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# Areas of Innovation in cities: From inception to maturity. The Case of 22@Barcelona

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**Abstract:** The knowledge based-economy provides the opportunity to create Areas of Innovation in old industrial districts to revitalize urban areas. In this context, Triple-Helix agents play complementary and co-evolutionary roles in the urban, economic and social dimension. New strategies are therefore needed to overcome the traditional science park perspective. The goal of this paper is to better understand the evolution of Areas of Innovation, from inception to maturity, and how, the role of the Triple-Helix agents change along their lifecycle. To illustrate this evolution we examine the case of 22@Barcelona, an Area of Innovation that transformed an old industrial district into a knowledge-based one, integrating urban, economic and social development. The original value of this work is that it proposes a new perspective for the theorization of Areas of Innovation.

**Keywords:** Areas of Innovation; Science Parks; Triple Helix; Clusters of Innovation; Innovation Districts; Knowledge Cities; Lifecycle; Co-evolution 22@Barcelona

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## 1 Introduction

Although the “triple helix” approach has been tested from different perspectives, scholars are still searching for new frameworks that help to better understand how innovation

ecosystems evolve. Science Parks built in regenerated zones of inner cities have generated important attention from a wide range of stakeholders, from policymakers to researchers of innovation ecosystems. Their role has been deemed as crucial in the evolution of the innovation ecosystems of cities in the Knowledge-based economy. However, traditional Science Parks have to evolve in order to play a significant role in the Knowledge Cities of the knowledge-based economy.

City planners can not avoid facing the challenge of playing a relevant role in the Knowledge-based Economy where face-to-face interaction, networking and trade remains vital (Landry, 2000). The tendency of urban planners is now to replace old manufacturers and industrial metropolitan areas with Knowledge Cities, which emerge from the balance between the production system and the urban cultural environment (Scott, 2006). Cities that stimulate and rejuvenate various forms of knowledge serve as knowledge centres (Knight, 1995) and attract a creative and highly skilled workforce (Florida, 2008). Unlike traditional Science Parks, Knowledge Cities host significant concentrations of creative industries, including high technology, artistic and cultural sectors, which are integrated in a wider social context (Scott, 2000).

This research combines the benefits from many studies that have been developed around cluster organizations (see e.g. Porter 1990, 1998) and the location of knowledge-based clusters in the inner cities (see e.g. Porter, 1997; Leibovitz, 2004; Godospini, 2006). In recent years, some scholars have also included the artistic, cultural and social approach in this research field and have focused on analysing Creative Cities (see e.g. Scott, 2000, 2006; Lazzeretti and Nencioni, 2005), Industrial Districts (Becattini, 1986, 1990); Knowledge Cities (see e.g. O'Mara, 2005) and Innovation Districts (Katz & Wagner, 2014).

By exploring conceptual frameworks like Triple Helix, Clusters of Innovation, Co-evolutionary theory, learning region theory and lifecycle of a new venture, our aim is to shed some new light on the process of the evolution of traditional Science Parks to Areas of Innovation in Cities that want to have a role in the Knowledge-based Economy. Although existing literature has focused on the evolution of traditional Science Parks, there is a lack of research clarifying those factors that explain the evolution, either organic or intended, from traditional suburban Science Parks to Areas of Innovation that participate in creating Cities for the Knowledge-based Economy. The goal of this paper is thus to propose a framework that assists in the understanding of the evolution of the Areas of innovation in cities, from inception to maturity, and how the role of the Triple Helix Agents (University, Industry and Government) changes along the lifecycle of an Area of Innovation.

For the purpose of this study, we use a case-oriented research, specifically, the 22@Barcelona district, a case of a sound effort in building an Area of Innovation promoted in the metropolitan area of Barcelona and that flourish from a traditional Science Park regenerated from an inner district of the city. The 22@Barcelona district is currently a model for 'innovation districts' in cities (Pareja-Eastaway and Pique, 2011; Cohendet et al. 2011 and Casellas and Pallarès, 2010, among others), also international stakeholders such as the International Association of Science Parks and Areas of Innovation (IASP World Conference 2009, 2012, 2013, 2015) consider 22@Barcelona as a reference source for policy transferability and experience-based knowledge. More than 354 delegations from all continents were visiting 22@Barcelona from 2011 until 2015 according to the data from the Barcelona City Council.

Complementary cases as the Boston's Innovation District, Porto Digital in Recife, Yachay in Ecuador, Skolkovo in Moscow, the *Quartier de l'Innovation* in Montreal and Kendall Square in Cambridge (MA) have been used to complement the extracted knowledge from the @22Barcelona Case. All these projects, are promoting Areas of Innovation that develop the Knowledge-based economy and combine the locations for working and living.

This research provides a new perspective for Areas of Innovation in cities, understanding that along the evolution of the Area of Innovation, all Triple Helix agents play different roles in the dimensions of the transformation (urban, economic, social and governance) and co-evolve in the phases of lifecycle (inception, launching, growing and maturity).

## **2. Transformation of Cities: New Economy Metropolitan Clusters**

In the last twenty years, many studies have analysed how cities are adapting to the global economy. Ranging from general overviews of development and organization of inner cities (Sassen, 1991, 1998, 2002; Knight, 1995; Gospodini, 2006) to more specific subjects such as gentrification effects (Atkinson, 2004), sustainable development (Hall, 1997), urban environment and health (McMichael, 2000), urban regeneration policies (Marcotullio, 2003; Atkinson, 2004; Thomson *et al.*, 2006), and cities' competitiveness (Brotchie *et al.*, 1995; Jensen-Butler *et al.*, 1997; Lever, 1999; Strambach, 2002), among others. Special attention has been paid to the development of the New Economy in the inner cities (Hutton, 2000, 2004) and of Urban Knowledge Parks (Bugliarello, 2004) and Creative and Knowledge Cities (Lever, 2002; Florida, 2005; Costa *et al.*, 2008; Pratt, 2008).

New cities retain hardly any of their former traditional, local and static nature (Porter, 1995). In the inner cities, clusters of interlinked firms and organizations operate at world-class levels of competitiveness (Porter, 1998). Companies take advantage of *social agglomeration* factors such as critical masses of skills and relationships, access to information, and the availability of specific infrastructure in a given field (Utterback and Afuah, 1998; Hutton, 2004; Porter, 1995). As a result of agglomeration effects, New Economy Metropolitan Clusters comprise not just isolated firms but rather substantial ensembles of dynamic industries (Hutton, 2004) that have been transformed into Urban Science Parks or Areas of Innovation (Luger and Goldstein, 1991; Massey *et al.*, 1992).

Increasingly, knowledge-based and technology-intensive industries are taking the place of old industrial—and, in some cases, even residential—districts in the large urban agglomerations (Hutton, 2004). As clustering forces drive talented, innovative and creative people to concentrate in the most knowledge-intensive cities and regions (Florida, 2008), in the New Economy the tendency is to attract the talent by promoting the creation of New Economy Metropolitan Clusters (Chica & Marmolejo, 2016) that set up “new” versions of traditional Science Parks.

These new Science Parks combine *technology*, including computer graphics and imaging, software design, multimedia industries and graphic design industries that have been deeply influenced by technological development; *culture* represented by creative human capital and design functions; and *place* more specifically the innovative milieu of the inner city (Hutton, 2004).

### **3. From traditional Science Parks to Areas of Innovation in Cities**

#### **3.1. Growth and Failure of Science Parks**

The evolution of Science Parks may be easily understood within the framework of the learning region theory (Morgan, 1997). First, this theory supports that the evolution of the development is based on an iterative process where policymakers act in a cycle of defining and re-defining innovative projects. Second, the theory supports that in many cases innovation is shaped by a variety of institutional routines and social conventions.

Furthermore, the Co-evolution Theory, explain the relation of Technology, Industrial Structure, and Supporting Institutions (Nelson, 1994). On the one hand, this theory poses that a new technology evolves along a relatively standard track from the time it is born to its maturity, and that firm and industry structure ‘coevolve’ with the technology. On the other hand, it is concerned with the development of institutions in response to changing economic conditions, incentives, and pressures.

The first steps of the Science Park evolution started with the extraordinary success of Silicon Valley. This healthy, resilient and sustainable innovation ecosystem arose spontaneously (Saxenian, 1994), from the co-location of research universities, investment capital, entrepreneurs and a talented workforce in an environment offering a high quality of life (Munroe and Westwind, 2008). Following a co-evolutionary approach, the success of this Cluster of Innovation (Engel and Del-Palacio, 2009) was rapidly recognized, and many regions around the world tried to reproduce it. However, by replicating the steps of the exemplary Silicon Valley evolution, in most cases, these agglomerations of knowledge-based organizations (Massey, Quintas and Wield, 1992) failed to become active Clusters of Innovation (Engel and Del-Palacio, 2009). Most of these archetypal Science Parks failed in the incubation stage or early stage, (Luger and Goldstein, 1991) and lacked a social dimension (Massey, Quintas and Wield, 1992) that led to the abandonment and disintegration of the archetypal Science Parks.

#### **3.2. Flourishing of Areas of Innovation**

The so-called Cities of Knowledge or Areas of Innovation are consciously planned communities that are physical manifestations of a particular political and cultural moment in history and shaped into new and influential high-tech urban environments (O’Mara, 2005). These metropolitan areas have a positive economic impact in their environment as they put into play many dynamic and innovative institutions and attract educated and skilled workers who consume cultural products of all kinds at an accelerating pace (Scott, 2000; Boix and Trullen, 2006). The goal is to promote a sustainable social and economic

reconstruction to reduce social polarization and renew the economy of the region (Etzkowitz and Dzisah, 2008).

In this context, the International Association of Science Parks (IASP) added “Areas of Innovation” to its name, and approved the definition of Area of Innovation as “places designed and curated to attract entrepreneurial-minded people, skilled talent, knowledge-intensive businesses and investments, by developing and combining a set of infrastructural, institutional, scientific, technological, educational and social assets, together with value added services, thus enhancing sustainable economic development and prosperity with and for the community.”

#### **4. Holistic Approach of Areas of Innovation in Urban, Economic and Social Transformation**

Areas of innovation create a model of dynamic innovation based on the concept of the “triple helix” (Etzkowitz and Leydesdorff, 2000) which enhances the confluence of Public Administration, Universities and Companies in order to develop synergies between these strategic agents. Collaborative relationships are on the basis of the development of the triple helix. Besides, the different actors involved are supposed to assume different roles than the traditional ones, providing therefore, the opportunity for innovation.

Certain cities definitely offer a better set of attributes for businesses and economic activity than others; these include simultaneously tangible assets in the form of physical elements easily measurable (i.e. highways, airports) and more indefinite elements such as image, the quality of governance and social and cultural features (Roberts & Sykes, 2000; Begg, 2002). In the following sections, some of these attributes are described.

##### **4.1. Infrastructures and urban development**

The historical development of cities has a huge influence on their current situation. The association of a city to a specific economic profile does not emerge immediately. To a large extent, the past determines the present of cities. Consecutive economic transformations inexorably leave their legacy in the territory.

The availability of good infrastructure and transport connections as well as centres of higher education, the availability of capital and labour with the necessary qualifications, together with an institutional context that favours the location of business through programs and specific actions such as fiscal exemptions or land at a below market price have been the factors traditionally considered as determinants of the economic location of business.

## **4.2. Companies and economic development**

Traditionally, special importance has been given to the advantages of agglomeration economies, the economies of scale and clustering as promoters of economic growth. Industrial clusters have been analysed and identified as playing a highly relevant role in the analysis of innovation and the definition of political support of industrial activity (Porter, 1990).

According to Porter (1998), clusters reflect a top-down approach to promote a certain region, which basically consists of grouping different stakeholders (universities, technology and research centres, business, management and financial resources both private and public) interested in working together in an economic sector.

## **4.3. Talent and social development**

Talent and social development underline the importance of particular equipment or urban attributes that contribute to the creation of an attractive environment for people. Since talent has become the engine of the new economy based on creativity and knowledge, these aspects associated with the region have become more important than location factors for economic activity (Florida, 2005).

Personal or professional networks, implicit or explicit, become the connectors between stakeholders who participate in different parts of the economic activity. In fact, network factors are an alternative formulation to the classical location factors, closely related to the aspect of connectivity that offers a good provision of infrastructures. Besides, they also involve those aspects which signpost the individual path of people and their attachment with the territory (Pareja-Eastaway and Pique, 2010).

## **4.4. Governance**

Areas of innovation are based on a model of dynamic governance of the “triple helix” (Etzkowitz and Leydesdorff, 2000) which enhances the confluence of public administration, universities and companies in order to develop synergies between these strategic partners to increase the competitiveness of the production system and assist in the creation, growth and consolidation of employment. Collaborative relationships from the basis of the development of the triple helix: this interaction results from the synergies created in the territory among stakeholders rather than from a ‘prescription’ from the authorities.

The different stakeholders involved assume different roles than the traditional ones, providing the opportunity for innovation. Consequently, vertical (sectors) and horizontal (transversal) governance are necessary to articulate clusters and the Areas of Innovation (holistic approach). The incorporation of citizens’ needs and city challenges in the quadruple helix (Leydesdorff, 2012) is another strategic decision to make when developing a governance model.

## **5. 22@Barcelona Case**

### **5.1 Overview**

22@Barcelona began as a unique opportunity to partially transform Poblenou, a neighbourhood with productive vocation that converted the old textile industrial district of Barcelona, into a platform for innovation and knowledge economy at an international level (Pareja-Eastaway and Pique, 2014).

In 1998, after a considerable political debate about how to regenerate the 200 Ha of obsolete industrial area, Barcelona bet decisively and unequivocally to preserve the production profile of this territory but also aiming at combining residential uses in the area. The 22@Barcelona District looked for a long term urban transformation that progressively regenerated industrial areas, both from the revaluation of its architectonic environment as from improving the quality of his public space. Instead of the conventional form of changing completely the urban space, this process was developed establishing a balance between maintaining and renewing, which allowed the definition of new urban images in a context of continuity with earlier forms.

The process started in 2000 with an initial phase of urban renovation and the provision of high quality infrastructures. In 2004, 22@Barcelona approached a new era of intense economic and social renewal: several strategies were developed aiming to create Urban Clusters of Innovation focusing on various emergent sectors which Barcelona considered should be represented in the city's economy. They were media, information and communication technologies (ICT), medical technologies and energy. In some cases, these sectors were clearly rooted in the territory like the media or ICT, in some others, they were a clear bet for attracting and promoting them in the city. At a later date, in 2009, design was added to the first four. The process aspired to concentrating on the territory businesses, public administration agencies and scientific and technological centres of reference in these strategic sectors.

22@Barcelona agency was created to manage the district from the very beginning looking for its economic promotion and the international projection of business and academia (research, education and knowledge transfer). Up until now, this agency has led all development projects to stimulate innovation in the district and has provided all support services to companies.

According to the Report 22@Barcelona 2000-2015, renovation has achieved on approximately 70% of the Poblenou industrial areas through 150 approved urban transformation plans, of which 141 have been promoted by the private sector. The total approved plans account for 3,029,106 m<sup>2</sup> of floor space. This is more than 140,000 m<sup>2</sup> of land for facilities and nearly 1,600 housing units with some sort of public subsidy.

Regeneration of the district has led to the establishment of 10 universities with a total of more than 25,000 students, 12 R&D and technology transfer centres, and the current census of businesses in the 22@Barcelona area shows a continued growth.

According to the 22@Barcelona Business Census 2015, more than 8,223 companies are located in 22@Barcelona, and more than 93,000 jobs are now in the district. The total turnover of the companies of the district is the 10,300 million Euros, 32.3% are Knowledge Based companies and the 27.4% are exporting companies. The 40.4% of the companies are related with Clusters.

## **5.2. Infrastructures and Urban Development at 22@Barcelona**

The objectives of the 22@Barcelona Plan were stated to renew the urban and economic Poblenou (Pareja-Eastaway and Pique, 2011) suggesting a compact and diverse city with a balanced and sustainable focus, instead of a model specialized on industrial land. Therefore, the new economic activities coexist with research, training and technology transfer, housing, equipment and trade, in one high quality environment, whose density makes it compatible with a balanced allocation open space and equipment.

On the one hand, through a system of incentives for the real state, urban renewal processes contribute to the redevelopment of all streets with the renewal of infrastructure, improved quality and capacity of the urban services and of the new organization of the urban mobility. In addition, free land was generated for the community from initial 100% private land, with the transformation, 30% of the land will become public land-to create new green zones, facilities and social housing. On the other hand, the so-called “@” activities are favoured. These activities are those that use talent as a main productive resource.

Thus, the progressive transformation of the industrial land solves historical deficits and restores the social and business dynamism that has historically characterized the Poblenou. Since the project’s inception in 2000 until now, the urban renewal project involves the creation of a diverse and balanced environment where most innovative companies coexist with research centres, training and technology transfer and with shops, housing and green zones, that promote social and entrepreneurial dynamism.

## **5.3. Companies and Economic Development at 22@Barcelona**

A cluster strategy was developed in the District in order to promote the Knowledge-based Economy. In 2004, adding value at the physical transformation (urban and infrastructure), 22@Barcelona developed policies centred on emerging sectors with local assets and international opportunities to grow: media, information technologies and communication (ICT) medical technologies and energy. In 2008 began the design cluster as a new strategic sector of Barcelona (Pareja-Eastaway and Pique, 2014).

Promoting urban clusters in the territory of 22@Barcelona, the district improved the innovative capacity of the ecosystem of innovation. Each of the five clusters of 22@Barcelona was located in the district in different levels of maturity. The methodology followed in all cases was on establishing a Cluster Program. 22@Barcelona promoted the creation of sectorial centres of technology transfer as tools for better connection between research (universities) and companies. 22@Barcelona was working on consolidating these, as Barcelona Media Foundation in the sector audio-visual and Barcelona Digital Foundation sector ICT. In 2009, support was given to BCD (Barcelona Center of Design) and the consolidation of IREC (Institute for Energy Research Catalonia) which together with b\_TEC were leading Energy Cluster.



In 2008, with the strategic objective of strengthening the support to companies that wanted to be located in the 22@Barcelona, the initiative 22@PLUS was promoted. The 22@ PLUS was conceived as a compact value proposition to companies looking at possible relocation in the district and consisted of a catalogue of services that included comprehensively all the elements of value added at 22@Barcelona. This initiative is now the Business One-Stop Service (OAE) for companies wishing to settle down in the district.

#### **5.4. Talent and Social Development at 22@Barcelona**

To develop a talent management strategy that supplied the raw material for the Knowledge Economy, 22@Barcelona managed the implementation of university centres in the district with the objective of locating talent in the district and installed critical mass of talent and new generations of talent.

It was promoted in primary and secondary schools with the aim of influencing scientific and technological vocations, entrepreneurship and understanding of global citizenship. These actions connected schools with clusters developed in the District (CreaTalent Program). As such, 22@Barcelona led to an approach of schools with businesses, promoting career guidance (Porta 22) and workplace internships (Staying in Company) and employability (Talent Marketplace 22@). Likewise, with the aim of developing a community of professionals in the District, 22@Barcelona promoted events such as the 22 @ Update Breakfast which served to interrelate across profiles and create a sense of belonging.

Universities and companies acted as true International magnet Talent. In this sense, landing performances were promoted for the international community, ensuring a comprehensive welcome. Publications such as "Welcome to Barcelona" which describes international schools or practical processes of life in Barcelona facilitate the implementation and integration of newcomers. In parallel, 22@Barcelona developed social programs in order to involve the neighbourhood. Programs as Digital District have included grandparents and parents in the process of the district by digital training programs.

#### **5.5. Governance at 22@Barcelona**

The 22@Barcelona was driven by public initiative with a long-term vision (20 years). For its development, it was necessary to share the vision and strategy with Investors, companies, universities, civil society and other public authorities. The involvement of agents in the process has been a key factor throughout the development. It has been promoting different hybrid structures (University, Industry, and Public Administration) that ensured alignment interaction and a collective project.

Vertically Triple Helix structures were promoted (Pareja-Eastaway and Pique, 2014) to take responsibility for each of the clusters. Barcelona Media Foundation and Barcelona Digital Foundation are good examples of governance. Horizontally it had promoted the formation of the 22@Network, the Association of Business and Institutions of

22@Barcelona. This partnership with the body of trustees and the commissions on Innovation, Talent, Sustainability and entrepreneurship acts transversely, bringing together enterprises and professionals of the District. The horizontal and vertical institutionalization served to strengthen the district beyond its initial impetus public, creating a governance matrix. The annual agreement with the 22@Network has facilitated the alienation and commitment to the development of the District.

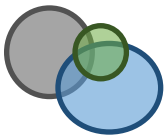
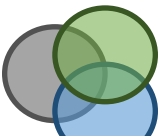

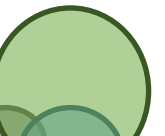
## 6. Proposing a Lifecycle approach for Areas of Innovation

An Area of Innovation (AOI) needs urban, economic and social transformation, as a result of the contribution of Government, Universities and Industry, from the inception moment until the maturity.

Taking as a simile the life cycle of a new venture (Freeman and Engel, 2007) the following section explores the different stages of development of an AOI: inception, launch, growth and maturity (Table 1). Taking advantage of the stages, it would be easier to better understand the role of every agent of the triple helix model (University, Industry, Government) in each phase for the different dimensions (urban, economical and social).

At each stage, the need to align hard and also soft factors in order to contribute to the mobility of the key resources of an innovation ecosystem—people, technology and capital—is also examined (Engel and Del-Palacio, 2009). Implications are discussed in terms of location decisions and the urban transformation of the region.

Table 1. Lifecycle of Areas of Innovation

	Definition	Launching	Growth	Maturity
Triple Helix configuration *				
Key role	Government and Universities	Adding tractor companies	Assignment of leadership in business associations and clusters	Explicit leadership from companies, talent and related networks
Talent and social transformation	Promoters	Managers of the AI	Communities and networks	International networks Local social networks
Companies and economic	Involvement of Key Institutions: Universities, Government and Associations of	Tractor Companies Location of research and technology centers	Attraction of companies Creation of companies	Growth models Decentralization and internationalization Super clusters

transformation	Companies	Incubation and landing services	Clusterization Open innovation Management	Megaregions Network of networks of research and innovation
Infrastructures and urban transformation	Planning	Utilities Consulting Real estate Developers	Investors Real estate Developers	Territorial growth Exporting the model

\* The blue circle denotes the government. In green, universities and research centers. In purple, industry and firms.

### 6.1. Inception

From an institutional perspective, the enhancement of a specific area with the aim of creating an urban innovation ecosystem requires identifying a local context that ensures that talent, technology and capital will be able to loosely flow (Etzkowitz and Leydesdorff, 2000). The location should also act as a space for interaction and residence. Nevertheless, each region shows particular identity features, such as culture, a distinctive educational system or a specific knowledge transfer policy, which shape the development of the region and determine its own learning capabilities (Doloreux, 2002). The transformation of the existing environment into an AOI is thus a complex issue.

In the definition stage, major strategic decisions on where to settle the innovation ecosystem are taken. Once the location is chosen, a feasibility study of urban, economic and social development is critical in order to evaluate the economic viability of the project. Given the peculiarities of each region, the conceptualization of AOIs and the form they might adopt differ from one case to another. Because of these differences, it is difficult to converge on a homogenous policy design. Nevertheless, from the study of current examples, it is possible to identify two opposed creation strategies. Differences lie in the desire to create something from new or to exploit something already existing by undertaking a formalization process. Accordingly, we distinguish between directed and spontaneous planning strategies.

The directed planning strategy evidences a deliberate creation scheme for concentrating innovative activities. Urban or metropolitan planned actions efforts are directed towards bringing together highly valued activities through infrastructure planning, usually guided by the intervention of industrial policy. In these circumstances, the underlying idea is to create something from scratch in an attempt to provide the territory with a more dynamic environment. The 22@ district in Barcelona, the Boston's Innovation District, and Porto Digital in Recife illustrate this strategy (Nikina and Pique, 2016). Powered by local authorities, these districts were originally industrial areas that had traditionally been very active, but over the years had been abandoned (brown field). Aiming at creating value-added activities that boost the economic dynamism of the city, local authorities lead a

transformation process that entailed an entire re-make and reinvention of those infrastructures and spaces that were underutilized, giving them a completely different purpose and usage. Also in directed planning strategies we will find projects like Yachay in Ecuador or Skolkovo in Moscow (Nikina and Pique, 2016), starting new developments of AOI's from green fields.

On the contrary, the spontaneous planning strategy is the result of an unplanned spatial concentration of innovative activity originated by the sum of independent initiatives coming from actors located in a particular area under the umbrella of anchor institutions. In this case, the AOI is created as a result of institutionalizing an endogenous dynamic environment that has emerged spontaneously. While at the beginning basic services are provided for the coverage of the daily activities, as the movement of resources (people, technology and capital) increases, there is a need for urbanizing the environment and providing the place with the appropriate spaces and infrastructures that transform the area into a living lab, including housing and real state opportunities, as well as recreation services. Aiming at improving the externalities and the interrelations between the different stakeholders located in the same geographical enclave, the AOI is then formalized. The Silicon Valley and the *Quartier de l'Innovation* in Montreal are perhaps the most iconic examples of this strategy

## **6.2. Launching**

The planning of land and the development of basic infrastructure lay the foundations for the installation of the first tenants. Anchor institutions such as universities, hospitals, or major corporations adopt a leading role, acting as innovation catalysts, particularly, in the launching stage. Anchor institutions are envisioned as important providers of knowledge and expertise. As such, they cluster and connect with start-ups, business incubators, and accelerators, in the pursuit of an innovation ecosystem that aligns research interests with business needs and social welfare. A good example of an AOI that has been built around anchor institutions is the Kendall Square in Cambridge (with the Massachusetts Institute of Technology and the Mass General Hospital acting as anchor institutions)(Nikina and Pique, 2016).

Anchor institutions are necessary but not sufficient. At this stage the innovation community needs to make use of its own resources, leverage core competencies, interact with similar communities, and experiment innovation by taking risk and a global perspective. Such an agenda of intentions helps develop the behaviours that would create value and enhance the innovation potential of the area. A top-down government and institutional action combined with a bottom-up emergent performance of entrepreneurs and investors can help in building the structures that enable such a culture of collaboration.

Alongside with reference buildings and incubators, housing and the social dimension must be considered to retain talent and attract investments. An Area of Innovation should

have a well-defined physical personality and a stimulant work and social environments. Subject to the creation strategy of the AOI, the historical development of the city may have a huge influence at this stage. The acceptance of a specific growth model neither emerges nor is fully implemented immediately. Consecutive economic transformations inexorably leave their legacy in the territory. Therefore, economic, social and institutional path dependency hinders or boosts the development of an AOI.

### **6.3. Growth**

This stage incorporates all the elements of the ecology of innovation, and mainly focuses on attracting businesses and investors, creating new ventures, and promoting business clustering and networking.

In this phase the AOI is well developed in urban planning and the infrastructures are implemented. The challenge is to attract in one hand real estate investors that will build buildings for allowing the landing of the future tenants, and in the other hand stimulate companies to choose the AOI as the right place to be for growing.

In parallel, it is also paramount to create a new generation of start-ups, offering them facilities and special programs to grow. Entrepreneurial competitions focused in the AOI's sectors, training programs, networking and specialized investment will be the magnet for attracting young talent.

The cluster strategy will need appropriate governance. The establishment of public-private-partnership (PPP) platforms aggregating universities, industry and government working together in common projects and promoting the best synergies between big corporations and new entrepreneurs and investors is a key step before the maturity process. In the case of 22@Barcelona, a cluster strategy was developed, promoting the clusters of IT, media, tech-media, clean energy and design. For each cluster, a PPP was created in order to manage the vertical clusters.

Horizontal links are also necessary, connecting professionals and companies in a transversal way and allowing a better integration of the international talent and the new companies located there. Continuing with the example of the 22@Barcelona, the 22@Network was created to promote these interactions and foster the engagement of the companies in the district with the project.

### **6.4. Maturity**

This stage focuses all its efforts on the development of activities that maximize the ecology of innovation and the connection with other international hubs of innovation. The global connections will be the key expression of the maturity of the AOI.

Following the Global Networks of COI framework (Engel and Del-Palacio, 2009) the adoption of a global perspective serves to enlarge the economies of scale. Mobility and unbundled interactions with other AOIs contribute to cross-fertilization and give firms a global advantage based on orchestrating diverse networks to exploit new opportunities and gain access to international assets and resources. These connections are created by mobile people and their personal relationships, which create linkages (weak ties, durable bonds and covalent bonds) that allow for the formal and informal exchanges of value. Because of these international connections, at this stage the AOI expands geographically to neighbouring areas. It might also become an international reference model for other areas.

In the social sphere, there is a clear focus on the integration of the international community installed in the area. The AOI assumes the leadership in talent management, particularly in attracting and retaining international talent combined with actions to specifically create and develop local talent.

The mobility of technology, money and people inside an AOI and with other external AOIs is exemplified with the case of the Israel/Silicon Valley Super Cluster of Innovation (Engel and Del-Palacio, 2011).

## **7. Discussion**

### **7.1. Archetypal Science Parks evolves to Urban Areas of Innovation**

We have analysed how cities are rapidly changing in order to respond to the requirements of New Economy activities. We have also shown why inner cities now are the place of knowledge-based companies and how these industries are innovative industries that require and attract a large number of skilled people.

We have contributed to the understanding of Areas of Innovation as successful manifestations of archetypal Science Parks. We analysed the evolution of governments' focus, from the promotion of archetypal Science Parks to the actual urban, economic and social development plans. We also showed that one of the goals of the new sustainable urban development is to promote the co-location and integration living areas in order to attract a large number of skilled people and to create a high-quality environment.

We have studied the case of the 22@Barcelona as an example of Area of Innovation development plan. This project aims to transform an old industrial neighbourhood of the inner city into a new innovative district consisting of universities, research centres and knowledge-based industries, as well as social and public facilities. Currently, the district is transforming the landscape of the old industrial district to a new Area of Innovation. The 22@Barcelona has a strategic location in the inner city, close and perfectly

connected to the city centre and other neighbourhoods and the region. The project entails a sustainable urban, economic and social innovation. The urban transformation aims to combine some old architectural elements with new creative and modern buildings. Additionally, the few traditional economic activities still remaining in the neighbourhood may be combined with knowledge-based industries, public facilities, social housing and green spaces, among others. From an economic point of view, clusters have been promoted, each represented by specialized research centers, universities, companies and government institutions.

According to the Triple Helix Model, the co-location of these specialized agents promotes synergies and collaborations among them. Additionally, as in an Industrial District, the co-location of diverse industries provides the environment the opportunity to “mix and match” and create new products (Pyke et al., 1990). Finally, from a social point of view, and unlike traditional Science Park organizations, the 22@Barcelona entails an important social development. More than four thousand housing units were planned for the area, and several programs were developed to help integrate the residents with the technology and economic development.

As in other urban redevelopment projects, 22@Barcelona project has caused some controversy. The most significant problems have emerged as a result of the spontaneous creation of independent and unregulated cultural and artistic movements in the area. In order to offer an alternative venue for these cultural organizations, public spaces have been designed for use by young artists and designers.

## **7.2. Holistic Transformation of Areas of Innovation**

Areas of Innovation need urban, economic and social transformation. The role of every agent of the triple helix (Government, Universities and Industry) is different depending on the dimension of the transformation.

Governments could add and impact with projects in the same area mixing local, regional, national, and in some cases international bodies (like the case of the European Union or international organizations). The government plays key roles in urban planning, infrastructures regulation and urban services. They attract companies and promote entrepreneurship. Develop sectorial programs and invest in research, innovation, entrepreneurship and sophisticated demand. Public-Private Partnerships are needed to organize and add all public and private contributions. In the case of 22@Barcelona, the City Council played a key role in public and private leadership.

Universities develop in Areas of Innovation all the functions of the Entrepreneurial University. Provide Talent from Education, Technology from Research and Knowledge Base Entrepreneurs from University Incubators. They are key pillars of the Knowledge-Based Economy. Universities also transform urban dimension with their buildings in the

city, they are anchors and magnet of knowledge based companies and services companies. They impact in the community providing fresh and young talent that will be mixed with the neighbourhoods, transforming the life of the streets. In the case of 22@Barcelona, Universities are the lighthouses of urban, economic and social transformation.

In the case of the Industry, companies are located in the Area of Innovation as they can offer the professionals a good place for working and living. Companies can take advantage of the outputs of the universities, hiring talent, using labs, absorbing technology and interacting with the new Knowledge-Based start-ups. Also Companies provide to universities experience, market technologies and focus on the real needs. They can Cluster with other companies, start-ups and institutions. In the Urban dimension, they are the tenants of the Building Owners, and pay the bill of the Investment of the Real Estate Developers. 22@Barcelona developed a comprehensive cluster strategy, attracting investors and promoting entrepreneurship.

Every member of the triple helix works in all the dimensions from different perspectives, but all the members are needed in the urban transformation, economical transformation and social transformation. Hybrid organizations are created for joining efforts and activities, like the Clusters Programs or Public-Private-Platforms Partnerships. Governance platforms are needed to organize and coordinate agents and functions. In the case of 22@Barcelona, Horizontal (22@Network) and Vertical (Clusters) were used to orchestrate the ecosystem of Innovation. Different models of Governance have been applied at the different Areas of Innovation, but always including all the agents in order to impact in all the dimensions.

### **7.3. Understanding the Lifecycle of an Area of Innovation**

We have found the evidence, in the case of 22@Barcelona, that in each phase, each agent works in a different way, and all the agents are necessary to fulfil all the phases.

A Co-evolution process is developed, interacting Government, Universities and Industry. All agents need the others to evolve, and hybrid organizations as clusters are coordinating expectations and actions.

In the **Inception moment**, a clear leadership of the Government is needed to create an Area of Innovation (in some cases the Mayor of the City, in others Regional and National Policies). The involvement of the Universities and Association of Companies are key factors to generate the Vision and trust in the project. Without clear rules of the uses of the land and clear vision of the kind of Area of Innovation will be difficult to advance in all the transformation.

In the **Launching moment**, the Area of Innovation will need basic infrastructures for starting, and the first buildings to settle the first users. Also, it will be necessary tractor



companies and universities for stimulating others to come. The Area of Innovation will need full time managers for promoting the place and organizing the landing of organizations and investors.

In the **Growing process**, investors will need clear pieces of land or buildings to invest or build. A Cluster strategy should be developed in the district. The creation of start-ups will be one of the sources of growing and innovation. Synergies will be needed among the tenants in the district. In the Social dimension, international professionals will need landing aid and the creation of communities and networks of people will generate synergies and sense of belonging.

In the **Maturity moment**, the Area of Innovation must evaluate to expand the area around the original District, or transferring the experience to other zones of the city. The Area of Innovation should be a hub of innovation connecting with other Parks and Areas, creating Superclusters of International Networks. In the Social dimensions, the Area of Innovation will include the whole society being involved. In terms of Governance, the leadership of the area should be in hands of the Associations of Companies and Social Entities.

In **each phase the roles of the triple helix agents, work for the next phase**. The Government, defining the use of the land, is allowing the universities and companies to be in the Area of Innovation. Universities, developing studies of Engineering, are providing key Talent at the Knowledge Based Companies. Universities, promoting entrepreneurship, are generating new start-ups that government and investors can fund in order to provide new innovations at the ecosystem. Big Corporation can buy start-ups as a way to absorb innovation. We see how the horizontal value chain of the urban, economic and social dimension is vertically connected with the governance of universities, industry and government.

Ecosystems of Innovation evolve, and each **Tripe Helix Agent co-evolve its roles when others adopt new functions**. In the case of Urban transformation, the first effort could come from the Government, investing in infrastructures and the first buildings. In a mature moment, the Real Estate Developers will invest in new building and the Government should not need to invest again in buildings. In the economical dimension, when the culture of entrepreneurship is needed, public programs are needed to finance start-ups. In Mature stage, Business Angels and Venture Capital firms can lead the investments. In the social dimension, in the inception moment, it will be necessary to transform the mindset of the neighbourhood. In a Mature moment, the culture of innovation and entrepreneurship in the schools will substitute some future public activities.

Every agent of the Triple Helix has its internal agenda. Universities play a long term vision, Government has the elections timeline in its agenda, and Industry pays salaries

every month and show the results in annuals basis. Aligning agendas at short, middle and long term visions, is a key issue in the Governance performance, in order to evolve the ecosystem in a synergic way.

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