Defying Conventional Wisdom by Creating Technology Parks in Immature Systems of Innovation: The Cases of Sophia Antipolis and TecnoVia

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Abstract
The literature on science and technology park location strategies suggests that at least three factors are considered critical: proximity to a world-class research university with enough scientific critical mass in technologically relevant domains of expertise, strong cooperation among governmental, academic and industrial entities around the project and the quality of life inherent to the chosen territory. This article argues that the absence of the first criterion may be partially compensated by the other two critical success factors. We look into the case studies of one of Europe's largest and most successful technology parks, Sophia Antipolis in the French Riviera, and compare its development guidelines with the strategic choices of TecnoVia, an innovation habitat under construction in the Brazilian state of Bahia. The hindsight on Sophia Antipolis' history indicates that the chances of survival and perpetuation of a technology park in such an immature regional innovation system as Bahia's will largely depend on its ability to emulate French Riviera's competency in seizing opportunities associated with global trends while optimizing the region's potential as a magnet for talent.
Key-words: Regional Innovation Systems, Technology Parks, Local Development

Resumo
A literatura sobre estratégias de localização de parques de ciência e tecnologia sugere que pelo menos três fatores são considerados críticos: a proximidade de centros de pesquisa científica com suficiente massa crítica em domínios de especialização tecnológica relevante, uma forte cooperação entre agentes governamentais, entidades acadêmicas e industriais ao redor do projeto e um alto grau de qualidade de vida inerente ao território escolhido. Este artigo argumenta que a ausência do primeiro critério pode ser parcialmente compensada pelos outros dois fatores críticos sucesso. Toma-se como referência o estudo de caso de um dos mais bem-sucedidos parques tecnológicos da Europa, Sophia Antipolis na Riviera Francesa, e compara-se o seu desenvolvimento com as orientações estratégicas do TecnoVia, um habitat inovação em construção na Bahia. A retrospectiva de Sophia Antipolis indica que as chances de sobrevivência e perpetuação de um parque tecnológico em um sistema regional de inovação imaturo como a Bahia depende em grande parte da sua capacidade de aproveitar as oportunidades associadas com as tendências globais e ao mesmo tempo otimizar o potencial da região como um ímã para a atração de talentos.
Palavras-chave: Sistemas Regionais de Inovação, Parques Tecnológicos, Desenvolvimento local

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Résumé
La littérature sur les stratégies de positionnement géographiques des parcs de science et technologies suggèrent qu'au moins trois facteurs sont considérés comme critiques: la proximité d'une université possédant une recherche reconnue mondialement et qui couvre suffisamment de domaines pertinents, une forte coopération des milieux industriels, académiques et gouvernementaux sur le projet, et finalement la qualité de vie du lieu choisi. Cet article démontre que l'absence du premier paramètre peut être compensée en partie si les deux autres facteurs sont suffisamment pris en compte. Il étudie notamment, le parc de Sophia Antipolis, un des plus grands et plus prospère parc de technologie européens, et compare ses choix de développement avec ceux de TecnoVia, un projet d'habitation innovant en cours de réalisation dans l'état brésilien de Bahia. Le recul sur le développement de Sophia Antipolis montre que les chances de succès et de pérennité d'un parc de technologie dans l'état de Bahia -- encore immature au niveau de l'innovation -- dépendra largement de sa capacité à suivre l'exemple de la Côte D'Azur, en étant capable de saisir les opportunités liées aux développements économiques globaux tout en optimisant le potentiel régional en tant qu'attireur de talent.
Mots clés: Systèmes Régionaux d'Innovation, Parcs Technologiques, Développement Local

Introduction

One of the premises shared by several authors on technology park location strategies is the assumption of the proximity to high level educational institutions as a key success factor (Luger & Goldstein, 1991; Cabral & Dahab, 1998a,b; Zouain, 2003; Hauser & Zen, 2004). Nonetheless, notorious exceptions to this rule are found among successful innovation habitats worldwide. The Research Triangle Park, for example, was established in North Carolina in the early 1950s when neither one of the three surrounding universities (Duke, NCSU and Chapell Hill) ranked among top American universities (Lima et al., 2006). Back then, the state ranked among the least developed in the nation, with its economy fully focused on the commodities of tobacco and textiles. In Sweden, the Ronneby Soft Center is another example of a Park located in a region without an established University or research institute. In fact the start of the technology center in 1987 was in itself a motivator for creating a new University two years later (Ylinepää, 2001). As presented below, the French Riviera also lacked its own regional university when the Sophia Antipolis research park was initially conceived in the early sixties. The local economy was entirely dependent on tourism and real estate investments.

This article looks into the historic reasons why Sophia Antipolis is considered one of the most successful technology parks in the world in spite of the incipient nature of the surrounding regional innovation system at the time of its conception. We then compare some of the innovation constraints in the French Riviera environment forty years ago with the current challenges facing the TecnoVia project in the state of Bahia. Finally, we make recommendations for policymakers in emergent countries to minimize certain risks associated with predominantly exogenous development strategies.

Immature Systems of Innovation

For over two decades, the notion of National and Regional Innovation Systems has helped researchers and policy makers understand the complex interplay between the three main actors of innovation: government, academia and industry (Lundvall, 1992; Nelson, 1993; Patel & Pavitt, 1994). Developing nations and underdeveloped regions of advanced

economies have looked into the successful interaction of these so-called "triple helix" actors in prosperous environments such as Silicon Valley or Route 128, trying to emulate their success by fostering inter-institutional arrangements and creating "innovation habitats" (Lima, 1999).

In order to gauge the size of the challenge facing immature systems of innovation wishing to catch up with technology-based regions, it is useful to establish the main structural differences among these environments. Albuquerque (1996, 1999, 2003) has consistently used statistical analysis on science and technology indicators to establish clustering criteria for the world's most significant National Innovation Systems (NIS). Basically, three kinds of NIS were identified:

- Fragmented or immature systems: weak intra-firm technological accumulation, poor national systems of education and few high ranking institutions of higher learning, low private commitment to invest in R&D. Some degree of scientific activity but the inability to translate science (publications) into technology (international patents), as only a minority of researchers are active in industrial contexts. Countries such as Brazil, India and South Africa belong to this category.
- Catching up systems: strong correlation between international patents per capita and economic growth (i.e., economic development based on high added-value, technology-intensive products). Educational performance is similar to mature systems. These systems tend to be "followers" in the innovation process, as they lack scientific critical mass to create their own breakthrough technologies. Much stronger industry-university linkages than immature systems. The category is represented by Korea, Taiwan, Singapore.
- Mature systems: with a long-established tradition of technology development, they have enough critical mass to generate spin-off effects from scientific and technologic institutions and to introduce leading innovations in specific niches or even sectors of the world economy. The vast majority of researchers work for the industry. Examples include the United States, Japan and Germany.

Of course not all regions in a National Innovation System have the same degree of maturity (Cavalcante, Lima & Ramacciotti, 2005). Brazil, for instance, has two of the world's 46 "technology-hub" cities, São Paulo and Campinas, which might be classified as "catching-up" regions (Hillner, 2000), whereas other areas of the country such as parts of the Amazon region lack even the basic elements of an immature system. Similarly, it can be argued that the French Riviera in the late sixties certainly didn't share the innovation maturity of Paris nor that of Cambridge.

On the other hand, science intensive regions not always manage to fulfill their potential as innovation habitats. In fact, there are several failure stories of an attempt to create technology parks in knowledge-rich regions (Luger and Goldstein, 1999). The following section discusses elements other than scientific excellence in creating successful regional development strategies based on the knowledge economy.

Technology Park Success Factors

After surveying over a hundred science and technology parks in the United States, Luger and Goldstein (1991) concluded that three factors were primarily associated with successful innovation habitats: proximity to knowledge-intensive institutions, "vintage" (or "pioneering status") and quality of life.

Proximity to sources of world-class scientific knowledge is the most frequently appointed criterion for successfully creating a virtuous university-industry relationship in any given territory. Citing the well known cases of Silicon Valley and Route 128, several authors (Cabral & Dahab, 1998a,b; Longhi, 1999; Zouain, 2003; Nilsson, 2006) appoint the proximity to Stanford and the MIT respectively as the source of scientific creativity that resulted in the technological density of those regions.

Luger and Goldstein have also found that earlier, pioneering parks tended to be more successful than newer ones. This "vintage" effect is partially explained by the fact that local inter-institutional learning processes take a long time to mature. Perhaps more importantly, however, the authors argue that the probability of any given park to attract R&D-intensive investments decreases as the offer of other high quality business environments increases, as it happened during the tech-park boom in the US during the 1980s.

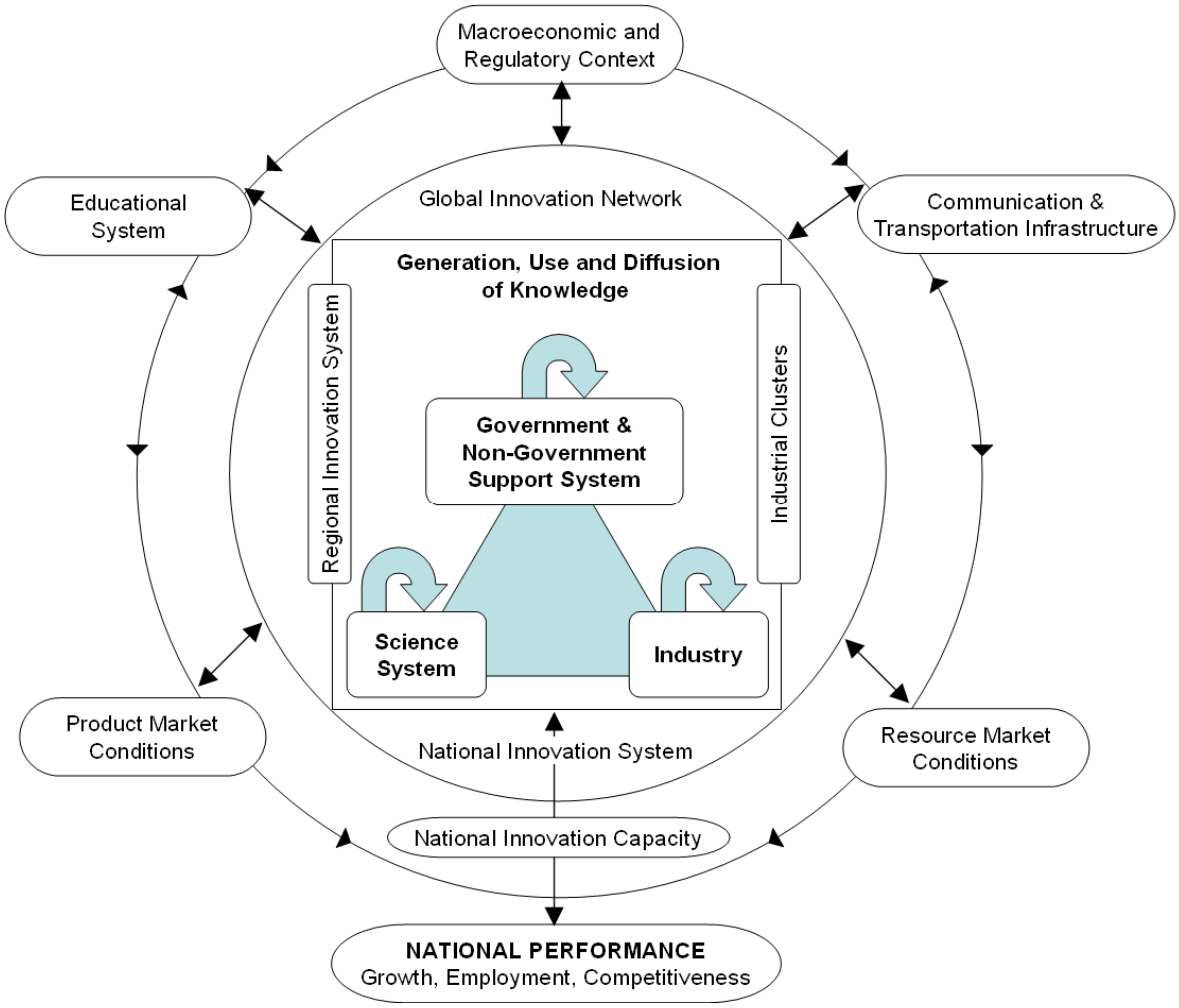

Exhibit 1. Innovation System Framework (Source: adapted from Viotti, 2003)

The third element, quality of life, helps to understand why certain university-rich communities such as Pittsburgh have failed to create highly successful technology parks. According to Richard Florida (2005a, 2005b), the low "coolness index" of the steel industry landscape in Pittsburgh explains why so many of its top talent students move to California when they finish college. Young, talented people tend to flee boring cities.

Other success factors for innovation habitats found in literature include a favorable image related to the project; access to a nearby local market for products; services produced in the

park; access to suppliers of components and services in the region; a local culture favoring innovation, entrepreneurship and co-operation; access to employees with adequate (and normally high) formal qualifications, access to venture capital and good communications and transportation infra-structure (Cabral & Dahab, 1998a,b; Ylinenpaa, 2001). Above all, the willingness to cooperate among economic, political and academic actors is perceived as a fundamental requisite. Such elements can be integrated in an overall model of innovation system such as presented by Exhibit 1.

How could the Sophia Antipolis project – with so few of these requirements – grow to become one of the most cited success stories in technology-based regional development in the world history? Are the institutional conditions that helped to forge this success reproducible elsewhere?

Sophia Antipolis, from dream to reality

> "The heavy industries which we now associate with the 19th century, like the haze and smog of Pittsburgh, of Birmingham, of Lorraine or of the Ruhr are now things of the past. The progress and the future no longer depends upon heavy resources, coal or ores… but upon the grey matter, education quality, environmental quality"[5]
>
> Pierre Laffitte, founder of Sophia Antipolis

In the 1960's the mention of Nice, Cannes or Antibes would not have evoked more than the picture of sun-bathed beaches and boats in the imagination of any French policy-maker. Science and technology was concentrated in cities like Paris, Lyon and Toulouse. In fact, at a time when the notion of "Research Parks" was hardly known, Professor Pierre Laffitte's idea of creating a "Quartier Latin" in the fields, in which people from academia, research labs and industries would meet for work and for fun, seemed outright delusional (Carayannis & Campbell, 2006).

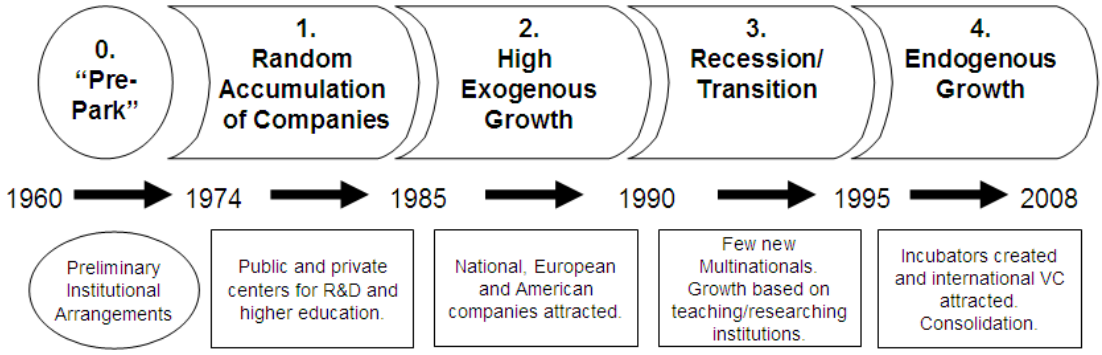

Exhibit 2. The four phases in the development of Sophia Antipolis (source: adapted from SMI, 2001)

In order to understand how this vision became reality, the chronology of Sophia Antipolis can be divided in five stages according to Exhibit 2. Phase "0" could be called "Preliminary Institutional Arrangements". It is a period marked by critical events such as the attraction of IBM and Texas Instruments in 1962 and decisions such as the creation of the University of Nice in 1965. The arrival of renowned research companies proved what before seemed implausible: the French Riviera's quality of life could be a decisive factor for attracting and keeping highly qualified knowledge-workers; these events strongly contributed to give credibility to Laffitte's ideas.

[5] Sophia Antipolis brochure edited by Savalor, Le Biam et Armines, 1972, p.2 (apud Rasse & Araszkiewiez, 2005)

The creation of the University in1965 was strongly influenced by the arrival of world-class multinational companies to the region. Even though this is considered one of the most significant evolutions of this period, it would take further twenty years, before the University formally included "Sophia Antipolis" in its name and for it to transfer most of its hard-science facilities into the Park (Longhi, 1999). Several knowledge-intensive activities start to flourish in nearby communities during the early seventies. The creation of the development agency "SAVALOR" marks the "year 0" of the park.

Phase 1 may be called the "Random Growth" period (SMI, 2001), a growth "without any precise strategy for technological development, as a result of an active marketing policy" (Longhi, 1999:337). In 1974 the Park manages to attract the first research company: FRANLAB. It is noteworthy how the concerted action of national and local authorities was necessary to relocate publicly funded research activities to the area during this period. With the attraction of the first private laboratories (Rohm & Haas, Digital Equipment, Dow Chemical) and a continued inflow from public resources and activities (Air France IT, École des Mines, CERAM Business School, National Water Office), the park acquires worldwide visibility as a playground for academic and corporate development activities.

Phase 2 is clearly the "High Exogenous Growth" stage. In the early eighties the relocation of major multinational companies to the south of France as a basis for their European operations leads to a surge in the number of jobs. The arrival of several large global companies and hundreds of smaller technology intensive firms take the total employment amount from under 2,500 in 1979 to more than 15,000 ten years later (Sophia Antipolis, 2008).

> According to local public policy makers, two dominant characteristics explain the success of the experiment at this stage: one is the active marketing strategy toward the international environment and the US market more especially; the other is the accumulation on site of technical facilities that contribute to give to the experiment an image of high modernity (in that respect, the establishing on site of a telecommunication network based on fiber optic technology had a considerable impact on the site attractiveness_at that time). (Quere & Coutures, 2002:4)

The growth crisis that started in the early nineties is connected with a change in the nature of the process of globalization. According to Longhi (1999: 339)

> The global restructuring of industry was associated with a substantial downsizing of the units of large international corporations on the site with, at the same time, an interruption in the flow into the park of new units of large technological firms. … It resulted in the location of more conventional activities without any high technology or technological content, and in the depreciation of the park's image

With the increased ease of worldwide networking thanks to Information and Communication Technology improvements, multinationals no longer made huge facility investments nor did they relocate vast amounts of personnel. This is characterized as a crisis period, during which non-technology related activities were allowed to establish in the park, contributing, according to Longhi (1999), to a depreciation of the park's image. As a result, the focus of the park's development strategy had to shift from exogenous growth (based on foreign tenant attraction and new employment generation) to endogenous consolidation (growth of existing companies). As can been seen in Exhibit 3, 1996 marks the first time when endogenous growth surpasses the exogenous process. Not coincidentally, this period is marked by the emergence of a series of cluster induction and coordination initiatives, such as the Telecom Valley association, the Hi-tech Club and the "Maison des Entreprises".

The final period, Phase 4, represents the maturity of the endogenous process. Even though companies are still attracted, most of the job creation results from the expansion and consolidation of existing firms. Today over 1,400 companies and institutions employ more

than 30,000 people. More than one million square meters of built surface have been developed. Information and Communication Technologies is the park's leading sector with 23% of the companies and 43% of the jobs, followed by general services (54% of the companies and 30% of jobs) and life sciences (4% / 9%). Teaching / researching activities account for 5% of companies and 12% of jobs (Sophia Antipolis, 2008).

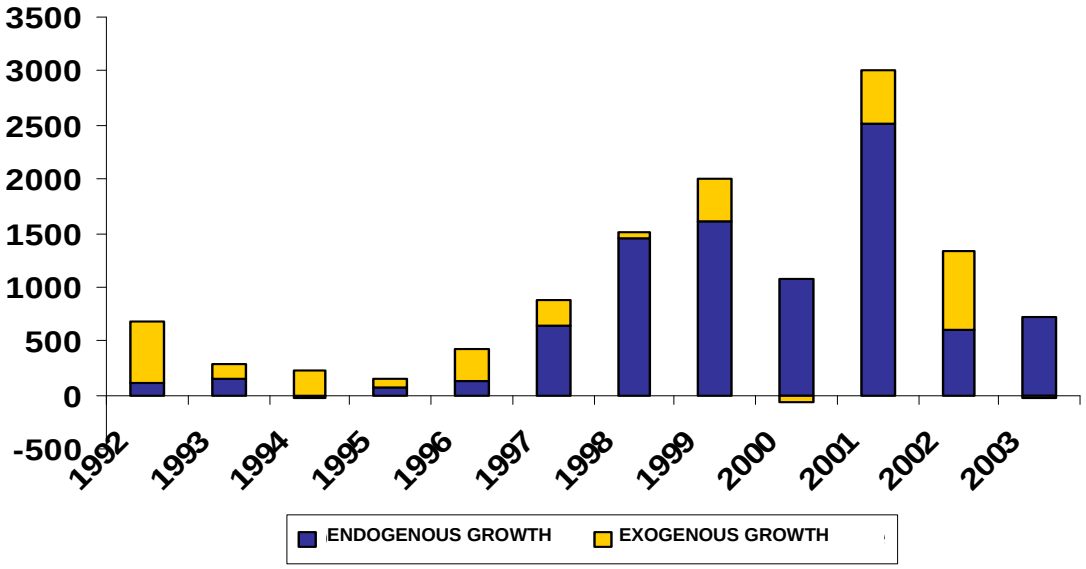

Exhibit 3. Exogenously vs. Endogenously Job Creation, 1992 – 2003 (Source: SAEM Sophia Antipolis)

In the ICT domain, the breakdown of large companies has been a major source for new local start-ups. One such example is Digital Equipment, which after having reached more than 1,100 jobs on site decreased its number of employees dramatically to little more than 200 people when it was merged with Compaq. As stressed by Quere & Coutures (2002), many of those high-qualified workers didn't wish to leave the Riviera and tried to establish start-ups such as consultancy agencies, software development and engineering companies. Besides, in their downsizing process a few large local companies (Alcatel, IBM, Texas Instruments) have developed 'private incubators' in order to stimulate start-up creation by former employees and thus continue to benefit from their innovative capabilities.

Whereas the ICT cluster achieved sufficient critical mass to generate spin-offs, in the other areas knowledge-intensive SMEs are not as common. Overall, these start-ups either work for external markets or rely on contracts with large local companies. In either case their ecosystem is considerably fragile, as on the one hand the distance to central markets represents additional costs that decrease competitiveness and on the other hand the reliance on single contracts expose them to the business cycles of local partners. SME's are thus often forced to relocate to the Parisian area to remain in business.

In spite of these limitations, Sophia Antipolis can be considered a notorious regional development success story. The Riviera is no longer known for its tourist attractions only. The park enjoys a worldwide reputation as one of Europe's most important technology hubs. Generating over 30 M€ in yearly local taxes. The site continues to attract highly paid professionals throughout the world who enjoy the regional high standards of living, working and consumption.

Implementing a Technology Park in an Immature System of Innovation

Like the Riviera forty years ago, the city of Salvador da Bahia is today still better known for its tourism than for its economic dynamics. The first two industrial districts were implemented in 1966 and 1978 (the CIA industry park and the Camaçari Petrochemical Complex respectively). Even though they represented an increase of 53% in industrial employment between 1970 and 1975, only 18% of the region's economically active population was in the industrial sector as late as 1980 (Brandão, 1985). While the subsidy-intensive CIA park failed to retain most of its industries after the end of the incentives period, Camaçari prospered to become the largest petrochemical cluster in the southern hemisphere. Among the latest to settle in the complex, Ford Motor Company invested over U$2 billion in 2001 to create a state-of-the-art manufacturing plant and, most importantly, a world-wide automobile design center with over 1000 engineers.

In spite of these recent developments, Bahia remains strongly underdeveloped both scientifically and technologically. Responding for roughly 5% of National GDP, Bahia registered a little more than 1% of the circa 50.000 patent requests by Brazilian citizens with the National Patent Office between 2000 and 2004. This compares with 47% from the State of São Paulo, 12% from Rio Grande do Sul and 6.8% from Rio de Janeiro (MCT 2008a). Apart from the recent investments in the automotive sector and its petrochemical legacy, Salvador does not present many high-added value manufacturing industries. The distance to the main consumer market of São Paulo (nearly 2,000 km) makes it logistically unattractive for manufacturing industries to establish themselves in the state.

As far as science indicators are concerned, Bahia contributed with only 2.5% to the 130,000 papers published in international journals between 2000-2003, compared with 38% from São Paulo, 16% from Rio de Janeiro and 8.6% from Rio Grande do Sul (MCT 2008b). The state is home to UFBA, one of the country's 16 higher learning institutions which meet the Carnegie Foundation criteria of "research university" status, with over 100 PhD theses a year in more than 16 different areas (Lobo, 2004). Nonetheless, international excellence remains restricted to a few domains in the fields of health and chemistry.

It is in this scenario that the state government decided, in 2004, to lead the creation of a technology park in Salvador, a project called TecnoVia. The elements above have been used both by critics and defenders of the project. Skeptics argue that the state lacks a minimum scientific, technological and economic critical mass for such an ambitious knowledge-based project. The proposers counter-argue that precisely because Salvador lacks a short-term industrial vocation it should follow the lead of regions like Sophia Antipolis in bypassing the industrial age altogether and using its quality-of-life assets to attract post-industrial activities. Indeed, a few parallels can be established in that direction:

- **Image shift due to landmark knowledge-based projects**: Ford's decision to implement its factory and worldwide design center in Bahia in 2002 may have a similar symbolic impact as IBM and Texas Instrument's decision to establish themselves in the French Riviera in the 1960s. Just as the computer companies influenced the creation of higher education institutions in Nice, the presence of Ford has stimulated the Bahian Federation of Industries to create an advanced automation research and training facility, CIMATEC. With a capacity to train 2,500 technical students per year and with 46 laboratories in the fields of mechanical engineering, electronics and robotics, the center has been one of the key players in promoting regional university-industry linkages. In 2003, for example, they were responsible for designing and developing a prototype of the first fully nationalized flexible video-endoscope in partnership with a regional company, generating two international

patents and earning a national innovation award (Rossino, 2006). With the dedication of the second building in 2007, CIMATEC has doubled its surface, now at 14,000 square meters.

- **Quality of life as talent magnet**: Just as the complementarity between living standards and attraction of knowledge workers played a key role for the development of Sophia Antipolis away from the business hub of Paris, Salvador's reputation for a fun lifestyle may help lure many knowledge-intensive projects from the traffic-laden, polluted megalopolis of São Paulo.
- **Eco-friendly development guidelines**: In Sophia Antipolis, two thirds of the entire area must remain a protected alpine-forest sanctuary. Companies are not allowed to construct structures that are taller than the treetops. As a result of these environmental policies, the park is considered one of the greenest innovation habitats in the world, strongly contributing to the image of well-being for those who work and live in the complex. Likewise (although in a much smaller scale), over 30% of the atlantic rainforest surface of TecnoVia will be preserved as natural environments for eco-tracks and leisure. All park buildings are conceived as a show-room for environmental technologies and energy efficiency. Furthermore, an integrated project of sustainability involving green building, mobility solutions, waste treatment and many other actions of positive environmental impacts will be developed in the area around the park. The idea is to make TecnoVia a role model and pilot platform for state-wide sustainability initiatives.
- **Logistic infra-structure**: Nice's connectivity, having one of the largest international airports in France, is paralleled by Salvador's position as the third tourism destination for foreign visitors in the leisure and international convention categories (Embratur, 2006). At six million passengers in 2007, Salvador's airport is the country's fifth largest (Infraero, 2008). The location of Sophia Antipolis close to the A8 highway was as strategic as TecnoVia's position at the Paralela Avenue, a high capacity corridor less than 5 kilometers away from the airport as well as governmental and academic decision centers. The second phase of the urban tramway is projected to serve this area.
- **Communication infra-structure**: Sophia Antipolis was one of the first zones in Europe to be served by ultra-high speed fiber-optics ATM networks at 155 megabits as early as 1997. This helped consolidate the park's vocation as a center for information and communication technologies. In the same manner, TecnoVia is one of the hotspots in the recently implemented optical network linking the main research facilities in the metropolitan area of Salvador, with speeds of up to 1,0 gigabit per second and more than 100 kilometers of extension. This will allow for worldwide high definition video-conferences, distance learning and data processing applications, decreasing the role of time and space as obstacles to collaborative technologic development.

Even though these similarities may inspire policy-makers in immature innovation systems to pursue their efforts to emulate the Sophia Antipolis experience, a number of dissimilarities must also be taken into account. Forty years ago, the French Riviera was an emerging region in a highly developed nation. By contrast, Bahia is an underdeveloped state in an emerging economy. Elements such as overall quality of infra-structure, social development and basic education indicators were much more advanced in Southern France than in Northeastern Brazil. On the other hand, the sheer scale of the Sophia Antipolis endeavor is not comparable. What started with as a 50 hectare pilot in the early seventies was quickly expanded to include

5 local communities spanning 2300 hectares. With its 50 hectare surface in phase 1 (started) and another 50 hectare surface in phase 2 (due to start in 10 years), TecnoVia is a tiny fraction of the French project. Finally, the French Riviera enjoyed a cosmopolitan atmosphere long before Sophia Antipolis was established. A favorite resort for several European travelers, its image was incomparably better positioned than that of Salvador, a still unknown tropical city in a country that only ranks 41 among international tourism destinations (UNWTO, 2008).

For all these discrepancies, any comparison between the two experiences must be regarded with extreme caution. Therefore this article is rather an exercise in understanding the key elements in developing immature systems than an allegation about the reproducibility of Sophia's experience.

Opportunities and Threats in Bahia: Lessons from the Sophia Antipolis Experience

In spite of direct comparison difficulties, due to the immature nature of both regional innovation systems, a few lessons can be drawn from the French experience regarding their internal (endogenous) and external (exogenous) growth strategies. Unlike Sophia, which relied solely on external sources of growth during its first decades of existence, TecnoVia has to combine exogenous attractiveness with endogenous dynamism from the start. As far as exogenous attractiveness is concerned, at least three aspects must be observed to ensure greater chances of success for TecnoVia: a) a solid budget for national and international marketing; b) attraction of prestigious anchor-tenants from public and private sectors and c) steady, reliable sources of financial incentives.

Indeed, as previously discussed, a technology park's image, the first strategic factor for exogenous growth, is often cited as one of the most vital predictors of its success. An adequate public relations and branding campaign at the local and global levels is essential to position the site as a potential player among leading technology clusters. Rather than using wide media coverage, which is expensive and often ineffective, Sophia Antipolis gained notoriety by targeting the right audiences with the right message at the right time. Such actions included assembling delegations composed of leaders of the various sectors of the local forces, academia, international companies, high-tech, banking, legal, young entrepreneurs association, exhibiting in world class technical events, inviting specialized journalists, giving presentations in conferences etc. TecnoVia, likewise, will need to substantially intensify its marketing campaign now that the park infrastructure is under construction. Creating a newsletter to keep stakeholders up-to-date on key developments, revamping the web-site, sending press releases to national and international specialized media are all elements of a continuous campaign to raise brand awareness and increase the image value of the project.

The second element for exogenous development, anchor-tenant attraction, is also essential to lending credibility to a park project in an immature innovation system. As previously seen, the location of IBM and Texas Instruments were very important to the Sophia project. But equally strategic was the effort by Pierre Laffitte and other leading politicians to influence the transfer of entire public research laboratories and knowledge institutions to the site, such as the prestigious École de Mines de Paris (engineering school), INRIA (information technology research center) and CNRS (multidisciplinary laboratories). On the TecnoVia side, similar breakthroughs must be achieved on the short term. The recent memorandum of understanding with Portugal Telecom to create 250 jobs by 2010 is a good start. Petrobras, the world's leading oil company in deep water drilling, has already defined the research laboratories from its Exploration and Production units that will be installed in the park; the company's downstream units are currently proposing TecnoVia projects as well. Internationally renowned biotech research laboratories such as Fiocruz and Monte Tabor have also confirmed

their intention to participate in the project. Other agreements have to be aggressively pursued. The degree of knowledge intensiveness in the profile of anchor tenant activities will largely determine the initial image the complex will generate worldwide.

Finally, experience has shown that a technology environment in the periphery of capitalism must provide investors with enough incentives to counterbalance the high transportation costs associated with locating away from central markets. In the case of Sophia, during the early stages, the regional government offered 50% local tax exemption for the initial 5 years and would also partially compensate the cost of land purchase in the case of "user-owner" acquisitions. In turn, the national government would temporarily reduce the cost of wages of knowledge-intensive tenants when they met the job generation targets agreed upon signing the contract, by paying out "one time deal" cash grants. At TecnoVia, a first step in the same direction is the recently approved "Inovatec" fund of €6 million / year, to be granted to innovative companies for infra-structure and equipments. Another measure is currently being considered to allow the state to partially compensate companies generating high-paying jobs.

In parallel to the exogenous strategy, endogenous growth must be encouraged at TecnoVia. By benchmarking the recent internal development of Sophia Antipolis, the following elements stand out as critical aspects of the endogenous strategy: a) strong support of existing local scientific networks of excellence; b) steady, reliable sources of start-up funding / incubation; c) balance between targeted tenant profile and support services.

Regarding the first endogenous development strategy, as shown by the chronology of the Sophia project evolution, the creation of local technology clusters was instrumental in promoting internal and external links between the knowledge base and regional innovative projects. Similarly, the TecnoVia team must identify domains of local competency with enough critical mass to spin off competitive business plans for high added value start-ups. Thanks to the longstanding tradition in the immunology department of the Federal University, for example, an opportunity has been identified to develop diagnosis kits and vaccines for neglected tropical diseases. Due to the perspective of technology transfer from partners in France and Sweden, these products can be developed locally at a fraction of the price currently paid by the Ministry of Health for imported kits. Such high value import substitution process will create applied research opportunities for several masters and PhD students who graduate from the local Federal University every year. Other examples include a partnership between CIMATEC and German research laboratories in precision devices manufacturing and the collaboration between the Physics Institute and Swedish research groups in the field of nanotechnology. These few projects which can be implemented by local experts based on international partnerships are fundamental to building a medium-term technology entrepreneurship spirit in TecnoVia. However, they will need long term financial, logistical and material support from local and national innovation agencies in order to succeed.

As to the second key endogenous element, start-up incubation, the Sophia experience is useful to illustrate the potential of this local development strategy. Pre-incubators have been one of the most recent phenomena in Sophia Antipolis. After its creation in 2001, the "PACA Est" pre-incubator has hosted over 65 projects, out of which 40 gave origin to viable start-ups, with an average of 6 jobs created per company. Following the natural vocations of Sophia Antipolis, 54% of the projects are in the domain of Information and Communication Technologies, 15% in Life Sciences and the remainder are related to various engineering areas. Over 60 patents have resulted from the pre-incubation activity (LARGILLET, 2006). The second pre-incubator, "TELECOM Paristech Entrepreneurs" was created in 2006 at the Eurecom Institute, a teaching and research center in the area of ICT which receives post-graduate students from high-ranking engineering schools from all around the world. In three years, 10 high technology companies have been created by Eurecom students.

One remarkable aspect of start-up incentive strategy in the Riviera is that it still lacks an actual "hosting" facility for companies that leave the pre-incubation stage. Judging by the rate of survival of exiting firms, however, this peculiarity does not seem to constitute a deficiency. Concerning available venture capital initiatives, local start-ups can rely on a regional fund called "PRIMAVERIS", which can lend seed capital or participate with up to €500,000 in equities for early-stage projects. National funds are also available for local companies, such as BIOAM (biotechnology), EMERTEC (energy and the environment) and I-SOURCE (ICT).

In Bahia, the state innovation agency FAPESB has recently implemented a fund to stimulate local start-ups. Even though resources are comparable to those available in the south of France, the existing incubators operate precariously and have very few high-added value projects. For TecnoVia, a "super incubator" needs to be created with enough sources of venture capital (privately or publicly supported) to attract the best business plans in the country and potentially from abroad. In fact, considering the low technological intensity of local and national projects, TecnoVia should focus on the few scientific domains in which local expertise can be found and look for business opportunities among projects originally submitted to American and European venture capitalists. Technology transfer agreements can be negotiated with these project leaders, who are often seeking partners to internationalize their growing knowledge-intensive business. The Riviera model shows how important pre-incubation is for actually generating good business plans. Contrary to their experience, however, an actual incubation stage in a protected environment may prove vital to increasing the chances of start-up survival in an immature system.

Last of all, a balance between primary and secondary activities must be sought in the tenant policy. One of the basic elements of Sophia's success was its ability to choose the right tenant profile according to the park's needs. General services (restaurants, hotels, entertainment centers) were fundamental to keep Sophia Antipolis lively and livable. On the other hand, having too many non-technology related tenants could have undermined the essence of the project's mission. TecnoVia, having a much smaller surface than its European counterpart, will have to be even more critical. As shown in Exhibits 4 and 5, the so-called "technocenter cluster" is conceived to be the multi-institutional hub at the heart of the Park, with areas designated for a restaurant, an executive hotel, a convention center, a library, a cybertheater ("virtuarium") and other structures for the popularization of science. Having these elements defined from the start will be important to "populate" and "popularize" the park. However a careful line must be drawn regarding non-finalistic activities, lest the park become merely a sophisticated business condominium.

It must be pointed out that in immature innovation systems such as Bahia's, threats tend of course to overshadow opportunities. The greatest risks such a project incurs are associated with the fact that it is inherently dependent on public efforts to compensate the lack of natural attributes for development. If on the one hand it has become easier to produce consensus about the role of innovation in local development, on the other hand the number of projects competing for the attraction of high added value tenants has increased exponentially. According to ABDI (2008), there are currently over 60 technology park projects in Brazil. This reinforces the notion that, unlike Sophia's experience, long-term endogenous growth may be a more feasible strategic choice for Bahia than short-term exogenous development.

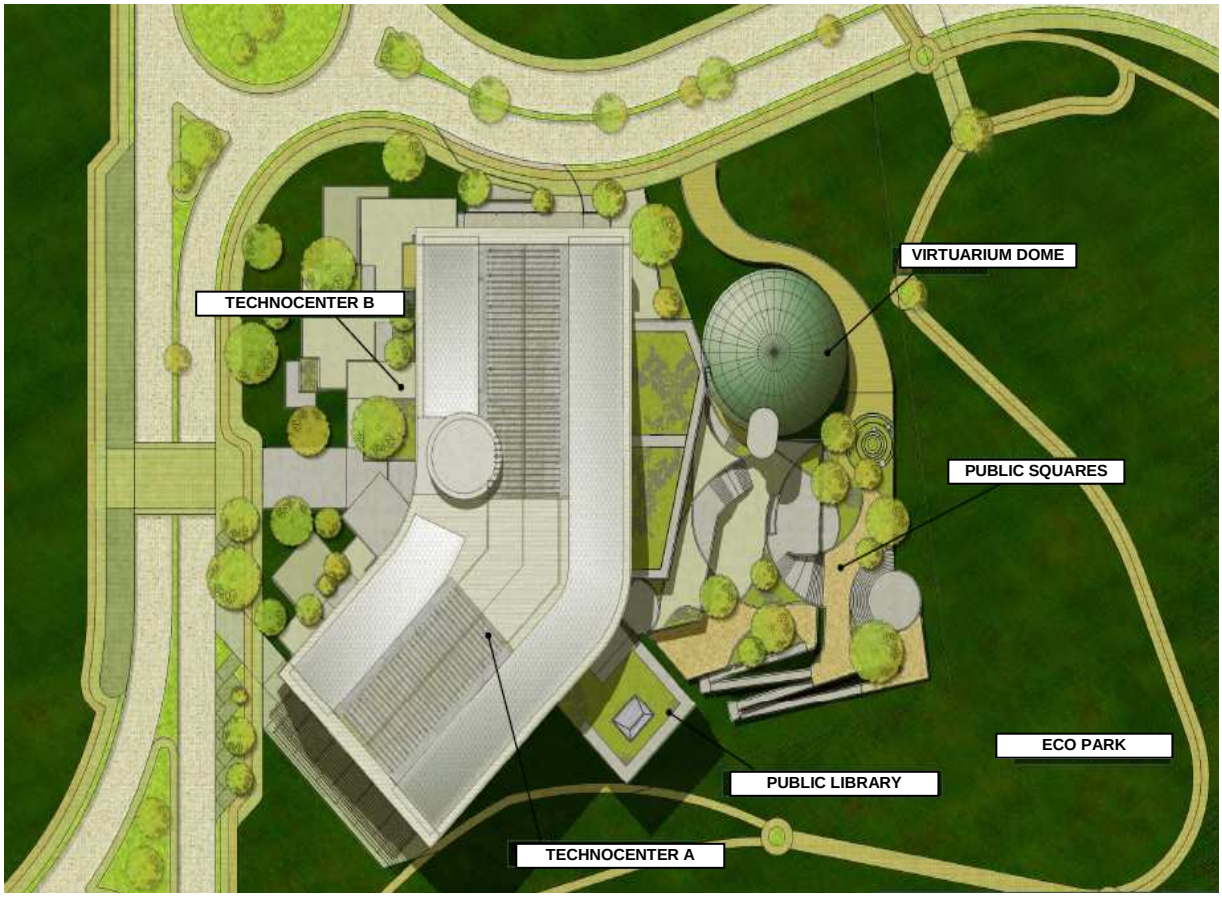

Exhibit 4. "TecnoCentro", TecnoVia's main building complex during the park's initial stages (top view)

Few of the Brazilian park projects are as inspired by Sophia's eco-sustainability concept as TecnoVia. Similar guidelines have been put in place to assure the preservation of green surfaces and buildings that "arise out of the forest". Regarded as a living laboratory for energy efficiency, TecnoVia aims at becoming a reference in sustainability. Obtaining the environmental license to start construction after long months of negotiation with NGOs and government authorities, it gained a considerable lead over less eco-orientated initiatives elsewhere in the country. As the rigidity of environmental laws increase, however, the fact that TecnoVia is located in a semi-protected urban niche of atlantic rainforest can become a threat as much as it has been an opportunity.

Besides, instead of considering itself a 50-hectare isle of prosperity, the TecnoVia project must be positioned as a hub with linkages in the entire regional innovation system – and with the "Knowledge Avenue" area in particular. If any real economic impact is to be expected, current and future knowledge-intensive assets surrounding the park area must be articulated to try to reproduce the scale of Sophia Antipolis. This "extended" TecnoVia would presently include one state-owned and two private universities, a state-of-the-art health institute for clinical trials and immunological research, the Federation of Industries, the State Government Complex, CIMATEC, the business district and the international airport, all within a 10 kilometer radius from TecnoVia, all interconnected by Paralela Avenue's express lanes.

In other words, in order to increase TecnoVia's chances of success, government policies must be consistent and far sighted. If financial incentives are not aggressive enough, if there is not a long-term political coalition on the local, regional and national levels, the project will be in danger of stagnating or degenerating. Other risks include the little involvement of key scientific communities and the lack of support by industry-related institutions. The good news

for TecnoVia is that, as was the case in the French Riviera four decades ago, apparently all these requisites seem to be in place. The Bahian project was started by a center-right wing government four years ago and has survived its first state-wide elections and a transition to the opposition left wing party, which kept the basic project guidelines. The support by the Ministry of Science and Technology, the state agency for innovation and the state treasury department has assured initial resources estimated in €30 million for the next two years. A governance structure is being put in place which gives the project political autonomy while keeping key academic, industrial and governmental stakeholders actively involved in policy making.

Exhibit 5. "TecnoCentro", TecnoVia's main building complex during the park's initial stages (front view)

Conclusions

Taking into account the similarities with the Sophia Antipolis model and its own peculiar virtues, TecnoVia seems to have a promising perspective of consolidation over the next ten years. Even though it lacks locally widespread sources of scientific knowledge, TecnoVia can deliver its message of sustainable development if it can continue to rely on the right combination of community leadership, focus on existing competencies, good branding and leverage of the natural attractiveness of Salvador as a magnet for talent – as did Sophia in the past. Yet the enormous rate of failure among technology parks as instruments of regional

development suggests that the challenges ahead must by no means be underestimated. Lacking critical attributes in science and technology, Bahia has to prove that it is as serious about fostering the knowledge based economy as the Riviera region did in the sixties.

Rather than to become overoptimistic, Bahia policy makers should be aware that comparisons with developed economies pose considerable difficulties. Even if several parallels do exist, any notion of reproducibility has to be approached with caution. Apart from the fact that French and Brazilian policy making priorities for science and technology are hardly comparable, the economic and technologic scenario has changed considerably over the last forty years.

The goal of this paper was not to prove the feasibility of TecnoVia by drawing comparisons with Sophia, but rather to indicate that it can never be too early to start investing in knowledge-based development even if the surrounding environment is not yet ripe. Rather than to wait for conditions to be mature, the Riviera experience shows that a self-fulfilling prophecy or virtuous cycle can result from the very process of starting to develop these activities. It shows that the densification of interactions among researchers, entrepreneurs and government agents is the first step towards a more diversified and prosperous society.

Territorial decentralization is as important an issue for Brazil as it is for France and other countries with highly concentrated development models. Technology parks may prove an instrumental element in keeping Brazil's incipient regional innovation systems from continuing to be brain-drained. Fixing local talents to generate high added value products and services is essential to Bahia and other secondary economic regions of Latin America. The growing awareness of these ideas among policy-makers on local and national levels may be one of the greatest evidences that the time is right to begin to plan the transition of underdeveloped economic regions into the principles of knowledge-based wealth creation.

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