Technology Parks as instruments for business innovation: A presentation of the Greek experience and an identification of transferable concepts and practices

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Abstract: In today's modern economy, development, acquisition and business exploitation of knowledge is a key element of economic development. The 'Technology Park' concept, as a practical means to cross-fertilize business needs and technological development, has already some decades of existence across the world. Nurtured for the first in the U.S it has now been widely adopted across the world, though not always with the same aspirations, resources, operational modalities and eventually results.

This paper will present and elaborate on how this relatively new paradigm for business innovation was implemented in Greece, in the 90s and especially the period from 95 till today. Based on this experience it will also suggest some rough guiding principles on how to proceed to set- up such structures, in other countries, where similar economy and society assumptions apply.

1. Introduction

In today's global economy it is vital for nations and the regions within nations to develop, maintain and support their competitiveness. A major factor in this is the development of innovative products and services, which in turn depends significantly upon the efficiency of transfer of technology from the academic and research institutions into the business community. A Science and Technology Park consists of a supporting infrastructure for the establishment and development of knowledge-based enterprises based in a location formally linked and usually physically close to a center of technological excellence, a university or research institute. It normally incorporates physical space, business management, and other services and a technology link to the center of technological excellence.

The simplicity of this general concept has become somewhat obscured by the plethora of names used: these include Science Parks, Technology Parks, Technoparks, Research Parks, Technology Business Incubators, Technopoles etc. Such organizations can differ greatly in scale, scope and range of services provided, but their common distinctiveness may all be encompassed by the operational definition given below.

The most useful definition of a Science Park is based on that originally formulated by the U.K. Science Park Association (UKSPA). This has been adopted almost verbatim by the International Association of Science Parks (IASP) and is employed by most of those concerned with the actual development and operation of such initiatives. A Science & Technology Park is:

- An initiative for the establishment and growth of technology-based enterprises.

- Formally and operationally linked to at least one center of technological expertise.
- An organization, which provides management support for its tenant companies.

These initiatives can vary greatly, even within one country. There is thus no question of a rigid definition or of a single transferable model being appropriate through the world. Its objectives, its location, economic climate and the local expertise and resources available should determine the characteristics of each Park.

2. An historical review

The initial concept of Science and Technology Parks emerged out of the needs of "entrepreneurial-minded academics" that wanted to improve the exploitation of academic research and yet remain close to their academic institutions (UKSPA, 1994). In addition, the industry started realising that it needed access to high quality research in order to be competitive in international markets.

The first Science Parks date back to the 1950s and are considered to be originally an American phenomenon. The most famous examples include Stanford University, its Science Park and Silicon Valley in California, Route 128 and MIT in Boston, and the Research Triangle Park in North Carolina. Monk et al. (1988) argue that the above three, best-known developments have not followed the same pattern. Although all have emphasised links with universities, their growth was for some the result of a clear policy initiative whereas others have evolved almost spontaneously. In addition, some have grown in areas offering high quality amenities while others in less favoured regions.

In the United Kingdom, Cambridge and Heriot-Watt were the first Science and Research Parks to be established in 1970 and 1971 respectively. In particular, Cambridge Science Park is considered to be the most successful Science Park in Britain. Its success derives from many factors, the most important of which is the emergence of Cambridge as a leading centre of high technology industry in Britain (Segal Quince & Partners, 1985). However, a major wave of establishing new Parks came during the mid- and late 1980s. Nowadays, there are fifty-one Science Parks with a property investment over £750M and a lettable area of 750.000m^2 (UKSPA, 1997). They house 1.367 companies with 25.300 employees.

According to Cabral and Dahad, (1993), Science and Technology Parks provide an ideal interface between universities and industry. They bring in close proximity highly qualified researchers and companies interested in advancing their technological base. Universities, which traditionally have rejected close industrial contact, endeavour more and more to become associated with high-technology development. Especially in cases where public funding was reduced, universities sought a more dynamic association with industry since the later has seemed likely to become the most promising replacement source of support.

Every Science Park has its own mix of priorities and objectives. However, all are expected

- To enhance the creation of new technology based firms (NTBFs),
- To help local industry in terms of technological independence,
- To contribute to the reduction of local unemployment by creating new jobs,
- To facilitate technology transfer particularly from universities or research centres to firms and,

- To stimulate the economic growth of the region.

Massey et al. (1992: 21) present various aims stated by managers and sponsors of the Parks set up in the UK during the 1980s. Apart from the above, a Science Park aims:

- To encourage the growth of existing NTBFs[1], as well as of the spin-off firms started by academics,
- To promote the technologies of the future,
- To create synergy between the firms,
- To improve the image of the academic institution in the eyes of central government and generate income for the institution.

Other objectives cited in the Science Park literature include: return on investment for the stakeholders reduction of the time required for technology commercialisation, and encouragement of multidisciplinary approaches to applied research and development projects.

Monk considers the development phases of a Science Park to be three (not necessarily successive). During the initial phase, issues such as land agreement, building construction and management require resolving. The second one, the marketing phase, focuses on promoting the scheme and ensuring the anticipated benefits to be realised. The third phase is the "post marketing" and is characterised by the on-going management of the scheme. In addition, the existence of effective technology transfer projects is tested. It is considered to be "ultimately the most critical phase" (Monk, 1985).

Spain and Portugal, like Greece, belong to the less favoured regions of the European Union. In addition the levels of Gross Expenditure on R&D are quite low for all three countries and the establishment of Parks is a recent instrument of science and technology policy.

The Spanish Technology Park has been initiated and promoted in a decentralised way by regional authorities without any central government involvement. The Parks intend to act as vehicles of technology transfer and investment for regional policy.

Although, Portuguese Parks are still in their infancy, the model which has been followed up to now is a centralised one: city councils in collaboration with ministries are responsible for the existing initiatives. Most of the Parks are instruments for economic development on a national rather than a regional level and they are heavily dependent on European support (Escorsa and Valls, 1996).

2.1 Science Parks and Regional Development

Science Parks are considered to be vehicles for technology transfer and important instruments for regional development. Moreover, it is argued that they stimulate the creation of high-technology based firms, and they increase local employment, contributing in this way to the economic growth of the region.

[1] NTBFs: New Technology Based Firms. A NTBF is defined as "any organisation exploiting scientific and other knowledge and/or established technology to develop products and/or services which are ultimately intended to be sold at a profit" (Westhead and Storey, 1994:163)

Therefore, the most frequently used indicators for assessment are employment data and statistics of new firm formation. Nevertheless, these figures should be considered in a context that takes into account the "age" of the Science Park and the economic and technological features of the region. For example, the Research Triangle Park in North Carolina housed firms employing almost 30.000 people in 1987. Considered this fact on its own, it is quite impressive. However, it took twenty-eight years to accomplish this figure (OECD, 1987). On its ninth birthday, in 1965, it housed only nine laboratories employing less than 1.000 people (The Economist, 1985). Cambridge, the largest Science Park in UK, had only seven occupants in 1972, yet in 1994 there were seventy-two companies. In addition, Heriot-Watt, established in 1972, took sixteen years to achieve the number of thirty-two tenant companies in 1994.

In order to judge the success of a Science Park, in terms of employment and new firm creation, a period of fifteen years should be allowed. Moreover, it should be noted that Parks cannot be expected to solve all the problems of local employment.

Science Parks depend on the features of the area that they belong and can either gain and incorporate the positive characteristics (Cambridge Science Park, UK), or attempt to escape from the inheritance of previous eras: unemployment, lack of suitable land and buildings, high levels of manual workers and low proportion of scientific workers (Aston Science Park, UK).

An important question to be asked, when a Science Park is being planned, is what will be its relation to the local economy. In other words, how the objectives and structures of a Science Park can be integrated to the prevailing regional situation (Massey et al, 1992). It is argued that Science Parks can act as instruments of regional development as long as they consider the local economic and social history, the regional political strategy and the general context of the local development. Science Parks that have been developed using a model, which was originated under different assumptions, have not always succeeded. Although it can be an important development model for a specific time and place, it may prove totally unsuitable to be transferred under conditions that do not resemble in their economical and societal aspects.

Currently there are more than 1000 Science Parks in operation worldwide. Most of them are members of IASP (International Association of Science Parks, www.iasp.org, 650 members) and AURRP (Association of University Related Research Parks, www.aurrp.org, 295 members).

3. The Greek experience

Greece in the 90s embarked on a systematic attempt to introduce the concept of the Technology Park in the Hellenic society. Four different parks were created at various parts of the country, mainly on the criterion of a spatial proximity with significant research capacities of the country. The first period, till '95, the results were rather disappointing. Despite the significant amounts invested in these exercises, few visible results could be claimed.

In the period from '95 till today this trend seemed to change as significantly more success stories were reported. The Parks seemed to gain some good credibility and, at least part of their business plans was on a very promising implementation path.

Recently, a major ideological shift at the GSRT (General Secretariat for Research and Development) that represents the higher research management level of the society is in process. The emerging attitude aggressively targets visible results and wishes to see practical and novel products and services meeting society's and economy' s needs. Research funding is channeled mainly according to these criteria. Pure, scientific, paper production is not per se any more considered as the ultimate scientific fulfillment. We do believe that this new approach will further increase the effect of the Technology Parks as an innovation incubation mechanism.

This section will present some operational details, activities, aspirations, etc. of the four main Technology Parks in Greece. The next section will attempt an evaluation of their successes and failures, and a first assessment of how the new ideological standpoint may affect their course, to the benefit of business and society.

3.1 The Attica Technology Park "LEUKIPPOS"

LEUKIPPOS is located in the facilities of National Centre for Scientific Research "Demokritos" which is ten kilometers northeast of Athens in a green suburb around the hills of mountain Ymitos. It was created as technological project of the National Centre for Scientific Research (NCSR) "Demokritos" in 1990. The initial aim was the promotion and diffusion of technological culture and technology transfer in Greek business and industries as well as in the public sector. Moreover, the creation of new small companies in the sector of advanced technologies was one of the initial concerns. Today the ATP LEUKIPPOS is hosted in a building 320m^2 (twenty offices of 14m^2) where five companies, a secretariat and the Liaison Office of NCSR "Demokritos" are accommodated. In collaboration with NCSR "Demokritos" it is possible to organise conferences and meetings in the main Amphitheatre of 420 seats with simultaneously translation facilities and three smaller Seminar rooms of 40, 40 and 80 seats.

3.1.1 Activities

ATP 'LEUKIPPOS' has activities connected with the five companies: **CSFTA** (Centre for Solid Fuels Technology & Applications), **SpaceTec Ltd** (Space Technology & Applications), **HELLASLAB** (Hellenic Laboratory Association), **TERRA Ltd** (Geographical Information Systems), **FIVI Ltd** (Centre for Cleaner Production) in the areas of telecommunications cleaner production, geographical information systems, space communications, exploitation of the solid fuels, etc. ATP 'LEUKIPPOS' acts as incubator for new companies in the areas of advanced technologies offering office space and equipment, secretariat support, networks services (ARIADNE-INTERNET), financial and market consulting.

In association with NCSR "Demokritos" it is possible in use the laboratory installations of eight (8) Institutes (Nuclear Physics, Nuclear Technology and Radiation Protection, Material Science, Informatics and Telecommunications, Microelectronics, Physical Chemistry, Biology, Radioisotopes and Radio-diagnostic Products) in order to make analytical studies of materials constructions of equipment for detectors, microelectronic devices and telecommunication networks as well as production of radio-pharmaceuticals.

There is an important activity on environmental problems, which results in consulting companies and the public sector. Also the group of ARIADNE and the members of the Computational Centre offer computer networks services. Through collaborators-consultants of the ATP LEUKIPPOS it is possible to give financial and legal advises and market services

for the creation of new small companies in the areas of advanced technologies where the Institutes of NCSR "Demokritos" are specialised.

3.2 The Thessaloniki Technology Park (TTP)

The Thessaloniki Technology Park was established in 1988 by the Chemical Process Engineering Research Institute (CPERI), one of the Institutes of the Foundation of Research and Technology Hellas, to meet the need for greater exchange of ideas, people and facilities between universities and industry. TTP was funded with 1.2 M€, by the Community framework support programme of DGXVI of the European Union in the context of the Operational Programme for research and technology of General Secretariat for Research & Technology (GSRT). The 7.500 m2 infrastructure includes CPERI's laboratories, Incubator facilities for companies, Administration Building and Conference center.

Figure 1: The Thessaloniki Technology Park (TTP)

In 1994, a separate company named Thessaloniki Technology Park Management and Development Corporation (TTP /MDC S.A) was created with the participation of FORTH/CPERI and major industries of Central Macedonia. The company promotes and enhances the activities of the Thessaloniki Technology Park in close cooperation with the Association of Industries of Northern Greece, Universities and research centres. TTP/MDC is a member of the International Association of Science Parks (IASP), and a partner of the Hellenic Innovation Relay Centre (H-IRC) belonging to the network of Innovation Relay Centres, run by the European Commission's Innovation Programme.

In March 2000 the Center for Research and Technology Hellas (CE.R.T.H) was founded. The center is organized with a central administration section and four Institutes: Chemical Process Engineering Research Institute (CPERI), Informatics and Telematics Institute (ITI), Transport Research Institute (TRI) and Institute for Agrobiotechnology (INA).

3.2.1 Activities/Regional Development

TTP/MDC promotes activities, which contribute to the increased competitiveness of the Greek industry with special emphasis on Chemical Technology, Material Technology, Food & Beverage, Textiles and Energy & Environment. This goal is pursued by participation in many European and national regional development programmes. Furthermore, TTP/MDC identifies present, future and latent industry needs within Northern Greece and links them

with technological innovation. An information network has been established and is continuously expanding encompassing research institutes, industries and regional development initiatives.

3.2.2 Technology Transfer

The Technology Transfer Center (funded by GSRT as a joint project of CPERI & TTP /MDC) serves as Industry-Research Liaison, performs partner searches, executes assessment and exploitation of research results, assists with RTD proposal preparation, submission and project management. Furthermore, it ensures information dissemination concerning research results, technological developments and the emergence of new technologies. Technology brokerage, technology search & assessment, technology transfer agreements, assistance for technology implementation is also provided. Finally measurements and testing quality control through promotion of analytical services (of CPERI and other laboratories) are also undertaken.

3.2.3 Research and Technology Development

CPERI provides services to local and European Industry for the following sectors: Environmental Fuels and Hydrocarbons, Energy Conservation and Alternative Energy Sources, Polymer Reaction Engineering, Solid Fuels and Environment, Aerosol and Particle Technology, Computational Process Systems Engineering, Electrochemical Processes.

Today CPERI implements 52 R &D projects, provides services to the industry having a total annual turnover of 2.8 M€ and occupying 118 employees of deferent specialties. Through the research carried out, CPERI has developed extensive know-how in areas such as: specialised software for polyethylene and propylene production facilities, environmental friendly catalyst for production of fuel.

3.2.4 International Technology Transfer

TTP/MDC is promoting technology transfer between Greece, the EU, the USA, Eastern Europe and the Balkans and Coordinates the Greek-American Initiative for Technology Co-operation with the Balkans.

3.2.5 Contract Education

TTP/MDC undertakes a leading role in contract education of industry personnel by serving as a link between Greek industry and internationally recognised experts in new fields of technology.

The TTP/MDC also organises, implements and participates in national and European training programmes. TTP/MDC studies issues pertaining to professional training and prepares training workshops on the use of technologies.

3.2.6 Incubator Building

The Incubator Building is open to companies, individuals, or legal entities interested in transforming innovative ideas into new technology, products or services leading to a successful business. Eleven companies are housed today in the incubator building.

TTP/MDC supports the companies by providing services such as: secretarial support, telecommunications, photocopying, ISDN networking, Internet, e-mail and assistance for the participation in European and National programmes. These companies are: **Biotrast S.A** Biomedical Engineering, Vocational Training, **G.As.E.P** Consultants, manufacturers & services in environmental protection issues, **Heletec** Software & Development in the area of Electronic Commerce, **Hellabio** Research, manufacture & marketing of biological reagent for invitro diagnosis of human diseases, **Mangos Salonica** Audio - visual services, **M.E.T.E.K** Trade, installation & service of analytical instruments and automation systems, Development of metrology, **Advanced Software Applications** Advanced software technologies, **NAMTEK** Technological application studies, CAD/CAM software and training, **Forthnet** Trans-Balkan, Electronic Clearance Centre .

3.3 The Patras Science Park (PSP)

The Patras Science Park moved into its newly completed premises in November 1998 and has since pursued its operational development. The building - offering an unobstructed view on the Patras bay and mainland Greece- is located in Platani, opposite the Rion - Antirrion bridge currently under construction and close to the University, the Hospital, the Inst. Of Chem. Engineering and High Temp. Chem. Processes and other innovative facilities.

3.3.1 Operational Framework

The operation and the projected development of PSP are summarized in the above model for the role of Parks in the new innovative environment. They stem from the recent legislative regulation for parks and they particulate as follows:

- Business Exploitation of R&D results giving emphasis on the attraction of new innovative technology based companies with a potential for rapid development (spin-offs, NTBC's)
- R&D - Production liaison, Promotion of Innovation, linking of Finance Innovation and Technology.
- Activities directed outside PSP aiming at: a) Enhancement of competitiveness, b) an environment favoring the innovative developments in the area.

The accommodation of other entrepreneurial activities is under consideration.

3.3.2 Facilities

At the current stage of development PSP has its own modern building which includes: The administration and development offices of PSP, Incubator and Innovation Center for the accommodation of entrepreneurial units, Development unit (Center for Innovation Management Techniques) and Services unit (Center for Technology Transfer), Auxiliary infrastructure and utilities, Presentation and Conference Room, Seminar and Meeting Room, Reception Room, Parking space, Biological cleaning unit.

3.3.3 Services

PSP currently provides:

- Basic facilities and business operation services
- Information and Intermediary services
- Business development services and in co-operation with third parties
- Business Restructuring services

3.3.4 Incubator and Innovation Center Operation

Three typical cases of spin-off enterprises are currently resident at PSP. They cover 40% of the available space. Three more applications are currently being evaluated.

The current tenants at PSP are: **ATMEL HELLAS SA, LYSEIS LTD, NYKA Co-operative.**

3.4 The Science and Technology Park of Crete (STEP-C)

Figure 2: The Science and Technology Park of Crete (STEP-C)

3.4.1 General Information

The Park operates in two buildings and has 4000 sq.m. of floor space with more than 100 offices and 12 labs, accommodating 25 technological and service companies in two buildings, at a privileged physical location, nearby Heraklion, the business centre of the island. It is situated at a short distance from the main town, 12-km away from the international airport of Heraklion and 4 Km away from the beach. The Park has developed one of the first “Resort Office” prototype in Europe, introducing an integrated concept for working and relaxing in an environment that promotes creativity, encourages commitment to new technologies and offers ample opportunities for all year-round enjoyment.

STEP-C Management Company (EDAP S.A.) is a private company with 26 shareholders mainly from the private sector. Two years ago, the Bank of Piraeus became the main shareholder and it is expected to play a vital role to the development of the Park. A small team of experts with a wide scientific and business background operates the Park.

3.4.2 STEP-C's strategic objectives

STEP-C has four key strategic objectives:

1. Technology Transfer

The transfer of research deliverables from the academic institutions to the industrial applications is the main objective of STEP-C. The newly established Centre of Technology Transfer (CTT) promotes this activity. The development of the CTT at the Park is a project financed by the Greek government (GSRT). The CTT is also developing mechanisms in order to provide technological support for the local businesses. The activities of the CTT include:

- Technology auditing
- Partner search
- Market research
- Technological Information
- Consulting services

STEP-C in collaboration with the Thessaloniki Technology Park (TTP) is developing a technology database (DB) which provide technological information to the interested members as well as information about partner searching, forthcoming events, etc.

2. Attraction of companies to the Park

STEP-C encourages small innovative companies to come and operate within its premises and take advantage of the availability of skills techniques and products. The role of the Park is to create the "Innovative Environment" and to connect the scientific and technical development with the regional one. The Park is working as an Incubator, nurturing small NTBFs, mainly spin-offs from FORTH and the UoC.
The Park is now hosting 25 small companies, providing office and lab space, technological support and business services. It also offers administrative and secretarial support as well as networking and web hosting. All services are offered at a very low cost.

3. Promotion of the Park products

This is a series of activities to promote research deliverables to the market. The Park provides technological and marketing support for the promotion of its members' products, with special interest to the application of new technologies for marketing, e-commerce etc.

4. Development of an Education Centre

The objective is targeted to reinforce and re-train key company staff members through advanced offerings, especially in the management and quality assurance areas. Successful courses have already been organised in the areas of quality systems (HACCP, ISO) as well as in innovation management techniques.

3.4.3. Success Stories

Five examples of spin-offs, which were developed in the Park, are briefly presented:

a. **FORTHnet S.A.** It is the successful outcome of the combination of scientific research and of entrepreneurial shrewdness. STEP-C is the place where FORTHnet, the largest Internet provider in the country was nurtured. It is a spin-off of FORTH, with a sound financial base and a very high growth rate. FORTHnet is specialised in the Telecommunications and Telematics applications Technology and employs more than 250 people. Since last month, its shares are traded in the Greek stock market and its market capitalisation is more than 180 M€.
b. **MITOS S.A.** It is a small company specialised in the organisation of conferences and tourism services. It runs the Crete Resort Offices (CRO), which offer two different working environments. One consists of a comprehensive Business Centre inside STEP-C with high-speed data lines and a full secretariat support. The other, from inside a five star hotel, nearby STEP-C, just by the beach, designed for holidaymakers who wish to "tele-work" occasionally from a luxurious resort environment.
c. **FORTH Instruments.** This is an activity of FORTH, which aims at the development of Multi-Spectral Imaging Systems for non-destructive analysis in the fields of Biomedicine, Forensics, Plant Pathology and Visual Art as well as Medical equipment like colposcope, and imaging system for retina diagnosis. In collaboration with Art Innovation B.V. (a Dutch company, based in Hengelo) it developed MuSIS 2007, a system for analysis and documentation of art works.
d. **MINOS Biosystems.** This is a very new activity for the exploitation of research results in the area of Insect Biotechnology. This is a holding company, which established in the UK, in collaboration with foreign investors and the idea is to develop spin-offs for the commercial exploitation of patents, which are related with the transfer of genes from one insect to other insects. This is a platform technology, which has the potential to use in other areas of Biotechnology.
e. **ETAN S.A.** This company was established very recently with the participation of two commercial banks and a local shipping company. Its main goal is the exploitation of research results from FORTH, collaboration with potential investors and venture capitalists, patents filing etc.

3.4.4 Cost considerations

The funding STEP-C received in the period since 1995 and in order to set up the building infrastructure and provide the services described above has been in the area of 3 M€. EDAP S.A, the Park managing company, employs the equivalent of 6- 7 persons full time and has in the recent years turned into a financially self-sustainable entity. This company retains a small "service fee" from all companies that have leased offices and laboratories at the Park

premises. In addition, it offers technology related services to businesses of the region and beyond, and has a regular participation to EU R&D programmes.

4. General assessment of the Greek "Technology Park" exercises

Overall, in the period from the early 90s till today the equivalent of about 10 M€ were invested in the practical development of the Technology Park concept in Greece. Four such cases were financed in various parts of the country. Further requests for other Parks have been at least up to this time rejected. This, according to our opinion has been very wise, as the time it takes for the four early implementations to mature and to enable a thorough assessment is significant. It is obvious that some solid conclusions should be drawn from the first wave of "experiments", before any further investment should be made in the same direction.

The General Secretariat of Science and Technology (GSRT) has in this period sincerely attempted to provide guidance and benchmarking opportunities to the Technology Parks. It has invited external experts to have them assist and assess the whole process. These have provided significant feedback and valuable steering information.

In the following paragraphs we will attempt an evaluation of the results of the overall attempt, i.e., to have technology parks effectively act as a technology transfer mechanism to business. This evaluation will comprise two parts, corresponding to two different point of views, a strategic one and a more tactical one.

4.1 The strategic issue

We believe that the real, the crucial background issue in Greece, and the EU more generally is the significant cultural gap between the world of business and the world of academia. This may also be the case in other areas of the world. Yet, in the US and Japan the efforts to achieve effective partnerships between these two poles of knowledge development has apparently been more successful. The EU, in fact, in many of its policy documents acknowledges the fact that it has not been able to match the pace and efficiency of these two other economic poles in managing innovation. R&D has been much more financed by the state than by the private sector. In the research infrastructure this has resulted to a somewhat introvert attitude. Also, to a detachment from what the real life problems.

Especially in areas where industrial activities are not too much intense (such as Greece) these symptoms go more deeply. Anyone who has experienced the everyday reality of a "combat" business organization has no difficulty in realizing the wealth of research stimulus. Yet, very often researchers, look down on this complex reality, considering it inappropriate for their advanced methods and too simplistic for their tools. That is a very-very wrong idea, based on ignorance rather than personal experience of any such simplicity.

Furthermore, researchers, by detaching themselves from the real world constraints very often appear to understand, very little of concepts such as "cost" or "time" and the impressive anxiety that often accompanies them.

In simple words, the value system of a researcher and a business executive are quite different. Will spatial proximity, such as the one by definition proposed by a Technology

Park, solve this problem? We believe the answer is more close to “no” than “yes’, although one should not discard altogether the bridging effect of this proximity.

What lies behind this discussion is that the strategic framework for bringing efficiently technology innovation into business includes a significant cultural element that will help breakaway from the latent suspicion. Hopefully, the GSRT appears lately to have embarked on this pathway, through a set of revolutionary measures that it has put on rail. These originate from the idea that technology research should be viewed as an investment, a clear payback should be targeted, and that scientific papers are just part of the story, maybe even not the most important one. The respective set of measures aim at:

- Putting **the emphasis as much as possible to practical results, and suggesting a breakaway from the mindset that dictates that “practical result = trivial research”.**
- Initiating **measures to foster an entrepreneurial spirit among researchers**, prompting them to participate in new, technology focused, enterprises.

The difficulties to walk on this path are paramount. Obviously, to reshape your value system, putting the emphasis on results (and not only scientific papers) is not a trivial demand. The inertia forces once again are impressive. They resist the very idea and claim that this policy will undermine the long-term effects of research. Yet, we do believe that the so claimed difference between long term and short term research has nothing fundamental and can therefore not be accepted as a credible ideological standpoint. It is just a matter of the payback time. What should not any more be encouraged is research without a practical focus, be it in one year (short term effect; practical research) or in one century (long term effect; fundamental research).

We do believe that such measures will set the correct strategic background that will drastically leverage the efficiency of the Technology Park instruments in Greece. The will set up a common communication language that at the end of the line will be to the benefit of both communities.

4.2 The tactical level

It must however be acknowledged that the Greek Technology Parks have enabled a number of success stories to flourish. Perhaps the most significant result is the very satisfactory rate of creation of high tech spin- off companies. It seems very unlikely that this rate would have been achieved without the very favorable environment created by the Technology Parks. Low space leasing rates, access to high quality and cheaply priced networking infrastructure, access to information services and research infrastructure are just some elements that have underpinned this success. Very soon the Technology Parks administration realized that this dimension of their operation should be a primary one. The concept of “business incubator” was established and pushed forward.

The investment policy of the Parks took strong account of this priority. While, at the very beginning excessive expenses were made for auxiliary spaces (meeting rooms, open air spaces, etc.) this trend was later abandoned. The same applied to the dimensions of the typical room(s). While at the beginning they were designed quite spacious (30- 50 m^2) so that they could attract departments and operations of larger and established companies, it gradually became clear that this was not the wisest policy. In fact, it should be stressed that established companies remained largely indifferent to the Technology Park infrastructure. Very few showed some sustainable interest. Even less really sought to establish a permanent

and operative presence at the Parks. The idea to attract established companies did not materialize. Such a dimension was part of most of the business plans that guided the strategy and planning process of the Parks. Though, from a narrow point of view this may seem to be a failure, more broadly it must be stressed that in most instances the swift shift to the "small, spin- off and high tech unit" created a viable alternative to this gap.

In summary, the **incubator concept still appears, as a development dimension, much more promising than the attraction of big and established companies**.

The "indifference" of the large companies to the Technology Parks is mainly connected to the strategic considerations described in the previous section. For this same reason, seen in retrospect to the strategic changes now put in effect, the situation may definitely change. It is however rather unrealistic to consider that this could happen in the very near future. Processes that involve reshaping of value systems, as the ones in question do not materialize from one day to another. So, putting the emphasis on spin – off creation should remain the core development dimension.

Between the success of the spin – off activity and the failure of the attraction of large enterprises there are many other activities, undertaken by the Parks that have been quite successful. Clearly, they have provided a number of services, such as pure information services, patent advising services, training, regional consulting etc.

The development of a tool for providing this kind of services was funded by the GSRT during the last 3 years with a significant amount of money (K€ 300 /project). It was the establishment of a "Center of Technology Transfer" in each of the Parks, which aims to provide technological support not only to the Park members but to the region business as well. A database was developed in each of the Parks who is open to the member companies. They can ask for technological information and support or for particular inquiries. One year after the commencement of this initiative, a relatively large number of collaborations have been established between the Parks and the local companies. It works very effectively as an important mechanism for establishing permanent relations of the research community with the local industry.

This spectrum of services has had some significant impact and should technically be viewed as a positive development. Yet, such services can, and is some instances have been also on the agenda of other bodies such as regional commerce chambers, development agencies, universities, etc. It is very difficult to judge if such services, not inherent to the Technology Park concept can be best delivered by the Parks or by other entities. Or rather, this is an issue to consider on a per case basis, taking account of the local particularities. The guiding principle should be to avoid activity overlapping that may result to a waste of resources and often also to a relationship crisis.

To concisely summarise this experience we should put the focus on the following

1. **Design the physical infrastructure taking strong account of your business plan**. If you plan to attract big companies you need a completely different layout compared to when you target an incubator center and small spin- off creation. This means **that the building infrastructure and the investment plan should follow and not precede the business plan,** as was mainly the case in Greece.
2. **Incubators almost always present an impressive challenge and a promising path, as technology parks appear to have a clear competitive advantag**e in setting up such operations.

3. **The attraction of operations of big companies appears to be a much more difficult task**. Though, if effected, its results may be far-reaching, the cultural and other difficulties in its implementation are often paramount and the failure odds significant.
4. A great number of other operations can also be accommodated in Technology Park facilities. Information services, training, advisory and consulting services, etc. are the usual examples. The Technology Park however very rarely has some competitive advantage in delivering such services, which very often are also on the agenda of other public and private organizations. **Such, auxiliary services, should be considered on a per case basis and a broader regional planning will be essential in order to avoid duplication of effort and wasting of resources**.

The emphasis is again put on the creation of a favorable strategic framework that will urge researchers to seek practical channels for their work, stimulate entrepreneurship and gradually establish a effective communication between business and academia based or research originating individuals.

5. Guidelines for the set- up of innovation management mechanisms

Based on the Greek experience presented above, we can now suggest some practical steps to the set-up of innovation management mechanisms, such as Technology Parks, etc. that can be of use to societies, with which comparable economy and social assumptions apply.

We would suggest considering the set-up of such organisations as a two-fold process involving **decision taking and planning** activities on the one side and **implementation and continuous evaluation** processes on the other side. Though these may obviously interact, at the very beginning of the whole exercise they rather form a sequence, e.g., clear decisions must precede any implementation activity.

5.1 Decisions and Planning

Simply put, the "decisions and planning" phase must provide solid answers to the five W's, Why, What, Where, What and Who of the whole undertaking.

This phase can be split in the following three sub-activities:

- At the highest governmental level, **a visionary understanding of the importance of innovation management (why?) as a tool to economic development must be in place**. Without this, any other consideration would be at least pre-mature. As soon as key policy makers have developed this sound vision, a more detailed strategy development may take place. Though this may appear a rather top-down procedure, we do believe that this is the way things start moving. **Enlightened individuals at key governmental positions are essential to put the process on rail**. This decision cannot be delegated to anybody else.
- **The very next level addresses the 'where?' and 'when?' issues. These are of a strategic nature and can be best addressed by authorities having a thorough understanding and a clear supervision of the particular society.** The localisation of the Technology Park must for example take account of the spatial distribution of the innovation potential of the country. The timing of the operation is strongly related to the broader policy priorities, the possibility of synergies, the maturity of the human

factor to accommodate the concept, etc. Normally, Park premises are located close to national R&D centres of excellence. Though this step is again a responsibility of key and high level officials it can now be significantly facilitated by external assistance, especial one that can effectively transfer relevant and best practice.

- As soon as the locality and the timing aspects have been set, **a third decision step will now be required, in order to build a much needed wide consensus among many actors. It is this consensus building process that will essentially define the details of the 'what?' issue and will suggest the best possible configuration for the 'who?'.** Though the above two steps are largely left to top governmental officials, this third process must involve a very large number of organisations and individuals. Regional authorities, research institutes, venture capitalists, external consultants are just the most obvious of this very necessary homogenisation process. Best practice can again be helpful to expedite the process.

At the end of the first run through this three-step planning process the strategic planning issues of the exercise should have been addressed and answered. The human factor should now be mature and a consensus must have settled in, among all involved parties.

5.2 Implementation and evaluation

A **usual malpractice in this phase is to create the building infrastructure and then create the business plan that is supposed to use it**. In this way you may invest a lot of money in industrial floorings, vacuum distribution networks, etc. that may be completely useless, if not an outright nuisance to the future users of the space. This has happened in Greece in some cases, leading to a simultaneous waste of money and a degradation of the quality of the space, due to the irrelevance of its installations to its eventual use. This is just a relatively innocent example, that we ourselves have given evidence of. Things may get much more serious if you, for example, set up buildings to accommodate small incubator-like offices and then realise that a promising business direction of your premises would be to set up resort offices, attractive to executives that would be interested to combine work and leisure.

The solid conclusion is that **a business plan should precede any investment or other activity**. The infrastructure investment and space layout should only serve this business plan and should be specified according to its recommendations and not any other need or consideration.

This heart of the business plan should lay down in a detailed manner:

- The **core activities** of the "Park" and the conditions under which individuals (e.g., researchers) or entities (e.g., established companies) can take part in or benefit of as well as the operational and infrastructural costs associated to these activities.
- The **possibly supplementary activities** (in close co-operation with the regional authorities and other involved entities) with an emphasis on the synergies, the avoidance of overlapping, etc, again with the above-mentioned cost considerations.
- The **networking activities**, which in the new economy are receiving a special, separate and increased attention, as they can drastically leverage your potential by

turning you in an active member of a broader community and raising the overall "reach" of your value proposition.

- The **management structure set- up and organisation,** detailing requirements for full time persons, for part time assignments, for external consultancy, etc. Most importantly, the following must be defined:
    - **The operational processes** (network support, marketing, etc.) and their assignment to existing or newly created **organisational units** (neighboring research institute network administration, etc.).
    - **The management roles,** which must be clearly and unambiguously defined. **Best practice dictates that there must always be full time manager of the Park activities**. Other roles can be prescribed, based on the business plan requirements.
    - **The basic administrative documents** (application forms, evaluation forms, reporting forms, etc.) the management will use in order to carry out the activities and assure their quality and consistency.
- The **financial resources** required, the timing of their use, the possible expectations in terms of returns on investment, etc.

In essence, the business plan formalises the identity and the role of the Park and describes some key operational features of it. Ideally it would end up with metrics like NPV (net present value), PP (pay back), ROI (return on investment), etc. Practically, we do believe that the payback sought should be of a more strategic nature that may not easily be captured in such figures. As an example, metrics such as the yearly creation of start-ups may be much more indicative of the success of the investment.

Yet, evaluation metrics will depend a lot on the activities targeted and it would be quite meaningless at this point to attempt to further elaborate on all possible choices.

6. The EU emerging trends

The Union boldly states, **"overall innovation performance continues to be disappointing"** (EU Innovation web site). Europe as a whole must become more innovative if the strategic goal set at the Lisbon Summit of the European Council in March 2000 - the Union to become the most competitive and dynamic knowledge-based economy in the world - is to be achieved.

The Commission has set five objectives:

- Coherence of innovation policies
- A regulatory framework conducive to innovation
- Encouragement of the creation and growth of innovative enterprises
- Improvement of the key interfaces in the innovation system
- A society open to innovation

For a thorough review of the EU emerging trends with regard to Innovation management and relevant instrument (e.g. Technology Park) role, the reader is advised to download the open to the public background document (published in year 2000) "Trends in European

innovation policy and the Climate for Innovation in the Union". This can be freely accessed at

ftp://ftp.cordis.lu/pub/innovation-smes/docs/cec_innovation_workingpaper_en.pdf

7. Conclusions

Technology Parks, by themselves, are no panacea for business innovation. Success as well as failure stories abound and one has to consider numerous aspects before understanding the essential reasons for either track. Even more, it is difficult to end up with some global recommendations for setting up and running Technology Parks. What may be wise in a developed environment may prove overoptimistic in an area of low technology sophistication. As a matter of fact, it is for this reason that we consider the Greek experience as more relevant to the Syrian society, at least when compared to the one of the northern EU countries.

This communication has attempted to present our hands on experience with the Technology Park concept in Greece during the last eight years, that it has "invaded" the Greek society. As always, many objectives were achieved and far more could have been realised and are perhaps now targeted. Going behind this universal and quite trivial statement we could however synopsize our "do and do/ not" experience as follows:

- Decision taking and strategic planning are essential, continuous and far reaching processes that should precede any practical undertaking in innovation management. They usually follow a top- down approach and are triggered by a vision of key officials, who realise the importance in taking practical action to support innovation and to bridge the business and the research potential of a country. **Though they usually kick off at the highest government levels, they must subsequently involve a broad range of stakeholders, such as regional authorities, research institutes, venture capitalists, external consultants, etc.** in an open and all- encompassing discussion that will help consensus build and best practice disseminate.
- **Institutionally, a favourable strategic framework needs to be elaborated that will put aside any ideological, institutional, etc. obstacles. The career path of young researchers should not include only scientific paperwork**. **Practical results should be at least equally appreciated.** Perhaps this was the point that was most vehemently contested in our society and that required the greatest political courage to push forward.
- Business planning is the first practical activity after the strategic planning of the initiative. **Business planning must accurately define what exactly is to be done, to the greatest possible detail. Activities, roles, processes, resources all need to be detailed at this point**. Only then should investment follow, strongly adhering to the business plan.
- The most promising development potential lies in turning the Technology Park in a mechanism to support research innovation, especially from young researchers with fresh and unconventional ideas and to help it transform in real life products and services. The **creation of a technologically sophisticated, yet lean and cost efficient working environment, appropriate to host small high-tech spin off companies has had by far the best payback.**

- **The attraction of departments of large companies did not appear equally successful, despite the fact that very intense attempts were made to motivate the very strong Hellenic lobby in the US in his direction**. Clearly, in the literature many cases of research outsourcing to centres of excellence are reported. However, for this to occur, it appears that many other parameters must also favourably contribute. In our case this has been most difficult to guarantee.
- In the attempt to attract established companies of departments of companies, a **number of incentives were proposed and tested. We do believe that such incentives make sense, provided they do not turn in a self-purpose**. Many companies were attracted initially to the Parks, in expectation of some financial funding. As soon as this occurred, or as soon as their patience was exhausted, they moved out again. In this perspective it is a wide belief that **tax benefits are far more efficient than outright funding**. They guarantee that a genuine interest is in place, when a company Department relocates in a Park premises.
- A number of side activities can be accommodated by the administration of a Technology Park. These can be the provision of various services, training programmes, etc. All this however must be designed at a regional or even national level to avoid overlapping that lead to tensions and waste of resources. **In all cases such activities must not weaken the core development dimension, that of providing the environment that will help research transform into final products. By themselves they do not justify a separate entity. Tactically they can be assigned to a Technology Park. Strategically they should never be their hot priority**
- The **attraction of private sector companies to the management of a Park is a very important issue**. Normally, this would provide one more mechanism in support of practical results. Yet, we believe **the management of the Park should remain with people that have a research background, or even better, a still ongoing research activity**, capable though to operate effectively between these two poles, i.e., research and business activity. Aggressive business executives and awkward researchers, seeking an exodus from a possible research unfullfilment, are examples of what should not be trusted to perform this difficult bridging role.

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