

SCIENCE AND TECHNOLOGY PARKS: HABITATS OF INNOVATION

By Joan Bellavista and Luis Sanz

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Authors short Curriculum Vitae

Joan Bellavista currently holds the position of President of the International Association of Science Parks (IASP), and is a member of the Advisory Council of the Spanish Association of STPs (APTE). He is the Delegate of the President of the Barcelona Science Park, and in 2005 he was also appointed CEO of the Catalan Network of Science and Technology Parks (XPCAT), an association that includes 19 Parks. Professor at the Sociology Department of the Economics Faculty, University of Barcelona, in 2007 he was named member of the Advisory Council for Science and Technology of the Spanish Government. His professional career was developed in the United Kingdom, Australia, Brazil, Indonesia, Dominican Republic, Tunisia and Spain. Author of several journal articles, he has also published a number of books on Innovation Development and Science and Technology Parks.

Luis Sanz has been the Director General-CEO of IASP since 1996. He has had an extensive career in the Science/Technology Park industry, and has been President of the IASP-European Division and Vice-President of the Spanish Association of Science and Technology Parks (APTE). He has been advisor to Science and Technology Parks (STPs) in different parts of the world (China, Italy, Panama, and Spain, amongst others). He has been the chief organizer of over 25 international conferences on STPs, entrepreneurship and innovation issues; a consultant for STPs and innovation agencies; and participates as an invited speaker at many conferences throughout the world every year.

Abstract

This introductory paper explores a number of topics on creativity and innovation discussed at the IASP World Conference held in Barcelona in 2007¹. The articles selected for this special issue are introduced, and theoretical and methodological approaches related to creativity and innovation are discussed. Moreover, the fundamentals, strategies, statistics, programs and networking variables concerning worldwide Science and Technology Parks (STPs) are submitted. The paper stresses the impact of the array of knowledge sources. It also analyses the role of the existing STPs' powerful tangible and intangible assets as well as the management of the multiple agents performing in organised network structures.

Introduction

Since its inception in 1951, Science and Technology Parks (STPs) have emerged all across the economic, social and cultural spectrum, showing a vivacity and adaptability that transcends temporal and geographic boundaries. Moreover, they have performed breaking institutional and organizational boundaries, facilitating a better integration of the multiple agents located in the parks, and facilitating the flow of knowledge and technology transfer among the participating agents. STPs are also active in the processes avoiding the brain drain, attracting new talent, creating opportunities for specialised jobs, and undertaking talent as one of the main assets to develop creativity and innovation.

By incorporating diverse public and private organisations (including innovative enterprises, technology-based start-ups, technology centres, research institutes and universities), STPs have become significant instruments of business innovation and development. The increasing implication of the agents, and the dynamic relationships among governments, universities and companies, are very helpful in developing the innovation systems. STPs have captured a leading position as an instrument to develop that process due to the integration of most of the agents involved in a micro/mini, and in a macro level of the innovation system based in network structures, as it is explained in the following chapters.

Creativity and innovation are key ingredients and driving forces for the development of STPs and its impact - they jump-start the economy of the surrounding area, and the successes boomerang back to the very organisations and institutions inside the park that unleashed the creativity in the first place. Such creative organisations and institutions in a STP in turn inspire creative professionals and creative people at all levels, setting the conditions for growth. Moreover, existing informal relationships among the personnel of the different companies, centres, universities, and the formal relationships (e.g. contracts and agreements) among institutions and companies add more potential value for creativity and innovation.

Following that reasoning, the main argument and objective of this paper refers to the role of STPs in developing processes of creativity and innovation, based on theoretical and practical contributions of STPs, methodologies recently developed, (e.g. strategigram) and the existing theoretical approaches regarding creativity and innovation. The issue of understanding, fostering and managing creativity and

innovation was the main topic of the 2007 IASP World conference held in Barcelona in July by the International Association of Science Parks. The papers presented in this special issue collect some of the most vibrant reflexions, discussions and cases presented during the conference.

1. Creativity, innovation and STPs

In the creativity literature, problem identification and construction lead to the generation of answers and outputs (Kijkuit and van den Ende, 2007). Network structures can facilitate creativity through the provision of massive information and ideas, generated in heterogeneous personal and organisational connections. The variety of knowledge and sources entail the management of understanding –both the technical and the personal— among the community involved in the development of innovation projects and services. In that sense, STPs play a special role in the management of complex and diverse tangible and intangible assets, targeting better innovative and creative processes and products. Moreover, the management of STPs' networks can even play a major role in the need for cohesion among multiplicity, thus facilitating a greater dimension of the mentioned targets.

STPs have the same elements of an innovation system. Basic elements of the innovation system, being physical infrastructures, research infrastructures, specialised services, talent, seed and risk capital, or technology transfer processes, all these elements can be found in STPs. Taking into account the local physical dimension of an STP, they may be considered micro/mini innovation systems. Furthermore, in many cases they are instruments connected with entrepreneurial universities, or knowledge institutions which have assumed the third mission of the university - the development and impact on the local and regional economy, and not only the educational and research missions. At present, STPs are increasingly working within networks of parks at the regional, national and international level, and also with networks of companies, organisations, and institutions placed in different physical locations outside the parks, even in long distance locations. Consequently, processes of knowledge exchange, contracts, agreements, strategic alliances, or talent attraction goes beyond the micro/mini level system into a macro level of the innovation system. Following that line of reasoning, the management of the diverse assets embodied in the parks networks, also play the role to accelerate cohesion among the multiple agents and actors involved in the development of STPs.

Some organisations may be aware of existing limitations of knowledge accessibility within their own confines. Within the parks, heterogeneous personal and organisational connections are facilitated in the variety of the different actors involved. In that sense, the role of knowledge sharing becomes essential to attain the required knowledge. Concepts of collectivism and reciprocity have been analysed by Hew and Hara (2007) as motivators to bridge the knowledge gap. Human knowledge resources must also be encouraged towards a creative environment and as a source of innovation, both on the individual and on the collective level. Creativity and innovation are based on the capability to integrate new knowledge in the existing one, and sharing the knowledge with other creative members of their own company or even other companies and organisations with strategic alliances (Hernard and McFadyen, 2008). Massive information and ideas flow among the different agents involved in parks activities.

Creative personnel are special drivers of the knowledge companies and institutions, although sometimes, creative people may collide with traditional organisational cultures (Murphy and Pauleen, 2007).

Knowledge has been classified in codified or explicit knowledge, and tacit, un-codified or implicit knowledge (Polanyi 1962, Hicks 1995). Codified knowledge appears in formal language and can be organised, stored, recorded and transferred. Tacit knowledge can be found in cognoscitive and technical elements, together with the accumulation of practical experience, use of instruments, skills and capacities of researchers, technicians and managers. The capacity to capture tacit knowledge is an element for creativity and firm success. Nonaka and Takeuchi (1995) proposed that the behaviour of socialisation, collective initiatives, informal contacts, and debates are all good schemes to capture tacit knowledge. And, as Castells and Hall (1994) advocated, communities of practice, invisible colleges, professional/personal relationships, affinity groups, or even weekend barbeques, are very helpful in those processes. Although the explicit and codified knowledge exposed can easily be observed in PCTs, tacit knowledge has a special role due to the continuous learning, communication, exchange processes, and routines among heterogeneous parks tenants and among the existing national and international parks' networks. Thus, the management of these complex processes becomes one of the main responsibilities of the parks managers and the network managers.

Another connected issue is the role of PCTs on the continuous process of creation, share and flow of knowledge. The creation of knowledge can be observed in the professional work done by the personnel of the institutes, research centres, NBTs and innovative companies sited within PCTs. The share of knowledge can be noticed in the agreements and joint projects among park tenants, when using shared technology platforms, in strategic joint ventures, or in mixed centres between public organisations and companies. The flow and dissemination of existing knowledge can be observed among university centres, R&D institutions, companies and markets through seminars, conferences, training courses, booklets, services, personnel mobility, marketing technology products, and through the networks of parks. In that sense, STPs are helpful in the process of densification of knowledge flows.

The availability of a stock of knowledge contained in individuals, organisations and networks is recognised as an important driver of economic growth, innovation, creativity, and territorial impact (OECD, 2001). It allows competitive advantages for some locations, leading to knowledge-intensive clusters (Romer, 1994; Solow, 1994). It has been stated that there are special spaces and environments to increase and accelerate innovation. Classical examples like Silicon Valley and the Route 128 have been quoted for many years, and STPs, technopolis, technology corridors, innovation regions, industry clusters, industrial districts, science and knowledge cities, and innovation milieu, have been analysed as key instruments or environments for that purpose (Roberts, 2005). Moreover, those environments take advantage of the great variety of knowledge and sources available in these micro/mini and macro systems of innovation with their networks.

Firms, clusters and networks illustrate a towering level of transactions across them and across their boundaries. Partnerships, mobility of employees, interaction with distance peers, meetings, conferences, projects, the use of free time, and the management of all

those resources, contribute to the improvement of the creativity outputs. In the services sector for instance, the knowledge-intensive business services have a similar behaviour to high technology manufacturing, especially those which are organized on a networking basis, and in areas as health, financing, education and business services (Miles, 2008).

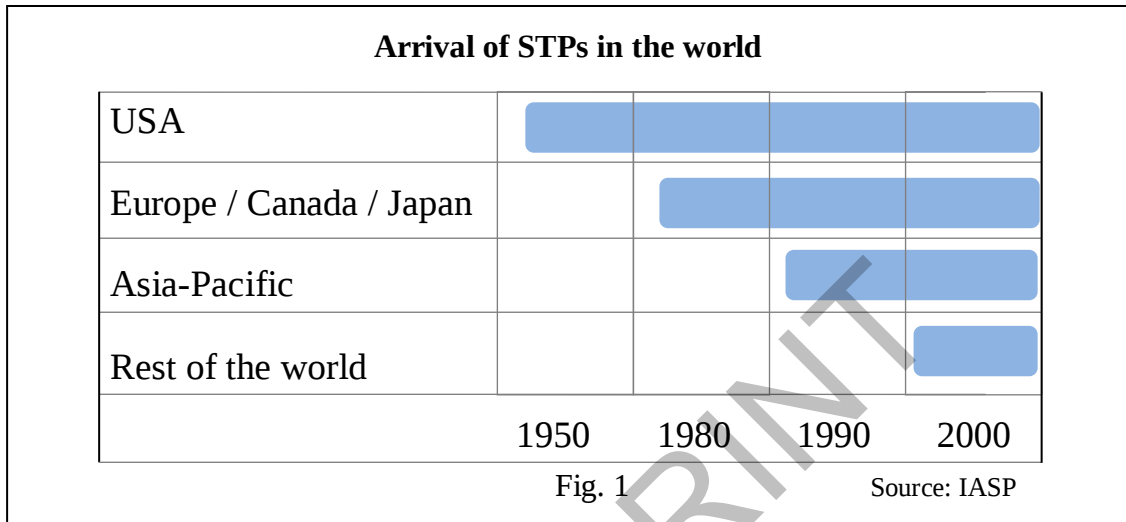
STPs and new research/technology-based companies made great contributions to the success of some regional economies in the last decades (Castells and Hall, 1994). The capacity to develop new technology-based products, processes, systems and designs in those decades, has been an indicator of creativity within a number of varied economic, social and political contexts. Some cultures have been considered more creative than others (Roberts, 2005), thus creativity can also be considered within the local/regional value system, as it is innovation and entrepreneurship.

Jerome Engel (2007) exposes the role of creativity in the context of difficult economic periods. Periods characterised by the lack of resources and operational structures malfunctions, elements that introduce the search for new key opportunities. Engel states that great innovation managers understand the paradox of entrepreneurial innovation and Florida (2002) emphasises in the processes of creativity and social change that occur in periods of economic crisis. Richard Florida's analyses illustrate the processes of economic growth in habitats open to creativity. Creativity is seen as a source of economic value, and diverse and open-minded locations are discussed as the right place for creative people to feel comfortable in both living and working environments: the rise of the creative class (Florida 2002, 2005; Florida and Tangli, 2004).

Moreover, other generic aspects may be considered in that framework for further analysis: conflicts of interest and the university-industry linkages based on Etzkowitz studies (1996), patenting patterns and researchers motivations based on Goktepe (2005, 2006), the "context" of creativity (Amabile, 1996), and the psychology of creativity (Guilford 1950, Csikszentmihalyi, 1997). Theoretical and practical issues concerning the environment and the motivations of creativity within specific organisations (Amabile, 1997; Amabile and Conti, 1999); creativity through entrepreneurship and innovation (Clark, 1998; Formica and Sanz, 2002; Bellavista, 2002); and the interactive learning processes in the context of the national and regional innovation systems (Lundvald, 1992, 1994; Cooke, 2001; Etzkowitz et al, 2005). References to the imperatives of Open innovation (Chesbrough, 2003), policies and evaluation procedures within the Triple Helix model (Etzkowitz, 2002; Etzkowitz and Leydesdorff, 1997), and issues concerning lateral thinking (De Bono, 1970) may also be considered, complemented by the use of Mode 2 of knowledge production (Gibbons, 1994), and the competence blocks developed by Eliasson (2000). In addition to most of the elements highlighted, government funding is also a key factor and a strong support in the development of innovation infrastructures and in the subsequent local and regional innovation system as a whole. This type of interventionism has also been discussed with regards to the role of the entrepreneur's dynamic activity and creativity (Roberts, 2005).

2. STPs building blocks and strategies

The history of STPs can be traced back to the early 50's, when “brands” such as Silicon Valley or Boston’s Route 128 became notorious examples of a new way to conceive businesses location and industry-academy collaboration. The basic concepts and ideas that shaped these projects, which are the results of a wonderful combination of planning, foresight and serendipity, were studied and adopted in different parts of the world, as shown in the figure 1.



The adaptation of these ideas to the different contexts has resulted in a very rich variety of STP models and strategies, some of them very different from each other indeed. Nevertheless, there are some common denominators, some fundamental building blocks shared by all STPs, which enable us to distinguish these projects from other kinds of more conventional industry and businesses areas and locations, whose main emphasis is on the real estate aspects.

The International Association of Science Parks gives the following definition:

A Science Park² 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.

Although other definitions of STPs may emphasise different aspects, 8 elements seem to emerge as common denominators that most of them take into account; we may consider them as the main STPs building blocks as shown in Fig. 2.

STPs main building blocks

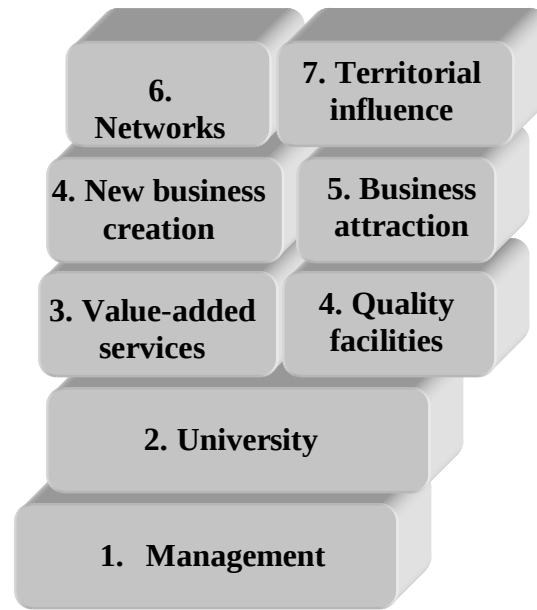


Fig. 2

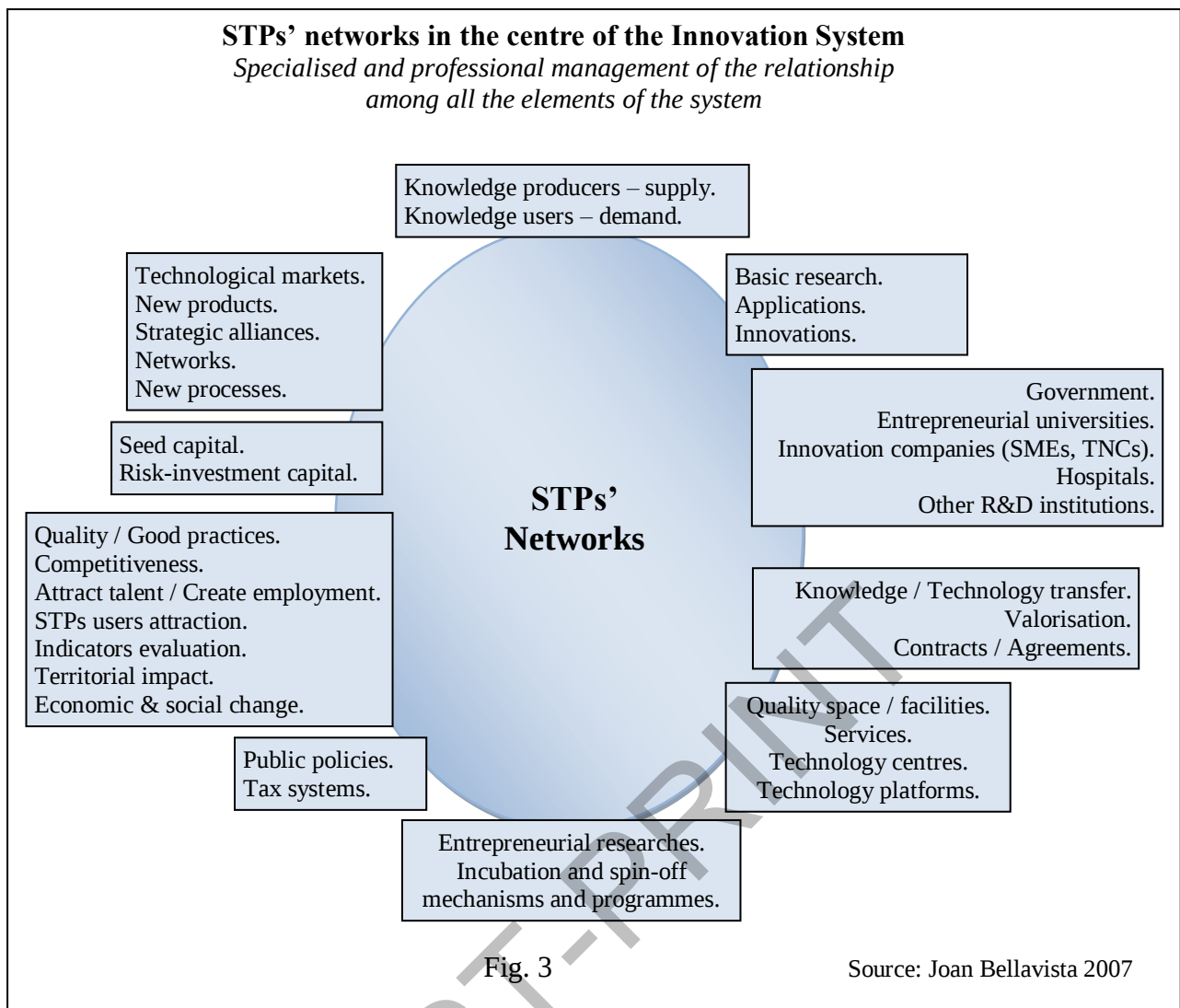
Source: Luis Sanz

1. At the core of every STP there is a highly specialised management team whose main task is to create and manage the adequate ambiance and services to stimulate the links and knowledge transfer between the various agents involved. They also implement the various tools and programmes necessary to incubate new technology-based firms, generally via in-house incubators, and to generate spin-offs. Managing the real estate elements may, of course be also under the responsibility of this team, but it is not its core job. STPs are, as overwhelming experience of many years has shown, highly management-intensive projects.
2. Quick and operative links to one or more universities is another essential element of every STP. This relationship may present a variety of formulas and its intensity may differ from park to park (as a general rule, for example, it will be more intense in Science or Research Parks than in Technology Parks), but it is universally accepted that no project can be counted as a STP unless this relationship exists. This means that one can find producers and users of knowledge within the same physical space of a given Park which is therefore both the supply and the demand side. Depending on the focus, some models incorporate basic research projects and others focus on more applied research, or directly into innovation procedures. From an institutional point of view, there are entrepreneurial universities, innovative companies, research institutes, hospitals and various other R&D and innovation organisations located within the Parks. Due to the rich combination of research and innovation organisations hosted within the Parks, both public and private, processes of knowledge and technology transfer, contracts, and agreements become especially feasible.
3. Beyond the usual ancillary services that they share with many other conventional industrial locations, value-added services are a real STPs' trade mark. Among

the most common ones we find: access to seed and venture capital funding, intellectual property consulting, international marketing, access to university research teams and labs, access to international networks, training programmes, and technology brokerage assistance, amongst many others.

4. Quality facilities, in a carefully designed space, which besides office and lab space for companies may also include (as is happening increasingly) residential areas, leisure facilities, social gathering spaces, etc. Many Parks also have full technology centres and technology platforms, devoting resources to specific technology and innovation clusters, with a high standard of research and technology expertise for the tenants.
5. STPs devote special efforts to promote and host innovation-based incubators and pre-incubators promoting specialised entrepreneurship, spin-off companies, and covering a wide range of services for the new SMEs hosted. Public policies devoted to research, innovation and competitiveness have a special place in STPs. The same can be expected for the taxation measures devoted to R&D and innovation. Parks are also significant instruments used to attract talent and create specialised and high standard employment. Good practices and competitiveness of their tenants are key elements in order to impact on the territory, leading to economic and social change as one of their targets.
6. Most STPs not only carry out efforts to create new technology-based firms, but also to attract already existing companies, who find a better environment to stimulate their innovation capacity and their acquisition of new knowledge and technology in a STP. The profile of STPs' companies lead to innovative products and processes, to strategic alliances and to technological markets.
7. Networking is an essential element of every STP, which in itself can be regarded as a network (indeed the firms and institutions located in a park are often woven into rich and complex networks) but also as nodes of broader networks formed by the ever increasing number of STPs throughout the world.
8. Mature STPs spill out their positive effects beyond their physical boundaries by involving companies and institutions that may not be located in the park, but that soon will make part of the park's network, in many of their programmes and activities.

So far we have depicted the constitutive building blocks of STPs which comprise an interesting set of tangible and intangible elements. But fully understanding these projects requires taking into account not only these structural elements, but also the vast web of users, clients, agents, functions and stakeholders that make up for the challenging complexity of modern STPs. When one draws a map of this broader web, the network element (and its management) become the gravitational centre of the modern STPs. Figure 3 presents this much broader picture from a network-centric angle.



3. Science and Technology Parks' strategies. IASP's Strategigram³

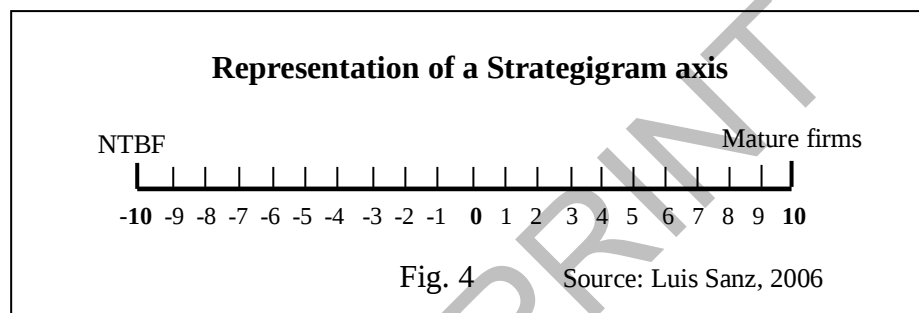
STPs present a wide variety of models in response to the many different contexts in which they operate. The richness of models is owed to not only the diversity of the social, economic and political contexts where they are found (where they need to adapt and provide services), but also to the natural evolution that has naturally emerged after more than half a century. This gives rise to an accumulation of knowledge, experience and a filter which separates the success factors, which are almost universal, from the other paths which have proved to be less productive. The existence of IASP which is now 25 years old, and the size of its international network, being present in 72 countries, has been an unquestionable accelerator in this constant exchange of experience, and consequently the accumulation of knowledge.

However, due to this diversity in the models, to be truly beneficial and fruitful it is necessary to have various conceptual tools and a method of analysis which allows a better understanding and classification. It is essential both for the theoretical study of STPs and for the practitioners. They can then carry out a meaningful benchmarking, studying success factors and best practices from those models which may have a similar strategy and are comparable to their own.

IASP Director General Luis Sanz has designed an analytical method which enables Science Park managers to see an outline view of the ‘strategic profile’ of their STP and then by being part of a database can therefore find other STPs with similar strategic profiles.

The IASP Strategigram is formed by 7 strategic axes. The two ends of each axis represent two different strategic options which are clearly at either end of the spectrum. Each axis takes into account a series of objective indicators which are obtained via the answers given by the IASP members that wish to make use of the Strategigram questionnaire. The ad hoc software designed for this tool assigns a weight to each of these indicators, and the final weighting gives a figure which determines the position of the STP on each axis, or in other words, determines what the STPs strategy is for that particular axis.

Figure 4 shows the graphic representation of a Strategigram’s axis:



For this example we have chosen axis n. 3 (“Target firms”). From looking at STPs worldwide, it can be seen that some have prioritised work with the “new technology based firms” (NBTF), dedicating the majority of their efforts to encouraging their creation through business incubation, stimulus from the spin-offs, entrepreneurship, etc. Alternatively, others focus on attracting already existing companies, aiming to offer them an environment and services that will allow them to improve their competitiveness via the increase in technological capacity and innovation.

On this axis, the first group would occupy the positions very close to the far left (NTBF), and the second group would be placed at the opposite extreme, close to ‘Mature firms’. The closer an STP is to an extreme, the greater the emphasis given by the STP to that particular strategic option. A central position would indicate that a STP gives equal importance and efforts towards working with both types of companies. Meanwhile, a positioning at -5, for example, would correspond to STPs who have the creation of NTBF as their main focus, but who recognise that attracting already existing companies is a key factor.

The 7 axes of the Strategigram are the following:

1. Location and environment.
2. Position in the technology stream.
3. Target firms.
4. Degree of specialisation.

5. Target markets.
6. Networking.
7. Governance/Management

The axes will now be discussed briefly, explaining the key indicators which are considered and taken into account for each.

Axis 1. Location and environment.

This axis reflects the degree of urbanisation of a STP. Its extremes are “urban” and “non urban”. The middle point would correspond to those STPs generally considered as semi urban.

Of course, the geographical location of a park is an important indicator to determine its position on this axis, just as the distance to the city centre, or the size of the city. However, there are other elements taken into account that try to measure the degree of urbanisation of a park, or the elements it may have to make itself attractive not only to companies and institutions but also to people, especially the new knowledge workers and the ‘creative class’. That is why the Strategigram also considers the existence of residential facilities in or near the park, leisure and commercial areas, cultural activities, sports centres, etc.

It is worth noticing that the position on this axis (and in fact on all of the axes) may change over time. The growth of the city may reduce the distance between the city centre and the STP; or the park management may add new urban elements such as housing.

Axis 2. Position in the technology stream.

By “technology stream” we refer to the set of processes, mechanisms and actions that enable the generation of technology and its circulation (transfer) from its sources (upstream) to its recipients (downstream), and eventually the pumping back of resources toward the sources to keep the flow running. This axis’ extremes are “research/upstream” and “market/downstream”.

It is safe to assume that upstream STPs work more intensely in conjunction with university departments and R&D institutions than with companies, and vice versa. However it is important to underline that the Strategigram axes usually indicate a degree of emphasis, and not an “either/or” situation; it’s obvious that STPs must work with both elements (research and markets) to be real STPs and not just extensions of a university in one case or mere business parks in the other⁴.

The indicators obtained through the Strategigram questionnaire for this axis refer to a variety of aspects such as the participation (% of ownership) that universities and private companies have on the park, the park’s location with respect to the university, number of labs and technology institutes in the park, ratios of park tenants with and without their own R&D departments, ratios of companies’ employees/R&D institutions employees, etc.

Axis 3. Target firms.

The third axis reflects whether a STP focuses more on attracting already existing companies or on the creation of new firms and start-ups (often referred to as NTBF or New Technology-based Firms).

We know that most STPs have both type of tenants, but it is important to determine the relative importance and emphasis that STPs attribute to each of them.

Incubation activities and the presence or easy access to seed and venture capital funding are the key indicators here, together with the intensity of the relation between the park and incubator's management teams, or ratios of park and incubator's number of tenants, amongst others.

Axis 4. Degree of specialisation.

This axis seeks to determine whether (and to what degree) a STP has chosen to specialise in one or a few technology sectors, or rather to take in companies working in any technology sector.

This is a very important strategic decision, and very often we also see that STPs that were initially conceived as "generalists" (non specialists), evolve towards a specialisation. Such evolution is sometimes the result of a well meditated decision and planned, but sometimes is in response to unplanned/unforeseen factors.

The extremes on this axis are "specialist" and "generalist". The middle point represents the semi-specialised parks, by which we mean STPs that admit activities related to any technology sector, but emphasise one or just a few of them.

Axis 5. Target markets

The position on this axis shows whether the strategy of a STP has a local/regional priority in terms of the companies that seeks to attract, or prefers to emphasise the attraction of foreign and multinational firms.

The marketing objectives and budgets, the eventual presence or work of a park abroad (via brokers, delegations, etc) and local vs. foreign tenant ratios are some of the indicators taken into account. The extremes are "domestic" and "international".

Axis 6. Networking.

It is widely accepted that networking is an essential element and success factor of every STP, and the IASP works intensely, not only in creating, maintaining and managing efficient networking channels and mechanisms within the STP industry, but also in promoting higher and more professional standards in the STP networking in general, and in the management of each STP own network in particular.

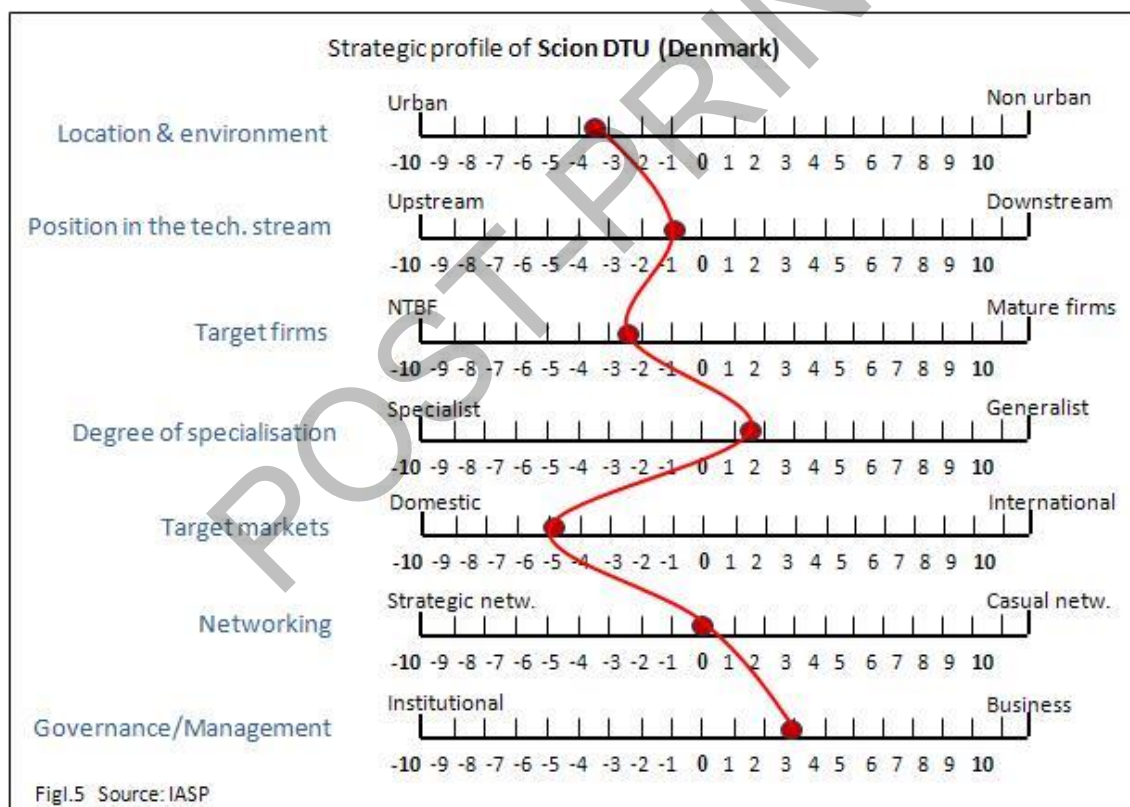
The axis of the strategigram helps us to understand the approach of the different parks to networking, determining how much "strategic value" is placed on networking. This axis' extremes are "strategic networking" and "casual networking".

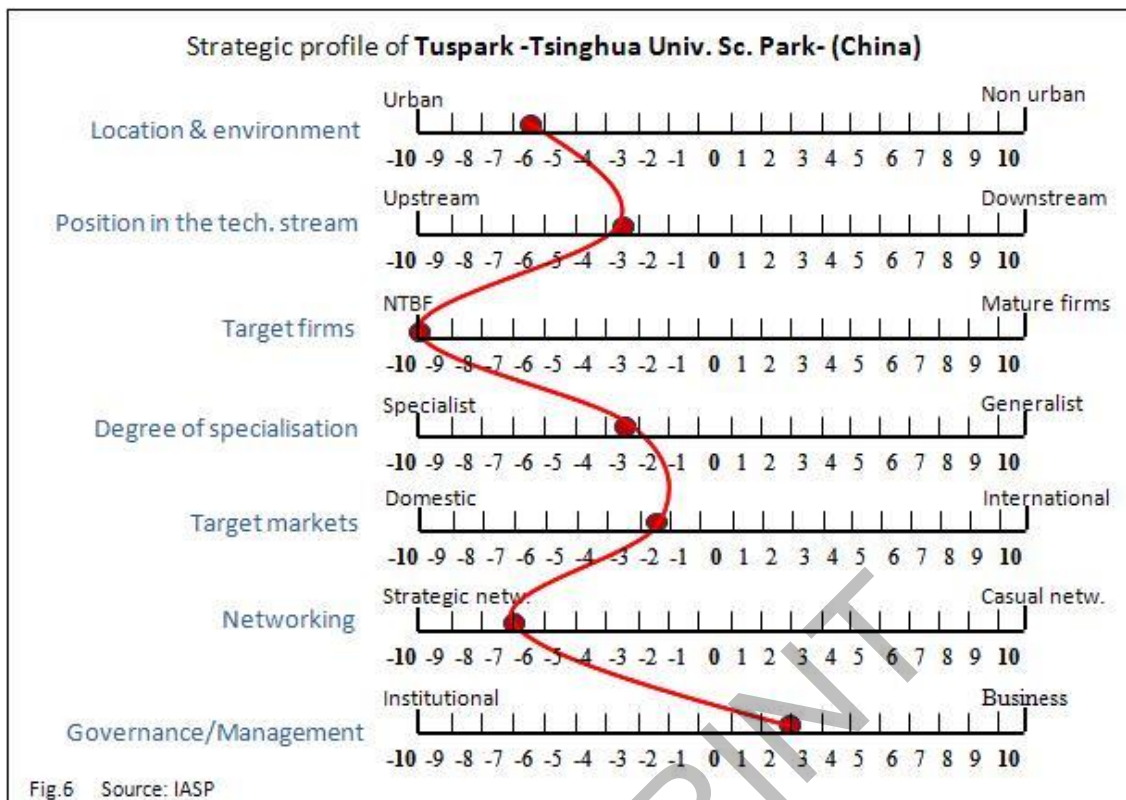
Some of the indicators used in this axis are: budgets allocated to networking, staff whose main task is related to networking, number of networking events organised by the park, number of networking events attended, active/passive participation of the park in formal/informal networks, etc.

Axis 7. Governance/Management.

A number of indicators related to the ownership structure and breakdown, composition of the governing bodies, profile of the CEO or equivalent title, salary policies, etc., allow the Strategigram to determine whether a STP is predominantly business or institutional minded. We wish to underline that this axis seeks to learn more about a STP than the simple distinction between public and private parks (purely based on the ownership), introducing many governance-related indicators as well. The extremes of this axis are “institutional model” and “business model”.

Figures 5 and 6 are two actual strategic profiles of IASP members, used to illustrate the functioning of this tool and the way the information is presented. (These profiles should be considered provisional until a new analysis is made once the Strategigram’s pilot phase is finished).





The IASP Strategigram has been operational for only a few months and its pilot phase will be finished in October 2009. Its results are being analysed and compared and the software fine-tuned before it becomes fully operative. However, and according to these initial results, we are confident that this tool will be very useful to STP managers that wish to have a comprehensive overview of the strategic profile of their park and to find out which other STPs in the world have similar strategies. The tool has also been successfully used in consulting studies conducive to the inception and construction of new STPs in the world, which opens up a wide range of uses for this methodology.

4. STPs success and constraint factors

The papers included in this special issue analyse a variety of topics related to STPs role and management, albeit having creativity and creative processes as their leitmotiv. The findings of the last IASP survey about the main STP success factors and constraints may enable the readers to complete the interesting vision of the STP industry that these papers portray.

IASP General Survey 2006-2007: technical data:

Questionnaire and answer gathering: November 2005 – August 2006.

Data analysis: November 2006 / January 2007.

Universe: 268 IASP full members (operative STPs only) in 65 countries.

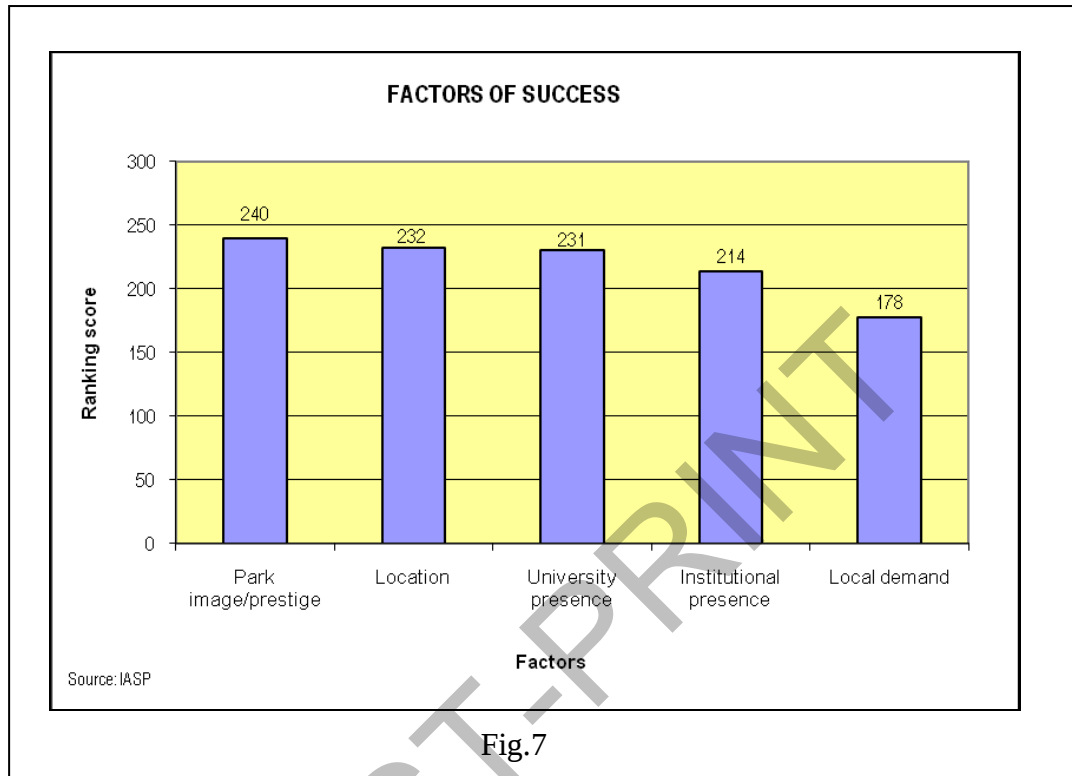
Sample: 77 IASP members (29% of the Universe).

Survey technique: on-line questionnaire

Survey director: Luis Sanz (IASP Director General)

Co-ordinator: Ebba Lund (Director-IASP Services & Communication Dept.)

The chart in Fig. 7 shows the main success factors for STPs, according to their managers. To establish the ranking, points were assigned to the different choices given for each of these factors (not important, slightly important, moderately important, very important, N/A) and then multiplied by the number of times that each of them was chosen.



Image/prestige of the Park is considered very important by 62% of Parks and moderately important by 18%.

Location is very important for 53% of STPs and moderately important for 26%.

Links to Universities is the third most important factor for STPs' success. 52% of Parks regard this factor as very important and 27% as moderately important.

Institutional support has also an important role in the success of STPs. 43% of Parks consider it very important and 29% moderately important.

Local demand is considered a moderately important success factor by 43% of the Parks.

To further our knowledge on the perception that STP managers have about factors affecting their overall performance, we asked about other issues that may affect Parks competitiveness.

Park managers consider that the overall quality of the tenant or resident companies is the most important factor affecting STPs competitiveness. In fact, 45% of Parks considers it very important and 32% moderately important. Moreover, no Park has considered this factor as not important.

The number and quality of the services that Parks provide to their tenants is regarded as very important factor of competitiveness by 21% and as moderately important as 49% of STPs.

The third major element of competitiveness is the differentiation of a region from other adjacent regions. 25% of the STP managers surveyed regard this as a very important factor of competitiveness.

The long experience of the authors as STP experts and managers confirms all this data. But for the advancing of the STP industry throughout the world, it is necessary to break down many of these findings further. For instance, while fully accepting the fact that the quality of the resident companies is of crucial importance for a STP success, a deeper understanding of the admission requisites that STPs should establish (that is, the criteria by which companies may be approved to locate in the park), is absolutely necessary. Moreover, the procedures through which said requisites are verified deserve careful consideration: it is quite obvious that although assessing the financial assets of a company or the percentage of the resources allocated to R&D or internationalisation activities can be relatively easy, evaluating the creativity capacities of that company can become quite a conundrum.

The 2007 IASP Conference in Barcelona, of which a sample of its most interesting papers is gathered in this special issue, threw a lot of light on many of these challenges, and we are confident that tools like the IASP Strategigram will also provide a highly interesting flow of new data which will enable new and fresh analysis about the STP movement worldwide.

5. The International Association of Science Parks: a global knowledge-based network. (www.iasp.ws)

The IASP was founded in 1984 and had its first site in Sophia Antipolis (France). It soon crossed European borders and turned into a worldwide organisation. As it continued to expand, IASP moved its central offices from France to Australia, then back to France and finally, in 1996 to the current Headquarters in Parque Tecnológico de Andalucía (Malaga, Spain), after a Board of Directors decision to set a more stable and professional management of the association.

From its founding dozen members or so, the IASP has had an ever increasing growth curve, today having nearly 400 members in 72 countries. In 2000 it opened its Beijing branch office which is now located at Tsinghua's University TusPark. Adding to its worldwide dimension, the IASP has 6 Regional Divisions that make its operations more flexible and diverse. These divisions are: IASP Asia-Pacific, IASP Europe, IASP Latin America, IASP North America, IASP West Asia and the recently created IASP Africa.

The IASP mission is to be the global network for Science and Technology Parks, and to drive growth, internationalisation and effectiveness for its members.

Indeed, IASP is the largest Science Park association in the world and the only one with a truly global nature. The IASP is committed to create value for its members, which implies going well beyond the conventional set of services that constitute the core activities of many associations. On the contrary, the IASP has designed its own “knowledge-based strategy”, aiming at delivering first and foremost knowledge, knowhow and best practices in every aspect related to the STP industry. This in turn means that the IASP emphasises creating and delivering services and products that are knowledge-intensive. There are two main IASP departments, “Services and Communication” and “Projects and Knowledge Management” which constantly work on the development of such services and products, such as the software-based IASP Strategigram; an increasing number of books and publications (among which it is worth mentioning the IASP “Learning by sharing” series); international and highly practical workshops and seminars; the IASP annual world conferences which have become the biggest events in the STP industry; and in cooperation with its partners of the World Alliance for Innovation (WAINOVA) the upcoming WAINOVA Atlas of Innovation, amongst many other initiatives.

The IASP is an independent and self-sustained nongovernmental organisation in special consultative status with the Economic and Social Council of the United Nations.

6. This special issue

In this special issue of the Science and Public Policy Journal, a number of selected papers from the XXIV IASP World Conference on Science and Technology Parks held in Barcelona on the 1-4 July 2007 are presented. The event was the annual Conference of the International Association of Science Parks (IASP), and the papers selected include the most important ideas and discussions build up among the experts.

The aim and contents of this special number is to explore STPs entrepreneurial environments and habitats, the analysis of social networks, connectivity processes and the instruments to build up successful parks networks. The theoretical basis and key mechanism to manage creativity in STPs and their tenants are analysed together with the management principles that should help diverse models to evolve. There is also the aim to measure and promote creativity, the analysis of the role of creativity on developing ideas, processes, products and services, and the study of existing tacit competences and cultures in STPs. Parks are also explored as catalysts for innovative and creative improvement in the territory.

Malcolm Parry, Director of the Surrey Research Park, and Marilyn Huckerby, Director of the South East England Enterprise Hub Network, analyse the case of the South East of England Development Agency and its creative dynamics and mechanisms to develop a successful network of Enterprise Hubs in its geographical area. The paper explores the theoretical basis of creative environments, innovation processes, the role of entrepreneurs and entrepreneurship in this context, the role of the risk capital to add commercial value, and a number of role changes operated at the stakeholders and on the cultural milieu level. The authors focus on the creative environment of science parks

and their tenants, stressing the linkages between knowledge generation and knowledge utilisation based on their own information, and the information and experience available from UKSPA. The paper discusses the central role of creativity on developing ideas, processes, and products and services towards a viable business. Science parks and incubators are seen as key instruments to manage creativity. Although the Hubs based on science parks have demonstrated their leading role, the authors underline the importance of the network model getting the support from universities, entrepreneurs, local authorities, business agencies, investors and service providers. The local level is assumed as the correct location to act within the context of the global economy, and in this case by means of the Enterprise Hub Network model.

Five members of the Patras Science Park in Greece composed of two research assistants, two R&D consultants and the managing director of PSP submitted a benchmarking analysis for creativity in high technology and conventional firms. Besides their involvement in the development of the Park, some of them hold teaching and research posts at the University of Patras and at the TEI of Epirus. Analysing what they define as one of the less favoured regions in the south of Europe, Western Greece, Patras Science Park is also analysed as a catalyst for innovative and creative progress in the region. Fostering and measuring creativity is one of the purposes of the paper, with a special focus on local firms. They make use of the theoretical frameworks available and the various approaches related to creativity, ranging from organisational studies, economic development, social geography, urban theories, and educational and human resource studies. Also, basic variables as culture, climate, systems, resources, skills and leadership, are used in order to explain the role of organisational creativity, and the role of surmounting the lack of studies analysing creativity in local firms. The small size of the local firms is analysed in relation to the fraction of firms highlighting creativity. The relationship between technological level and the use of creativity is also explored, and the skills and resource management is also related to the general performance.

Paulo de Miranda, Director of IASP's Projects & Knowledge Management department, together with Julia Zardo and Jose Alberto Aranha, address the issue of creativity (or "creativity") taking as an assumption that this concept is already widely accepted as a key factor to foster competitiveness in terms of social, technological and innovation capital and growth for an ever increasing number of entrepreneurial environments or habitats. The discussion about understanding creativity is organised around three elements considered central for a consistent interpretation on this issue: people, environment and culture. The article also provides some reviews on creativity as a market factor as a valuable form of consumable goods and services; on how it is intimately linked with the "competitiveness-innovation" binomial; and also describes creativity as an agent for transformation for the growing spectrum of business and technologies impacting what are now called creative industries. However, what this article attempts to explore is the entrepreneurial environment and what it constitutes in this context. Secondly, how people, or in this case the entrepreneurs themselves, are the essence of any vibrant and creative environment, particularly when attempting to foster the growth of an entrepreneurial culture among newly innovative firms. And thirdly, when creativity becomes part of an entrepreneurial environment and forms part of a business culture, it is possible to say that more and more elements of culture become unique and an authentic characteristic of that environment, which will sustain and energise it continuously.

Finally, Ilkka Kakko, Managing Director of the Global Oasis Network, and Sam Inkinen from the Finland Futures Research Centre, Turku School of Economics, present an article with the suggestive title “The Homo Creativus”. They explore the so called humancentric role of the third generation of science parks, and the management principles that should help that model to evolve. Creativity is conceived from the different existing approaches studied in a great variety of fields such as history, sociology, psychology, and education amongst others, and the different aspects of these such as person, process, product or environment. It is stated that the dynamic interaction among creative individuals needs to be managed through the serendipity management model: attracting talent looking for unexpected competence using and developing trust in varied environments. The authors consider the capability of serendipity management to develop breakthrough innovations. The assorted social networks, the emergence of complex structures coming from simple entities operating together, and tacit competence in a face-to-face expert collaboration based on synergy and energy are the basic conditions. The Global Oasis Network presented uses and supports open innovation and new management paradigms. Tolerance, diversity and connectivity become key aspects and attitudes to succeed in the so called fruitful collisions through random encounters. Another keyword is “flow”, defined as a state of deep concentration, involvement and task enjoyment as a basic behaviour also to be managed.

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² The IASP definition of "Science Park" encompasses other terms and expressions such as "Technology Park", "Technopolis", "Technopole", "Research Park" etc. Although there may be certain differences between them, projects under these afore-mentioned labels share many goals, elements and methodology and therefore come under the remit of this definition.

³ IASP Strategigram: © Luis Sanz

⁴ Up to a certain extent we can presume that STPs clearly positioned in the upstream zone of the axis respond to the "Science Park" label, whereas those positioned at the other end, i.e. in the downstream zone respond to the "Technology Park" label.