34th IASP Annual World Conference
Istanbul, Turkey

Shaping the next generation of STPs and AOIs

Plenary Session 6:
"The future"

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Abstract. The accelerated pace of technological evolution, along with new business models, new governance propositions and cultures will shape a next generation of tech businesses that challenge virtually all our assumptions about how to promote innovation environments. Science and technology parks (STPs) have been used as the main strategy to make tech-based companies thrive in competitive ecosystems. Though STPs are just now transitioning from a third generation model (3GSP), or even a fourth generation model (4GSP), emerging issues indicate that alternative futures challenging the futures of the latter model are already on course. This paper is a preliminary study examining some of the weak signals shaping the next generation of STPs.

Keywords. futures studies, weak signals, science and technology parks, STPs

1. Introduction

The world is accelerating. New technologies, new social configurations and new crisis are arriving at faster paces every day. Networked and intelligent machines, engaged and experimental entrepreneurs, unimagined business models, reimagined environments. All this brave new world rising in the last couple of years will radically transform how we create goods and services, how we do business, how we run them and even how (and if) these companies will profit. Artificial intelligence, robotics, digital fabrication, nanotechnology, blockchain technologies, biotechnology, all these game changers happening all at once and at an even faster pace will set new standards, new business models and forms of organization, new foundations and even the very concept of business as we know it, especially, but limited to, the technology industry. If these changes will impact so deeply in the tech industry, the very way in which cities and countries promote these companies will also change. That is, the reinvention of the tech business and the tech company may demand that not just the role, but the very role of science and technology parks (STPs) be changed in the next decade.

For few decades the primary way in which cities and states have dealt with the development of technology and innovation went through the construction of dedicated areas and the promotion of public policies dedicated to the development of technology-based business and research institutes. The steep advancements in technology, communication and manufacturing in the early 80s generated a clearer comprehension of the fundamental importance innovation has for development and generation of wealth. Another widespread perception is that high-technology companies have critical role in the creation of new jobs. It was under that scenario that the world has seen a high increase in the number of STPs around the globe in the last few decades [Phan et al 2005]. STPs are primarily designed to foster innovation by allowing an environment of close cooperation between complementary institutions, usually at the same geographic area or region. Moreover, most of the STPs have among their objectives: to drive and focus initiatives to foster innovation, accelerate the creation of innovative and technology based companies and promote knowledge transfer between the academy and the market [Siegel et al 2003] [Phan et al 2005].

In order to accomplish that, STPs are properly and formally established organizations, with clear administration. They are often the result of public-private partnerships with the influence of multiple stakeholders (governments, entrepreneurial groups, academic community, etc) [Phan et al 2005]. In summary, Science and technology parks are "expected to provide access to critical human and physical capital for innovative companies" [Siegel et al 2003]. Another frequent objective of the Science and technology parks is to have an impact at the urban area it is located on, driving the development of specific areas or serving as the means for public policies on urban revitalization, densification or development, especially in Brazil [Zouain and Plonski 2015].

But what if the notion of jobs, formal jobs in particular, mean something completely different 15 years from now? What if geography is less important to closer cooperation than common purpose or casual encounters? What if the institutions involved in STPs are changed? What if new forms of governance and new metrics other than investment or revenue be the dominant way of measuring a companies' success?

This paper will raises some of these questions as a preliminary look at emerging issues challenging the futures of STPs. In it, signals of change will be examined in light of an specific episteme within Futures Studies. The paper will define the current, mainstream generation of STPs, differentiate from a newer, still under establishment generation of STPs, and ask how the signals challenge these assumptions.

2. Third and Fourth Generation STPs
In 2008, IASP in partnership with the Institute for the Future (IFTF) conducted a series of workshops focused on the futures of STPs. The resulting document, Future Knowledge Ecosystems [Townsend 2009] identified major themes and signals shaping the nature of this domain and were subsequently the subject of another analysis in The Fundamentals of Third Generation Science Park Concept [Kakko 2013]. In sum, the competitive edge of third generation science and technology parks (3GSPs) are:

- Focus on individuals and community building

- Pre-incubation – or network incubation as the 3GSP term goes – is strongly supported

- Ecosystem thinking

- Healthy balance between effectual entrepreneurship, start-ups, SMEs and established companies, also social entrepreneurship and virtual teams/organizations are supported

- Investments directed into advanced communication technology and community building – not necessarily into the real estate and new infra

- Geographically dispersed locations – like having a node (coworking space) in downtown location – and main activities in the university campus area

- Workspace design – both physical and virtual collaboration platforms – supporting open innovation principles and community building

- Understanding the importance of "sticky knowledge" in regional development context

- Serendipity management methodologies widely used

As new as it might seem, these concepts are already being pushed forward towards a next generation, whose premises that are still being delineated. An attempt at a fourth generation model (4GSP) was imagined even imagined [Formica] focusing on similar aspects, but considering the technological and entrepreneurial environment of the time. This new model is characterized by:

- Brain Exchange - the creation of an inter-cultural context of mobility and integration, opposed to a multi-cultural context of emigration and separation

- Circular Causality in the research domain - invention-to-innovation teams that work as very focused, mid-term research enterprises

- Multiple stakeholders - competitors, partners, complementors, suppliers, and customers

- Experimental Labs - foster special focus on high- expectation entrepreneurship and lean companies

It goes beyond the scope of this paper to establish the degree of success of different models of STPs, but the most successful STPs seem to be positioned somewhat between (or transitioning from) a third generation model and a fourth generation model. Both seem to address many of the most important issues that will impact STPs in the next decade, but since the future is accelerating, complexity and uncertainty are rising and the future is not what is used to be, it is necessary to consider other, more recent developments in technology, business models and societal changes that have the potential to radically change this environment in a very short time..

3. Finding Signals of Change

Spotting signals of change is probably the most fundamental activity in futures studies. Specifically, weak signals are the base of any attempt to vision and trace alternative futures. Although not often precisely defined on literature, weak signals can be understood as snippets of information regarding the potential of change of a system. Or according to [Mendonça et al 2004], "information on the likelihood of events whose probability is estimated to be very low but to which is attached a high uncertainty concerning the impact of those events and the trends that can develop afterwards, if any". Weak signals can also be defined as "small developments with potentially high impact" [Bishop and Hines 2014]. These can be emerging technologies, researches, new business, new behaviors, etc. Anything that challenges how we understand the world or, most fundamentally, how the status quo is defined. Also, how it reinforces some assumptions in new, creative ways. A weak signal, then, is any small development that challenges our assumptions about the present for they have a high potential of eroding the status quo and shape the future at the same time.

Most importantly, weak signals indicating changes in one domain can be found examining other domains [Bishop and Hines 2014]. That is especially important when researching futures of STPs. Since these are ecosystems, collections of different organizations, businesses, technologies, policies and people, it's necessary to employ horizon scanning techniques in a number of different domains related to STPs, take these more particular signals into consideration and examine them in search of assumption being challenged.

The weak signals analysis is usually a constituent tool within the environmental scanning activities. Horizon scanning and weak signals analysis are two of the most common futures studies approaches for systematic identification of emerging issues (trends, threats, risks, opportunities) and evaluation of its potential developments in the future. As per [Van Rij 2010], horizon or environmental scanning can be defined as:

"Horizon scanning is the systematic examination of potential (future) problems, threats, opportunities and likely future developments, including those at the margins of current thinking and planning. Horizon scanning may explore novel and unexpected issues, as well as persistent problems, trends and weak signals. Overall, horizon scanning is intended to improve the robustness of policies and to identify gaps in the knowledge agenda". Environmental scanning applications can be divided into six stages [Sutherland et al 2009]:

- **Scoping the issue** - agreement among all participants on the questions the project will answer.

- **Gathering information** - application of tools to collect relevant and credible information within the previously defined scope. It can be employ literature research, expert groups workshops, among other techniques.

- **Spotting signals** - consists on identifying the indications (signals) which best describe what is happening in the scope selected.

- **Watching trends** - study historic performance to identify emerging trends.

- **Making sense of the future** - establish the relations among drivers and trends, based on the information gathered to allow the description of possible, plausible, different and relevant futures.

- **Agreeing the response** - search the agreement on the preferred future and derive or plan the necessary steps to reach it.

  Thus, the main challenges for environmental scanning are to gather credible and relevant evidences that will support planning and decision or policy making [Amanatidou 2012]. Such methods have recently been used on several different private and public organizations for strategic purposes, including national level departments in governments like UK, Denmark, Netherlands and Singapore [Van Rij 2010].

  In the case of STPs, the scanning's scope searched for signals among the information technology field - researches, businesses education and digital culture - in books, publications, news and eye-witnessed developments in STPs.

4. Signal Analysis
After scanning the horizon after weak signals of change that'd impact STPs, a total of 10 signals were collected and analyzed to "make sense of the future" comparing them with assumptions about 3GSPs and 4GSPs, how the signal challenges or reinforces them and its potential impacts.:

The signals and their analyses are as follows:

a) Descentralized Autonomous Organizations (DAO)

- What's the signal: A blockchain "company" run exclusively by algorithms.

- Making sense: It challenges the assumptions that humans are needed to assure an organization's governance. It also challenges the Focus on individuals and community building, Geographically dispersed locations, Workspace design and Serendipity Management in STPs models. Incorporeal, fully digital organizations have the potential to turn the whole industry upside down. If DAOs become a reality, entrepreneurship could be reduced to the creation of better algorithms, which would require a total reinvention (if not obsolescence) of STPs. Its bodiless structure demands no working space, challenges traditional business incubation and acceleration programs, it even redefines

the ter entrepreneur. The role of research environments, closer to universities, would be much more important for creating these organizations. Also, much of STPs as policymakers could be automated by a DAO - it could manage and allocate resources, develop projects and flawlessly report to stakeholders.

b) Numerai

- What's the signal: A hedge fund run solely by algorithms.

- Making sense: It challenges the assumptions that humans are needed to manage investments. It reinforces the notion of Investments directed into advanced communication technology and community building but in a new, radical way. First, it uses data science to "predict" what kind of investment will work and pays in Bitcoin for that prediction. Second, it's a bottom up initiative and extremely distributed (2,700 investors). This signal changes the startup ecosystem, providing an easy way to invest in risky ventures based on data alone. It also reinforces the Brain Exchange, Multiple Stakeholders and Experimental Labs assumptions about 4GSPs, and the Pre-incubation in 3GSPs, but again in more radical ways.

c) Tapioca Valley

- What's the signal: Entrepreneurs from Caruaru, Pernambuco, are setting up an STP of their own.

- Making sense: It challenges the assumption that STPs are public policies driven and implemented by governments and the Experimental Labs item in STPs model. Tapioca Valley is an attempt by a number of tech entrepreneurs from Caruaru, in Pernambuco's countryside, to establish an STP. Inspired by Porto Digital, the STP is made of SMEs that are willing to rent a building in downtown Caruaru even if they don't get support by the local government. This may indicate that coworkings and business associations are evolving to something more connected to geography and community-making.

d) BeerOrCoffee

- What's the signal: BeerOrCoffee, a Tinder-like app for entrepreneurs.

- Making sense: It's the Starbucks effect without Starbucks. It challenges the assumption about Serendipity Management, putting that notion one step further. Serendipity management has been a hot topic in developing STPs communities. But apps like BeerOrCoffee show that managing serendipity may take another step. Designing/engineering serendipity via apps and algorithms may produce a much more profound effect in connecting not just business partners, but workers/entrepreneurs with complementary skills. The signal may also indicate that managing or designing serendipity may not be of an STPs concern in the next few years.

e) Smart Villages in India

- What's the signal: India is sponsoring 60 "smart villages" in its countryside

- Making sense: STPs, usually taken as examples of "smart cities" are focused on entrepreneurship and tech development, which is not the case here. It also challenges the assumptions in STPs models of Balance between entrepreneurship, start-ups, SMEs and Experimental Labs. Smart Villages may be a new kind of STP or area of innovation emerging out of a strong driver: positive impact. These villages focus on energy innovation and are focused on hyperlocal development instead of market-driven entrepreneurship. These villages may indicate that STPs, who already have a high impact in urban environments, may begin focusing on developing social wellness and community development.

f) Subject-less education in Finland

- What's the signal: Finland removed the divisions between subjects in its schools

- Making sense: Tech companies are built under specialties. But education is becoming less specialty-focused and more experiential/experimental, developing broad knowledge and problem-finding skills. Though sticky knowledge is fundamental in regional contexts, knowledge is becoming a flux, shared by a number of people without a proper specialist.

g) 42

- What's the signal: a computer science university without teachers, subjects or fees in Silicon Valley.

- Making sense: learning, especially in superior schools, always needed tutors and subjects. No more. But many teachers quite often become entrepreneurs or serve as the entry point for new startups. Community building, Brain Exchange and Sticky knowledge classh in amplified, potentially disruptive way in 42. Learning is not only project-based, but the development of projects and the research for subjects approiate to the project are totally up to the students. It's an Experimental Lab in itself, but it may also indicate, because of its exclusivity, that only the most talented coders will experience a startup-like education envirentment.

h) Moving back from Silicon Valley to San Francisco

- What's the signal: entrepreneurs move back from the Bay Area to San Francisco

- Making sense: The Silicon Valley area on the periphery of San Francisco has always been the place for tech entrepreneurs and their enterprises. But slowly tech entrepreneurs are moving back from Palo Alto and other cities to San Francisco. Despite the high prices in rents, these entrepreneurs are chosing better quality of life and fun of a major city instead of the always business, always research life of the Valley. It reinforces some assumptions about Geographically dispersed STPs, but in a different way. Entrepreneurs are chosing life instead of workspaces.

i) Porto Digital: a lab to live in

- What's the signal: Porto Digital STP will have a crèche and has a hostel

- Making sense: STPs are basically number of policies and geographies to leverage a tech-based business ecosystem. But it may become a set of policies to build a different kind of neighborhood focused on living spaces and not just businesses. Porto Digital, a Recife-based STP is about to build its first crèche to help mothers keep working in the park. Also, it's slowly gaining living spaces in the form of hostels and hotels, so it may indicate that it may become a hybrid between Silicon Valley (where companies and families coexist) and more traditional policy-focused STPs.

j) Masdar fails to deliver

- What's the signal: Masdar smart city fails to deliver after 10 years

- Making sense: Traditionally, STPs are areas built from the ground up to house research labs, startups and big companies, all in one single building. One radically augmented approach appeared ten years ago in Abu Dhabi. Masdar, a planned smart city started being built with the purpose of attracting scientists, entrepreneurs and the general public to populate an area deep in the desert. After ten years, it still hasn't delivered its promise, challenging the assumption that STPs built from the top down (contrary to the spontaneity of Silicon Valley and the bottom up strategy of Porto Digital, for example) are still a valid model. It challenges the notions of Serendipity management, Brain Exchange and Experimental labs.

5. Final Considerations and Further Developments

The world is experiencing accelerated change and the tech industry is experiencing it in an even faster pace. Science and technology parks will have to deal with new technologies that will enable new business models and forms of organization that'll radically transform how and where they tech businesses are established. This paper examined some signals of change challenging assumptions of two new or emerging STPs models. Though it's still not enough to draw any conclusions – especially because Futures Studies are not about conclusions, but qualified questions and scenario building – it's fair to assume take some aspects into consideration based on the signals collected and the challenges they pose:

- Future STPs may not be just for companies or businesses. They may be "parks" built for living or for leveraging communities' wellness. Policies may be directed to social innovation and not just for building profitable companies.

- Highly connected, impact-driven entrepreneurs may use technologies to improve the lives and the infrastructure of their communities without the help of governments of even formally constructed STPs.

- The role of education should also be taken into consideration. STPs may well be ecosystems of knowledge, but the construction of this knowledge will be extremely decentralized and informal. The classic role of universities in helping establish STPs and startups may change radically in the next few years.

- STPs may still be about policy-making and business, but extreme tech like AI, Big Data and Blockchain may automate many of its leader's roles and even automate funding, and incubation

- These technologies may also be used to push serendipity one step further. Engineering or designing serendipity in extremely dispersed environments may be the primary role of STPs. They may move from policy-making machines to fortuitous encounters open spaces. From buildings to people.

Next steps in this research effort include gathering more signals of change, challenge every aspect of STPs models shown befor, talk to specialists in the field and finally run futures workshop to build scenarios and, most importantly, design directives for next generation STPs.

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