

CHAPTER 7 – EMBRACING SCIENTIFIC AND TECHNOLOGICAL CHANGE

To Promote Scientific and Technological Innovation as a Path to Development

Cities should strengthen scientific research and technological innovation, as well as establish and improve systems for using new technologies. They should accelerate the application of scientific findings in order to improve the quality of people's lives and create new industries and jobs. They should apply principles of openness and mutual benefit in strengthening scientific and technological exchanges and collaboration to promote urban development around the world.

Shanghai Declaration on Better Cities, Better Life

1. ISSUES AND CHALLENGES¹

1.1. SCIENCE AND TECHNOLOGY, GLOBALIZATION AND INNOVATIVE CITIES

As local leaders, it is important for us to understand that cities that are innovative can achieve advantages in globalization. The success of cities and their inclusion in globalization can be measured by the capacity they have to bring out new ideas and spread them. Therefore, as local leaders, our role is to design policies that foster linkages and innovation networks. Key to the ability of a city to innovate is its ability to develop systems that allow it to use the assets of science and technology. This chapter will suggest a framework of measures that local governments can adopt to employ science and technology as a strategy for sustainable local development.

The rise of digitalization that has occurred in the past decades is having a direct impact on cities. Regional and urban disparities are reinforced or diminished through access and utilization of electronic infrastructure. One challenge for urban leaders is to develop strategies that would enable a city to actively participate in the knowledge economy.

In modern societies, cities are more affected than rural areas by natural and man-made disasters. Experience has shown that science and technology can play an essential role in enhancing the safety of cities. Research in science and technological innovation should be directed toward improving the ability of cities to plan for and cope with a range of threats and to successfully manage crises when they do occur.

¹ This chapter was authored by Jose Monroy, with valuable input and contributions from Li Guangming.

The sustainable development of cities is challenged by many risks related to pollution, hazardous waste, climate change and resource scarcities. The application of scientific and technological advances in the areas of energy, safe drinking water, environmental protection, and information and communication technologies can help meet those challenges and provide solutions for sustainable urban development.

Science and technology innovation can be a key driver of economic growth and prosperity. Developing an innovation culture within the city can help science and technology initiatives take wing. City leaders can achieve an innovation culture by promoting entrepreneurial spirit, enhancing training of the technological talent pool, strengthening science and technology policies, stimulating the growth of hi-tech industries, expanding the protection of intellectual property, and fostering scientific awareness through public education.

Creating an innovative urban environment requires strong links to the science and technology communities. Such links permit industry's uptake and commercialization of public-sector research results, which can augment industry's own research agenda. Feedback to the research community allows it to better orient its research to address social and economic problems. Within urban areas, innovation environments often take the form of Science and Technology Parks. Science and technology (S&T) parks closely related to universities are strong engines of economic growth. They are instruments that can help sustain a knowledge-based economy and enable market-oriented technological development. As places of creation and innovation, S&T parks attract investments, as well as highly-qualified professionals.

The Stanford Science Park emerged in the 1950s as a university-owned park associated with Stanford University. It pioneered the use of clustering of technology-based firms and property-based initiatives close to centres of learning. Located in the San Francisco Bay Area, Stanford Science Park initially hosted Hewlett Packard, General Electric and Lockheed Martin and played a pivotal role in the development of Silicon Valley.² Nowadays, it remains at the forefront of innovation as it is home to some of the most groundbreaking new companies, like Google and Facebook.

1.2. KEY ELEMENTS AND ADVANTAGES OF SCIENCE AND TECHNOLOGY PARKS

In urban areas, S&T parks can be focal points for fostering innovation and connecting cities with the global economy. A S&T park can be defined as an organization whose main purpose is to improve the well-being of the community where it is located by encouraging a culture of innovation and competitiveness through knowledge-based institutions and related businesses. Managed by professional experts, a S&T park nurtures and directs the exchange of knowledge and technology between universities, R&D institutions, companies and markets. By doing so, a S&T park promotes the establishment of innovation-based companies by incubation and spin-off processes.

² http://lbre.stanford.edu/realestate/research_park

S&T parks are a core element for sustainable development in urban environments in the 21st century. They allow cities to be connected and attractive in the global economy by developing industries that will lead the way in the decades to come. In order to achieve this purpose, S&T parks are characterized by several key features:

- The establishment and management of a S&T park results from a collaborative effort of multiple stakeholders: firms, public authorities, academia, members of the financial sector as well as educational and research institutions.
- A science park involves the provision of infrastructure and support services for businesses. This supposes strong investments in real estate in order to make available of first-class office space and facilities.
- S&T parks, by enabling technology transfers (both in terms of physical hardware as well as the more important software of knowledge, skills, procedures, know-how, etc), perform an economic development function. Science parks draw together large businesses and start-ups in the same place: they enable clustering as well as the development of networks and trust. This allows the transmission of ideas and knowledge, which foster new companies, innovation and ultimately, growth.
- Local governments can identify a specific economic sector they wish to develop because they can judge whether they have a comparative advantage in it. This is why science parks may have a focus on a particular type of industry such as ICT or bioengineering.

For instance, the Indian city of Bangalore provides an interesting illustration of an urban area that concentrated its science and technology efforts for the development of an ICT cluster.³ Historically, Bangalore has been the site of important military infrastructures. Public policy has also favored Bangalore as a science and technology site by locating the seat of the Indian Space Programme in the city. These precedents were essential in setting the stage for the emergence of ICT in Bangalore: they allowed the development of an industrial culture in the city.

Having its own University since 1964, Bangalore was also home to several research institutions, most notably the Indian Institute of Science, which prepared the Indian elite in the science field. Further, the State of Karnataka, where Bangalore is located, was also very proactive in the development of science and technology as it adopted a voluntarist policy in favor of ICT in 1997. This materialized in the development of two important science parks, the International Tech Park Limited and Electronics City, which allowed Bangalore to successfully become an ICT hub in Asia. Nowadays, the city accounts for the production of 35 per cent of India's software and hosts 55,000 ICT professionals as well as 103 ICT R&D centers.

³ Grondeau, A. (2007). *Formation and emergence of ICT clusters in India: the case of Bangalore and Hyderabad*. *Geojournal*. 68: 31.

2. POLICY OPTIONS TO ENCOURAGE SCIENCE, TECHNOLOGY AND INNOVATION

2.1. INNOVATION AS AN ENABLER OF DEVELOPMENT

In both advanced and developing countries, innovation plays a central role. Innovation is a generator of employment as well as of stronger productivity through knowledge creation and its following application and dissemination. Likewise, innovation is a tool to advance social development. In order to foster innovation, it is essential to prioritize efforts in long-term sources of growth: education, infrastructure and research.

This process should comprise structural reforms in innovation policy. Innovation policy needs a new conceptualization in order to shift from a targeted policy focused on R&D and specific technologies to a more comprehensive approach comprising the many actors and factors that play a role in innovation performance.⁴ With this, the policy's goal should not be merely innovation as such, but its application in order to make life better for individuals and society at large.

In this process, cities have an essential role to play. As local leaders, we need to understand that cities are at the forefront of innovation. They are the spaces where innovation takes place: while concentrating different actors and elements, they have the capacity to interrelate them. Specifically, cities can undertake particular actions that would enable their transformation into innovation environments:

- Cities can concentrate on the development of science and technology parks. The establishment of a S&T park sustains the local production of goods and services oriented to the information economy. Further, it attracts innovative companies in which ICT is the main means of networked organizations.
- Cities can also focus in the establishment of a new social organization, in which the main organizational support is Information and Communication Technologies (ICTs). Through the new interaction networks opened by ICTs, various groups and social movements can find new channels of expression.
- Finally, cities can prioritize the individual and collective use of ICT intensive goods and services.

Through promoting these actions, local governments can ensure that cities are truly attractive and connected to global communication networks. Allowing connectivity and interaction is an important step to foster innovation. Innovation cannot occur if a city is not integrated and up to date with the major orientations occurring in globalization. An innovative environment may be territorially located

⁴ OECD (2010). *Ministerial report on the OECD Innovation Strategy: Innovation to strengthen growth and address global and social challenges*.

within a city and its surroundings, but through communication networks, it interacts and is connected to the rest of the world.

2.2. GENERAL GUIDELINES FOR DEVELOPING S&T PARKS

If you are a local leader aiming to enhance your city's integration into the knowledge economy through the establishment of a science park, you can follow general guidelines that would assist in its conceptualization and development:

- A Project Management Team (PMT) composed of management and local development experts, responsible for leadership of the park should be designated. Local governments can assist the PMT by organizing workshops drawing on best practices, case studies and S&T park master planning development from advanced economies: sharing such information might prove essential to understand how to successfully develop science parks. The specific aim of these workshops should be to assist in the preparation of feasibility studies⁵ that carefully assess the challenges associated with developing a science park and also the opportunities which the city can take advantage of in order to increase the park's chances of success.
- A S&T park should focus on the challenges of their potential customers in order to truly address their needs. This can be achieved by the inclusion of the stakeholders and the parties involved in the conceptualization and management of the park: through collaboration and cooperation, S&T parks can preserve stakeholder trust and rally their support.
- Further, local governments must remember that the success of a science park is strongly determined by the development of a long-term vision for it. The challenge that local leaders face is to imagine a vision combining both a solid practical approach based on needs with an ambitious projection, in order to generate enthusiasm. The long-term vision and strategy of the park should be established in a master plan that embodies how the S&T park will achieve its objectives.
- From project inception, local governments should also seek ways to secure funds and generate interest amongst potential international park clients. Carefully developed feasibility studies and a clear vision established in a master plan might prove essential to legitimize the park as an investment project.

As local leaders, we have to be proactive in the development of S&T park strategies. We need to truly include stakeholders in the planning and management process as well as to clearly understand the objectives we wish to pursue. In addition, we must remember that other factors also intervene in the

⁵ Connell, P., *Building Science Parks for the 21st century: Strategic issues and feasibility analysis*. International Association of Science Parks.

success of the park and are important to take into account. Of these factors, the existence of an entrepreneurial culture in local society is most relevant. It should be a priority of the science park to encourage such a culture by cooperating closely with universities and businesses.

Another frequent factor in the success of S&T parks is the presence of projects that serve as an anchor to development. Such projects lead the way, generate initial revenues, attract small companies for servicing large companies and foster enthusiasm, thus triggering development. Finally, and perhaps more importantly, local governments must adapt science parks to local circumstances. Whilst valuable lessons can be learned from experiences with S&T parks around the world, models should not be copied; each project's characteristics should depend on what is at hand. The idea is to adjust the science park to "answer to local competitiveness".⁶ Science parks should be based on the strengths they see in their scientific and business environment.

UNESCO provides capacity development and technical assistance in S&T park development. UNESCO has organized several training workshops in this field and supports member states in all phases of S&T park development such as in preparing a feasibility study of S&T park development.

2.3. THE PIVOTAL ROLE OF UNIVERSITIES

In the development of science parks, local governments have to remember that universities play a pivotal role.⁷ Universities are spaces where new ideas and knowledge are created. They are also sites where interaction and networks leading to innovation are fostered. As such, as local leaders, we must remember that for a science park to succeed, it is essential to establish strong linkages with universities. When a science park is developed, local governments can get universities involved as either shareholders (with an ownership share) or as stakeholders (with an interest in the management of the park). It is up to local leaders to carefully assess what place research will take in the overall strategy of the park.

However, it is important not to overemphasize the institutional aspect. Institutional linkages could prove to be less significant when compared to the synergies that can emerge between research institutions and companies through the sharing of premises and the sharing of knowledge. Therefore, local leaders should concentrate on how to encourage synergies between research-based institutions and business to occur. Physical proximity between research institutions and business encourages the development of a culture of both formal and informal meetings in a relaxed environment. This can later on materialize in a constructive collaboration. In addition, if interaction between research and business occurs, it can lead to an enhancement in the mutual understanding of both parties. Business and research could cooperate in defining what kind of knowledge should be produced and what kind of

⁶ European Investment Bank (2006). *Science Parks: A tool for the development of the knowledge economy?* Scope for the EIB Group Support.

⁷ Ibid.

knowledge should be applied. This could prove to be of great importance in the establishment of a strategy for the creation of value.

UNESCO actively promotes the interaction between science, technology, innovation and economic development through its University-Industry Science Partnership (UNISPAR) Programme. UNISPAR promotes links between universities and the productive sector, with emphasis on the establishment of science and technology parks. Within the framework of UNISPAR, an active programme is UNESCO Chairs.⁸ The main partners are universities and research institutes, NGOs, foundations and public & private sector organizations. The programme offers, training, academic exchanges, research and a platform to share information. One of the most active UNESCO Chairs in science, technology and innovation is hosted by the Sun Yat-Sen University in Guangzhou, China.

2.4. PROACTIVE MANAGEMENT TO FOSTER COMMUNICATION AND NETWORKS

Once the park has been conceptualized and is in place, local governments give importance to its effective management. Management is at the core of the success of any science park.⁹ Managers, through their decisions and actions, can help trigger innovation among business, enhance technology transfer and provide support to enterprises, especially small and medium enterprises, when it comes to networking, management and international strategies. Local leaders must carefully choose the park leadership, as managing a science park is a delicate task. Managers should have a multidisciplinary mindset combining the expertise of a scientist, a politician and a business person.¹⁰ Further, managers should be skillful in interacting with the local environment and reaching the actors involved in the innovation system, especially entrepreneurs.

Concretely, there are 4 components that managers can emphasize to assure the provision of high-quality services and management to the actors in a park:

1. Development programmes that fully integrate incubation schemes should be put in place. The existence of such programmes allows the development and diffusion of entrepreneurship, especially among small and medium enterprises.
2. Managers should also focus on creating a pleasant work environment. In order to do so, they can encourage a culture of sharing infrastructure services such as offices, conference rooms and telecommunications as well as to provide leisure and cultural activities. This would enable communication and motivation among park actors.

⁸ <http://www.unesco.org/en/unitwin/university-twinning-and-networking/>

⁹ Baccanti, M. *Modern trends in the management of science and technology parks*. International Association of Science Parks.

¹⁰ European Investment Bank (2006). *Science Parks: A tool for the development of the knowledge economy?* Scope for the EIB Group Support.

3. When managing office space, managers should keep in mind to allow flexible premises in terms of size. This permits the hosting of companies ranging from small incubated start-up firms to large companies. As such, partnerships can be developed. By being physically close together, small and large companies can interact and communicate. Large companies have brands and power, while small companies have entrepreneurship and novelty. Together, by combining their skills, they have the potential for effective innovation.
4. Managers should take care of the reputation and the image of the park. This involves developing a marketing strategy that can attract attention in the global information economy.

S&T parks exist to foster innovation. With this in mind, managers must actively help businesses to overcome barriers to innovation. These may include access to finance and access to technology. For each of these, managers must ascertain how they can help users of the S&T park to overcome these barriers. For example, how can they really help new companies bridge the gap between research and commercialization of a new technology?

2.5. DESIGNING S&T PARKS: THE “LEARNING VILLAGE” MODEL

Science and Technology parks are generally urban mega projects or peri-urban projects located next to university campuses. They are large-scale infrastructure and real estate projects that have the capacity to transform a city. Further, by utilizing high-quality architectural and landscape design components in their master plans, science parks have the ability to change the physical appearance of cities.

Since science parks present an enormous potential to physically and economically transform urban areas, as local leaders, we must remember to seek ways to successfully integrate urban mega projects into the existing urban fabric and environment. Science parks have the capacity to transform a city, but they must do so while successfully relating to it. Thus, it is important to conceptualize science parks as fully integrated living urban environments that combine different uses. They must be communities, not just work spaces.

Planning science parks following the “learning village” model can be an effective way to make them truly vibrant urban communities. Three elements compose the “learning village” model:

- Businesses
- Educational centers
- Residential areas

Integrating these three elements allows technology parks to become urban areas where people can work, play and sleep. Concretely, it means including different land usages, a clear design promoting public space, as well as efficient linkages to public transportation into the master plan. Science parks are not just spaces where people work during the day and are empty at night but spaces that urban

residents can enjoy and appreciate at any given time. This can exponentially multiply the efficiency of a S&T park, by making it a pleasant urban area where the environment fosters innovation through its livability. The everyday use of the latest IT-based improvements in the science park can also contribute to and support its success. They allow inhabitants and users of science parks to be globally connected, while living, learning and working in a clear geographical area.

3. CASE STUDIES

3.1. SOPHIA ANTIPOLIS, FRANCE - A PIONEERING EXPERIENCE IN S&T PARK DEVELOPMENT



A building within the Sophia-Antipolis science and technology park

Photo credit: www.sophia-antipolis.org

Located in the French Cote d'Azur, next to Nice, Sophia Antipolis is one of the pioneering science and technology parks. Developed over a period of over 30 years, Sophia Antipolis is the product of a close collaboration between public authorities, research institutions and the private sector.¹¹ Essential in the development process was the role played by Pierre Laffitte, a local politician who assumed a proactive leadership in the conceptualization of the park by bringing together different actors in the political, business and research spheres.

Using science and technology to promote regional development in a highly centralized country - France is characterized by a deep culture of centralization. The French capitol has traditionally concentrated many of the political, cultural, economic and social forces and activities that

¹¹ http://www.sophia-antipolis.org/index.php?option=com_content&view=article&id=14&Itemid=15&lang=fr

lead the country. In an effort to spread economic development throughout the territory, the French Central Government created a National Agency in charge of Regional Development (DATAR) responsible for implementing regional economic development plans. These regional plans were strongly based on the establishment of regional universities, research and innovation centers that would spur growth in middle-sized cities. However, in the 1960s, Nice and the Cote d'Azur were mainly perceived as touristic and recreational areas and were not really targeted as focal points of regional development utilizing science and technology.

An engineer by training, Pierre Laffitte was convinced that, in order to be truly effective and successful, research and innovation had to be in tune with business needs. Wishing to bring economic development to the Cote d'Azur and to make it a leader in innovation, he had the groundbreaking idea to develop a research cluster in the municipality of Valbonne, in the Nice region. This countered regional development plans that placed Nice as a recreation cluster.

Orchestrating local groups and public authorities for the establishment and success of a S&T park - With the aim of realizing his ambition of establishing a S&T park in the Cote d'Azur, Pierre Laffitte organized the creation of SAVALOR, a non-profit Group of Economic Interest (Groupement d'Intérêt Economique) that, in French law, allows two or more parties to share and lead common actions in order to further develop their activities. This allowed him to bring together local and regional governments with research institutions and private business partners, most noticeably IBM and Texas Instruments. SAVALOR played a main role not only in bringing actors together, but also by acquiring land.

The creation of a Syndicat Mixte d'Aménagement, a local planning unit in charge of developing the area followed. Strict planning rules were established that conceptualized Sophia Antipolis as not only a research and business center but also as a community mixing residential areas, parks and recreation facilities. It is essential to point out that the site where the park is located is topographically and geographically unique, set in between mountains and in proximity to the Ocean. As such, there was strong attention placed to the quality of the urban environment being created, by putting emphasis on architecture and the provision of green areas and open spaces. In the development process, it was the philosophy of the project to take advantage of the quality of life of the area and the pleasant surroundings to establish a unique space that would encourage innovation and research.

In its initial stages, the project did not benefit from direct support from the French Central Government. Sophia Antipolis nonetheless benefited from the moral support of the DATAR, the National Agency in charge of Regional Development. It was from local government units that the project derived its main support. In particular, Sophia Antipolis was backed by a strongly proactive research policy from the Département Alpes Maritimes, the territorial administrative unit where the project is located. The Département government placed research and innovation as the core of its local development strategy, thus encouraging and supporting the Sophia Antipolis project. The local government gave strong financial support to university education and National Research Centers in the S&T park site.

All these actions allowed Sophia Antipolis to realize its ambitions as a European science hub with an international reach. According to 2008 figures, the park hosted 1400 companies, 30,000 employees, 5,000 students and 4,000 public researchers. It is home to companies in diverse science fields, ranging from chemistry and biotechnology to ICT. The park is also marked by the presence of a local association that organizes cultural events and fosters informal communication and networks among tenants. This creates a local spirit, and fosters trust and innovation.

Lessons Learned:

The case of Sophia Antipolis illustrates the importance of local leadership in the success of a science park. In the development process of the park, the role played by a visionary leader with a clear ambition was essential in orchestrating political support for the project. Further, the leadership nurtured networks between different actors in both the private and public sphere – researchers, local and regional government authorities and business. By challenging some national French development plans, Sophia Antipolis illustrates how ambition and perseverance are pivotal in realizing a project.

Sophia Antipolis is a pioneering example in S&T park development. It is one of the first urban development projects using science and technology as a strategy of development, therefore its story and characteristics are most valuable.

3.2 SAN DIEGO, CALIFORNIA - THE IMPACT OF A UNIVERSITY IN ESTABLISHING A BIOTECH CLUSTER



Biotechnology is a rapidly growing high-tech industrial sector

Photo credit: www.xconomy.com

On the border with Mexico, San Diego is located outside the usual US high-tech regions of Northern California and the American Northeast corridor. The economic base of the Californian city was strongly dependent on defense spending (the military has a strong presence), tourism and real estate. However, in the past two decades, San Diego's economic activities have shifted their orientation. The city became one of the most economically diverse and knowledge-based, fast-growing regions in the United States. San Diego used innovation in science and technology to become a dynamic, state-of-the-art research cluster. Nowadays, San Diego is home to 75 research institutions, 1,900 IT companies, 600 biomedical and life science companies and 250 clean tech companies.

Strongly focusing on research, the city has one of the largest critical masses of biotech R&D and clinical testing institutions in the US. San Diego's success is a story of how a university, research institutions, the business sector and the government came together to establish a world class biotech and communications cluster.¹² Important connective institutions allowed the establishment of networks and the dissemination of information, thus fostering a culture of cooperation and innovation. In this process, a strong navy presence in the city was a powerful asset, as the military was often involved in R&D research projects. The military can act both as a source of R&D funding and as a large and sophisticated consumer.

The pivotal role of research institutions - In the development of San Diego's biotech cluster, three educational and research institutions were essential in triggering R&D efforts and projects: the University of California at San Diego (UC San Diego), and the world-famous biomedical research centers, Scripps Research Institute and Salk Institute, which operated as the industry foundation and brain trust. Founded in the 1950s and 1960s, the three institutions were created to encourage education and research and succeeded in attracting talented and entrepreneurial researchers. UC San Diego was nonetheless the leading institution. Its reputation in biotech research was almost unsurpassed for cluster development. Biotech companies concentrated around UC San Diego or alternatively located in industrial parks within 10 minutes of each other and with easy access to university labs and scientists. Thus, proximity fostered cohesion and provided the city with a collegial spirit.

Alumni and scientists from the three institutions have been responsible for initiating dynamic R&D firms. These firms have often played the role of incubators for new companies. Most notable in this regard are UCSD alumni Ivor Royston and Howard Birndorf, founders of Hybritech, a breakthrough bioengineering firm. The company made millions, legitimizing and directing attention to the biotech field as a great potential investment opportunity. It built trust in the local business and financial community as it proved that biotech investments were a viable reality in San Diego. Further, former employees of Hybritech that deeply benefited from the company's success reinvested their resources in the area by supporting other start-ups. Hybritech left as a legacy a culture of local venture capitalists ready to invest in R&D projects. It created a culture prone to take risks in innovation.

¹² Wu, W. (2005). *Dynamic Cities and Creative Clusters*. World Bank Policy Research Working Paper 3509.

The role of mediating institutions to nurture networks - Essential in the success of the cluster has been the free flow of information and communication between company leaders, university faculty, research scientists and students. UC San Diego has played a pivotal role by launching CONNECT, a networking programme bridging the university to financial and business interests. CONNECT was in fact a joint project of UC San Diego, the city government of San Diego and the private sector. Its main aim is to commercialize local science and technology achievements worldwide and to attract entrepreneurs and investors. CONNECT has supported the development of more than 2,000 start-up companies.

BIOCOM, a life sciences association comprised of 550 companies and research centers in Southern California, also plays a pivotal role in the nurturing of exchanges and communication.¹³ It has promoted informal networking and given professional development assistance. More importantly, it allows biotech firms to have a unified political voice, which has proven essential to secure water availability from the local government for future development projects.

Lessons Learned:

San Diego provides a clear illustration of how a university can play a pivotal role in a strategy that uses science and technology to promote new economic activities. UC San Diego was the keystone of San Diego's growth. It acted as the element that made all the other actors and ideas in the innovation environment come together. It helped to nurture networks and facilitate innovation and research. The university has successfully leveraged support from existing companies to create future growth and has enabled innovation networks to sustain that growth. Through BIOCOM and CONNECT, San Diego showcases how mediating organizations can successfully support the development of a science and technology hub.

San Diego's biotech industry illustrates how local political actors, universities and business can come together and trigger development based on science and technology. Governmental involvement was reduced to a minimum. It was the university and research institutions, closely working with the business sector, that took the lead. However, it is essential to point out that if Federal and State resources had not been present to fund UC San Diego, the biotech cluster would have simply not existed. The case illustrates the resiliency of local actors to truly collaborate, exchange ideas, create networks and mobilize capital to use science and technology to change the economic base of a city.

¹³ <http://www.biocom.org/>

3.3 CAMPUS BIOMETROPOLIS, MEXICO CITY - AN INTERNATIONAL MEDICAL RESEARCH HUB FOR LATIN AMERICA



An illustration of future development of the Medical Research Hub in Mexico City

Image credit: architecture-now2.blogspot.com

Campus Biometropolis is an initiative by Mexico City Government and the Mexican National University, UNAM. It is a 71 hectare urban mega project located in the South of Mexico City. By fostering networks and encouraging innovation and research, Mexico City's government expects to develop a new economic sector through the creation of an international medicine hub in Latin America.

Campus Biometropolis is part of a broader long-term economic development strategy by the municipality following the concept of the city of knowledge. Mexico City's government has the ambition of making Mexico City a strong player in the information economy. It strives to take the city's economic transition into the next phase of economic development by triggering activities related to the knowledge economy. Campus Biometropolis is meant to be a physical space where this ambition can materialize. It is destined to be a physical space of the city of knowledge where innovation and research are produced but also where people can live, work and enjoy the city. The project is comprised of 5 specific components:

- Education and research hospitals
- Labs and applied research facilities

- New technology companies
- Schools of medicine
- Residential and commercial areas

Further, as an urban mega project, Campus Biometropolis is structured around 3 clear lines of development: research and development, environment and urbanism. These three lines interact and embody the project's development strategy.

Research and Development - In the Southern area of Mexico City, there is an existing cluster of institutions in the medical field developed in the past six decades. These institutions comprise specialized state hospitals and public health institutions as well as research facilities linked to the National University. However, despite this concentration, the institutions haven't been integrated. Campus Biometropolis aims to accomplish that. In terms of research and development, the main objective is to enable networks and cooperation between existing institutions in order to provide a space for innovation and top international research in the medical and biological field. By emphasizing Mexican research, Campus Biometropolis expects to elevate it to international standards.

The government carefully assessed in which specific medical sectors Mexico City had a comparative advantage because of its existing institutions and facilities. It identified 5 areas to be developed further:

- Oncology
- Nutrition and Diabetes
- Geriatrics
- Cardiovascular Diseases
- Infectious Diseases

As a project, Campus Biometropolis is closely linked to the industry and risk capital communities and counts on many stakeholders from the private sector. The government lends support in legal areas, for example by speeding support for patent registrations. All these actions are expected to establish a healthy business environment.

Environment - Campus Biometropolis' location is truly unique. It is sited in the crater of an ancient volcano. The project is well integrated into its surrounding physical environment. Fifty percent of the project site is destined to be green areas and there will be a natural protected area administrated cooperatively by the Municipal Environmental Office and the National University. In this way, Campus Biometropolis is meant to foster a unique sense of place.

Urbanism - Campus Biometropolis is meant to introduce a new concept of urban development in Mexico City. The project is a physical space that embodies the idea of the city of knowledge. Marcelo Ebrard, current Mayor of the city, referred to the project as representing a "new urban model". It is a space where activities deemed for the future have a coexisting relationship to the environment that

surrounds them. This is made possible by paying close attention to the quality of the public realm, especially infrastructure planning. Key to this is promoting public transportation with intermodal centers for good connections, and by facilitating smooth traffic circulation.

Lessons Learned:

Campus Biometropolis provides an interesting illustration of the actions that local governments can undertake to promote sustainable urban development through the use of science and technology. The project provides a clear example of how science and technology can be used to trigger new economic activities directly linked to the information economy. Campus Biometropolis was seen as a needed platform in Mexico City. Its objective is to build confidence amongst Mexican research organizations to innovate and trigger projects that deliver products and services at top international standards.

The project also provides an interesting illustration of how projects can be conceptualized to be in harmony with their existing environment. Campus Biometropolis doesn't just demonstrate how local governments can mobilize science and technology to create spaces for the city of knowledge; it also shows how such spaces can be conceptualized in order to be a truly unique, distinctive environment.

3.4 MEDIA 21 -- TRANSFORMING SINGAPORE INTO A GLOBAL MEDIA CITY



A building in Media City lights up the night sky of Singapore
Photo credit: <http://www.mof.gov.sg>

Singapore is a highly planned city and it conducted an assessment of various options it could undertake to ensure the city's continued success in the future global economy. It decided to develop the Media 21 initiative. This project envisions Singapore as Asia's leading media marketplace and financial hub. It aims to make Singapore a global city that creates, develops, trades and distributes media services and projects in the international market. In focusing on media, Singapore is targeting a wide range of industries encompassing printing, broadcasting, film, publishing, and digital, internet-based media. As part of the Media 21 project, the city government is building a conglomeration of state-of-the-art buildings meant to locate and cluster high-tech Media companies. The Singapore Media Development Authority's (MDA) main objective is to develop in Singapore a vibrant media cluster that fosters homegrown media enterprises while appealing to foreign direct investments.

Several clear principles being followed are outlined in the Media 21 strategy:

1. **Establish Singapore as a media exchange center.** This entails appealing to the best world media companies by providing state of the art infrastructure, a skilled workforce and an incentivized operating environment. To support this initiative, the Singapore government will extend the city's financial infrastructure to make it reach the Media sector.
2. **Export made-by-Singapore content.** This strategic thrusts aims at boosting exports by Singapore media production units through cooperation agreements with overseas governments and industries. It is expected that this would allow access to joint ventures as well as foreign distribution networks and markets.
3. **Deploy digital media.** The government realized that the city was missing a state-of-the-art system of digital production, so it aims at attracting high-end digital production companies by establishing a multi-disciplinary digital post-production studio. Among other things, this initiative also comprises strong R&D investments in digital media technologies as well as creating a Media Lab and a Digital Technology Development Scheme providing support to projects in digital media.
4. **Internationalize Singapore media enterprises.** Because the size of the Singapore internal market is rather small, media enterprises must expand their markets overseas. As such, it is the purpose of the government's MDA to provide support in encouraging international market development. It will play the role of matchmaker to ease business networking and co production efforts with overseas actors.
5. **Augment media talent.** In order to make Singapore a global media city, it is essential to develop media aptitudes and a cultural mindset open to experiment with media instruments. As such, the MDA, in collaboration with the Singapore Ministry of Education, plans to foster creative writing and artistic design at the pre-school, primary and secondary levels. Further, the government aims at developing media talent at the University level in order to attract foreign employers.

6. **Foster a conducive business and regulatory environment.** The objective is to guarantee that policies and initiatives meet international best practices: a positive regulatory environment is essential for businesses to prosper. The challenge is to ensure that regulations are consistent and clear, and provide a friendly operating environment for media production companies.

Lessons Learned:

By integrating Fusionopolis with university research centers, it is Singapore's aim to go beyond the idea of a simple science park. Singapore wants to develop a Media Hub. The key in this strategy is interdisciplinary work. By bringing together different fields of expertise in science and technology and over 3,000 scientists from over 50 countries, Singapore aims to be at the top of international research.

Fusionopolis is not conceptualized as only work and research spaces. By mixing commercial activities, residential areas as well as office space, it is an urban environment where the scientist can work, live and play. Residential areas are equipped with state-of-the art appliances; they include seamless environments as well as experimental network appliances. This makes Fusionopolis a clear illustration of what the city of the future could look like. A science hub based on the knowledge economy where the urban environment is internationally oriented and supported by the most innovative technology applications.

3.5 THE “TORCH PROGRAMME” IN CHINA -- A NATIONAL POLICY FOR ESTABLISHING SCIENCE PARKS



Beijing's Zhongguancun Science Park is part of a national plan to build up scientific and technological research capacity.

In the early 1990s, the Chinese government launched a comprehensive science and technology policy initiative under the umbrella of the “Torch Programme”. The initiative aims to “mobilize the technological capabilities and resources of research institutes, higher education institutions, and large and medium-size enterprises to develop high and new technology products, establish technology-oriented enterprises, and pave the way for the commercialization of innovations that will emerge from science and technology research”.¹⁴

The development of science parks is at the core of the programme. Science parks were established in 53 large Chinese cities since the beginning of the 1990s. The Chinese government is actively seeking to promote technology diffusion and foster synergies between the companies, academic and financial institutions surrounding the parks. By introducing state-of-the art infrastructure and new technological resources to the industrial base, the Chinese government estimated that the selected cities would become focal points for high-tech development. Tax exemptions and the encouragement of foreign direct investment (FDI) were policy instruments mobilized to back up the initiative.

The application of these policies showed early signs of success. The Torch Programme succeeded in developing clusters of high-technology firms in the science parks it established. This concentration

¹⁴ Hu, A.G. *China's Technology Park and Regional Economic Growth*. Prepared for “The Fourth International Conference on the Chinese Economy: The Efficiency of China's Economic Policy”. Cerdi, Clermont-Ferrand, France. October 23-24, 2003.

promoted economic spillovers in the cities where the parks were located, supporting economic growth. However, as the development of science parks was strongly linked to FDI and policy incentives rather than natural technological synergies, their contribution to sustainable growth remains contested.

Lessons Learned:

Despite some limitations, the “Torch Programme” showed measures of success by promoting urban and regional growth. Most importantly, it illustrated how a government can be truly proactive in designing a national science and technology policy. It presents a clear picture of the policy instruments that governments can use for science and technology initiatives.

The “Torch Programme” raised an important question for policy-making. Is it possible to design a science and technology policy that fosters networks merely through policy incentives rather than natural technology linkages? The question remains unanswered. However, the initiative does prove that the government can play an important role.

3.6 THE INNOVATION HUB -- GAUTENG, SOUTH AFRICA



The Gauteng Innovation Hub is at the forefront of efforts to build a knowledge economy in Johannesburg and Pretoria, South Africa

A new industrial strategy for a changing world - The political transformation that South Africa experienced beginning in 1994 caused strong transformations in the country’s provincial economies. Gauteng, the province where Johannesburg and Pretoria are located, dealt with the changing context by establishing a new Trade and Industrial Strategy that could benefit both cities. In the mid-90s the economy was being strongly influenced by the rise of information technologies. Foreseeing the effects that the knowledge economy might have, Gauteng Province articulated its new industrial strategy accordingly. It established three development priorities, closely related to growing economic sectors in the knowledge economy:

- The strategy aimed at making Gauteng a “smart” province by focusing on industries linked to information and communication technologies (ICT).

- Gauteng also concentrated its efforts to facilitate the transition of its industrial base into high-value added manufacturing.
- The third facet of the strategy involved further development of the service sector, in particular the tourism industry. A well-established and innovative service sector is a powerful support for knowledge-based activities.

Gauteng decided to focus its economic development strategy on the knowledge economy after a careful assessment of its economic characteristics and structure. The assessment noted that Gauteng has a large proportion of South Africa's formal employment and benefits from a well-developed tertiary education sector. It is also home to South Africa's largest concentration of research activities composed of a number of science councils, universities and R&D centers. The combination of these elements signified a likely high-demand for electronics and ICT products as a potential source of growth in the future.

The development of a science park at the core of the strategy - In order to foster its integration into the knowledge economy, Gauteng decided to create a research-intensive cluster. This is how The Innovation Hub, a science and technology park, came to be. Through the provision of supporting infrastructure, the Provincial Government aimed to attract high-technology companies of all sizes and stages of growth.

While attracting new economic actors related to the information economy, Gauteng also promoted innovation, through the exchange of knowledge and the access to local and global markets. One rationale behind The Innovation Hub was to attract foreign direct investment. It was argued that the arrival of new resources and the transfer of innovation and knowledge would foster economic activities linked to science and technology in the country.

In planning The Innovation Hub as a local economic development strategy, there was careful evaluation of the feasibility of the project. Several assessments were made:

- Were the actors for such a development in place?
- Could the Province provide the adequate level of resources and support needed for a S&T park development? How would the available resources articulate with the ambitions?
- What was the main ambition of the S&T park? What did Gauteng want to achieve with the S&T park? Were the possible models of development well understood?

The Innovation Hub Development - After undertaking evaluation studies to establish a long-term vision for the project, The Innovation Hub was launched in February 2000. The park was established on a site midway between Johannesburg and Pretoria, and close to the University of Pretoria. In the initial stages of the park, The Innovation Hub became a member of the International Association of

Science Parks, an international network of science parks, which provides key technical expertise and recommendations for conceptualization and management.

The leadership of the S&T park resides mainly with public authorities. The Gauteng Provincial Government operates as the main shareholder of the park through Blue IQ Investment Holdings. The Gauteng Provincial Government plays a pivotal role in the success of the park, as it has key functions. It provides funding to put in place the core infrastructure and incubation facilities. In collaboration with other parties, the Gauteng Provincial Government is in charge of strategic direction and long-term vision for the Hub. Further, the provincial Government also guarantees support at the local and national levels for the park. As a main shareholder of the park, the Gauteng Provincial Government ensures access to the Gauteng Economic Development Agency (GEDA) and its related venture capital instruments. Further, it assures access to other local and provincial sources of revenue, such as international donor funds and local sources of development finance.

It is important to acknowledge that the Gauteng Provincial Government, while being the main shareholder of The Innovation Hub, has a wide range of entities as cooperative partners: these include the local business community, local governments, research centers and universities. This close collaboration is essential to enable synergies.

One of the main roles of the science park has been to act as an incubator of business start-ups. This accomplished through the provision of technical and infrastructure support for the new companies. Incubation activities have allowed the hub to attract and foster firms in a wide range of fields related to science and technology including bioscience, electronics, ICT and engineering.

Lessons Learned:

The Innovation Hub illustrates the actions that urban leaders in developing countries can undertake to reduce the digital divide. The project is part of a strategy aiming at pushing Johannesburg's and South Africa's integration into the knowledge economy. It shows the proactive role of the Provincial Government in bringing actors together, sharing knowledge and best practices and establishing a long-term development and business incubation strategy. This allowed the Innovation Hub to become a successful and functioning science and technology park in Africa.

4. BETTER CITY, BETTER LIFE – SUMMARY OF MEASURES TO TAP SCIENCE AND TECHNOLOGY FOR URBAN INNOVATION AND DEVELOPMENT

Developments in science and technology are pointing the way to new directions in sustainable urban development. Investing in science and technology allows cities to become truly integrated into the knowledge economy; and innovative cities can develop significant advantages in globalization. At the same time, investing in science and technology enables the development of clean, high-tech activities that are expected to experience strong growth in decades to come.

As local leaders, we have to be proactive in the development of a local science and technology strategy. This can be realized through the establishment of S&T parks. The emergence of S&T parks should be based on a careful evaluation of the comparative advantages that a city may have in science and technology. Above all, a S&T park must enable networks, foster communication and involve a wide range of stakeholders (research institutions, local governments, and the business sector). Building linkages between these different actors allows urban areas to truly become innovation environments which set the stage for growth. Science and technology can be a driving force for development in the 21st century. As local leaders, we must embrace this idea and design policy accordingly.

Strategy 1: Foster urban areas as innovation environments through the creation of networks and linkages that encourage innovation in science and technology.

POLICY OPTIONS	
option 1	Shift Innovation policy from a targeted policy focusing on R&D and specific technologies to a more comprehensive approach comprising the many actors and factors that play a role in innovation performance.
option 2	Make innovation in science and technology a catalyst of growth through the development of Science and Technology Parks (S&T Parks). Policy-makers are responsible for finding structures articulation between the physical territory and the much subtler social, spatial, economic, cultural and innovation systems present in urban areas. This can be achieved through the establishment of S&T Parks.

Strategy 2: Develop clear guidelines and a clear vision of the use that the city wants to make of science and technology.

POLICY OPTIONS	
option 1	Designate a Project Management Team composed by management and local development experts. The Team should encourage the development of feasibility and assessment studies aiming to identify in which science and technology sectors the city has a comparative advantage. Opportunities should be acknowledged, but also challenges and difficulties.
option 2	Involve multiple stakeholders in the development of the park. The establishment of an S&T Park results from a collaborative effort between firms, public authorities, academia, members of the financial sector as well as educational and research institutions. This would help the S&T Park to focus on the challenges of its potential customers, thus truly addressing their needs.
option 3	Establish a long-term vision for the S&T Park embodied in a master plan. As local leaders, in order to generate enthusiasm, we need to imagine a vision that combines a solid practical approach based on needs with an ambitions projection. As a planning document, the master plan would materialize this.

- option 4** Establish strong linkages with universities. Universities are spaces where new ideas and knowledge are created, and where interaction and networks leading to innovation are fostered. Depending on local conditions and the place that research will have in the S&T Park, governments can decide to make universities participate either as stakeholders (owning entirely or partially the Science Park) or as stakeholders (with an interest in the management of the Park).

Strategy 3: Encourage a proactive management style to foster communication and networks. Managers should combine the skills of a politician, a scientist, and a business person.

POLICY OPTIONS

- option 1** Promote synergies between research institutions and businesses. In this, concentrating on proximity can be essential. Proximity encourages a culture of informal collaboration, which later on can materialize in trust, exchange and ultimately innovation and growth.
- option 2** Managers should put in place development programmes that fully integrate incubation schemes: such programmes allow the development and diffusion of entrepreneurship.
- option 3** Managers should allow flexible premises in terms of office size in order to host both small start-up companies and large firms. Their interaction and collaboration can lead to combined skills in entrepreneurship and novelty, and ultimately innovation.

Strategy 4: Conceptualize S&T Parks in order to be communities where people can work, play and sleep that are integrated within their existing urban environment.

POLICY OPTIONS

- option 1** Design S&T Parks to combine business areas with education centers, residential areas and cultural facilities. As urban mega projects, S&T Parks should provide high-quality architectural and landscape design that closely integrates them with their surrounding urban fabric.
- option 2** Incorporate the use of the latest IT improvements in order to make the S&T park a pleasant and efficient environment. This will allow S&T park inhabitants to be globally connected while living, learning and working in a clear geographical unit.

5. RELATED LINKS

- International Association of Science Parks:
<http://www.iasp.ws/publico/intro.jsp>
- New York Academy of Sciences:
<http://www.nyas.org/>
- European Investment Bank Conference: "Science Parks - a tool for the development of the knowledge economy?"
- <http://www.eib.org/projects/events/conference-science-parks-a-tool-for-the-development-of-the-knowledge-economy-luxembourg.htm>
- UNESCO Science and Technology Park Governance
<http://www.unesco.org/new/en/natural-sciences/science-technology/university-industry-partnerships/science-technology-park-governance/>
- Science Parks around the World (by region)
<http://www.unesco.org/new/en/natural-sciences/science-technology/university-industry-partnerships/science-parks-around-the-world/>

Case Studies

- Sophia Antipolis, France:
<http://www.sophia-antipolis.org/>
- The Innovation Hub, South Africa:
<http://www.theinnovationhub.com/>
- Campus Biometropolis, Mexico City:
<http://www.biometropolis.mx/>
- Biopolis and Fusionopolis, Singapore:
<http://www.a-star.edu.sg/?tabid=860>
- Masdar, Abu Dhabi:
<http://www.masdarcity.ae/en/index.aspx>