Innovation Habitats and Regional Development driven by the Triple Helix:

Perspectives from a *South American School of Thought and Action*

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Abstract

The paper presents an analysis of the evolution of Science Parks and other Innovation Habitats in Brazil and Argentina from the perspective of professionals directly involved in the implementation of these initiatives. Among the findings, the paper singles out: (a) The Innovation Habitats emerge basically from interactions within the Triple Helix; (b) The Innovation Habitats are in practical contact with the future; (c) In order to be successful, they have daily to overcome difficulties steaming from frameworks anchored in exhausted *social paradigms*. This conjunction of facts open a singular opportunity for the Innovation Habitats in each region: to lead the promotion of a new kind of regional development program (such as a *Regional Project for the Future*), conceived and implemented under the aegis of the new *social paradigm* that emerges worldwide – the *Knowledge-based Society*, aiming to built a region that is socially responsible and competitive in the Global Knowledge-based Economy. Finally, the paper presents suggestions regarding *Regional Projects for the Future*.

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Innovation Habitats and Regional Development driven by the Triple Helix: Perspectives from a *South American School of Thought and Action*

I. Introduction

South America, as any place in the world, faces the challenge of promoting regional development processes that are socially responsible and competitive in the Global Knowledge-based Economy.

This paper overviews one of the attempts to respond to this challenge, stemming from South American professionals involved in the development of some of the *Innovation Habitats* (such as *Business Incubators, Science Parks and Sector Clusters)* in Brazil and Argentina, following concepts and initiatives pioneered by Professor Terman and other professionals at Stanford University, in the 20th Century.

The networking of the quoted professionals evolves since the 1980's and may be seen as an emergent *South American School of Thought and Action on Innovative Regional Development.*[1]

For the present work, South American Science Parks and Sector Clusters in different phases of evolution have been analyzed, in especial those listed in Table 1.

Table 1.

Brazil (States)	
Brasília, DF	Parque Científico e Tecnológico da Universidade de Brasilia; Parque Tecnológico Capital Digital (Brasília).
Ceará	PADETEC (Fortaleza).
Espirito Santo	Parque Tecnológico de Econegócios (Cariacica).
Minas Gerais	Parque Tecnológico de Itajuba; Parque Tecnológico Uberaba.
Paraná	Parque Tecnológico de Pato Branco.
Pernambuco	Porto Digital (Recife).
Rio de Janeiro	Parque Científico e Tecnológico da Pontifícia Universidade Católica do Rio de Janeiro; Parque Tecnológico do Rio de Janeiro, Parque Tecnológico Sul Fluminense (Resende and other municipalities).
Rio Grande do Sul	VALETEC Park (Campo Bom and other municipalities); Parque Científico e Tecnológico da Pontifícia Universidade Católica do Rio Grande do Sul – TECNOPUC (Porto Alegre and other municipalities); Caxias do Sul IT Cluster; Parque Científico e Tecnológico da Serra do Rio Grande do Sul (Caxias do Sul and other municipalities); Parque Tecnológico de Santa Maria; TECNOSINOS - Parque Tecnológico de São Leopoldo.
São Paulo	Polis de Tecnologia (Campinas); Parque Científico e Tecnológico da Universidade de Campinas – UNICAMP (Campinas); Parque Tecnológico de São José dos Campos; Parque Tecnológico UNIVAP (São José dos Campos).
Sergipe	SergipeTec (Aracaju)
Argentina	
Ciudad Buenos Aires	Distrito Tecnologico de Buenos Aires; Buenos Aires IT Cluster; Polo Tecnologico Constituyentes
Provincia de Buenos Aires	Parque Científico e Tecnológico de Castellar; La Plata IT Cluster; Parque Científico e Tecnológico de Pergamino; Parque Científico, Tecnológico y Empresarial Austral (Pilar).
Cordoba	Information Technology Cluster (Cordoba).
Mendoza	Mendoza IT Cluster.
Misiones	Parque Tecnológico Misiones (Posadas and other municipalities)
Santa Fé	Parque Tecnológico del Litoral Centro (Santa Fé); Polo Tecnologico Rosario.
Binational	
Argentina - Brazil	Parque Tecnológico Binacional Posadas (Argentina) - Pato Branco (Brazil).
Paraguay - Brazil	Parque Tecnológico Itaipu (Foz do Iguaçu – Brazil; Hernandarias - Paraguay).

[1] See, for example: [ALVES J. F. 2004], [AUDY, J.N. 2006], [FIATES, J. E. A. 2009], [GALIAN, C. 2004], [LAHORGUE, M. A. 2006], [MAZZAROLO, C. 2003], [SPOLIDORO, R. 1989, 1992, 1994, 1996, 1998, 1999], [SPOLIDORO, R., et al. 2002, 2004, 2005, 2006, 2008, 2009, 2010, 2011], [ZOUAIN, D. M. 2002], [ZAMPIERI, N. L. V. 2009].

The participants of this School of Thought:

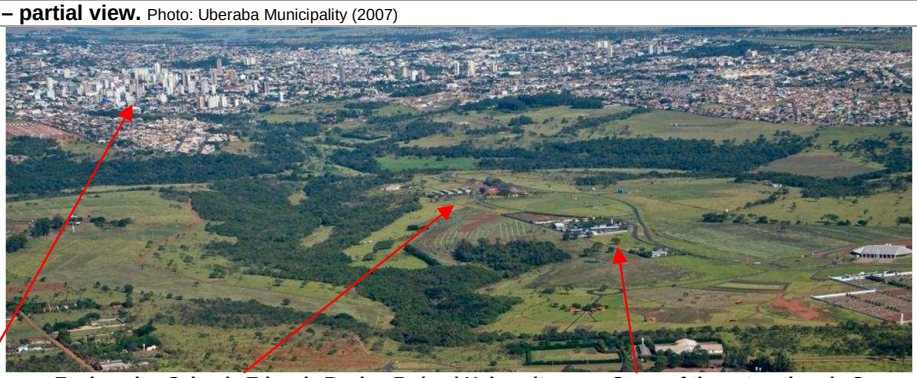
- Share visions, values and practices regarding regional development processes that are socially responsible and competitive in the Global Knowledge-based Economy;
- Use, as basic strategies, the design and set up of *Innovation Habitats* and *Regional Projects for the Future* (described below);
- Are aware that hard work, persistence and courage are required to change regional frameworks and behaviors that are anchored in exhausted *social paradigms* (defined below);
- Assume that the desired socially responsible and competitive regions, at least in the case of South America, shall be based on a development process that is, simultaneously:
  - Democratic;
  - Socially fair;
  - Moral;[2]
  - Sustained in all domains;
  - Builder of a sustained rising standard of living for all citizens;
  - Respectful toward diversity;
  - Secular;
  - Competitive in the Global Knowledge-based Economy;
  - Promoter of the collective self-esteem;
  - Able to help other regions to built similar regional development process.

II. Photos of some Brazilian and Argentinean Science Parks

II.1. Parque Tecnológico Uberaba, MG, Brazil

Segment 1 of the park covers 1,600 hectares, adjacent to downtown, and encompasses the experimental farm of *Minas Gerais Agriculture Research Company* and *Brazilian Agricultural Research Corporation* - EMBRAPA at Uberaba, two federal universities, a private university, knowledge-based companies, and environmental reserves. Segment 2 covers a corridor along a highway nearby and hosts several high-tech companies on animal genetics.

Segment 1 – partial view. Photo: Uberaba Municipality (2007)



A Biotechnology company (animal genetics) in Segment 2 of Parque Tecnológico Uberaba. Photos: Geneal.

[2] [HABERMAS, J. 2003]

II.2. VALETEC Park, Sinos Valley, RS, Brazil

Local Segment 1 has 100 hectares within a traditional campus-like format. Segment 2 encompasses a corridor along a highway and hosts several knowledge-based companies, created locally decades ago, which have strong R&D capabilities and conquered international competitiveness, as well as the central campus of Universidade FEEVALE (a Regional Communitarian University).

Central Building, Segment 1, and innovative companies in Segment 2. Photos: R. Spolidoro and VALETEC (2007)

II.3. Parque Tecnológico Misiones, Provincia de Misiones, Argentina

Segment 1: Posadas, and Segment 2: Eldorado, with its Business Incubator. Photos: Misiones Technology Park

Local Segment 1 encompasses the central campus of *Universidad Nacional de Misiones,* the *Argentinean Agribusiness Research Institute* - INTA at Posadas, and several innovative knowledge-based companies. Other *Local Segments* are disseminated in Misiones Province and host several innovative companies.

Photo: Parque Tecnológico Misiones (2009)

II.4. TECNOPUC, Porto Alegre, RS, Brazil
Parque Científico e Tecnológico da Pontifícia Universidade Católica do Rio Grande do Sul

Former barracks of the Brazilian Army, adjacent to the university central campus, were refurbished and became the initial buildings of the TECNOPUC. New buildings allowed hosting a larger number of corporative R&D centers and high-tech companies that participate of cooperative R&D projects congregating the university, companies and government

Refurbished barracks of the Brazilian Army now host R&D centers high-tech companies. Photo: PUCRS (2006)

Some of the new buildings of TECNOPUC
Photo: R. Spolidoro (2010)

II.5. Parque Tecnológico de Pato Branco, PR, Brazil

Local Segment 1 encompasses the campus of the Parana Federal Technology University at Pato Branco, a condominium of high-tech companies, a convention center, and a natural park.

Segment 2 encompasses downtown quarters. It hosts cultural centers, creative industries and other knowledge-based companies.

Photo: UTFPR at Pato Branco (2009)

II.6. Castellar Science and Technology Park, Buenos Ares Province, Argentina

The park has 700 hectares and encompasses the *Argentinean Agribusiness Research Institute* - INTA at Castellar, several R&D Centers, innovative companies and universities nearby.

A biotechnology company in a refurbished warehouse of the INTA, in the park.

Biotechnology R&D Center, congregating INTA, universities and private companies. Photos: R. Spolidoro (2009)

II.7. Parque Tecnológico de São José dos Campos, São José dos Campos, SP, Brazil

The park encompasses a deactivated factory that has been refurbished, several R&D centers, several high tech large companies - mainly in aeronautics and energy, and universities nearby.

Photo: Parque Tecnológico São José dos Campos (2009)

II.8. SergipeTec – Parque Tecnológico Sergipe, Aracaju, SE, Brazil

Segment 1 was set up in a building that was idle and has been refurbished to house the initiative.

It hosts R&D centers, business incubators and several knowledge-based companies. New premises are under construction nearby, adjacent to Sergipe Federal University campus.

Photo: SergipeTech (2007)

II.9. Parque Científico e Tecnológico da Serra do Rio Grande do Sul, RS, Brazil

Local Segment 1 encompasses the central campus of Caxias do Sul Regional Communitarian University, R&D centers, high-tech innovative companies, a Business Incubator and the urban texture nearby.

Photo: R. Spolidoro (2009)

Segment 2 encompasses another campus of the university and a corridor that hosts many knowledge-based large companies, some of them created locally decades ago, which have strong R&D capabilities and conquered international competitiveness.

Photo: http://www.frasle.com.br

II.9. TECNOSINOS - Parque Tecnológico de São Leopoldo, RS, Brazil

Segment 1 encompasses the campus of the University of the Sinos Valley - UNISINOS, and adjacent areas.

TECNOSINOS hosts 52 knowledge-based companies, mostly on the ITC sector, and has created 2,100 jobs.

Photo: TECNOSINOS (2009)

II.11. Polis de Tecnologia, Campinas, SP, Brazil

Polis de Tecnologia is linked to the CPqD, a private R&D center, created in the 1970's by TELEBRAS, the former telecommunication company owned by the federal government.

In a campus-like ambiance of 35 hectares, the technology park hosts the CPqD (R&D Center), several high tech companies (many of which are spin offs of the CPqD), 4,000 researchers, and recreational and sports ambiences.

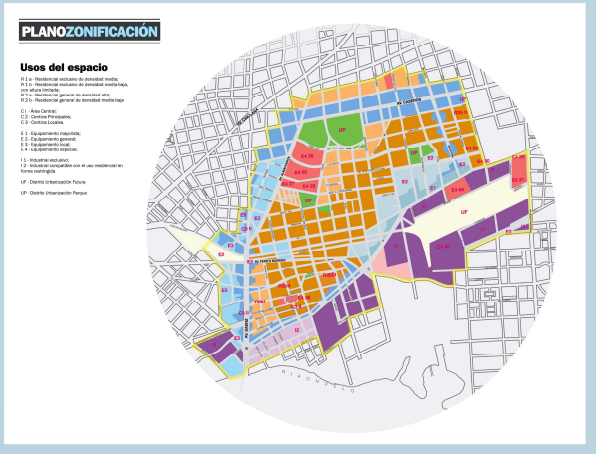
Photo: www.polisdetecnologia.com.br

II.12. Distrito Tecnologico de Buenos Aires, Ciudad de Buenos Aires, Argentina

The Distrito Tecnológico de Buenos Aires is a Technology Park disseminated in the urban texture of the Argentinean Capital, close to downtown, in quarters counting with deactivated industrial plants. These premises have being refurbished to host knowledge-based companies in sectors as Information and Communication Technology, and Design.

Photos: http://eternabuenosaires.com/2011/03/antes-despues-centro-metropolitano-diseno/cmd-hall and
http://estatico.buenosaires.gov.ar/areas/produccion/promocion_inversiones/distrito_tecnologico/graficos/zonigr.jpg (June 2011)

Centro Metropolitano de Diseño in a refurbished deactivated industrial plant in the urban texture.



II.13. Porto Digital, Recife, PE, Brazil

Porto Digital is a Technology Park disseminated in the urban texture of Recife Island, where the town was born in the 17th century. Several deactivated buildings in the island have been refurbished to host high-tech companies and corporate R&D centers. More than one hundred companies on Information and Communication Technology are already in the park, providing 4,000 qualified jobs. Porto Digital tenants are eligible to get attractive financial support to restore and use historical buildings, as the one below, at the right.

Photos: Porto Digital: www.portodigital.org.br

II.14. Parque Científico, Tecnologico y Empresarial Austral, Pilar, Argentina

The Parque Científico, Tecnologico y Empresarial Austral is associated to the Universidad Austral and hosts several high-tech companies.

Photos: www.parqueaustral.org

II.15. Parque Tecnológico del Litoral Centro, Santa Fé, Argentina

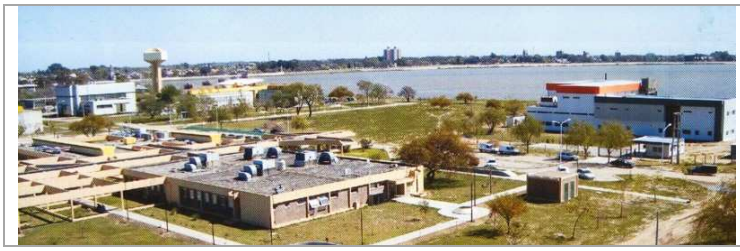


Photo: www.ptlc.org.ar

II.16. Parque Tecnológico Itaipu, Foz do Iguaçu (Brasil) and Hernandarias (Paraguay)

Itaipu Technology Park initially used refurbished buildings, on the Brazilian and Paraguayan shores of the Parana River, once offices, restaurants and residences to support the building of Itaipu Brazilian-Paraguayan Power Plant, one of the biggest electrical generation plants in the world.

Itaipu Technology Park on the Brazilian shore.
Photo: Parque Tecnológico Itaipu

III. State of the art of *Innovation Habitats* and *Innovation Regions*

III.1. Silicon Valley: An innovation Region: a Global Model or Unique Anomaly?

Based on findings of renewed scholars:[3]

- Among outstanding *innovation regions* throughout the human epopee, the authors singled out: Ionia - in ancient Greece, Florence - in Renaissance Italy, and the Silicon Valley – from the mid 20th century on. Other candidates to be shortlisted would include China in the 10th to 13th centuries (Song dynasty), Baghdad's in the 10th and 11th centuries, and Western Europe during the Scientific Revolution and Industrial Revolution.

- Though rare, outstanding innovation regions seem to be neither unique nor anomalies; and seem to emerge as the outcome of a conjunction of singular factors – including a lot of look.

> Ancient Greece - especially Ionia - is a good example. It is well known that this region pioneered the idea that laws of Nature, rather than capricious gods, govern the world, and reality can be known through systematic and empirical inquiry. Furthermore, that those ideas gave birth to modern science and technology and to institutions as democracy. Table 1 synthesizes some of the singular factors leading to Ionian's achievements.

Table 1. Some of the singular factors leading to Ionian's achievements

Factors	Comments
Geography	The region, a broken-up one, with many island and peninsulas, stimulated the set up of autonomous communities, able to stay independent of powerful empires.
A constellation of city-states	The ancient Greek world, with hundreds of city-states (*poleis)* at the shores of the Mediterranean and the Black Sea, with a common cultural background and the same language, offered a fertile soil for commerce and exchange of ideas.
Free thinking	The region neither belonged to powerful states - which are usually hostile to free thinking, nor was under a privileged priestly caste with a vested interest in the status quo.

[3] [DURANT, W. 1942; 1943; 1953], [SAGAN, C. 1997], [WATSON, P. 2005], [BURCKHARDT, J. C. 1860], [HALL, P. 1998 *apud* Cultural Initiatives Silicon Valley 2001]

Rational thought	The polis' assembly stimulated citizens to persuade one another by mean of rational debate.
Open economy	A maritime merchant economy prevented isolation and parochialism, and stimulated the exchange of ideas regarding practical problems, such as navigation and logistics.
Scholars	Scholars were hired by merchants, entrepreneurs and rulers to teach and to debate ideas, and even helping to plan new towns.
Language's structure	The Greek language has an alphabet allowing a biunivoc correspondence between speech and written text, and a subject-predicate pattern of sentence structure that favored the idea of the law of identity in logic, important platforms for the development of science.[4]
Whether	A pleasant whether favored the dialogue of citizens in outdoors public spaces.
Gatherings	Pan-Hellenic Games, festivals of common deities, and pilgrimage to prestigious oracles stimulated travels and gatherings, favoring the exchange and spreading of ideas.

An interesting exercise would be to correlate factors in Table 1, from ancient Greece, with conditions underlying the Silicon Valley's evolution. Free thinking ambiences and a *lingua franca* are obvious shared factors. Other correlations may be hard to set, especially in the case of peculiar factors, as the following one.

> The cold war ignited a huge flux of federal R&D funding for microelectronics companies in the Silicon Valley in the 1960's. Those contracts did not allowed patenting the results; and the Californian's laws allowed easy turnover of key people and immediate use of the knowledge acquired in the last job for private purposes. The mix of these singular and temporary factors led to a constellation of spin offs stemming from strong high-tech companies, with remarkable new achievements.[5]

It is also worth to note that the Silicon Valley itself has been producing spin offs worldwide under the format of *innovation habitats*, which nowadays outnumber thousands of initiatives.[6]

A preliminary conclusion can be drawn: It is very difficult to replicate the set of factors underlying an outstanding innovation region. But, it is possible to study those conditions, and try to promote their development elsewhere.

III.2. Evolution of Science Parks

According to the International Association of Science Parks:[7]

> A Science Park (and synonyms such as Research Park) is an organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions.
>
> To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities.

In spite of this definition, there is neither singular characterization nor uniformly accepted definition of a Science Park in the academic literature. Under the title of Science Park there are initiatives with a wide diversity in objectives, size, scope, scale of activity, and strategies.[8]

Furthermore, the definition adopted by IASP encompasses a broad spectrum of innovation habitat categories, since a room hosting a couple of small high-tech firms to a complex network of innovation actors within a huge region.

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[4] [WATSON, P. 2005], page: 302.
[5] For example: [GIRARD, B. 2006], [OHMAE, K. 2005], [PACKARD, D. 1995], [PORTER, M. 1998], [REICH, R. B. 1989], ROSENBLOOM, R.; SPENCER, W. 1996], [SAXENIAN, A. 1994], [STURGEON, T.J. 2000], [TAJNAI C. E. 1985]
[6] IASP; AURP; UKSPA; ANPROTEC; AAIPPT
[7] IASP: www.iasp.ws
[8] [National Research Council, 2009]

On the other hand, the conventional model of a Science Park, based on an exclusive and huge area in a campus-like environment, at the outskirts of the town – as the *Research Triangle Park* and *Sophia Antipolis*, is being confronted by surprising new formats of innovation habitats that emerge within the urban texture, including housing and city amenities, aiming to nurture creative and learning communities.[9]

However, *Research Parks* within (or adjacent to) the campus of universities (and public research centers) possibly will continue to evolve in order to support the transformation of these institutions, from ivory towers to *innovation engines*, playing an expanded role in economic development.[10]

TOWNSEND and co-authors,[11] in a recent publication on scenarios for Science Parks in the next twenty years, foresee:

- In spite of the importance of the existing Science Parks, they will be increasingly threatened by the emergence of entirely new models of innovation habitats, engendered by digitally connected networks of small and temporary physical places that provide more collaborative,[12] more flexible and less costly homes for invention.
- Possibly, over the next twenty years, regions will count with three different and simultaneous scenarios regarding Science Parks:
  - Existing Science Parks that will continue to operate and will be upgraded;
  - Networks of small and temporary physical spaces, connected through the cyberspace, providing more adequate homes for the industrial and research communities to work together on innovation projects;
  - Vacant tracts of Science Parks that failed or never became reality.
- In any case, as the regional knowledge institutions develop, *small research spaces* (also understood as *innovation zones* or *local segments of science parks*) will proliferate throughout the territory.[13]

III.3. Regional knowledge ecosystems and innovation regions

According to TOWNSEND:[11]

- *Regional knowledge ecosystems* (or *innovation regions*) will emerge as new platforms for economic development.
- Economic development practice will shift from trying to copy the success of others to building tacit knowledge based on local cultural and industrial resources.
- As scientific knowledge and tools become available anywhere on-demand, it will be paramount to promote knowledge ecosystem elements that provide the capacity for repeatedly reinventing the regional industrial and innovation capacity.
- The emphasis on real estate development and infrastructure will be replaced by an emphasis on actively managing activities and knowledge creation, and mechanisms that link local assets to global markets.
- There will be a crucial need for new governance structures that, acting as a custodian of the regional ecosystem frame, can boost the territory to become an innovation region.

These new governance structures, according to recent publications of the *Association of University Research Parks,*[14] will possibly be based on socially responsible and innovative interactions within the Triple Helix[15] (also known as Sábato's Triangle).[16]

[9] [ENGARDIO, P. 2009]
[10] [TOWNSEND, A. et al: 2009]
[11] [TOWNSEND, A. et al: 2009]
[12] [TAPSCOTT, D.; WILLIAMS, A.D. 2006]
[13] Interesting to note that this trend was already observed in Western Europe in the 1990s: [TOSI, A. 1995]
[14] [AURP 2008]
[15] [ETZKOWITZ, H. 2002], [ETZKOWITZ, H. et al. 2007]
[16] The role of the triangle formed by Government - Academia - Industry to support innovation was described in 1968 by the Argentineans J. SÁBATO e N. BOTANA: [PLONSKI, G. A. 2000]

IV. Methodology

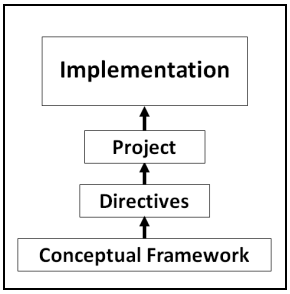
IV.1. Overview

Regarding the development and evaluation of *Innovation Habitats* and *Innovation Regions,* the quoted *South American School of Thought* formulates and uses methodologies suitable to local conditions, such as the *Innovative Regional Development Methodology*.[17]

This Methodology advocates that the project of an *Innovation Habitat* (and of an *Innovation Region*) must be formulated according to *Directives* stemming from a *Conceptual Framework*, as illustrated in Figure 1.

The Conceptual Framework emerges from the interpretation of the circumstances in which the initiative is inserted. This interpretation requires multidisciplinary teams – including philosophers, sociologists, and historians, for example - focusing on *search strands*, such as those commented in the next Chapter.

It assumed that the success or failure of any enterprise begins with the correct set up of the Conceptual Framework and Directives that shall guide its project and implementation, as sadly reminded by the Titanic.



Besides command mistakes at the night of the accident, the tragedy was also a result of misinterpretation of the conceptual framework and erroneous set of directives that guided the design of the ship.

For example, the number of lifeboats was proportional to the displacement of the ship, according to the British law at the time, not to the number of people onboard. Boats for everyone were considered to be unnecessary: the North Atlantic route was supposed to have plenty of boats that could easily respond to a distress call sent by the Titanic using the newborn wireless telegraph system.[18]

IV.2. Some *search strands*

IV.2.1. Paradigm Transitions[7]

A *Theory of Paradigm Transitions* has been shaped within the *School of Thought* stemming from the following reasoning lines:

- Despite the extraordinary achievements of mankind in the last hundred years, the world society is performing poorly in its pursuit to overcome critical global challenges, such as ensuring sustainable development for all while addressing global climate change and other issues outlined in *The Millennium Project*.[19]
- The difficulty in solving problems is mostly due to the use of wrong theories or, conversely, to the nonexistence of adequate theories.[20]
- Our generation lives a *transition of social paradigm* (defined below). The *Industrial Society*, inaugurated by the Enlightenment Age and the Industrial Revolution in the 18th century, was replaced by a radically different era, the *Knowledge-based Society*, engendered by the acceleration of the rhythm of advancement of science, technology and innovation in the last hundred years.[21]
- Other *transitions of social paradigms* occurred before (e.g. from the Middle Ages to the Renaissance), what, added to transitions of *technology paradigms* and *techno-economic paradigms*,[22] offer rich material for the development of a theory aiming to subsidize the solution of problems brought by such shifts.

Some of the axioms of the *Paradigm Transition Theory*:

[17] [SPOLIDORO, R. 1989, 1992, 1994, 1996, 1998, 1999], [SPOLIDORO, R., et al. 2008, 2010, 2011].
[18] [HEYER, P. 1995]
[19] Millenium Project: www.millennium-project.org/millennium/challeng.html
[20] [POPPER, K. R. 1963]
[21] [BOULDING K.E. 1964], [PEREZ, C. 1994], [WATSON, P. 2005], [SPOLIDORO, R. 1998]
[22] [SPOLIDORO, R. 1998], [PEREZ, C. 2004]

1. A *social paradigm* is the *standard form* with which a community perceives the reality and responds to its challenges.
2. A *social paradigm* stems from a conjunction of several factors regarding the community that is under scrutiny, especially:[23] (a) Natural environment, such as geographical location, climate, and natural resources; (b) Historical conditions, such as beliefs, and social and cultural institutions; (c) Capacity to generate and acquire knowledge and to use it.
3. A transition of a social paradigm occurs when a change in the above factors is able to radically modify the *standard format of perception and behavior* of a community. The present worldwide transition of *social paradigm* seems mainly due to an extraordinary amplification of the humanity's capacity to generate and acquire knowledge and use it for practical purposes.
4. It is very difficult for people and institutions formed under a certain paradigm to perceive the advent of a new paradigm and to move on to it.
5. Efficient answers to challenges brought on by a new paradigm do not come from ideas and tools created under exhausted paradigms, but from new and revolutionary concepts and instruments.
6. The development of the quoted innovative concepts and instruments requires courage to challenge dogmas and consecrated behaviors, and intellectual boldness to dream beyond any limit.
7. It is impossible to solve the problems brought forth by a new paradigm if one stays anchored to exhausted paradigms.
8. A new paradigm generates a break in the *status quo*, which creates extraordinary opportunities for newcomers who are able to conjugate their creativity to opportunities in the new realities.
9. A new paradigm creates *new entities*, often designated by neologisms. These new entities only are fully understood and developed within the environment of the new paradigm to which they belong to.
10. Entities created under a new paradigm may seem science-fiction to persons educated under the aegis of an exhausted paradigm.

IV.2.2. Characteristics of the new *social paradigm*: the Knowledge-based Society

A comparison of the Knowledge-based Society and the Industrial Society is presented in Table 1.[24]

Table 1

Aspect	Industrial Society	Knowledge-Based Society
Market	Domestic markets, expanded through wars.	Global market, expected to be regulated through international treaties.
Nation competi-tiveness	Cheap labor, natural resources, capital, etc.	Education of the people and their capacity for generating and using knowledge for innovations.
Main economic sectors	▪ Chemicals ▪ Automotive industry ▪ Electronics ▪ Civil Engineering ▪ Agribusiness ▪ Pharmaceuticals ▪ Information Technology ▪ Telecommunications ▪ Electrical Energy	The economic sectors from the Industrial Society will remain important, but promising new sectors emerge, mostly as convergences of once isolated areas, such as: ▪ Synergy of education, culture, leisure, sports, healthcare, arts and modern technologies. ▪ Convergence of Information Technology, Communications and Content - ICCT. ▪ Convergence of Healthcare, based on medical sciences, biotechnology, ICCT, robotics, nanotechnology, pharmaceuticals, etc. ▪ Agribusiness based on biotechnology, ICCT, image processing, and advanced logistics. ▪ Synergy of a wide spectrum of specializations aiming at solving complex problems, such as the global warming and the approach to *singularity conditions*.[25]

[23] [FUSTEL De COULANGES, N. D., 1945], [SOJA, E. W. 1990], [WATSON, P. 2005]
[24] [SPOLIDORO, R. 1998]
[25] For example: [KURZWEIL, R. 2005], [European Union: 2009]

Political models	1. Representative democracy. 2. Nation-state.	1. Participative democracy with online interaction between elected representatives and citizens. 2. *Virtual Region-states* within *Nation Communities*.
Government	Strong intervention in the economy and in other fields.	1. More regulatory and less executive. 2. Promotion of socially responsible development.
Development	1. Centered on economy 2. Little concern to social responsibility. 3. Centralized planning. 4. Incentives to attract or retain cost-driven industries.	1. Socially responsible development models. 2. Growing importance of *Regional Projects for the Future*. 3. Investments in talent and infrastructure to support *innovation-driven clusters* and *innovation regions*.
Environment	Irresponsible use of natural resources.	1. Ecological awareness. 2. International regulations.
Approaches	1. Knowledge fragmentation. 2. Little interaction between specializations and institutions.	1. Multidisciplinary approaches. 2. Synergy between institutions and specialties. 3. Networking of people and institutions.
Information Infrastructure	1. Local radios, TVs and newspapers. 2. Limited access to telecom services.	1. Optoelectronic interactive worldwide networks, with a virtually unlimited number of channels. 2. Easy access to global telecommunication and database services. 4. Online social networks with staggering consequences.
Technology innovation	Generated within companies' walls.[26]	Generated by networks within *innovation regions*.[27]

V. Findings from the development of Innovation Habitats in Brazil and Argentina

V.1. Overview

The analysis, with the support of the quoted Methodology, of *innovation habitats* in Brazil and Argentina, especially those in Table 1, in comparison with similar initiatives worldwide, indicates:

1. The comprehensiveness of the IASP definition of Science Park, since it encompasses a wide spectrum of Innovation Habitats categories and formats, became an obstacle, at least in Brazil and Argentina, to a further formulation of public policies to support the development of these initiatives.

   Policymakers may reasonably ask *what exactly* is expected to be fostered, what specific instruments are necessary, and how the impacts will be evaluated. In some cases, in view of the lack of references, policymakers may be tempted to impose conventional templates on Science Parks and other Innovation Habitats to be funded. This tactic may be inadequate in view of the course of evolution of innovation habitats, and innovation regions, commented in Chapter III.

2. In this context, the best strategy should be to recognize the right of each Innovation Habitat (including Science Parks) to define its own characteristics, provided it meets the definition adopted by IASP.[28] In order to promote such strategy, it seems necessary to set a definition of *Innovation Habitat* able to encompass all categories, respecting the possibility of evolution of the involved concepts.

[26] [PEREZ, C. 2004]
[27] [SPOLIDORO, R. 1998], [PEREZ, C. 2004], [The Science University Center 2009]
[28] IASP: www.iasp.ws

V.2. Definition of Innovation Habitat

The work of the School of Thought allows suggesting the following definition:

An Innovation Habitat is an organization that:

- Behaves like a *new sort of infrastructure to bring together the ideas and people that drive innovation*[29] within the new *social paradigm* - the Knowledge-based Society;
- Is adscript to a set of physical spaces (that are not necessarily contiguous);
- Congregates complementary and interrelated intensive knowledge companies and other innovation actors (such as universities, R&D centers, service providers, and governmental agencies) whose expertise and functions reinforces one another's;
- Has formal governance, managed by specialized professionals;
- Its main objective is contributing to a local and regional development process that is socially responsible and competitive in the Global Knowledge-based Economy, and that may contribute to the international cooperative effort to overcome global challenges;
- Emerges and evolves mainly based on creative and socially responsible interaction of the Triple Helix;
- Promotes synergy between participants, other actors of innovation, and the market;
- Promotes local creation, attraction, setup and development of knowledge intensive undertakings (as high-tech enterprises, creative industries, universities, and R&D centers);
- Offers added value services to participants, including, for example, offering of high quality spaces and infrastructures, technical certification services, cooperative R&D projects, and significant participation in the *Regional Project for the Future*.

V.3. Categories and hierarchy of *Innovation Habitats*

Though there is an accelerated evolution of the characteristics of the innovation Habitats, it is assumed that in the next ten years, at least, it will be necessary to have a classification of their categories and formats. A suggestion is presented in Table 2. The classification of examples is based on the authors' experience and information in websites.

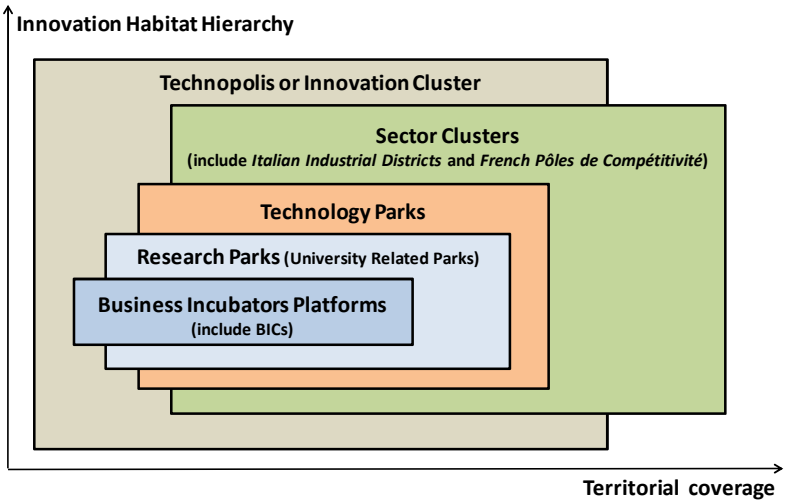
Table 2. Suggested categories of Innovation Habitats[30]

Technopolis, **Innovation Cluster**	Organization on a region that: ▪ Has a Governance based on the interactions within the Triple Helix; ▪ Promotes the synergy of actors of innovation and markets; ▪ Promotes the innovation in all domains; ▪ Provides value added services to participants. **Examples:** Pato Branco Tecnópole (Brazil); Rennes Atalante (France).
Sector Cluster	Organization on a region with a concentration of interconnected companies and institutions in a particular sector that: ▪ Has a Governance based on the interactions within the Triple Helix; ▪ Promotes the synergy of the participants, other innovation actors, and markets; ▪ Provides value added services to participants and associate entities; ▪ Aims a continuous competitive evolution of the ensemble.[31] **Examples:** Pergamino Biotechnology Cluster; Uberaba Biotechnology Cluster

[29] Inspired by [The University City Science Center 2009]
[30] See Bibliography for references
[31] [Porter, M. E. 1998]

Science Park, **Technology Park,** **Innovation Park**	Organization, adscript to a set of physical spaces, that:[32] ▪ Has a Governance based on Triple Helix; ▪ Promotes synergy among complementary and interrelated intensive knowledge companies and other innovation actors (especially universities, R&D centers, service providers, government) and markets; ▪ Facilitates the local creation, setup, and growth of knowledge intensive firms; ▪ Provides value added services to participants. **The Technology Parks have two formats:** **1. Concentrated in one area:** Examples: Research Triangle Park (USA), Sophia Antipolis (France). **2. Disseminated in the urban texture or the region through *Local Segments*:** Examples: VALETEC Park, Uberaba Technology Park, Porto Digital (Brazil); Misiones Technology Park and Distrito Tecnologico de Buenos Aires (Argentina); Kista Science City (Sweden); *Sites technopolitains* - Rennes Atalante (France); AREA Science Park (Italy).
Research Park	Similar to Science Park, with the following differences: ▪ The initiative belongs to an university or an R&D center, which may undertake the Governance; ▪ Tenants must necessarily participate of R&D projects developed conjointly with the university or the R&D center. **The Research Parks have two formats:** **1. Concentrated in one area:** Examples: PADETEC, Parc Científic Barcelona **2. Disseminated in the urban texture or the region through *Local Segments*:** Examples: TECNOPUC, Heidelberg Technology Park
Business Incubation Platforms	An organization that: ▪ Facilitates the creation and growth of innovation-based companies through incubation and spinoff processes; ▪ Provides, in temporary bases, value added services and quality space and facilities to emerging businesses. Examples: ❑ Business Incubators associated to AIPYPT - Argentina, ANPROTEC - Brazil, and INCUPAR – Paraguay; ❑ Business and Innovation Centres – BICs, European Union; ❑ Small Business Development Centers, USA.

A hierarchy of the categories of *Innovation Habitats*, based on definitions in Table 2, is suggested in Figure 2, bellow.



[32] Inspired by IASP and Mjärdevi Science Park, Sweden

V.4. Innovation Habitats and innovative regional development programs

Innovation Habitats, due to interactions within the Triple Helix and their practical contact with the future, seem to have a growing participation in the significant and innovative regional development programs, as illustrated in Table 3. These innovative development programs are understood as *Regional Projects for the Future* (commented ahead) or similar initiatives.

Table 3. *Innovation Habitats* and *Regional Projects for the Future*[33]

Region	**Innovation Habitats and other interactions within Triple Helix**	**Regional Projects for the Future or similar**
SICOVAL Commonwealth of Municipalities, Toulouse, France	Labège Innopole and other Innovation Habitats	SICOVAL *Programme de Développement Durable*
Lyon, France	Lyon Gerland and other Innovation Habitats	GrandLyon Great Projects
Montpellier, France	Montpellier Technopole	Montpellier Agglomération grand projects
Silicon Valley, US	Stanford Research Park	Joint Venture: Silicon Valley Network
Huntsville, AL, US	Cummings Research Park	Regional Economic Growth Initiative
Triangle Region, US	Research Triangle Park	Competitiveness Plan Research Triangle Region
Barcelona, Spain	22@Barcelona and other Innovation Habitats	Plan Estratégico Metropolitano de Barcelona
Coventry, Solihull & Warwickshire, UK	University of Warwick Science Park	Coventry, Solihull and Warwickshire Technology Corridor
Sinos Valley, Brazil	VALETEC Park	Sinos Valley 2024 Project[34]
Metropolitan Stockholm, Sweden	Kista Science City and other Innovation Habitats	Stockholm City Plan
Boston Area, US	Public-private partnerships oriented to promote develop Innovation Habitats	MetroFuture: Making a Greater Boston
Austin, US		Opportunity Austin
Greater Louisville, US		Greater Louisville Project
California Innovation Corridor, US		California Innovation Corridor WIRED Initiative

V.5. Regional Project for the Future

The objective of a *Regional Project for the Future* is to promote the transformation of the respective territory into an *Innovation Region*, or, at a higher level of abstraction, in a *Region socially responsible and competitive in the Global Knowledge-based Economy*.

According to the Methodology, a *Regional Project for the Future*:

- It is an entity of the new *social paradigm* - the Knowledge-based Society, and is conceived and implemented under the aegis of this new paradigm.
- It is not an upgrade of traditional or conventional development plans, which are based on linear projections and the fragmentation of the knowledge - typical of the Industrial Society. On the contrary, it is based on non linear projections and multidisciplinary approaches in order to cope with growing multifaceted and complex problems.
- It is based on socially responsible and innovative interactions within the Triple Helix and other forces of the society. Under this quality, it is a practical exercise aiming to promote the regional transition from exhausted social paradigms toward the new paradigm.
- It is built progressively in a bottom-up approach through driving vectors called *Structuring Initiatives*.
  - A *Structuring Initiative* is an action that, though drawn within a small domain, contributes significantly for the accomplishment of the objectives sought by the *Project for the Future*.
  - Each *Structuring Initiative* is formulated with the help of a *Conceptual Framework* and *Directives,* established by multidisciplinary teams, and takes into account several *strands of research*, such as characteristics of paradigm shifts, foresights, local and regional contexts, and community suggestions.
- The Project for the Future shall be ignited, in each region, by the Governances of the *Innovation Habitats*, since these initiatives are privileged bridges toward the future. This perspective is a paramount opportunity for the development of the Innovation Habitats themselves.

[33] See Bibliography for references of Innovation Habitats and Regional Development Programs.
[34] [SPOLIDORO, R. 2008].

V.6. Example of a *Structuring Initiative*

Among possible *Structuring Initiatives* of a *Project for the Future* one may single out, for example:

- Developing Innovation Habitats;
- Stimulating the universities to move from the conventional model to the entrepreneurial one;
- Encouraging entrepreneurship as a regional goal;
- Developing an innovative public transportation system.

The last topic is selected to illustrate the concept of a *Structuring Initiative*.

Developing an innovative public transportation system

It is appalling the fact that public transportation, in a growing number of towns and metropolitan areas in developing countries, is approaching a chaotic situation. Several hours of commute (up to seven hours per day have been found!) are imposed to a great number of citizens.[35] The alternative, based on individual automobiles, adds to gigantic traffic jams, a general increase of time lost in displacements, enormous pollution, and higher costs for the citizens.

Some of the main net results of this situation are:

- An increased erosion of the civilization process,[36] since absent parents have neither time to educate properly their children nor to pass on them the moral and cultural values required to built an evolved society;
- An extraordinary decrease of the *Gross National Happiness*, since the standard of life is quite low for those who have no time to enjoy the existence and fully develop their human potentials;
- There is an extraordinary increase of waste, pollution and greenhouse effect.

In spite of these scary perspectives, plans to solve the problems, such as the set up of modern transport systems in great metropolitan conurbations, are severely threatened by the soaring costs of expropriations and demolition of the actual urban fabric, conjugated or not to building an efficient subway network.[37] Solutions for these situations are certainly not simple.

However, we still have time to avoid similar catastrophes in thousands of rapid growth towns and conurbations, mainly in developing countries.

The development of *Innovation Habitats* in Brazil and Argentina are indicating a possible strategy toward this goal, through *projects for the future* ignited by Science Parks and other Innovation Habitats. Such is the case of the *Sinos Valley Project for the Future* (still in the first steps), connected to VALETEC Park,[38] to which the following Structuring Initiative belongs.

Multimodal Public Transport System in Sinos Valley, Brazil

The *Multimodal Public Transport System* conception stems from a Conceptual Framework and Directives, as commented in Chapter III. In this case, the Directives are, for example:

a) Every citizen living in the urban fabric must have, within 1,000 meters around his or her residence and working place, a *multimodal public transport station* (Figure 3).

   - A *multimodal public transportation station* shall integrate systems based on technologies such as subway and surface trains, trams, light railways, cable cars, telepherics, buses freeways, conventional roads, bikeway system, and boats.
   - Each station must have enough parking lots for buses, automobiles, motorcycles, and bikes.

[35] [TV Record 2011] TV Record: Caos do transporte público do Brasil: www.sediscute.com/2011/01/o-caos-do-transporte-publico-no-brasil.html
[36] [ORTEGA Y GASSET, J. 1930]
[37] [PUCHER, J. 2005]
[38] [SPOLIDORO, R. 2008]

- A certain number of *multimodal stations* will act as *urban centralities* displaying the ambience of the *classical city*.[39] Under this title, they shall host elements such as commerce and service shops, restaurants, coffee-shops, cinemas, theaters, public library, public services agencies, temples, nursery, health care unities, and fitness centers.

b) The *Sinos Valley Multimodal Public Transport System* must be connected to the *Interurban Infrastructure Corridors System* (Figure 4).

c) Since the Sinos Valley and neighbor regions' population is growing and the urbanized areas sprawling, the available land for the future *multimodal public transport system* is becoming scarce.

Therefore, the *effective preservation of the necessary land* to ensure the existence of the systems (corridors and stations) in the future may be as important as setting them up in the short or medium term.

d) The design and implementation of the systems shall be networked with similar activities worldwide, such as those of *Polis - European Union*,[40] and of *Transport Research Board - U.S. National Academies*.[41]

Figure 3: Example of a *Multimodal Public Transport Station*[35]

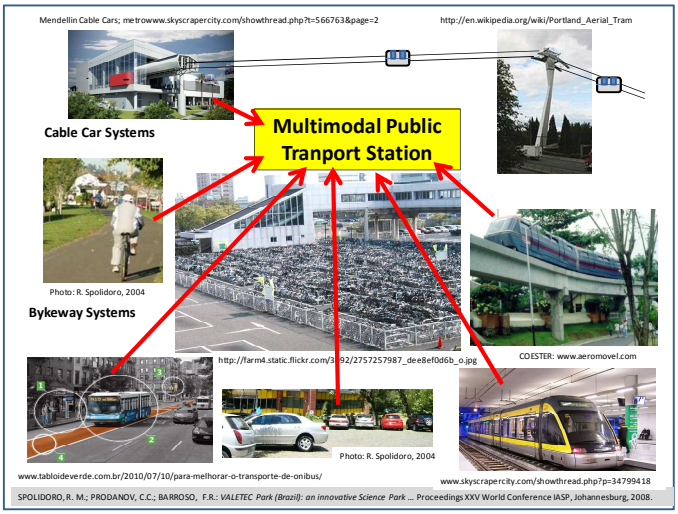
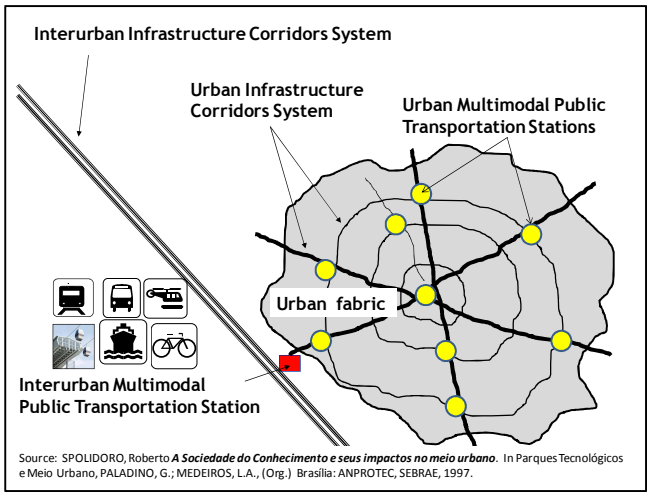


Figure 4



[39] Ambience of the classical city: ORTEGA y GASSET, Jose, apud [GOITIA, F. C. 1982]
[40] European Cities and Regions Networking for Innovative Transport Solutions: www.polis-online.org/index.php?id=486
[41] Transport Research Board, U.S. National Academies, U.S. National Research Council: www.trb.org/AboutTRB/Public/MissionandServices.aspx

VI. Conclusions

Regarding the evolution of Science Parks and other Innovation Habitats in Argentina and Brazil, one may sum up:

1. Science Parks and other Innovation Habitats in Argentina and Brazil are the outcome of several factors. The authors single out:
    - Socially responsible and innovative interactions within the Triple Helix (Government, Academia and Industry) and other elements of the organized civil society;
    - Alliances and partnerships of the public and private sectors.
2. In this aspect, the said Innovation Habitats emerge with some characteristics adherent to the new social paradigm, as synthesized in Table 2.
3. However, the Innovation Habitats' development is significantly hindered by mentalities, legal instruments and institutions formats that remain anchored in the exhausted social paradigm (the Industrial Society), such as:
    - Many universities and R&D institutions still appraise and remunerate their professors and researchers according to the number of papers published in international science journals reviewed by peers. This reflects a practical disconnection of the institutions with the urgent need, in the Knowledge-based Society, of effective contribution of their staff to technology innovation, development of new companies and generation of jobs.
    - Most Urban Development Plans continue to be conceived and implemented based on assumptions used in the middle of the 20th century, such as a planet with unlimited resources, indestructible environment, no limits to growth, and endless suburban sprawl without innovative and ecologically correct public transportation systems.
4. Therefore, the very existence and the success of Science Parks and other Innovation Habitats in Brazil and Argentina rely on the capacity of these initiatives – counting on the interactions within the Triple Helix - to overcome a great amount of outdated mentalities and frameworks bonded to exhausted social paradigms.
5. Innovation Habitats are, in principle, well suited for this challenging function. They are in practical touch with the future as well as with difficulties steaming from mentalities and frameworks anchored in depleted paradigms. And must prove daily that they can overcome those difficulties as they move forward shaping the best of the possible tomorrows for the region.
6. However, this objective will not be accomplished if the Innovation Habitats, even if they have some characteristics of the Knowledge-based Society, think and behave as entities of the exhausted social paradigm.
7. A paramount opportunity for Science Parks and other Innovation Habitats in Argentina and Brazil is, within the respective territory, to lead the formulation and the promotion of the *Regional Project for the Future*.
8. The main objective of each of these Regional Projects for the Future is a twofold mission:
    - To provide grounds for the practical development of new methods, under the aegis of the new social paradigm, for innovative planning and construction of the future.

      One must note that the *method* may be more important than *results*, as illustrated by the Scientific Method.[42]

      The development of new methods to build a better future includes, *inter alia*, improving and enlarging innovative interactions within the Triple Helix.
    - To pull the territory from exhausted paradigms and launch it competitively - and with social responsibility - into the Global Knowledge-based Economy.

[42] Inspired on [SAGAN, C. 1997]

VII. Policy implications and directions for further research

1. Creative interactions within the Triple Helix shall be understood as one of these new and revolutionary concepts and entities, among others – as the Cyberspace – that are being carved under the aegis of the new social paradigm, the Knowledge-based Society.

2. Outstanding results of these creative interactions, in Brazil and Argentina, are several *Innovation Habitats*, and their deployments as *Regional Projects for the Future*, understood as innovative strategies paving the construction of innovation regions.

3. The evolution of Innovation Habitats in South America, however, indicates that it is not always easy, in every region, to structure fruitful, creative and lasting interactions within the Triple Helix.

4. There is no demerit in this situation. These interactions, as entities of the new social paradigm, often must be developed from scratch. And this task frequently requires overcoming frameworks and behaviors harbored in exhausted paradigms.

5. In this context, the authors suggest to Triple Helix constituents in every South American region that intends to become competitive and socially responsible in the Global Knowledge-based Economy:
   - To refine creative and lasting interactions within the Triple Helix and other forces of the society through a reinforced support the development of *Innovation Habitats* and the formulation and implementation of *Regional Projects for the Future*;
   - To promote studies on actual *Innovation Habitats* and *Projects for the Future* that are under development, in South America, based on the quoted creative interactions;
   - To promote benchmarking of these initiatives with analogous ones worldwide;
   - To identify strengths, weaknesses, opportunities, and threats associated to these initiatives;
   - To offer innovative support to overcome problems and to foster and consolidate achievements.

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