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#10. LEARNING FROM BRAZIL: INSPIRATION OF TRIPLE HELIX INNOVATION

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Organizational adaptation, experimentation, and hybridization, have been the hallmarks of innovation in Brazil as the country evolved from an authoritarian to a democratic Triple Helix.

As Ary Plonski reminds us, Brazil was in a tri-lateral mode before the Triple Helix (Plonski, 2013). Sabato's Triangle, the Argentinian physicist and science policy analyst's, top-down, government-led, model, provided a rationale for large-scale technology development projects during the military regime era from 1964-1985. This earlier theoretical substrate may have helped prepare the ground for the Triple Helix, but the two concepts are significantly at odds with each other, especially in their sources of inspiration.

Indeed, the triangle and the helice may be seen as expressions of societal regimes based on opposing authoritarian and democratic principles. A dynamic Triple Helix began to emerge in Brazil only with the breakdown of the military regime in the early 1980's, and the emergence of democracy. Brazilian Universities were a source of critical discussion groups that often took further steps to foment opposition to an authoritarian regime. They performed a role much like the scientific societies in sixteenth and seventeenth century Europe that were islands of free discussion, infusing new ideas into rigid monarchical regimes, precipitating their inevitable downfall (Heller, 1999).

A similar process of social change was telescoped into a shorter time period in Brazil. In the following we track a Triple Helix development process that shifted from single to multiple sources of inspiration, producing hybrid spaces at the intersection of the helices and a series of hybrid organizations, a regime that we have elsewhere called "meta-innovation" (Etzkowitz, Mello, and Almeida, 2005).

THE INCUBATOR COMES TO BRAZIL WHERE IT FINDS ITS TRUE HOME!

The revolutionary political dynamic in Brazil induced a trans- formation in innovation regime, as well as governance. Creation of civil society, the sea in which multiple sources of inspiration swim, is the prerequisite for a Triple Helix of university-industry- government interactions. Civil society is a form of social organization in which people may freely associate, discuss, and work together, to organize new initiatives, openly and transparently. Brazil's transition to a civilian regime, with freely interacting institutional spheres, organizations and individuals, allowed a lateral mode of

university-industry-government relations to emerge.

Instead of a hierarchical structure with other institutional spheres subordinated to government as in Sabato's Triangle, a space for interaction, brainstorming, and negotiation of joint arrangements, opened up between the institutional spheres, and their members, as they became more equal to one another with the ascension of democracy. Without a civil society base, only a static innovation model with limited initiative, typically directed by government is possible. Once democracy was achieved, Brazilian academics turned their attention to university and social reform.

The flow of individuals abroad, picking up ideas and experiences that they bring home and reinterpret to meet local needs, provided 'starter yeast' for a Brazilian Triple Helix through a process of 'innovation gain,' the inverse of brain drain. Instead of loss of highly skilled persons, typically to the developed country where they trained, innovation gain is the accession of high-level skills through returning graduates and foreign visitors and importation of novel organizational models. These flow to the developing country to fill gaps and help advance the innovation system. How incubation and the incubator migrated to Brazil from its source in the United States is a tale of organizational technology transfer. Indeed, the translation from incubator to "Incubadora" is the story of an evolving concept whose utility is only partially realized in a developed country and finds a broader expression, and fuller realization of its potential, in a developing country.

The incubator was a US invention in the 1940's Southern California aerospace industry. It began with the organization of a "skunkworks", a place where an R&D project that did not fit the firm's remit, but management wanted to encourage, was located in an underutilized space away from the rest of the company. The semi-independent innovation support structure for new ideas, under the wing of a large firm, was expanded into an "incubator" format in which a group of unrelated projects could be undertaken simultaneously. They could even be spun off as independent firms, in the event R&D success could not be incorporated into the sponsoring firm's strategy. Several companies, including Control Data in Minneapolis, and General Electric (GE) in New York, developed this model further, and it was eventually extended from incubation into corporate venture capital, but that is another story. However, the emergence of the incubation movement in Brazil is an "innovation in innovation," or improvement in the conditions that foster innovation.

The Triple Helix model understands innovation as a broader phenomenon than product development: making 'innovation in innovation' sensible to researchers, practitioners, and policymakers, is one of its basic tenets. To better understand innovation in innovation in Brazil, we focus on the reinterpretation of the incubator concept. The incubator was transferred from industry to university, from GE to Rensselaer Polytechnic Institute (RPI), by a GE researcher, Pier Abetti, who brought it with him when he moved from the firm to the university as a Professor.

Brazilian academics, having visited the US and seen the RPI incubator in operation, or learning about it, had the idea to organize a similar project. For example, Maurcio Guedes from the Federal University of Rio de Janeiro (UFRJ) started an incubator at COPPE, the graduate engineering school. In the early 1990's it was located in a temporary building on the university campus, and Guedes often worked from a desk placed under a tree. Guedes persuaded the Rio de Janeiro

Municipal Government to provide funds to build a permanent facility.

It was a controversial idea at the time for a public university to be involved in business activity. The incubator project had not received formal university approval and functioned as a temporary project. When he received the offer of funds from the municipality, the university had to approve the incubator or turn down the funding offer. The incubator facility was built at the edge of campus, with room for approximately a dozen proto-firms simultaneously, a director, and an associate director to handle internal and external management, and "incuba gula," a luncheon restaurant at the center of the building to encourage interaction among members of different firms.

Why incubation flourished and realized a broader format in Brazil is a function of the limits of R&D resources, organizational creativity, and societal needs. Academic initiatives in forming incubator facilities, recruited local governments; then industry associations became involved, followed by NGO's and national government. The original concept for the incubator was to assist the formation of high tech firms derived from research done by professors. However, the academic research base in Brazil at that time was relatively small, so the potential for academic entrepreneurship and firm formation was not large. Nevertheless, by adapting the incubator model to local conditions, the concept was expanded and put to a variety of other uses. Brazil soon had a higher rate of incubator growth than in the States, where the concept had originated.

FROM INDIVIDUAL TO COLLECTIVE ENTREPRENEURSHIP

Initially located on the outskirts of the university, physically as well as organizationally, the incubator gradually became more central to academia as it provided the base for development of entrepreneurial education. The incubator also took a step towards a Triple Helix innovation system by facilitating university-industry interaction. The expansion of incubation use from high-tech to a broader universe was based on the insight that the incubator, rather than solely an expression of the emerging economic and social development mission of the university, was that the incubator is fundamentally part of the educational role of the university, but with a mission to educate groups in how to organize and operate an organization. This insight led to the application of the incubator to the problem of poverty, assisting groups of favela residents to form cooperatives and create their own jobs (Almeida, Mello and Etzkowitz, 2012).

There is an incipient organizational revolution in higher education, from educating individuals to shaping organizations as well. This transition has been more difficult to discern since it typically takes place in academic contexts, such as incubators that have been viewed as part of the "third mission", rather than as part of the educational function of the university. A special graduation ceremony at the Pontifical Catholic University of Rio de Janeiro marked the departure of firms from the university's incubator facility "Project Genesis".

At the end of the ceremony each firm was given a certificate, implicitly recognizing that the university was training and graduating organizations as well as individuals. Incubation also connects back to the academic degree format by mandating a limited time period in the facility. The organizational/educational role of the incubator extends after graduation through a "club", linking groups of alumni firms with potential partners. Just as the university trains individual students and sends them out into the world, it is now doing the same for organizations.

Instead of using the concept only to form new firms, the incubator model was creatively adapted to the task of raising the level of existing firms and filling gaps in low-tech clusters. This model was called the "traditional incubator", followed by the mixed incubator, with both high tech and traditional firms, and the design incubator to assist with product prototyping. Project Genesis, directed by Jose Aranha at the Pontifical Catholic University of Rio de Janeiro, carried this efflorescence of incubation further through creation of the cultural and social incubator formats. Project Genesis exemplifies the creative role that an interface organization can play in the 'Second Academic Revolution", the university's assumption of a leading role in economic and social development.

THE BRAZILIAN ENTREPRENEURIAL UNIVERSITY

As academic researchers make their research relevant to addressing societal needs, they gain new sources of theoretical inspiration (Etzkowitz and Viale, 2010). An evaluation self-study of FAPESP, the science funding and science policy agency of the state of Sao Paulo, found that this reverse linear process had begun under cover by some applicants to the Agency's basic research funding program, who were hiding their applied achievements while heralding their theoretical advances (Cozzens, Etzkowitz, and Howells, 1997). Once it was uncovered, FAPESP accepted the dual role of science in advancing understanding and economic development, and henceforth highlighted it, thereby building public support for the agency. FAPESP then took the next steps of organizing a networked genomic research project on a disease affecting the local orange crop, and inaugurated an innovation- funding program to support the development of high-tech start-ups.

The link between research and academic entrepreneurship is well known, even if sometimes controversial. But what can be said about the original teaching mission of the university and its role in Triple Helix relations? A distinctive entrepreneurial university mode has arisen in Brazil from the teaching as well as the research mission of the university, introducing an ethos of entrepreneurship to a broader population, on the grounds that it is equally relevant to the arts and social sciences as to engineering and the physical and biological sciences; to low tech as well as high tech ventures.

Entrepreneurial education, rather than being encapsulated in a single Center for Entrepreneurship, or focused narrowly on business and engineering students, is spread broadly throughout the university. At PUC Rio and he University of Brasilia, students in all disciplines are required to take a basic course in entrepreneurship. Every student learns to write a business plan just as they learn to write an essay to present ideas or a scientific research report to explain data. In an era when there is an oversupply of graduates and an undersupply of available jobs, it is essential to have this skill to write a document which sets forth clear objectives and delineates the means to realize them, place costs against those steps and, a staged plan of how to achieve those goals.

Entrepreneurial training should be part of the basic education not only of engineering and business students, but arts and performing arts students, so they may organize an art gallery or theatre group, just as computer science students may organize a software or a video game business. As a training process, a venture may be sale of snacks to fellow students, a band, or a baby-sitting service. Entrepreneurial skills should be widely available to all, not in the expectation that everyone will form an enterprise, but that graduates may become intrapreneurs and innovate within existing organizations as well.

The University of Sao Paulo established a program of student companies as part of an SME interface strategy. Each group of students is given a room with a computer and a telephone. They can be in science, engineering, or in the humanities and social sciences. In the humanities a student company translates documents. Social science students assist in the organization of conferences. The students, through their companies, become an interface between the university and its resources, and small and medium sized firms, through a service called 'dial-a technology." A company can telephone and be connected to a student company who can then deal with some of their needs. If the project becomes larger, or greater expertise is required, the firm will be put in touch with a staff person and eventually with a faculty member, if necessary .

A University-SME support program in South Korea links firms directly with faculty members, but capacity is limited due to faculty availability (Duke et. al, 2006). The Internship in SME's programme at the University of Aveiro, Portugal, utilizes students as the interface with firms, not only to introduce new knowledge to the firms, for example through logistics software packages, but also to solve the problem of status difference between Professors and often much less educated entrepreneurs. They have less difficulty interacting with students, who can act as a conduit to the university, bringing back problems that are beyond the students.

BACK TO THE SCIENCE PARK

In Portuguese, "dora" is an all-purpose suffix denoting active agency, a state of becoming, and is widely applied to name any artifact incorporating that purpose. An intriguing art exhibition at the cultural center in a former bank headquarters in Porto Allegre, several years ago, featured dozens of objects representing the "doras", like computadora, but did not include the incubadora. Perhaps its absence was because it was not instantiated in a reasonably sized physical object suitable for an exhibit, although photographs or a video might have worked to portray an organizational concept that has become an icon.

Brazilian towns aspired to have a fountain in their town square as a symbol of municipal status in the 1930's. In recent years, the presence of a municipal incubadora has surpassed the fountain as a sign of modernity. The 'elective affinity' between Brazil and the incubator, and the question of why the incubator movement in Brazil grew more rapidly than in the US during the 1990's, was puzzling for a time. The answer provides a clue to understanding "innovation in innovation," the emergence of a Brazilian Triple Helix, and the temporary displacement of the science park by the incubator.

The devolution from a science park to an incubator model of innovation in post-military Brazil tracks the transition from Sabato's Triangle to the Triple Helix. Several science parks had been constructed in Brazil during the military regime, following the classic model of low-lying, dispersed buildings in the outskirts, familiar to the Stanford and Research Triangle examples in the US. However, in the States, these projects either arose bottom-up as at Stanford, or laterally as an initiative from state government in cooperation with North Carolina's business community. In Brazil, science parks of that era were an expression of the national government, instituted without a sufficient innovation base.

In post military regime Brazil, apart from the relative lack of high- tech firms emanating from

universities to move into these parks, in contrast to the Stanford Park, or the ability of a regional government to attract government and multinational firm labs as in the North Carolina case, there was insufficient central government funding to maintain and develop these isolated physical infrastructures. Research funds for universities suffered decline, opening the way for a creative response in the form of an alternative, smaller scale, approach to academic development and innovation.

The Brazilian model of incubation is an inter-networked format of networks of local incubators that are inserted in broader regional and national networks, and ANPROTEC, the national association of incubators and science parks. The Brazilian incubator phenomenon has as a key feature a framework for incubator development that may be called "Incubador de Incubadoras," or Incubator of Incubators. A well-established incubator with experienced staff serves as the hub of a network to mentor the staff of newly established facilities, typically located in smaller universities.

The "Incubador de Incubadoras" model, systematically developing and transferring incubation expertise, is a Brazilian contribution to innovation in innovation. To move incubation ahead in an environment that does not have networking as a strong element in its culture, it may be formally introduced. Such a strategy has been adopted by Milan Polytechnic, using the incubator on the main campus as the Incubator of Incubators, to do training and benchmarking for its branch campuses. On the downside, the Brazilian networking culture is complemented by a highly bureaucratic regulatory regime that inhibits start-ups [1]. Brazilian incubators often have a legal special status, exempting incubating firms from some highly bureaucratic rules and procedures that inhibit entrepreneurship, thus providing a hidden impetus to incubation.

After decades of incubator and academic entrepreneurship development, the stage was set in Brazil for a return to the science park model. But this time science parks were organized as extensions of successful university incubators, like the one at UFRJ, or as part of an entrepreneurial university development project as in Recife, the less developed Northeastern region of Brazil. The UFRJ park was built around a joint research/test facility for deep sea drilling platforms, a collaboration with Petrobras, the national oil company. The Recife project was based on collaboration among the computer science departments of several area universities.

A staged joint development plan included a consulting firm, CESAR, that was organized to market academic computer skills to solve problems for Brazilian firms, and earn funds to support the joint academic and business development project. A task for a supermark et chain was an initial pr oject. The best Masters students were sent abroad for their PhD's. A declining business district on an island, the city's original center, was rebranded as Porto Digital Science Park, and many of its buildings were remodeled to house software start-ups. The long-range plan was to move all of the area computer science departments to a joint campus at the science park. The Board of Directors of Porto Digital, including representatives from the areas universities, industries, and governments, served as an informal Triple Helix consensus space, brainstorming new ideas for knowledge-based

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[1] Personal communication to the author (2002) from the Director of FABERJ, State of Rio de Janeiro Science Policy Agency.

development.

THE COMMUNITY UNIVERSITY WORKING BETWEEN ACADEMY AND INDUSTRY [2]

It is much debated, in both developed and developing countries, whether the third mission of the university enhances or detracts from its previous missions of teaching and research. For those who believe a focus on economic and social development is useful but believe it could detract from teaching and research, a strict separation of functions is the answer. On the other hand, advocates of integration, argue a "more the more" thesis in which academics with practical experience become better teachers, bringing real-life examples into the class room and new research ideas into their lab, inspired by industrial problems in which they discern theoretical implications.

The Brazilian community university, typically found in southern Brazil, is an intriguing compromise. For example, Feevale University in Novo Homburgo, is organized on a matrix principle. In the morning faculty spend their time in their departmental offices and labs, organized on the disciplinary Mode One model. In the afternoon, they move to offices of interdisciplinary centres, focused on the industrial, agricultural, and social problems of the region, a Mode Two applied research and development model. The division of labour between department and centre is reminiscent of the academic development of the University of California Berkeley, in which a series of state funded centres, dealing with governance issues, became an impetus to research growth on that campus, setting it on the road to distinction as a world class university.

The Innovation Law of 2004 [3] allows creation of "the firm in a lab," a joint academic research group and business firm that produces research results, journal articles, and marketable products, at one and the same time in a common unit housed within the university. At the Pontifical Catholic University of Rio Grande do Sul, the 4G biotechnology hybrid, located in the University's Science Park, saves resources by eliminating the need to duplicate facilities, since the early stages of spin-off can legitimately take place within the academic lab. It also addresses the Valley of Death created by the necessity, under strict conflict of interest rules, to make too early a separation between academic research and the conduct of business. This recent development is the latest example of innovation at the interface of university-industry-government.

CONCLUSION: THE BRAZILIAN TRIPLE HELIX

The Triple Helix is a metaphor, model, and inductive thesis of the social order of an emerging knowledge era. Like previous societal modalities, it is related to technological change, but the Triple Helix drives technological change as well as being driven by it. Brazil is a living laboratory of Triple Helix R&D, where the implications of imported concepts like the incubator have been

more fully realized than in their home of origin, and new hybrid innovation formats have been created like the firm-in-a-lab. Top down direction of innovation in Brazil was displaced by bottom-

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[2] For an analysis of Brazilian universities, along traditional dimensions, such as the Carnegie categories and their analogues, together with a discussion of rankings, see Joao E Steiner, The Brazilian Research Universities, www.iea.usp.br/english/articles. \

[3] For an analysis of the causes and effects of eh Innovation Law of 2004, see Maculan, A and Mell, J (2009), University start‑ups for breaking lock‑ins of the Brazilian economy, *Science and Public Policy*, 36(2), March, 109‑114.

up initiatives, and lateral interactions as a consequence of political transition.

Whereas biological evolution relies on chance mutations; the Triple Helix relies on human intervention that has the capacity to thoughtfully shape change and direction, even if such capabilities are not always utilized. *T op down direction of innovation in Brazil was displaced by bottom-up initiatives and lateral Triple Helix interactions as a consequence of political transition.* As a framework for 'innovation in innovation,' creating new formats to enhance technological and product innovation under varying societal conditions, it has the potential to develop into a universal theory of innovation.

REFERENCES

Almeida, M, Mello, J and Etzkowitz, H. (*2012)* Organizational Innovation in a Developing Country: Invention and Diffusion of the Brazilian Cooperative Incubator, *International Journal of Technology and Globalisation.*

Audy , J and Borges, S. (2013) *ANPRO TEC - Promoting Innovative Enterprise*, *Helice*, 2 (1).

Cozzens S, Etzkowitz, H and Howells, J. (1997) *Socio-Economic. Returns on Investment in Basic Research: Advisory Report.* Sao Paulo: FAPESP.

Duke, C, Etzkowitz, H, Kitagawa, F and Rhee, B. (2006) Peer Review Report: Busan, Republic of Korea, OECD/IMHE Project: Supporting the Contribution of Higher Education Institutions to Regional Development, www.oecd.org/ document/35/0, 3343, en_2649_35961291_35602979_1_1_1_ 1, 00. html#Busan.

Etzkowitz, H, Mello, J and Almeida, M. (2005) Towards 'meta- innovation' in Brazil: The evolution of the incubator and the emergence of a triple helix *Research Policy* 34 (4): 411-424.

Etzkowitz, H and Viale, R. (2010) Polyvalent Knowledge and the Future of the University *Critical Sociology*.

Heller, A. (1999) *A Theory of Modernity*. Oxford: Blackwell. Plonski, A. (2013) Developing Brazilian Triple Helix Leadership**,**

Helice, 2 (1).