

XX IASP WORLD CONFERENCE ON SCIENCE AND TECHNOLOGY PARKS

June 1-4, 2003 - Lisboa, Portugal

**THE EVOLUTION OF NTBF TENANTS ON TAGUSPARK – 1998 TO 2002  
PERSPECTIVE**

ALEXANDRE PESSOA  
EDUARDO LOPES

TAGUSPARK  
Av. Prof. Dr. Cavaco Silva, nº 33  
2780-994 Porto Salvo, Portugal

E-mail: [alexandre\\_pessoa@hotmail.com](mailto:alexandre_pessoa@hotmail.com)  
[edlopes@isq.pt](mailto:edlopes@isq.pt)

Internet: <http://www.isq.pt>

**ABSTRACT**

Taguspark is a privileged synergetic environment where tenants interact and can create partnerships, integrating in the innovation chain and being more competitive. Tenants' dynamics were analysed in 1998, when the park's model was incomplete – there were no higher education institutes located on site. Since then, HEIs and the park's services have started operating on site, thus completing the park's model.

This paper re-evaluates NTBF<sup>1</sup> dynamics in Taguspark, finding the main changes in company morphology, their interaction in the park and the main implications of HEI<sup>2</sup> proximity to their activities. It is done by a qualitative analysis of the situation, mapping the tenant's dynamics evolution and drawing some conclusions within the Science & Technology Park concept.

**Keywords:**

Innovation  
Science and Technology  
NTBF dynamics  
Science and Technology Park  
Taguspark

---

<sup>1</sup> NTBF: New Technology-Based Firm.

<sup>2</sup> HEI: Higher Education Institute.

## INTRODUCTION

The need to compete in global markets has led industry to seek development of products and processes to increase productivity. If competing by market price is an initial solution, the inherent limitations and production costs have forced the industry to seek new differentiation solutions among products and services, causing deep changes in the competition concepts, and thus creating a need for competitive advantages rather than comparative advantages.

Recent economic models indicate the 21<sup>st</sup> century economy as a knowledge based economy, where innovation is the source of competitive advantage for companies and where fast, technology based companies can play a major role, either by disruptive technological innovation or by quickly absorbing technology and, via incremental innovation, improving products and processes. New Technology-Based Firms (NTBF), recent and small companies in which Science and Technology are cornerstones of growth, arise directly from these models. These companies, with very own characteristics, are usually created by high technology entrepreneurs, operate in emerging market niches and, thanks to their high growth rate and dynamism, can play an important part in the development of the Science and Technological fabric of countries, contributing to their economical development and to the reinforcement of their competitive position in the global market. These companies also have an influence on the innovation models themselves, adding flexibility, speed and multiple input-output dimensions to the traditional innovation cycles, relying mostly in interactive and networked innovation models.

Recent years trends in the industry, with shorter product and process life cycles have emphasized time-to-market and flexibility, especially on new technology sectors – IT, telecoms and media. This has created a broader momentum from fully in-house innovation cycles to partnership based innovation, leveraging on player's core competences in the value chain for obtaining faster results with reduced capital expenditure. The 1999-2001 Internet boom, with many small "fast track" companies integrating vertically in the value chain, leveraged heavily on this concept, making it a de-facto standard in these industrial sectors. Many of these "fast track" companies, heavy adopters of the partnership model, are NTBF's promoting both radical and incremental innovation and many times relying on external support for their start-up phase. Science and Technology Parks are one of the potential sources of such support.

Taguspark, Portugal's largest science and technology park, aims being synergetic environment, where NTBF's, higher education institutions and large companies interact and promote innovation. The park is based on the traditional Science and Technology Park concept, whit a property based implementation where large companies R&D, higher education institutes, and NTBF's benefit from geographical proximity and support services as an incentive for creating synergic relations. The park started nesting NTBF's and large companies in 1995 and has incorporated higher education institutes in 2000-2001, thus entering its "entrepreneurial" stage and being able to develop its full potential.

Taguspark has been analyzed from several angles, ranging from the conceptual model (Laranja, 1991; Maltez & Varela, 1997), its institutional implementation (Parkinson, 1997) and the NTBF's dynamics (Pessoa, 1998). The NTBF's dynamics snapshot of Taguspark in 1998 was structured around two environments: the macro-environment, which comprised both the park with the larger tenants and the environment around it (Quinta da Fonte, Universidade Atlântica,...); and the micro-environment created by the NTBF tenants. Such study looked for evidence of a virtuous cycle of cooperation among tenants in a non-typical Science Park implementation.

On this paper we will follow-up that previous study, drawing some conclusions on the park's role in NTBF's dynamics.

For that, the parks deployment strategy is revisited, followed by a re-analysis of 1998 data and comparison with the early “entrepreneurial” stage of the park’s NTBF’s in 2002. This analysis is structured around two main issues:

- First we will analyse the park’s micro-environment evolution. This allows an evaluation of main changes in companies’ morphology, activities, projects and motivations from 1998 to 2002.
- After that, the NTBF’s dynamics is analysed, allowing an insight of their relationships with other tenants and entities in and outside the park physical space. The objective is to determine whether there has been an evolution with respect to their interaction in the park and towards outside and the main implications of HEI proximity to their activities

Finally, the above findings are discussed within the Science & Technology Park concept, drawing conclusions and attempting to identify additional paths of study leading to a more thorough assessment of NTBF dynamics in Taguspark.

## **TAGUSPARK IMPLEMENTATION STRATEGY**

The Science and Technology Park concept, created in the United States of America gained popularity and world acceptance, having been adopted in European Union, Middle and Far East and Latin America. The essence of a Science and Technology Park is to provide an environment which facilitates the interchange of resources, ideas and people between their tenants – both on-site companies and research organizations such as HEIs.

A Science and Technology Park is usually a property based initiative that gathers several technology generation and diffusion process agents - Higher Education Institutes, Research Centres and NTBF’s - seeking the creation of connections among these to promote scientific and technological activities such as Research and Development (R&D), technical and scientific training and scientific and technological services, acting not only in the artefacts (prototypes and products) but also in the other two dimensions of technology: knowledge (scientific and technological training) and capacities (experience and practical training).

The underlying innovation model for most Science and Technology Parks is the linear Technology Driven Innovation model, assuming that innovation will be triggered by Science and Technology, and in the assumption that geographical proximity will stimulate connections among the several players (Monck et al, 1988).

The traditional Science and Technology Park deployment cycle undergoes two phases: an initial phase (institutional), in which larger tenants (HEI, Public Non-profit Institutions and larger companies R&D departments) are located, and a second phase (entrepreneurial) in which smaller dimension tenants (NTBF’s) start operating. These phases usually have long implementation cycles and depend not only on the ability to locate the larger tenants in the institutional phase, but also on birth rate of NTBF's in the entrepreneurial stage. This approach usually implies an important financial effort to the project, since it does not fully exploit part of the park’s infrastructures during the initial period (Vedovello, 1995). Taguspark deployment strategy is, however, different from the above described.

Facing a scarce possibility of getting a high occupation rate in short term, if basing it only on companies “born” in the Park, the park administration opted to promote the location of already existing NTBF’s in the physical space of the park, in order to “quick start” an innovation atmosphere and minimize the financial effort for the project. However, due to external factors, HEIs were not able to move into the park in the early years, thus creating a non-typical situation: by 1998, Taguspark had a high NTBF occupation, but some of the park’s larger tenants (the HEIs) were absent, causing the park to be in an intermediate phase.

This intermediate stage had very specific characteristics:

- a first wave of companies with common characteristics (young, small, agile, with entrepreneurial spirit and great focus and capacity of technology absorption) located in a well defined physical space;
- a physical space that was conceived with the objective of promoting the knowledge exchange and establishment of relationships among tenants ;
- a group of park's services specifically created to support financial and management needs of NTBF's;
- potential complementarities in value chains among companies with different activities in the same technological sector

Such an environment posed an opportunity to evaluate if geographical proximity and Taguspark Administration incentives and initiatives would be able to create company-company relations among tenants and if there was any indication of the creation of a virtuous cycle of company-company interaction in the physical absence of HEIs.

1998 analysis was a case study, based on interviews and questionnaires with both the park's management and a sample of the NTBF's. The findings of such study were that, although Taguspark tenants were typical NTBF's and there were several cases of potential value chain integration among them, they lacked the will or the ability to cooperate and partner with each other within the park space. Tenants were also not very responsive to the park's internal marketing efforts. 1998 findings did not identify a virtuous circle within the parks premises, although there were several success cases with tenants and external entities.

2002 analysis is based on the park's published information and on a questionnaire. The main objectives are to create a new snapshot of the park and to map the evolution of previously analysed tenants. Its findings are addressed in the next sections.

### **TAGUSPARK'S MICRO-ENVIRONMENT: THE NTBF'S**

In 1998, already operating before their location on Taguspark, the medium age of the tenants was 5.5 years. On average, the companies were in the Park for little more than two years. Since then, more than 50% of the original 95 tenants have moved out or, in some cases, ceased their activities. During 2002 Taguspark had an average 100 NTBF's, mainly existing companies. The average age has decreased to 4 years, and companies were in the park for an average 3,5 years.

In 1998, Human resources structure of tenants is strongly based on higher education graduates (BsC), with a relative weight of 68%. HR's without higher academic training represent 25% and MsC/PhD only 7% of the total - usually the founders of the companies. The average staff per company grew from 7,5 FTE in 1998 to 9 FTE in 2002, although only 5% of companies have above 20 people.

As per their origin, 17% of the observed companies are "spin-off" of HEI (IST, UTL), 22% are subsidiaries of Multinational Companies and 61% of the companies were founded locally by Portuguese entrepreneurs. These data are similar to other investigators (Felsenstein, 1994; Vedovello, 1995), which refer larger incidence of creation of NTBF's starting from independent "entrepreneurs" versus HEIs initiatives.

Companies' motivations for on-site location were very similar: two of the Park's characteristics (Credibility given by the park and better facilities) were pointed as the main advantages for 60% of the companies. The remainder indicated lower start-up costs and the ability do establish relationships with other technology based companies as the main drivers for their location on site.

It was possible to contact some of the companies that already left the park and are still operating. The majority of these companies stated lack of larger facilities by a fair price as the main drivers for moving out the park as some of them had experienced an accelerated HR growth.

Most existing companies turnover has grown steadily (in some cases, spectacularly) from 1998 to 2001, with a lower growth rate in 2002. This can be explained mainly by external economic factors rather than changes in their internal performance.

The average R&D expense in the companies is about 23% of their turnover, 3% higher than the national average. The human resource structure for R&D and other science-technology related activities is about 24% of total FTE. R&D is mainly self-financed by the tenants, although joint development programmes and formal R&D contracts also exist.

With respect to their activity sector, since 1998 there has been a major increase in IT/software production related activities, mainly on web/Internet, mobile telephony and iTV areas. Remaining sectors (Thermodynamics, Biotechnology, Electronics, Energy, Physics, Chemical, and Environmental) had smaller variations.

Regarding the companies' activities, many are involved in R&D related activities (14% in Project Management and 10% in Prototyping and Testing), although none had R&D as its core activity - when this activities exist, they involve mainly new applications in existent technologies or improvements for existent applications. An in depth analysis of these companies activities shows that their main activities are related to technology absorption and incremental innovation, rather than radical innovation (usually associated to a larger risk). These companies (both local and subsidiaries) are the more prolific and leverage mainly on networked, interactive or demand-pull innovation models rather than the technology-push model.

There are, however, exceptions: some software/telecoms companies are involved in radical innovation, leapfrogging from traditional product into new products and new business models. A closer analysis on these companies shows that some of them are subsidiaries of larger international companies, with no local R&D in Taguspark.

The number of successful projects and innovations has grown steadily from 1998 to 2002 (19 to 26). Some projects examples developed in the Park are the Black Box for Tankers and intelligent sensors (SEST), ASICS and navigation systems and fleets administration (TECMIC), active filters and circuits CMOS (CHIPIDEA), via-verde (MicroDesign), Neoshop (Neosis), AMFS and GASCA (RTSN2). Some of these projects were only developed by the companies of the Park (SEST), developed for specific customers (CHIPIDEA) or included in international projects (TECMIC, UNILASER and RTSN2).

The above analysis shows that Taguspark tenants' morphology hasn't changed much since 1998: these companies fit on the traditional Science and Technology Park NTBF model and can, therefore, be addressed in the dynamics evolution analysis of next section.

## **NTBF'S DYNAMICS: INTERNAL AND EXTERNAL RELATIONSHIPS**

The analysis of tenant dynamics within and outside the park is based on three premises that infer, respectively, a possibility, a potential of interest and a capacity.

- The first premise (possibility), addresses the reality of the Taguspark versus the Science and Technology Park model, in which a progressive migration is assumed between the lineal model of innovation and the interactive model. This premise considers that it will be possible the creation of symbiotic relationships among NTBF's tenants of Taguspark, irrespective to the physical location of IES. For such it leverages in the fact

that these tenants operate in similar technological areas and similar, although in different points of the innovation chain.

- The second premise (potential) assumes that, in these markets, the innovation chain corresponds to the value chain, having growth potential in intermediate activities. Therefore tenants will be interested in creating symbiotic relationships that allow mutual growth and reinforcement of competitive position in the markets where they operate.
- The third premise (capacity) considers that once in a favourable atmosphere to the establishment of connections, and by the action of a structured strategy of exchange promoted by the park, the tenants will have the capacity to identify common areas of interest and create symbiotic relationships.

These premises reflect the possibility of, once within a synergetic environment, tenants will have the possibility of creating a virtuous cycle of cooperation. The results of such analysis are addressed below.

In 1998, almost half (43%) of the interviewed tenants had relationships with other park's tenants. The type of relationships were almost equally distributed among high and low level, being 50% limited to informal contacts (change of ideas, access to equipments or technical literature, without involving payment of services). With respect to high level relationships, 31% were formal contracts, and the remaining 18% implemented as isolated contracts. The relationships among tenants are mainly half-yearly or monthly (39%, 39%), with only 23% of weekly contacts.

Relatively to external contacts network, the percentage of companies with partnerships is 54%. Of these, 39% are processed with Portuguese companies, 25% with companies out of Portugal, 25% with Portuguese Universities, 7% with Foundations and Associations and only 4% with the State. The way these partnerships are implemented is different from the existent inside of the Park, with formal contracts, in the extent of agreements, responsible for 29%. The isolated contracts rise to 26% of the total, being the joint development programs and the informal relationship responsible for 23% and 23%.

High level relationships are mainly created with tenants on whose activities are Consultancy and Sale and Systems Integration, and mainly done with the outside. On the other hand, companies of the groups Project Management and Prototyping, which in the extent of the Park developed informal relationships, develop essentially formal relationships with the exterior, mainly Contracts or Development Agreements with Portuguese entities or HEIs. Observing their human resource structure, it is verified that these groups have the largest incidence of MSc and PhD, which can indicate a larger propensity for this type of connections as function of the academic qualifications.

As in 1998 findings, most of 2002 tenants declared not to possess any relationship type with other Park's tenants and just about half indicated having more than simple commercial (purchase and sale) relationships with the exterior. Analyzing the partial overlap of internal and external connections per company, it is seen that the overlap decreases from 70% in 1998 to 64% in 2002. This shows that there still exists a minority of tenants who are more eager to create partnerships and joint actions with other companies and institutions, integrating vertically in the innovation and value chain.

An in depth analysis of this phenomenon shows some main trends on the way tenants interact (both in and outside the park):

- Older companies have kept their original patterns: this minority is, unsurprisingly, the group of tenants dedicated to Consultancy and Sale and Systems Integration, dedicated largely to incremental innovation.

- Younger companies, however, are the main driver for growth in relationships, mainly relying on isolated partnership contracts for specific development and projects. Although these companies main fully benefit from the parks innovation environment, they interact mainly with entities outside the park and show a low interaction pattern with other park's tenants.

With respect to the park's HEIs, contacts exist mainly as informal contacts. Some tenants expect to have formal relationships (joint projects and subcontracted development) in short to mid-term. The data shows geographical proximity of HEI as secondary for the establishment of formal relationships (R&D contracts, development agreements, HR sourcing).

## CONCLUSIONS

Taguspark is the largest Science and Technology Park in Portugal. Based on a private administration, Taguspark is an ambitious project that seeks not only the reinforcement of connections between Universities and Industry but also the development of an entire area of key sectors of the Portuguese Industry, contributing like this to competitiveness of Portuguese companies in global markets. The park has leveraged on a bold implementation strategy that privileged a quick operational start-up, reducing financial effort. This strategy has proven results, with a high occupation rate of existing facilities.

The NTBF dynamics analyzed in 1998 indicated two main trends:

- Taguspark NTBF tenants were more eager to ignore each other rather than to cooperate or compete. Connections in the park were basically informal, while connections to outside the park were mainly formal – joint development, commercial R&D agreements, and commercial contracts.
- The absence of higher education institutes in Taguspark limited its ability to fully explore its potential. In 1998, with no HEI physically located on site, the park's model was not complete. Nevertheless, some NTBF's had joint projects with external HEI, which posed an opportunity for evolution after its location in Taguspark.

These trends directly reflect the park's launch strategy: not having HEIs locally, the park management actively promoted on site placement of existing NTBF's, which already had their contact and business network. Their main reasons for moving to the park were better facilities at low cost and benefiting from the park's prestige and not a privileged environment for interaction with other tenants.

With the location of HEI in 2000-2001 and the implementation of the incubation project, the park's occupation model is complete. Tenants have also evolved since 1998: new companies have either moved in or were born in the park.

The park's model is complete: a privileged interaction and synergy environment exists.

2002 re-evaluation indicates some additional trends and findings:

- There is a very high leave rate in smaller Taguspark tenants. Companies tend to stay in the park for three years and then leave, pushed by their HR growth and the need for larger facilities. This is not an immediate indicator of company success, although can indicate a bias of such. Like in 1998, most of newer companies already existed before moving into the park.
- Tenant's structure hasn't change much since 1998: they are young; they have an average 9 HR, mainly higher education graduates, and are essentially created by local entrepreneurs. Although they have a higher growth rate than national average, this can be explained by their relative youth.

- Tenants activities are more related to other science and technology activities (consultancy, systems integration,...) than with R&D. The average tenant R&D expense is similar to the national average, although the dedicated human resources R&D and related activities reach 24%. These companies are mainly dedicated to external technology absorption than to its local creation, being mainly "challengers". With some exceptions, Taguspark NTBF's have a low ownership of technologies in which they base their activities, with a theoretical or practical appropriation level, and shared exclusiveness. After their location in Taguspark, these companies have shown little significant change in the type of science and technology activities they develop.
- The collected data shows that relationships exist among tenants, but are essentially informal or based in commercial activities (goods and services). The geographical proximity can contribute to the informality of connections. The largest amount of structured agreements for technological development exists with external Park entities, suggesting that the tenants that develop such relationships don't seek or need geographical proximity for their establishment, being supported mainly in communication networks.
- The geographical proximity will have, like this, influence in informal relationships, whose added value for companies is of difficult quantification, not being demonstrated that its existence promotes the creation of formal connections of technological diffusion.
- The topology of the connections suggests that Park's tenants don't try to develop symbiotic connections among them, assuming indifference positions. Taguspark NTBF tenants are still more eager to ignore each other rather than to cooperate or compete.
- Regarding the park's HEIs, there are mainly informal contacts. Both HEIs and tenants expect to have formal relationships (joint projects and subcontracted development) in short to mid-term. There is also potential for HR sourcing directly in HEIs.

With respect to the initial hypothesis (the virtuous cycle), the observed relationships among Park's tenants are mainly informal and sporadic, resulting essentially of geographical proximity rather than structured business development plans. Contacts among tenants are largely a direct product of their location in the Park, not being foreseeable that they can generate effective synergies.

Most relationships occur between park's tenants and outside entities, being based in formal agreements and structured cooperation for technological diffusion, knowledge generation and added value creation. These relationships do contribute to the reinforcement of the competitive position of tenants and, although the location in the Park provides credibility to the tenants, it is not decisive for the creation of these synergies. An internal virtuous cycle of cooperation among tenants is not yet verifiable, although evidence shows the opportunity for such cycles to be created with the HEIs (by HR sourcing and subcontracting) and with external entities, specially the surrounding industrial and office parks.

This paper analyses Taguspark as an instrument of Science and Technology development in a local environment, by the incentive of relationships among small new technology based firms and with other park's tenants, as a means to promote science and technology diffusion and adoption and therefore reinforce these companies competitiveness. For that we characterize a well defined environment in a period of time and geographical context, for determining whether connections among tenants arise and what is their impact on their activities and competitiveness. By its self imposed limitations, this paper does not cover additional areas which may prove important for additional assessment on the park's NTFB dynamics.

Within the park's environment, a more detailed analysis of local HEI and NTBF's can be done, addressing specific issues like joint projects and success cases, observing NTBF's while entities and not necessarily as a community.



Additional research can also be done regarding to relationship establishment with external entities. Evidence shows that a detailed analysis of the relationships between Taguspark tenants the industrial parks in the bordering areas of Taguspark (Queluz, Cacém, Colaride, Mem-Martins, Abóboda) can address the positioning of Taguspark as a Technopole, thus addressing the impact of the Park in the socio-economic development of the region.

## REFERENCES

- Barbosa, J.N.; O Parque de Ciência e Tecnologia e a Universidade do Porto, Boletim Univ.Porto 17, pag.30-35, Porto, 1993
- Dosi, G., Arcangeli, F & David, P.; Frontiers in Technology Diffusion, Oxford University, 1991
- Eto, H. & Fujita, M.; Regularities in the growth of high technology industries in regions, Research Policy, vol.18, pag.93-110, 1989
- Felsentein; University-related science parks – “seedbeds” or “enclaves” of innovation?, Technovation, Vol.1, Nº2, pag.93-110, Elsevier Science Ltd, 1994
- Ferguson, R.; Panacea or Let-down? Science Parks in the Literature, TeknikBroStiftelsen i Stockholm, August 1995
- Fontes, M; The role of NTBFs in the Technological Development of a Less Advanced European Country: A Study of NTBF creation and evolution in Portugal; draft version to be published in Technology, Innovation and Enterprise – The European Experience, 1996
- Godinho, M.; University-Industry relations in Portugal, MSc thesis, Imperial College os Science and Technology, 1986
- Iking, B; The evolution of Science and Technology policies in Portugal with special reference to the relationship between the Scientific Base, Industrial Innovation & the Acquisition of New Technologies; UNU/INTECH, 1996
- Laranja, M; Feasibility Study for Portuguese science parks, a proposed model, MBA thesis, Warwick, 1991
- Laranja, M.; O papel da pesquisa universitária em países menos desenvolvidos na Europa: o caso do INESC, AITEC, Lisboa, 1996
- Laranja, M., Simões, V., Fontes, M.; Inovação Tecnológica, Texto Editora, Porto, 1997
- Maltez,L. & Varela, V.; Taguspark – Science and Technology Park, an active centre of competences in greater Lisbon, XIV IASP World Conference on Science and Technology Parks proceedings, Trieste, 1997
- Massey, Quintas, Wield; High Tech Fantasies – Science Parks in Society, Science and Space. Routledge, London, 1992
- Monck, Porter, Quintas, Storey with Wynarczyk; Science Parks and the growth of high Technology firms. Croom Helm, Kent, 1988
- Mytelka, Lynn; Strategic Partnerships – States, Firms and International Competition; Pinter Publishers, London, 1991
- Parkinson, Lesley; Innovation and Science Parks: The Portuguese Experience at Taguspark; UTL, 1997
- Pessoa, A; Competitividade Industrial: a transferência de know-how no Taguspark, MSc thesis, Universidade Aberta, 1999
- Rothwell, R.; Successful industrial innovation: critical factors for the 1990s, R&D Management, 22, 3, 1992
- Teece, D.; Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy; Research Policy 15, pag.285-305, North-Holland, 1986
- Tidd, J., Pavitt, K., Tidd, J., Bessant, J; Managing Innovation : Integrating Technological, Market and Organizational Change, John Wiley & Son Ltd, London, 1997
- Vedovello, C.; Science Parks and University-Industry links: A case study of the Surrey Research Park. University of Sussex, 1995
- Westhead and Stoney; An assessment of firms located on and off Science Parks in the United Kingdom. UKSPA, Coventry, 1994