broad scope real estate planning that normally include also Science and Technology Parks (hence the Greek suffix *polis*)

The definitions of SPs do not conspicuously refer the need of space but rather focus on the general goals of SPs (wealth increase, promotion of entrepreneurial culture and competitiveness) and define the typical associated institutions in a broader sense (companies, centres of knowledge, markets) (see Box 2). Furthermore, a SP is said to transfer knowledge and technology (knowledge and technology flows, spin-off creation, operational links with centres of knowledge creation), business incubation activities (incubation processes, start-up support), also providing other value-added services and at last space. IASP's definition also stresses the need of specialised professionals for the management of these activities.

Dwelling on this point – that provided services and networks should be the focus of SPs to enhance effectiveness in promoting innovation – our research sample was extended also to Business Incubators (BI). Typically, SPs house and manage BIs and, to some extent,

such organisations can work as tenant-feeders of SPs and share the same goals of increasing wealth and regional competitiveness.

### Box 2. Definitions of Science Parks

**IASP, [www](#).** 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 institutions. 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.

**UKSPA, [www](#).** A Science Park is a business support and technology transfer initiative that: - encourages and supports the start up and incubation of innovation led, high growth, knowledge based businesses; provides an environment where larger and international businesses can develop specific and close interactions with a particular centre of knowledge creation for their mutual benefit; has formal and operational links with centres of knowledge creation such as universities, higher education institutes and research organisations.

Also the concept of BI has been evolving since the 1970s when it emerged amongst other small enterprise support initiatives, from the low renting of space providing management training to entrepreneurs in the 1970s to a collaborative service provider, offering consultancy, networking and venture capital access<sup>1</sup> (Lalkaka and Bishop, 1996; CSES, 2002; Marques, 2005) (see Box 3).

### Box 3. Definitions of Business Incubation

**National Business Incubation Association, [www](#).** Business incubation is a business support process that accelerates the successful development of start-up and fledgling companies by providing entrepreneurs with an array of targeted resources and services. These services are usually developed or orchestrated by incubator management and offered both in the business incubator and through its network of contacts. A business incubator's main goal is to produce successful firms that will leave the program financially viable and freestanding. These incubator graduates have the potential to create jobs, revitalize neighbourhoods, commercialize new technologies, and strengthen local and national economies.

**UK Business Incubation, [www](#).** Business Incubation is a unique and highly flexible combination of business development processes, infrastructure and people, designed to nurture and grow new and small businesses by supporting them through the early stages of development and change.

**Lalkaka & Bishop, 1996.** (...) incubators exist to support the transformation of selected, early-stage business with high potential, into self-sufficient, growing, and profitable enterprises. By reducing the risks during the early period of business formation, the incubator is intended to contribute to economic growth through sustaining enterprises that otherwise fail due to a lack of adequate support; creating present and future jobs, and other socio-economic benefits.

**CSES, 2002.** A business incubator is an organisation that accelerates and systematises the process of creating successful enterprises by providing them with a comprehensive and integrated range of

---

<sup>1</sup> For a full discussion about definitions of BI and SPs, see SPICA – The Science Park and Innovation Centre Associations Directory available online in <http://www.spica-directory.net/definitions/>

support, including: Incubator space, business support services, and clustering and networking opportunities.

By providing their clients with services on a 'one-stop-shop' basis and enabling overheads to be reduced by sharing costs, business incubators significantly improve the survival and growth prospects of new start-ups.

A successful business incubator will generate a steady flow of new businesses with above average job and wealth creation potential. Differences in stakeholder objectives for incubators, admission and exit criteria, the knowledge intensity of projects, and the precise configuration of facilities and services, will distinguish one type of business incubator from another.

**OECD, 1997.** Technology incubators are a specific type of business incubator: property-based ventures which provide a range of services to entrepreneurs and start-ups, including physical infrastructure (office space, laboratories), management support (business planning, training, marketing), technical support (researchers, data bases), access to financing (venture capital funds, business angel networks), legal assistance (licensing, intellectual property) and networking (with other incubators and government services).

Like the definitions of SPs, the definitions proposed for BIs do not focus on physical space but rather dwell on the effective combination of services that may include physical premises for incubated firms as the key defining feature of BIs. We contend that space can be even less essential for the performance of a BI: incubation is much more than providing a key-in-hand office and during early stages of development, office space can be unnecessary and even inappropriate for the start-up firm's needs.

Interesting to note as well that the promotion of regional and local development appears adjacent to the BI concept like it did already in the SPs, confirming the relevance of our decision to study both types of organisations in Portugal to assess, in a broad perspective, the role of technology- and knowledge-transfer institutions in the promotion of innovation.

The methodology chosen was case study based on written questionnaires, open phone interviews with management of each SP and BI and other general sources like newspapers or practitioners newsletters. Despite our focus on the offer side, whenever needed we also interviewed a sample of tenants of a given SP or BI (the demand side) using the same techniques, in order to guarantee more accuracy in the information surveyed.

## **SCIENCE PARKS AND BUSINESS INCUBATORS IN PORTUGAL**

The SP and BI phenomenon is quite recent in Portugal dating from the beginning of the 1990s. However, in the late 1990s and more recently, a new wave of SPs and BIs has sprang. The country has currently 12 SPs and 13 BIs with very similar features: i) promoted collaboratively by local or regional authorities, universities and private organisations (companies, industrial associations, etc.); ii) located around cities and in well developed urban areas; iii) funded predominantly with public funds (either from EU, national government or local authorities) and enjoying funding via national incentives programs or via EFRD for operational costs; iv) apart from two, all SPs and BIs are generalist housing and incubating companies of any sector of activity (see Table 1, Table 2 and Table 3).

The lack of specific governmental policy in this area did not help to build a model for the setting up of SPs or BIs and thus all of them seem to differ in their trajectory. Yet the collaborative partnerships between the main regional (and sometimes national) actors of the system of innovation promote the role of technology transfer from knowledge production institutions to companies and markets these infrastructures may have.

**Table 1 – Main characteristics of Science Parks in Portugal**

Science Park	Location	Foundation	Companies	Universities in the SP	R&D institutions in the SP	Main Sectors of Activity	Services Provided
Lispolis	Lisbon, Lisbon and Tagus Valley Region	1993	90	No	INETI – National Institute of Engineering, Technology and Innovation AFTEM (Associação para a Formação Tecnológica em Engenharia Mecânica e Materiais)	Services 41%, IT and related 31%, Consultancy 19%	Administrative support
Madeira Tecnopólo	Funchal, Madeira	1997	26	University of Madeira	CITMA - Madeira's Science and Technology Centre AREAM – Regional energy and Environment Agency	Services 46%, IT and related 35%, Consultancy 15%	Management support Administrative support Marketing Venture capital access Graphical design
PTM/A	Almada, Lisbon and Tagus Valley Region	1994	22	No	No	Services 68%, Consultancy 27%	Accountancy Management support Administrative support Venture capital access, via idea contest
TagusPark	Oeiras, Lisbon and Tagus Valley Region	1995	164	Technical Superior Institute - Technical University of Lisbon	ISQ – Quality and Welding Institute (ranked 6th in business R&D expenditure in Portugal) INESC – Computer and System Engineering Institute IEFP – Training and Employment Institute	IT and related 48%, Universities, R&D centres and Public Institutions 21%, Services 13%, Other 10%	Accountancy Management support Administrative support Marketing Consultancy Training Venture capital access
Tecmaia	Maia, North	2001	41	No	IPVE – Portuguese Viticulture and Enology Institute CEIIA – Centre for Excellence and Innovation in the Automotive Industry	IT and related 29%, other 24% (Automotive, Optoelectronics, Materials, Fluid Mechanics), Services 17%, Consultancy 17%, Biotechnology 7%	Accountancy Management support Administrative support Marketing Venture capital access Information access
ParkUrbis	Covilhã, Centre	2005	9	No	No	IT and related 66%, Biotechnology 11%, Services 11%, production 11%	Not established
Tagus Valley - Tecnopólo Vale do Tejo	Abrantes, Centre	2004	6	No	No	Production 43%, Consultancy 29%, Analysis and Testing 14, Training 14%	Administrative support
Biocant Park	Cantanhede, Centre	2006	4	No	BIOCANT - Biotechnology Innovation Centre	Biotechnology 100%	Management support Administrative support Training Access to venture capital

**Table 2 – Main characteristics of Business Incubators in Portugal**

<b>Business Incubator</b>	<b>Location</b>	<b>Foundation</b>	<b>Companies*</b>	<b>Main Sectors of Activity</b>	<b>Universities or other R&amp;D institutions linkages</b>	<b>Services Provided</b>
CEIM	Funchal, Madeira	1997	12	IT and related, Consultancy, Services	Located inside Madeira Tecnopólo	Administrative support
CiDEB	Porto, North	2000	23	Biotechnology, Environment, Agro-Alimentary	Located in side the Biotechnology School, it is wholly owned by the Portuguese Catholic University	Management support Administrative support Marketing Venture capital access Graphical design
IEUA	Aveiro, Centre	1997	17	Consultancy, Biotechnology, it and related	Wholly owned by a R&D institute associated to the University of Aveiro	Accountancy Management support Administrative support Venture capital access, via idea contest
IPN Incubator	Coimbra, Centre	1996	52	IT and related, Consultancy, Services, Biotechnology, Production, Analysis And Testing	Wholly owned by a R&D institute associated to the University of Coimbra	Accountancy Management support Administrative support Marketing Consultancy Training Venture capital access
NET	Porto, North	1989	117	Consultancy, Biotechnology, Manufacturing, Services, IT and related	Universities in minor scale among the shareholders	Accountancy Management support Administrative support Marketing Venture capital access Information access
OPEN	Marinha Grande, Centre	2005	0	No tenants	Universities in minor scale among the shareholders	Not established
Sogist	Porto, North	2001	6	IT and related	Two universities own the incubator and the University of Porto chairs the board of directs	Administrative support

**Table 3 – Origin of companies in SPs and BIs (only represented the cases in which data was available)**

	Start-up		Uni Spin-Off		R&D Institutions Spin-Off		Branches		Relocated		Others		Total
	#	%	#	%	#	%	#	%	#	%	#	%	
<b>Science Park</b>													
Lispolis	47	52%	2	2%	1	1%	12	13%	28	31%	0	0%	90
Madeira Tecnopólo	13	50%	0	0%	0	0%	0	0%	7	27%	6	23%	26
PTMA	21	95%	0	0%	0	0%	0	0%	1	5%	0	0%	22
TagusPark	40	24%	4	2%	5	3%	15	9%	65	40%	35	21%	164
TecMaia	10	24%	4	10%	2	5%	8	20%	8	20%	9	22%	41
TagusValley	3	43%	0	0%	0	0%	0	0%	3	43%	1	14%	7
BioCant Park	1	25%	1	25%	0	0%	0	0%	2	50%	0	0%	4
<b>Total SP</b>	135	45%	11	6%	8	1%	35	6%	114	31%	51	12%	354
<b>Business Incubator</b>													
CEIM	11	92%	1	8%	0	0%	0	0%	0	0%	0	0%	12
IEUA	1	17%	2	33%	1	17%	1	17%	0	0%	1	17%	6
IPN	1	7%	7	50%	3	21%	0	0%	0	0%	3	21%	14
Sogist	6	100%	0	0%	0	0%	0	0%	0	0%	0	0%	6
<b>Total BI</b>	19	50%	10	26%	4	11%	1	3%	0	0%	4	11%	38
<b>Totals</b>	154	39%	21	5%	12	3%	36	9%	114	29%	55	14%	392

Yet some categories related to different stages of development can be observed:

- **Developed**, although some are going through major changes currently, are Tagus Park, Lispolis, Madeira Tecnopólo, PTM/A, Tecmaia, NET and IPN Incubator. Tecmaia and NET recently made their plans for expansion public, Tagus Park is inaugurating the expanded area in the main building and has planned the urbanisation of 90ha and IPN Incubator constitutes itself as a different juridical person. Yet, we consider them developed in the sense that they have operated in a stable way for some years and have solid development plans. The lessons extracted from these cases confer thus more soundness to our conclusions;
- **Just Starting** are Biocant Park, Tagus Valley and OPEN. Although Tagus Valley had its start some years ago, only in 2006 is seemingly blossoming and finally carrying on with the planned setting up of the park; the same is happening with OPEN, originally planned in 1997 it still did not have any tenant company at the time of research; Biocant Park was also recently inaugurated although it has already a research centre established in its premises. For these reasons, the lessons distilled from these cases have inexorably to be tentative or in the best scenario, potential. In the cases of Tagus Valley and OPEN some future effects will be speculated;
- **Developing** we find the remainder, i.e., CiDEB, ParkUrbis, Sogist and IEUA. Inaugurated in the last two years (apart from Sogist), all of these infrastructures are still developing and trying to position themselves according to their environment: ParkUrbis is considering a thematic focus/pole in health sciences; CiDEB is going through a fission to establish two thematic incubators instead of the current one; IEUA is also still trying to define itself, currently introducing major changes as well as recovering some ideas from the early years of operation; and Sogist never actually developed (its premises were never occupied significantly) and stated that 2006 will be its decisive year to continue or permanently close.

Keeping in mind these differences and based on the analysis of all the detailed case studies, we present subsequently the major lessons that can be distilled from the Portuguese case study.

## LESSON ONE: UNIVERSITY LINKS

**The need of universities.** The overwhelming majority of the Portuguese SPs and BIs has some kind of linkage to universities or other centres of knowledge production (see Table 1 and Table 2): in SPs it is typical to share the same location whereas BIs are normally owned by associations that put together, *inter alia*, universities and both private and public R&D institutions.

Notwithstanding the formal linkage or the co-existence in the same space, the effectiveness of the university links is actually more important and more difficult to observe in our cases. The relative location and the distance between knowledge production institutions, markets and companies seem to be less important than the intensity of the links created between them.

For instance, NET does not have any university or R&D institutions inside its premises and has incubated several academic spin-offs. On the contrary, Sogist is strongly linked to one of the biggest universities in Portugal (the University of Porto is one of the shareholders and had, at the time of research, the presidency of the board of administrators) and it was a major flaw in incubating new ventures. Far from these extremes in intensity of university links, Tagus Park has a research-oriented university campus inside its premises and strong links to R&D institutions, either associated or located within, and still does not



exhibit a significant number of university spin-offs. In fact, Tagus Park is outnumbered by Tecmaia in terms of spin-off companies.

**Organisational alignment.** Yet both SPs house a significant number of high technology companies which allow us to think that companies look for being established closely to centres of knowledge. The absence of academic spin-offs might be a reflex of the role of the university itself in promoting this kind of activities as part of professorship or research career. The organisational incentives like royalty distribution or promotion and tenure guidelines are important and “such changes are warranted at institutions that wish to place a high priority on technology commercialization” albeit the difficulty to change the norms and values that are deeply entrenched can not be underestimated (Phan and Siegel, 2006). In Portugal such changes would even have to be approved by the national parliament, as most of the universities are public and regulated by national law. However, such career incentives were observed in CiDEB providing sheer evidence that the question of changing norms would depend more on political will than on cultural resistance. (We recall that CiDEB belongs to a private university.)

**Science and technology do make a difference.** The university’s or R&D centres’ institutional links not only have to be effective, but have also to be active in scientific and/or technological areas. To be sure, we are not advocating the primacy of science and technology over different areas of knowledge; but it is obvious that to promote a successful science and/or technology park, science and/or technology production and both fundamental and applied R&D activities are imperative.

It this sense, it is not surprising that Madeira Tecnopólo does not have any academic spin-off in its premises. In this case, as valuable and renowned the economic research made in the Economics Research Centre of the University is, one can hardly foresee an academic spin-off or a new technology-based company arising from purely theoretical economic research. Furthermore, the nature of the university, combined with the intrinsic regional characteristics, contribute to the reduced number of science- or technology-based companies. Opposite, the IPN Incubator possesses the right conditions to house academic spin-offs as it is owned and managed by the university via IPN, a research centre in the fields of automation, informatics, materials, geotechnical and pharmaceuticals.

The situation of Tagus Valley is illustrative also: it is not expected to be particularly successful in terms of academic spin-offs and attracting science and technology-based companies, if the strategy remains unaltered. With no links to universities or research centres in the fields of science and/or engineering, it is highly unlikely that this kind of firms arises or relocates there.

## LESSON TWO: QUALITY OF MANAGEMENT

The role of management observed in the majority of the case studies appears to be a mere confirmation of previous works that already stated it as a critical variable for the success of any SPs and BIs (see e.g., Aernoudt, 2004; Grimaldi and Grandi, 2005; Löfsten and Lindelöf, 2002). Aerts et al. (2005) refer also to specific tools like adequate screening process in BIs as important features in these infrastructures.

Yet those authors underline the importance not providing though examples of good or bad management or what may be considered as quality of management. By quality of management we mean more than management skills. Management skills are perhaps what one has after graduating from management school and some years of experience. Yet, SP and BI management requires more than that.

**The management profile.** In a recent conference held in the EIB in Luxembourg, a round table constituted by managers of European SPs highlighted the critical role of

management from the very beginning of any SP operation (EIB, 2006). Their view is that a SP park manager has to combine the profiles of a scientist, a politician and a businessman being able to communicate effectively and interact with different actors of the system of innovation. As for BIs, the profile is not far from this maybe apart from scale: BIs are significantly smaller than SPs and thus can seldom aspire to more than making a modest firm-level contribution in terms of regional development whereas SPs often become the core of the economic transformation of a given region.

This profile is particularly important in Portuguese SPs and BIs as most infrastructures are owned by local or regional authorities, university or other knowledge production institutions and private institutions. Tagus Park, Biocant Park, and IPN Incubator are seemingly the best examples of this holistic view applied to their management:

- Tagus Park is an urban project and therefore intrinsically gathers all the referred competences: i) policy, for the regional development planning; ii) scientific, as the university involvement show (a campus located within and the creation of joint-venture laboratories); iii) and business, as the orientation towards markets and the attraction of anchor companies suggest (e.g. the park is home to Microsoft's Portuguese headquarters);
- Biocant Park combines as shareholders a significant number of important actors in the local and regional systems of innovation and furthermore was able to attract model companies in Portugal in the fields of biotechnology (the focus of the park) to harness the potential arising from the already established R&D centre;
- IPN Incubator is strongly linked to the university via a research institution (owned partially by the University of Coimbra). However, its nature is rather different than CiDEB's or IEUA's since the BI is open to all kinds of projects and it is the embryo of the SP project in development in the city. So far, IPN Incubator carried an effective strategy and succeeded, not only in incubating companies, but also in fostering commercial links between companies and developing an important network of companies in the region.

Opposite, Sogist, PTM/A, Tagus Valley and Madeira Tecnopólo are less successful in incorporating policy, scientific and business oriented perspectives in their management:

- Sogist is partially owned and managed by the University of Porto and it is located in the premises of another engineering school in the same city. Yet it was described by their former tenants as not significant to their development having not provided anything else than the space at high prices.

The policy view was clearly disregarded in Sogist in terms of internal promotion of the incubator, establishing networks or promotion of any kind of activity to bring attention and tenants to the BI (the BI was never full). In the same way, management has not been business oriented as the current emptiness of the BI and the lack of internal activities suggest. Tenants referred to not only the high prices of space but also to services including networking or consultancy as unaffordable for nurturing companies;

- The case of PTM/A reflects the same disarticulation in terms of effectively combining policy and science issues: the existence of a nearby SP/BI (not surveyed), in a more attractive location (inside the university campus) is clearly overseen by the management of both infrastructures and has potentially contributed to the scientific failure of this SP. We believe that the subsequent need to make the premises profitable deviated completely any scientific or business orientation, transforming PTM/A in a office rent space;

- Tagus Valley, as previously stated, is located in a region that *prima facie* does not gather the conditions for the success of such ventures (e.g. lack of knowledge production institutions). In terms of policy, the existence of a significant cluster of automotive companies (DPP, 2002; GEPE, 2002) is seemingly disregarded in terms of legacy and preferential areas for business incubation or relocation in the park;
- In the case of Madeira Tecnopólo, we contend that priority was given to policy issues promoting regional development and urban revitalisation more than scientific ventures or technology transfer.

**The services.** Crucial to the quality of management are also the services provided to tenants. If it is true, for instance, that BIs position themselves according to their tenants in terms of offered services (Grimaldi and Grandi, 2005), this positioning depends on the awareness and capabilities of the operational management being thus included in what we coined as quality of management. Arguably, this premise is only true if the tenants are demanding enough in terms of services; we contend however that the needs of tenants (that are no more than the customers of SPs or BIs) must be known by the management of the SPs or BIs, for this is one basic principles of supporting business.

Incubating business is more than providing space and basic services like communication and parking. In the same way, SPs' definitions stress more intangibles like value-added services than physical infrastructures. Additionally, the case studies seem to point that adaptation of services is fundamental for the success of the SP or BI and its tenants.

In the EIB conference on SPs (EIB, 2006), the panellists of the round table highlighted four value-added services that can be provided to tenant companies: i) incubation schemes; ii) shared infrastructure for work and leisure; iii) flexible premises allowing companies of all sizes to dwell; iv) and image and reputation of the park.

Bearing this in mind, in terms of services it is clear that IPN Incubator and CiDEB have the leading role in terms of adequacy to their tenants:

- IPN Incubator developed several models of incubation having the capability currently to incubate in its premises and virtually, which resembles somehow specialised consultancy services. Furthermore, a special model of incubation for graduate companies is used to keep people together in terms of contacts sharing the same information system. The package of services includes space and its maintenance, consultancy via external networks, internal activities to promote links between tenants, access to venture capital, etc.;
- In the case of CiDEB, incubated companies have access to academic and business mentorship which comprises expertise in biotechnology and markets. This university-based incubator has what may be dubbed as an integrated approach, creating the right incentives for both entrepreneurs, internal and external mentors to fully embrace these activities and promote its growth and success. The package of services includes flexible space, access to university's knowledge via libraries, professors, internal and external mentoring, access to venture capital, adequate customised training for entrepreneurs, etc.

In the other extreme, we find Sogist and Madeira Tecnopólo. In both cases, a mismatch of services provided to companies and their actual needs was observed. To be sure, each one of the companies enjoyed the space and maintenance and administrative support like reception and communications. But business incubation requires much more than that, for instance, screening tenants needs and tackle their demands supporting them in their start-up phase.

While in Sogist the incubation contract was the main constraint to companies, in Madeira Tecnopólo the incubation program itself is the cause of dissatisfaction: the overwhelming majority of companies is admitted to the BI via a regional award. Each entrepreneur is awarded with services valid for only a year. These services are apparently rigid and cannot be exchanged for anything else than meeting rooms, communications, consultancy, etc. Most of the tenants are being admitted based on business plans, those services will only be critical some time after, in the worst case, when the one year period is over.

**Innovative ideas.** Also useful to characterise the quality of management is the existence of innovative ideas that define the management style. For instance, Tagus Park's project for establishing a competence centre that combines all the existing competencies within the park's firms in order to be able to cope with the demands of new customers is a very good example.

Another good example comes from IEUA and the supplier program that allows tenants to combine their orders for services like rent-a-car, travel agency, office material, among others, and enjoy reduced prices.

Further innovative management ideas include the gradual shift of selection criteria that enabled links amongst companies in IPN Incubator or Biocant Park's establishment of an incentive program for attracting not only companies but also skilled human capital to the region to develop applied research in biotechnology.

## A TYPOLOGY FOR COMPARING

One of the main difficulties in classifying the SPs and BIs studied is scarcity of distinguishing factors. For instance, some models in found literature depict both SPs and BIs in terms of public vs. private ownership (de Boulard, 2005; Grimaldi and Grandi, 2005; OECD, 1999). In this sample, apart from university-based BIs that show some private BI features, all the cases have the same characteristics: owned by regional authorities, universities and industrial associations, service-focused providing a stable and sometime rigid package of services and incorporating several features of major urban planning (size, diversified complementary infrastructures like swimming pools, etc.).

Yet above we have seen that in the context of the major lessons in this study, it is possible to somehow distinguish SPs and BIs according to their performance in those vectors.

**Table 1. Summary of performance of SPs and BIs in terms of the lessons learned**

	<b>(-) Quality of Management (+)</b>	
<b>Stronger University Links</b>	Biocant Park OPEN	IPN Incubator CiDEB IEUA
<b>Weaker University Links</b>	Lispolis Madeira Tecnopólo PTM/A Tagus Valley Sogist	Tagus Park Tecmaia ParkUrbis NET

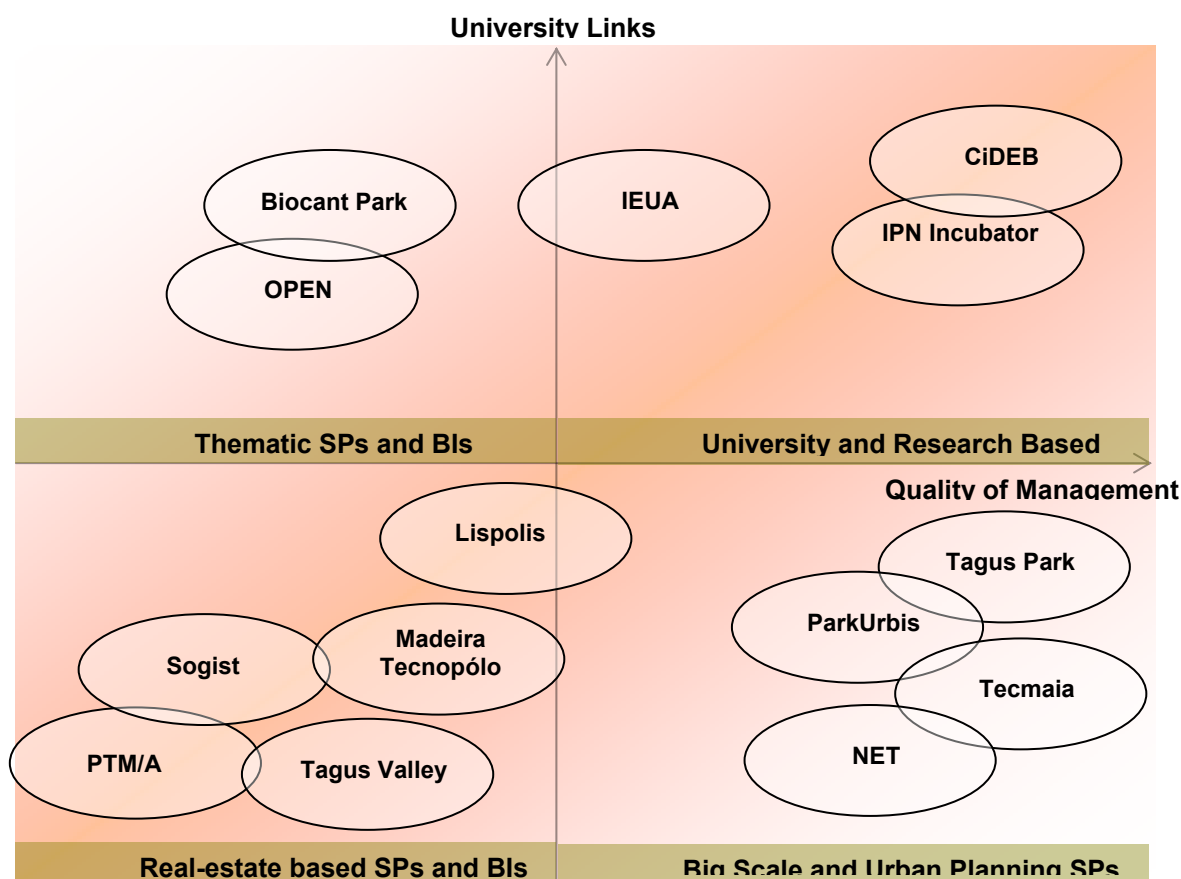
It is intended that the vector **quality of management** does not have a scale, not even of extremes like the **university links**. The reason has to do with the fact that this vector is actually a combination of several factors, i.e., profile of management, services and innovative ideas, and no pattern was found for the three. For instance, Biocant Park is highlighted as an example of management profile for the combination of three distinct views in the operational management of the park while in terms of services it will probably never develop as much as IPN Incubator or CiDEB, as it is a thematic park and its tenants will not demand so.

Now, applying this classification to the present cases:

- **Real-estate based Science Parks and Business Incubators** can be described by relying mainly on space rent in terms of services to provide their tenants. That situation is clear in the cases of PTM/A and Sogist. Madeira Tecnopólo and Lispolis are not so extreme cases as they provide more to their tenants, e.g., business incubation and a bigger universe of tenants; nonetheless, both SPs are based in property management and do not exhibit strong urban planning features. Finally, Tagus Valley also positioned itself in this group although it is still too early to say.

All these infrastructures are characterised by: i) weak or less effective university linkages, even though in some cases universities are shareholders; ii) lack of holistic views that encompass policy, scientific and business oriented perspectives in their management; iii) and inadequacy of services provided to tenants;

**Figure 1. Schematic representation of the Portuguese Science Parks and Business Incubators<sup>2</sup>**



<sup>2</sup> The position in the axes does not obey to a rigid absolute scale but is rather a mere order, i.e., the relative performance of each SP or BI against its peers.

- **Big Scale and Urban Planning Science Parks and Business Incubators** are characterised not only by their scale but by a strong component of urban planning. To some extent, these infrastructures are mere pieces of a bigger plan and are part of what we may call technopole. Tagus Park, Tecmaia and ParkUrbis, still in expansion having several infrastructures planned (e.g., hotels, residential areas, leisure infrastructures like swimming pool, golf courses, etc.), illustrate well this category.

NET is also included in this groups due to its scale and also for sharing the main features of this category: university links exist and are effective, although they are not the core activities of these infrastructures; and high quality of management in terms of services provided to tenants, and innovative ideas emerging from an adequate integration of policy, science and business skills;

- **University and Research Based Science Parks and Business Incubators** are defined mainly for the privileged linkages to the university or other knowledge production institutions and for providing a mix of services that not only meets tenants' needs as contributes positively to local and regional economies.

This is clearly the case of IPN Incubator and CiDEB: university-based, both harness research coming from their laboratories and offer a customised package of services ranging from access to in-house expertise to networks of contacts and mentorship.

Also in this category is IEUA. Despite not having a mix of services so developed and valuable available for its tenants, the model of incubation is rather similar to IPN's and in terms of innovative ideas and strategy it is performing above average;

- Finally, **Thematic Science Parks and Business Incubators** are characterised mainly by strong and effective university links, allowing them to focus on research and technology transfer to markets in their specific area. However, in terms of services they are not as developed or flexible as University and Research Based Science Parks and Business Incubators. Arguably, tenants do not need the same flexibility of services and therefore management develops an optimal package of services that has undeniably high value added for their tenants, but is rather rigid throughout time.

This is the case of Biocant Park. Its strong university links and the focus on one specific sector – biotechnology – permitted them to focus their services on providing laboratory space to rent and privileged access to the research centre premises existent in the park.

Also in this category we see OPEN, mainly for its links to universities and a technological centre. Without tenants at the time of research, little can be said about the services provided. Curiously, this BI does not declare itself as thematic or sectoral. Yet due to its location, promoters and owners it is not surprising that its tenants will somehow be related to the mouldmaking industry, which has existed in the region for more than 50 years.

Any categorisation is far from describing perfectly all the analysed cases. As shown and discussed in the previous pages, some cases do not seem to fit in just one category and combine elements of two or even more categories. Nevertheless, the discussion on typology sheds light and contributes to a better understanding of the position of each infrastructure in Portugal.

To be sure, Figure 1 does not present a ranking but rather assesses SPs and BIs in what we distilled as the ultimate lessons to be considered and thus the major issues to retain and to be analysed. As previously stated and corroborated by reviewed

literature, there is no better model but rather different objectives to be pursued and carried.

## CONCLUSIONS

In the end two major conclusions arise: Science Parks and Business Incubators do have a role and a positive impact in promoting innovation if properly managed and have effective university linkages. The quality of management depends basically on three vectors: i) the management capability of comprising three different but integrated perspectives in daily operational management, i.e., science, business and policy; ii) the capability of providing adequate innovation support services to tenants and iii) the capability of exploring innovative ideas and establishing management practices that go beyond tenants needs and expectations. As for the effectiveness of university links it is crucial that: i) knowledge in science, technology and engineering is produced; and (ii) the organisation is aligned and committed in engaging in new ventures.

Our main contribution in the present work is a better and wider knowledge of these institutions in Portugal, their activities and their drivers for success. Moreover, as this is the first comprehensive study of this kind about such infrastructures in the country, the authors discussed the effectiveness of SPs and BIs as a tool for the promotion of innovation and economic development.

## REFERENCES

Aernoudt, Rudy, 2004. "Incubators: Tool for Entrepreneurship?," Small Business Economics, Springer, vol. 23(2), pages 127-135.

Aerts, K., Mathyssens, P., Vandenbempt, K., 2005. Critical role and screening practices of European Business Incubators, DTEW Research Report 0560, K.U.Leuven, 26 pp. (Submitted to Technovation) (available online in [http://www.econ.kuleuven.be/fetew/pdf\\_publicaties/0560.pdf](http://www.econ.kuleuven.be/fetew/pdf_publicaties/0560.pdf))

Castells, M. and Hall, P., 1994. Technopoles of the World, Routledge

CSES, 2002. Benchmarking Business Incubators, Final Report requested by the European Commission, Centre for Strategy and Evaluation Studies, February 2002, Brussels

de Boulard, M, 2005. Science Parks: A Tool for promoting Regional Growth? An investigation of the Belgian case, Université Catholique de Louvain, Département de Sciences Économiques

DPP, 2002. The Automotive Cluster in Portugal (O Cluster Automóvel em Portugal), Department of Prospective and Planning, Ministry of Finance (Departamento de Prospectiva e Planeamento, Ministério das Finanças), Lisbon (available online in [http://www.dpp.pt/gestao/ficheiros/cluster\\_automovel.pdf](http://www.dpp.pt/gestao/ficheiros/cluster_automovel.pdf))

Edquist, C., 2005. Systems of Innovation in The Oxford Handbook of Innovation, ed.: Fagerberg, J., Mowery, D., Nelson, R., Oxford University Press, pp. 181-208

EIB, 2006. Science Parks - a tool for the development of the knowledge economy?, Luxembourg (presentations available online in <http://www.eib.eu.int/news/events/event.asp?event=145>)

Fagerberg, J., 2005. Innovation: a Guide to the Literature in The Oxford Handbook of Innovation, ed.: Fagerberg, J., Mowery, D., Nelson, R., Oxford University Press, pp. 1-26

GEPE, 2002. The Automobile: a (Globally) Innovative Cluster (O Automóvel: um Cluster (Globalmente) Inovador), Bureau of Economic Studies and Prospective (Gabinete de Estudos e Prospectiva Económica, Ministério da Economia), Lisbon (available online in <http://www.gee.min-economia.pt/resources/docs/publicacao/DT/dt43.pdf>)

Grimaldi, R. and Grandi, A., 2005. Business Incubators and New Venture Creation: and Assessment of Incubation Models, *Technovation* Vol. 25, pp. 111-121

Hackett & Dill, 2004. A Systematic Review of Business Incubation Research, *Journal of Technological Transfer*, Vol. 29, pp. 55-82

Lalkala, R. & Bishop, J., 1996. Business Incubators in Economic Development – an initial assessment in industrialising countries, United Nation Development Programme, New York.

Löfsten, H. Lindelöf and P., 2002. Science Parks and the growth of new technology-based firms—academic-industry links, innovation and markets, *Research Policy*, Vol. 31, pp. 859-876

Lundvall, B.-Å. and Borrás, S., 2005. Science, Technology and Innovation Policy in The Oxford Handbook of Innovation, ed.: Fagerberg, J., Mowery, D., Nelson, R., Oxford University Press, pp. 599-631

Marques, J. P., 2005. Business Incubators with linkages to the University and Industry-University Cooperation: the Portuguese case (in Portuguese: As Incubadoras de Empresas com ligações à Universidade e a Cooperação Universidade Indústria: o caso de Portugal), Ph.D. thesis, University of Aveiro

OECD, 1997. Technology Incubators: Nurturing Small Firms, Organisation for Economic Co-Operation and Development, Paris

OECD, 1999. Business Incubation: International Case Studies, Organisation for Economic Co-Operation and Development, Paris

Phan, P. and Siegel, D., 2006. The Effectiveness of University Technology Transfer: Lessons Learned from Quantitative and Qualitative Research in the U.S. and the U.K., Working Paper 0609, Rensselaer Polytechnic Institute, Troy, NY (available online in <http://www.economics.rpi.edu/workingpapers/rpi0609.pdf>)

Vanhoudt, P., 2006. Presentation in EIB Conference: Science Parks - a tool for the development of the knowledge economy?

Zhang, Y., 2005. The Science Park Phenomenon: Development, Evolution and Typology, *International Journal of Entrepreneurship and Innovation Management*, Vol. 5(1/2), pp. 138-154

### Internet Sites

AURP – Association of University Research Parks	<a href="http://www.aurp.net">http://www.aurp.net</a>
EBN – European Business Innovation Centres Network	<a href="http://www.ebn.be">http://www.ebn.be</a>
NBIA – National Business Incubation Association	<a href="http://www.nbia.org">http://www.nbia.org</a>
Observatory of European SMEs (retrieved May 2006)	<a href="http://www.eim.nl/eng/index.cfm/13,0,90,html">http://www.eim.nl/eng/index.cfm/13,0,90,html</a> (retrieved May 2006). Further information can be found in



	<a href="http://ec.europa.eu/enterprise/enterprise_policy/analysis/observatory_en.htm">http://ec.europa.eu/enterprise/enterprise_policy/analysis/observatory_en.htm</a>
SPICA – The Science Park and Innovation Centre Associations Directory	<a href="http://www.spica-directory.net/">http://www.spica-directory.net/</a>
UKBI – United Kingdom Business Incubation	<a href="http://www.ukbi.co.uk/">http://www.ukbi.co.uk/</a>
UKSPA – The United Kingdom Science Park Association	<a href="http://www.ukspa.org.uk/">http://www.ukspa.org.uk/</a>
UMa – University of Madeira (Universidade da Madeira)	<a href="http://www.uma.pt">http://www.uma.pt</a>

### Science Parks and Business Incubators Resources

Tecparques - Portuguese Association of Science Parks	<a href="http://www.tecparques.pt">http://www.tecparques.pt</a>
Biocant Park	<a href="http://www.biocantpark.com/">http://www.biocantpark.com/</a>
CEIM – Madeira Company and Innovation Centre (Centro de Empresas e Inovação da Madeira)	<a href="http://www.ceim.pt">http://www.ceim.pt</a>
CiDEB	<a href="http://www.esb.ucp.pt/cebi">http://www.esb.ucp.pt/cebi</a>
IEUA – University of Aveiro Business Incubator (Incubadora de Empresas da Universidade de Aveiro)	<a href="http://ie.web.ua.pt/">http://ie.web.ua.pt/</a>
IPN Incubator	<a href="https://www.ipn.pt/si/incubadora/">https://www.ipn.pt/si/incubadora/</a>
Lispolis	<a href="http://www.lispolis.pt">http://www.lispolis.pt</a>
Madan Parque	<a href="http://www.madanparque.pt">http://www.madanparque.pt</a>
Madeira Tecnopólo	<a href="http://www.madeiratecnopolo.pt">http://www.madeiratecnopolo.pt</a>
NET	<a href="http://www.net-sa.pt/">http://www.net-sa.pt/</a>
OPEN	<a href="http://www.open.pt/">http://www.open.pt/</a>
ParkUrbis-	<a href="http://www.parkurbis.pt/">http://www.parkurbis.pt/</a>
PTM/A - Technological Park of Mutela/Almada (Parque Tecnológico da Mutela/Almada)	<a href="http://www.caixadimagens.pt/ptma">http://www.caixadimagens.pt/ptma</a>
Sogist	<a href="http://www.sogist.pt/">http://www.sogist.pt/</a>
Tagus Park	<a href="http://www.taguspark.pt">http://www.taguspark.pt</a>
Tagus Valley	<a href="http://www.tagusvalley.net/">http://www.tagusvalley.net/</a>
Tecmaia	<a href="http://www.tecmaia.pt/">http://www.tecmaia.pt/</a>