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Technology Innovation Spaces and Scale Synergy: Business Incubators - Scientific Parks - Technopoles

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ABSTRACT

This paper analyses the characteristics and results of this process of creation of synergy between innovating initiatives in different space scales, from technology based business incubators till the regional space for innovation, through a Science and Technology Park and the various research and development centers, academic and non-academic, that are located in Curitiba. The work emphasizes the aspects and tools of the management of a regional space for innovation.

A historical summary of the process of creation of the project Curitiba Technology Metropolis is presented in the paper, as well as a description of the processes of interaction between the institutions, the difficulties faced during the implementation of the initial project of the Science and Technology Park, the profile of the business incubators and their relationship with the other technology assets in the region, a description of these technology assets and their relationship with the project of the Science and Technology Park, the strategy for the development of a regional space for innovation, the profile of the management entity and the conclusions based on the results achieved so far.

CONTENTS

1 INTRODUCTION

The international experiences show that the technological innovation processes are generally locally based. Contrary to the general idea that everything is globalized, and that includes technology and knowledge, the processes of innovation occur mainly through the interaction of firms and institutions that are structured at local and regional level.

In that way, the local clusters and their capacity for technological innovation as a factor of competitivity acquire extreme relevance in the promotion of the economic and social development of the regions, especially in developing countries.

The formation and growth of these clusters goes through the structuring of local innovation systems or structured local innovation and technological innovation environments. These depend on a strong interaction amongst the main agents: Universities, Government and Companies. The so-called technological innovation spaces or habitats for innovation – business incubators, science and technology parks, technopoles – are environments that favor the synergy of these agents.

The presence in Curitiba, capital of the state of Paraná, Brazil, of innumerous entities of research, development and promotion of innovation and technological development, as well as the characteristics of its special organization have lead to the creation of a movement destined to structure a local innovation space or technopole.

The concept of technopole as a structured process is a French invention, and it is in this country where the concept has become popular. This movement that has lasted for over 30 years continues to grow in several other countries, because the benefits that it brings in terms of creation of enterprises and employment and improvement of quality of life are evident.

Each technopole follow the regional vocations and has their own characteristics, but they show some common characteristics, such as creation of wealth and employment - with a high quality of life – from technology based companies; the excellence of academic knowledge as basis for the creation of enterprises; the collective will of the academy and the business community and the important contributions from the local government.

The Curitiba Technology Metropolis project (towards a local innovation system) must follow the same characteristics. Its early state of development shows the importance of one of the common aspects of every process of this kind: the interaction, the collective efforts and synergy between the various actors.

The spatial dimension of that interaction is very important, in the sense of the relationships between business incubators and science and technology parks in the structure process of technopole, structured innovation environments or local innovation systems

2 THE ANTECEDENTS

Curitiba's urban management model has developed innovative systems and technologies aimed at environmental preservation and quality of life improvement. This allowed State and the city's governmental entities, Universities and private companies, to develop competencies in those areas. In the last 30 years, several initiatives with international recognition made Curitiba a center added value services provider and an attraction pole for talents who looked for an adequate environment for innovative, creative and intellectual work.

In these conditions, in 1996, the Paraná's Federal University (UFPR), made a proposal for creation of a technological-scientific park in an area near downtown. The proposal was assumed, in 1999, by the State Science and Technology Secretariat and gained a wider scope: the science park should become the center of a local innovation system, based on articulation, not only between the entities located in the park, but also between other technology and scientific institutions in the city and metropolitan area.

The implementation of this local innovation system will allow Curitiba and its metropolitan area to become a social, economic and geographic environment with the following characteristics:

- production and trade of technology-based products and services as an important component of the economic activity;
- use of the local vocations in the economic activity based on science and technology, so that the local inhabitants take part and advantage of it;
- main source of technological development will be the permanent innovation originated by the academic activity combined with the entrepreneurial spirit of the private sector;
- existence of a technological development promotion program, based on a partnership between the municipality, the State government and the private sector;
- technological activity integrated to the urban space and the natural environment;
- recognition, by the population, of the importance of the technological activity in the maintenance of the local economy and quality of life;
- national and international recognition of the region as a reference center in some strategic technologies.

The creation of the local innovation system is now in the institutional articulation phase, the first step in a long path which begins by the search for interaction and consensus among its several actors.

3 THE SYSTEM ACTORS

The technology sector, the private sector, the universities sector, the government sector and the institutional sector (private and public entities that promote entrepreneurship, innovation and technological development) are the main actors in the technopolitan process, as seen in the successful international experiences. In fact, one of the cornerstones of successful technopoles are technology-based enterprises, created on the basis of innovation generated on universities or R&D institutions, both private and public.

The Technology sector, composed by the public and private institutions that have activities of R&D, develops basic technology and transfers it to the companies, stimulating technology innovation. In Curitiba, in this sector, institutions such as the Institute of Technology of Paraná-TECPAR, the International Center of Software Technology-CITS, the technology based business incubators and the academic centers of applied research, should be mentioned.

The universities sector (universities and other higher education institutions) creates knowledge and trains human resources in the technological area and other sector necessary to the technopolitan process, as management, marketing, law and economics. Curitiba has a great number of higher education institutions that, because of their activities, play important roles in the creation of a local innovation system: the Federal University (UFPR), the Federal Centre for Technological Education

(CEFET), the Catholic University of Paraná (PUCPR), Tuiuti University of Paraná (UTP) and the Positivo University Center (UNICENP), are some examples.

The private sector, represented by the technology-based enterprises of the region and the surrounding entrepreneurial environment, has the mission of turn knowledge and innovation in successful products and services. Additionally, service providers help to compose the business environment that is essential to the technopole creation process. In Curitiba, medium and small-sized companies have taken an active part on the structuring process of the local innovation system, amongst them must be mentioned BEMATECH S.A. (model of a successfully incubated company), SIEMENS and Brasil Telecom, as well as representatives of the industrial sector, such as the Association of Businessmen from the Industrial City of Curitiba and the Industries Federation of the State of Paraná.

The governmental sector has a double role in the process, promoting and supporting its implementation. The promotion includes institutional and marketing activities that stress the importance of the technopole, while the support includes the creation of the basic needed infrastructure for the various components of the technopole as well as the creation of mechanisms for attraction of technology-based firms. In Curitiba, the main institutions representing this sector involved in the technopolitan process are the State Science and Technology Secretariat, the State Commerce and Industry Secretariat and public companies as the State Electricity Company (COPEL) and the State Water and Waste Company (SANEPAR).

The institutional sector is a facilitator of the whole process. It contributes to the creation of new companies, capacitates entrepreneurs, stimulates innovation and quality, offers advanced knowledge, facilitates access to financing and coordinates strategic projects, or, briefly, intermediates and creates qualification and entrepreneurial growth. In Curitiba, some of the most important institutions that play such role are: the Brazilian Small Enterprise Support Service (SEBRAE), the Euvaldo Lodi Institute (IEL – branch of the State's Industries Federation responsible for the University-Industry interaction), the National Industry Training Service (SENAI), the Brazilian Quality and Productivity Institute (IBQP), the International Software Technology Center (CITS), and the PROINTER Institute, private entity in the field of international cooperation for technological development.

4 THE BUSINESS INCUBATORS

The Technology business incubators are the first and basic kind of innovation spaces and the main promotion mechanism of the entrepreneurship culture in the technological area.

Brazil has presently a very important movement of technological incubation, counting on about 200 incubators, according the the National Association (ANPROTEC).

Curitiba has 4 technological incubators, and one of them is the second oldest incubator in the country – INTEC, Curitiba's Technological Incubator – which hosts enterprises from several sectors and which is maintained by one of the most important technological institutions in the State, the Technology Institute of Paraná – TECPAR.

Apart from INTEC, there is the International Software Incubator (IIES), managed by CITS, and which has the mission of preparing small innovative software companies for the international market.

There is also the NEMPS, Projects and Entrepreneurship Center of the Federal University, which has pre-incubation and incubation programs for enterprises created by students and alumni.

The fourth technological incubator in Curitiba is the Technological Hotel, part of the Entrepreneurship program of CEFET, which hosts enterprises in the process of creation by CEFET's students.

Curitiba has also a non-technological incubator. The Business Innovation Center/Project Incubator is managed by the Higher Mercosul Management and Economics Institute (ISAE/FGV), and hosts companies in the areas of technological, management and marketing services.

INTEC was the first initiative in Curitiba to support the creation of technology-based companies offering a special and specific space for that purpose, with a strong history of interaction

with research institutions (TECPAR), Universities (PUCPR), and the private sector (IEL/PR). The most successful enterprise graduated from an incubator in Brazil took part in the INTEC program, and the case brought a renewed and ever-growing interest to business incubators and their role as promoters of technological entrepreneurship. Its implementation in the TECPAR campus made obvious the need for interaction between the incubators and research institutions.

Afterwards, the creation of IIES reinforced not only the importance of the interaction with a R&D Center (CITS, in this case), but also with other innovation spaces. IIES is located in the Software Park, first thematic Science Park in the State.

The creation of the NEMPS' and the ISAE/FGV's incubators, the first one located in the UFPR campus and the second one located in the FIEP´s main building in the area of the Curitiba's Technopark, mean the most recent results of the synergic relation between the actors of the local innovation system and between different kinds of innovation spaces: incubators and science parks.

5 THE SCIENCE AND TECHNOLOGY PARKS

In Curitiba there are two innovation spaces of the level of the so-called technology parks: a theme park, the Software Park, and a multi-area science and technology park, the Technopark.

The Software park is located in Curitiba's Industrial District, tem kilometers from downtown. Its objective is to offer the needed marketing, institutional and physical basis for start-up or expanding software companies.

A truly edge-technology center, the Park is supported by research and education institutions as well as private enterprises. It is a mechanism for the transformation of the city in a center for the development of new ideas and intelligence through software, in which there can be developed national or internationally innovative products.

Because of the Park, created in 1996, Curitiba was home to the first of the thirteen Software Export Units that belong to the National Software Export Program, Softex-2000, which aims at making software one of the main Brazilian export products.

It is in the Software Park that two other important actors in the local innovation system are located: CITS and IIES.

By the time the Software Park was created, the proposal to create another Science Park, the Technopark, was launched. Located in an area close to downtown and described by the city's land use legislation as a Special Educational Sector, the Technopark counts with three Universities in its area, and the main institutions that are part of the State's Industries Federation, as well as other public and private institutions for technological and entrepreneurial promotion and training. This array of entities represents about 200 research units linked to graduation and post-graduation courses and about 2000 people dedicated to R&D in Technology and Innovation.

The recent opening of an innovation center – the Technocenter - in the heart of the Park's area adds to the number of existing technological assets and, most important, gives the park an emblematic building, symbol of the city's transformation to adapt to the new economy.

The Technocenter will house several education, research and development entities that are linked to the State and Municipal government, also University entrepreneurship and technology transfer projects and high technology companies' R&D units.

6 OTHER TECHNOLOGICAL ASSETS

Besides the several research laboratories located in the three Universities within the Technopark's area and the R&D units in CITS and the Software Park, it is worth mentioning that in Curitiba's metropolitan area there are other important technological assets which compose the local

innovation system. Some of them are linked to Universities and others are independent, but all of them receive public and/or private support.

Among those linked to Universities, some of the most important are the CEHPAR – Center for Hydrology and Hydraulics; NIMAD – Development and environment interdisciplinary unit; CCE – Center for Computing; CEPPA – Food research and processing center; CESEC – Center for civil engineering studies; CIEG – Geoprocessing studies integrated center; GEOSS – Geo-systems applied research center; CIEL – center for electronic instrumentation; ISAM – Environment sanitarization institute and STI – computing technology services.

Among the independent R&D and innovation entities, besides the above mentioned CITS and TECPAR, it is important to highlight CITPAR – Paraná's technological integration center; SIMEPAR – Paraná's meteorology system; LACTEC – Institute of Technology for the development; ICI – Curitiba's computing institute; CPPI – inmunobiolocs research and production center; IBMP – Paraná's molecular biology institute; IBQP – Brazilian quality and productivity institute; CNTS – center for new software technologies; Rede TIC Paraná – Paraná's information and communication technologies promotion network; NTS – the Brazil-Japan software technologies business network; UEB – Brazilian electronic university; GameNet – network of computer games companies and the Prointer Institute, private advisory entity in the area of international cooperation for technological innovation and development.

7 THE LOCAL INNOVATION SYSTEM

The local innovation system's development strategies are decentralization and synergy. In fact, the aim is to create a certain state of mind and a way of life. It is about obtaining constant evolution, excellence – measured by its benefits to society and economy – of those existing and future intellectual competency centers.

The system's structure process is the result of an intense interaction and synergy among institutions fro each of the sectors that are the main actors of the technopolitan process. Thus, from the technology sector, TECPAR, through its Technological incubator – INTEC, has had a prime importance role when demonstrating the benefits of technological innovation in enterprise creation. In the academic sector, the Federal University has developed the first Science park proposal and the catholic university has assumed the secretariat in the first meetings of the several institutions. In the private enterprise sector, big companies, as SIEMENS and Brasil Telecom have greatly participated in the process. In the governmental sector, the State Science and Technology Secretariat was the main propeller in the process, making public resources available for the projects elaboration and coordinating the institutional articulation work. The municipality, through the city's Urban research and development Institute – IPPUC, assumed the urban development project of the Park. In the institutional sector, IEL/PR has financially complemented the support to the project and the Prointer Institute and the TIC Network elaborated the preliminary studies for the local innovation system's structure.

The actions will be carried out by the several actors in the process, following their own vocations. The financial resources for its development and the result-achieving interaction will come almost completely from existing sources – federal, state and municipal – for business development and technology. The federal Sector Funds could provide the most part of the necessities, since apart from financing technology development, they have work areas that support incubators, science parks, technopoles and local and regional development projects based on innovation and technology transfer.

The city's assets and its reputation as innovative must be explored as one of the local innovation system's consolidation basis. Concerning communications, internal and external, the focus must be in the innovation and not only technology. With this strategy, the region begins with great international recognition and national primacy, while when speaking about technology, the situation is not the same.

While the system's structure and consolidation will search for wealth generation, it will also make efforts to make it available by the biggest possible part of the population. The communication

and information technologies must, in this sense, be used intensively and extensively both as wealth generators and facilitators of the system's conduction and also wealth distribution tools.

The initial work plan aims at producing, within a year's time, the Strategic Plan. With clear objectives and commitment from all actors involved, this time frame should be enough for the development of the first version of the Strategic Plan. This version would be periodically reviewed and activities would be designed, according to the initiative of the actors and to the opportunities identified.

The initial work plan includes the following items:

- Technological assets – detailed study about the region's technological assets (institution, field of work, human resources, physical resources, realizations, future plans), beginning with those already listed.
- Strategic areas – detailed characterization of the technological excellency areas (tendencies, involved technological assets, national and international benchmarking business potential and potential of clusters development, beginning with communication and information technologies (specially educational software, telecommunication systems, free software tools and applications); biotechnologies; atmospheric science application; health sciences and urban management.
- Innovation spaces and entrepreneurship – characterization of the innovation and entrepreneurship spaces of the region (business incubators and science parks), analysis of their competitive advantages and weaknesses and recommendations for their development.
- ICT actions – covering the use of such technologies as a facilitator of the conduction of the system's structuring and consolidation process, with intense and extensive use of the internet and distributed work tools, in digital inclusion and interactive citizenship programs.
- Communications plan – with the objective of gaining internal mobilization and promotion outside the region, the communications plan is a tool of the greatest importance for the synergy strategy, since it will be the mobilization of all the agents and not only the interference of the government and its investments that will keep the process running.

8 THE SYSTEM'S MANAGEMENT

There is already a reasonable amount of experience accumulated, both in Brazil and abroad, about the conduction of regional development processes based on technology. This experience shows that always exists an entity with specific objectives, which congregates the efforts of the society under the inductive role of the local government as one of the most effective ways to coordinate the process.

It is important, in this case, to understand that such inductive role does not mean leadership, under risk of the whole process being seen as a government activity, and not a collective one. Governments begin and in a short period of time, while the whole technopolitan process starts achieving results in a medium period of time. Besides, initiatives that have the mark of one administration will not always have its priority maintained by the following administrations.

The existence of a specific entity presents a series of advantages, but has some difficulties, among which one of them is its maintenance. Among its advantages we may point at its independence (in relation to the agents), agility (of decision making and action taking), and the possibility of learning and specialization.

Apart from the specific entity, there are two other possibilities: the coordination activity to be absorbed by an existing entity, or its execution by a commission representing the several agents or actor of the process: from the technological sector (institutes and other local R&D entities); from the academic sector (local higher education institutions); from the private enterprise sector(technology-based local companies or big technology users); and from the governmental sector (entities related to economic, technological and entrepreneurial development, from the state and municipal governments).

This commission may count on support from professionals with experience in the area of regional technological development promotion. Thus, the members of the commission would be able to direct and supervise the activities (as a Managing Committee), without compromising their activities in their entities of origin.

In Curitiba, the first step was the constitution of a Multi-Institutional Technopolitan Commission, composed of representatives from all the institutions involved in the process. The commission formed some work groups, responsible for the first and most important actions: communication and advertising; institutional policies and technological assets mapping.

Experience also indicates that the coordination, no matter how it is structured, will have more chances for success if it is based on principals such as participation, transparence, impersonality, neutrality and stimulation. The coordination will report to a managing committee, composed in the same way as the temporary commission and which must approve the strategic plan and define the coordination's work guidelines.

9 CONCLUSIONS

The creation of a structured environment for technological innovation in Curitiba counts on a significant helping factor: the interaction between the main actors of the process: technological, academic, governmental, entrepreneurial and institutional sectors.

The intensity and the quality of the participation of each of these sectors in the technopolitan process is very different. The most relevant are those linked to the business incubators and to the science and technology parks.

In fact, the successful experience of a technological incubator linked to a state research institute was the origin of a science and technology park project, developed at a federal government university. The presentation of this project in a forum with the most important regional entities related to the technological development enabled a better understanding of the needs and advantages of the interaction between them. This comprehension allowed the preparation of the local innovation system‘s project.

The preparation of this project and its results have shown two things: that the existing scale relation between business incubators, science parks and technopoles, all in the condition of innovation spaces, does not imply in a hierarchy relation nor in a origin sequential relation.

The importance of the business incubators in the creation and development of a local innovation system is not smaller than that of a science park, and incubators can be created before or after the park.

In fact, in Curitiba, if it is true that the origin of the project of the local innovation system was the project of a science park, it is also true that the technopole project was developed in parallel and simultaneously to that of the park.

Similarly, it is in the business incubators we find the best example of a successful interaction between the worlds of research and business, of the transformation of knowledge in products, of the relation between science and technology.

On the other hand, the formal creation of a technological innovation center (the Technocenter) located in a science park (the Technopark), that exists in fact but not legally and that will house several entities and projects, shows that the synergic interaction among the several actors of the process is able to create spaces, which in their turn, are new synergic environments and give real existence to spaces not formally structured.

In other words: business incubators, science parks and technopoles are elements of a systemic structure – with spatial and institutional dimensions – focused on innovation and local and regional technological development.

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