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A dynamic model of entrepreneurial ecosystems evolution

Abstract

Recent contributions on Entrepreneurial Ecosystems (EE) literature tend to highlight the need for a deeper theory-based discussion of the concept and a dynamic approach on the EE evolution. The objective of this article is to contribute to this on-going discussion by proposing a novel theoretical model to understand the origin and evolution of EE, paying special attention to the drivers that are relevant to explain the successive developments in the EE trajectory and the differences between developed and developing EE. We draw our model from the study of four different empirical settings: two well-known and developed EE (Silicon Valley and Israel), and two less developed and less studied EE (Santiago de Chile and Buenos Aires).

Our model is composed by two ontologically different levels of dimensions: (i) framework conditions (culture, STI platform, business structure, social conditions and social capital) and (ii) five dynamics or drivers (the entrepreneurial dynamic, the business dynamic, the investment dynamic, the institutional dynamic, and the government and policy dynamic). Evolution, in our model, is conceptualized as a self-reinforcing process by which EE are constructed and developed over time, resulting from the co-evolution and interactions of the five dynamics and the framework conditions. Consequently, each EE would follow its own trajectory, moulded by its initial conditions, the relative importance of the different dynamics, and the interaction process between dynamics and framework conditions.

Keywords: Entrepreneurial ecosystems; Evolution; Latin America; Silicon Valley; Buenos Aires; Santiago; Israel

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Introduction

The entrepreneurial ecosystem (EE) concept has captured the attention of policy makers in the last years and nowadays it is widely used. However, the interest in the EE within the academic community is quite recent (Alvedalen and Boschma 2017). Due to its novelty, EE literature has grown in an accelerated, dispersed and fragmented way (Stam and Van de Ven 2018; Acs et al. 2017). In addition, recent reviews tend to highlight the need for a deeper theory-based discussion of the concept and particularly, a dynamic approach on the EE evolution (e.g. Brown and Mason 2017; Stam and Van de Ven 2018; Alvedalen and Boschma 2017; Cavallo, Ghezzi, and Balocco 2018).

In addition, much of the previous research tends to be based on the examination of case studies from highly successful regions and mature ecosystems, giving a tautological character to the phenomenon (Stam and Van de Ven 2018). This type of approach, although illustrative of the functioning of a virtuous ecosystem is not so valuable to understand less developed ecosystems, with different types of actors, relations and trajectories (Spigel 2017).

Precisely, this article tries to contribute to this on-going discussion by proposing a novel theoretical model of EE evolution, paying special attention to the drivers that are relevant to explain the development process in the EE trajectory and the differences between developed and developing EE. We rely on a multiple case study research design (Yin 1989; Eisenhardt and Graebner 2007) by analysing four different empirical settings: two well-known and developed EE such as Silicon Valley and Israel, and two less developed and less studied EE such as Santiago (Chile) and Buenos Aires (Argentina). The insights derived from this model and its constituent propositions may open new discussions among scholars but also would be

very informative to policy makers trying to understand how to intervene on their own cities and regions in order to develop or strength their EEs.

Recent contributions about EE evolution

Mack and Mayer's study (2016) is one of the first that directly and explicitly address the evolutionary process of an EE. Based on a historical analysis of the Phoenix EE, these authors portray an evolutionary model that comprises four stages: birth, growth, sustainment and decline. Each stage is characterized by a different entrepreneurial dynamic (the net result of firm births and deaths) and the co-evolution of several EE components that resemble Isenberg's (2010) domains: policy, finance, culture, markets, support institutions and human capital. Interestingly, this conceptual model illustrates how the relative importance of each EE component varies as the EE evolves. At the beginning, some contextual factors like culture, human capital and market opportunities matters the most, whereas in subsequent stages, specialized support organizations and policies have a more relevant role. In the same vein, more recently, Colombelli, Paolucci, and Ughetto (2017) elaborated a model which focuses on the changes in the governance structure throughout the EE evolution, from a hierarchical mode towards a more relational mode as long as the complexity of actors involved in the EE increases.

Appealing, though, this kind of approach remains descriptive to some extent and shares most of the criticisms that growth-stage models received from the organizational literature (Levie and Lichtenstein 2010). In particular, the idea of an immanent growth sequence from an early less developed stage towards a more mature, specialized and differentiated one. Given its biological nature the adoption of the 'ecosystem' analogy would lead in principle to this kind of assumptions.

Also inspired in the biological analogy, but without such restrictive assumptions, Auerswald and Dani (2017) propose an adaptative life-cycle model to understand Washington's biotech EE evolution, based on the literature of clusters evolution and complexity (Martin and Sunley 2011). Unlike Mack and Mayer (2016) this model recognizes some stages but accept non-linear paths and recursive loops during the evolution. Nevertheless, it lacks a deeper discussion of the drivers that move the EE from one stage to the other and the actors behind these drivers.

In this regard, Brown and Mason (2017) make an explicit mention to the leading role of entrepreneurs in the evolution of the EE by means of the self-reinforcing process of the 'entrepreneurial recycling' (Mason and Harrison 2006). 'Scale up' ecosystems (i.e. their definition of mature ecosystems) are characterized by its ability to create growing firms that become large corporations; an outstanding level of social capital and dealmakers and a comprehensive pool of funding sources that ease the transition from seed investment towards the IPO (Brown and Mason 2017).

This idea of a self-reinforcing and path-dependent evolution is also present in the recent model proposed by Stam and Van de Ven (2018). Based on Stam (2015), this contribution distinguishes between systemic and framework conditions and establishes some causal relationships between them. They state that EE elements are "*...mutually interdependent and co-evolve to enable or constrain entrepreneurial outputs in a territory over time.*" (Stam and Van de Ven 2018, 7). These authors test this and other two theoretical propositions using an index for 12 regions of the Netherlands. Their results show on the one hand the existence of positive feedback effects between outputs (proportion of high-growth firms) and the rest of the EE elements, providing support for the existence of a self-reinforcing process led by entrepreneurs and their growth prospectus. On the other hand, these authors found significant

positive autocorrelations for each EE element (i.e. systemic and framework conditions), showing the prevalence of path-dependent patterns of resource accumulation in each ecosystem. Finally, they demonstrate the co-evolution of some framework and/or systemic conditions, for instance, the triad between culture, talent (workforce) and intermediaries (support network). All in all, this model points to the need of adopting also a systems perspective when it comes to understand how an EE evolves over time.

Summing up, the dynamics of EE has been signalled as a vacancy area within the recent EE literature. Therefore, some efforts have started to provide a deeper understanding of the dynamic nature of the EE and its evolution. In common, these contributions highlight the self-reinforcing, non-linear and path-dependent nature of EE evolution. As well, they tend to focus on entrepreneurial outputs (i.e. blockbusters, growing firms, spin-offs) as the main indicator of EE vitality. However, there are still some unanswered questions like the role of each EE element in the evolution of the system, how each element relates to the rest and how to capture different growth trajectories departing from different initial conditions and EE configurations. This is especially relevant to understand less developed EE and its contrasts with developed EE. Some of these questions will be addressed by in the following case studies and in the conceptual model proposed in this article.

Methodology

The research methodology adopted in this article is a multiple case study design (Yin 1989). This research strategy is particularly useful for theory-building when there is not enough extant theory and where the research tries to address “how” and “why” questions (Eisenhardt and Graebner 2007). In addition, qualitative research is well suited for the study of the complex nature of the EE concept and its evolution as Roundy, Bradshaw, and Brockman

(2018) clearly stated. Finally, the adoption of a multiple case design would allow us to identify conceptual relationships within and between the studied cases, a fact that is of paramount importance since one of our objectives is to analyse similarities and differences in the evolution of developed and developing EE.

Giving this objective, we choose two cases of well-developed EE, the Silicon Valley and Israel (in particular, the ecosystem located in the triangle constituted by Tel Aviv, Jerusalem and Haifa). Although these ecosystems may be considered as international benchmarks, there are important contrasts among them especially when it comes to the incidence of deliberated *versus* spontaneous forces in their evolution. On the other hand, we choose two less developed and less studied EE (Santiago de Chile and Buenos Aires). Both are ranked in the Runner Up category of the Global Start-Up Ecosystem Report (Startup Genome 2017) but again, showing some differences as regard the initial framework conditions and the profile of the actors leading their evolution.

Multiple case studies use a myriad of different source of data (Yin 1989). Hence, we rely on previous research but also on personal interviews with key informants and in-site visits to each ecosystem held by the authors (Kantis 2018)¹. In addition, for the Latin American cases we depart from previous studies carried out by the authors (Diaz and Kantis 2017; Federico and Álvarez Martínez 2017; Álvarez Martínez et al. 2016)². Secondary information from the

¹ The following list refers to the interviews held in the Silicon Valley case: Robert Eberhart (Stanford University), Jorge Zavala (TechBa, SV), Rebeca Hwang (Rivet Ventures, SV), Magdalena Coronel (Institute of Americas, San Diego, California), Adolfo Nemirovsky (LatipNet, SV) and Agustín Di Marco (entrepreneur at 500 Start Ups). In Israel the following persons were interviewed: Greg Horowitz (T2VC), Igal Erlich (Yozma Fund), Saul Singer (Start Up Nation), Elio Nudelman (link2sur), Morris Teubal (Hebrew University of Jerusalem), Oren Gershtein (Ideality Roads), Harry Yuklea (Technion), Harold Weiner (Terra Ventures), Laura Altschuler (Duo.idb), Miriam Erez (Technion), Rafi Nave (Technion), Yoav Tzura (Jerusalem Venture Partners VC), Aaron Mankovsky (Pitango Venture Fund), Itai Bek (advisor of the Chief Scientist Office) and Uri Gabai (Chief Scientist Officer).

² The authors gratefully thank the helpful collaboration of Sandra Díaz from Ematrix (Chile).

web pages of several ecosystem's organizations has been also used in this research to elaborate the case studies.

Results

Silicon Valley

The history of the Silicon Valley started at the first decades of the 20th century. At that time, Stanford graduates had to migrate to find jobs on the Eastern Coast. In order to change this reality, Stanford University decided to build a new institutional vision which favoured leveraging capacities and institutional resources (for instance, R&D projects from national government). This new institutional project was devised and led by Frederick Terman who was a professor at Sandford University and a former member of MIT (Kaplan 2000; Blank 2008).

In this context, the creation of Hewlett-Packard played also a pioneering role at the end of the 1930's. Hewlett and Packard were both Terman's students, who used to encourage his students to open their own firms, and even invested and mentored some of them. In the case of Hewlett-Packard, its founders gained experience in Eastern coast companies and returned to the Valley following Terman's advice (Blank 2008). Over time, some others followed their steps. Iconic Silicon Valley firms like Litton and Varian Associates also based their innovative technological developments on the knowledge platform fostered by Stanford University. Graduates' and students' entrepreneurial initiatives would find an unparalleled place to develop ideas and a powerful "feed" in the projects that Stanford had reached with the Department of Defense thanks to Terman's proactive leadership. Again, this process did not occur in the vacuum. It stemmed from the knowledge constructed from researching in

some extremely useful technologies in the Second World War, such as the developments coming from the Radio Institute or the Microwave Laboratory.

During the 1950s Stanford's scientific and technological park was created, attracting to the Valley companies such as IBM, G.E, Westinghouse, Ames Research Center and Lockheed Aircraft and giving room to some 150 companies (Kaplan 2000). A different business dynamic started to take place.

We cannot state that Terman and Stanford University had a deliberate strategy to build "an ecosystem" such as Silicon Valley. However, we can underline their vision and role in seeding some basic conditions, i.e., the knowledge base and the entrepreneurial spirit. These two factors would let grow some other unforeseen ones which were vital to enhance the growth and excellence of Stanford's knowledge platform and the emergence of the ecosystem. In the mid-fifties, the National Aeronautics and Space Administration (NASA) and the Defense Advanced Research Projects Agency (DARPA) were created as a response to the Space Race started after the Soviet Union launched the Sputnik-1. By means of increasing military contracts, these agencies fuelled the knowledge base from the universities and gave incentives to the creation of new firms (Mazzucato 2015). In parallel, new companies were created in the Valley and became iconic. The Nobel Prize winner William Shockley founded his pioneer firm in the field of semiconductors. Years later he was abandoned by eight engineers with outstanding academic credentials who persuaded the industrialist Shairman Fairchild from New York to invest in their project. Fairchild was interested in researching on satellite and missile systems and the relevance of transistors (semiconductors). They lured him with the idea of becoming the primary partner in a hybrid company that would be both a start-up and an affiliate of Fairchild Company. Fairchild Semiconductors was key in the Valley's technological revolution by generating many spin-offs such as Intel.

Additionally, in 1958 a key point in the development of the venture capital (VC) industry took place when the Small Business Investment Company (SBIC) Act was passed. This regulatory initiative would foster the financing of new innovative companies through a new incentive in which each dollar invested by a private company was matched with three dollars invested by the State. This incentive led in the 1960's to the creation of several venture capital firms levered with public resources (e.g. Bank of America, American Express Continental Capital, Pitch, Johnson & Draper and Sutter Hill). However, it was not until the 70s that the VC industry really started to grow. Current venture capital funds such as Sequoia Capital, Kleiner, Perkins, Caufield & Byers, the Silicon Valley Bank, Greylock, New Enterprise Associates and Accel, Andressen Horowitz, or Founders Fund all date back to the 1970s and 1980s. And it boomed in 1980 with Apple's IPO. The emergence of this VC industry paved the way for the advent of new specialized service providers, such as law & accounting firms.

These events laid the foundations for the increasing emergence of new companies that enhanced the Valley's conditions and contributed to building a stronger base of companies, mainly in the semiconductors area. In the early seventies, the Valley was plenty of new firms in this sector providing to the computing industry. As long as this entrepreneurial development process took place, some experienced entrepreneurs started to act as mentors, and new institutions acting as bridges between the entrepreneurs and mentors were created.

The confluence and co-evolution of different companies, on the one side, and investors, on the other, shaped a virtuous cycle with the universities. The latter provided their knowledge base for innovations and often facilitated contacts because of the dual activism displayed by some professors that were also in the business sector. Over time, the trust base grew stronger and favoured the development of a dense social capital based on an open, creative and horizontal culture supported by the territorial proximity typical of the Western Coast of San

Francisco. This social capital was materialized in the creation of informal spaces, events, and the emergence of dealmakers (Napier and Hansen 2011; Brown and Mason 2017) who moved from place to place laying bridges to make things happen and giving room to new possibilities.

Since this entrepreneurial process took place in different technologies over time, it helped Silicon Valley to mature without specializing just in one single industry. This helped the Valley to overcome serious challenges such as the end of the Cold War (and its impact on defense contracts), and the Japanese competition starting in the 1980's (Saxenian 1996).

The spin-offs have been the most significant component in Silicon Valley dynamics for decades. Without them, the system could have never matured. However, this platform of newly created firms developed, scaled and coevolved together with the VC industry. Later, the phenomenon of the so called "entrepreneurial recycling" (Mason and Harrison 2006) enhanced this dynamic. As a result, successful entrepreneurs and executives from technology companies were enrolled in the creation of the most recent wave of new support organizations such as accelerators, co-work spaces, venture builders as well as new VC funds.

In sum, from an organizational perspective, Silicon Valley is an ecosystem defined as an emerging collective endeavour starting with the capabilities and resources activated by the action of institutional entrepreneurship. Opportunity identification and context exploitation were part of the game. Over time certain dynamics leveraged pre-existing conditions contributing to transform the Valley into a fertile ground due to the presence and dynamic emergence of some factors and actors, each one with its institutional and entrepreneurial logic and drive. On the one hand, culture has always been open and risk tolerant. On the other, universities and companies played a key role in the formation of an important stock of entrepreneurial human capital.

Furthermore, academics and entrepreneurs have been crucial as mentors and investors facilitating the emergence of social capital. Also, lawyers have acted as business builders bridging entrepreneurs. These different actors have been vital to build networks and facilitate the emergence of new firms. They have furnished entrepreneurs with new ideas, data, advice and resources, not only in the individual processes but also in the development of a collective dynamics.

However, all this process took place without an explicit, collective leadership or a deliberate shared and devised strategy. It was the confluence of different forces and their interaction with the opportunities and resources existing in the broader national context.

The Silicon Wadi (Israel)

Although Israel could be considered as a single ecosystem due its dimensions, the largest high-tech companies' concentration is localized in the geographical area around Tel Aviv, Haifa and Jerusalem. This ecosystem shows different features. There has been a clear State leadership for many decades and the business supportive institutional platform has relied on a public-private partnership, with public and private components levered over time.

In the initial phase, the State played a key role through an important investment process that gave rise to some companies and enterprise groups that have contributed to building primary housing infrastructure, the Defense industry and universities (Nitzan and Bichler 2002). The State proactively led the process by attracting and absorbing several Jewish immigration waves that contributed to a population increase from one million inhabitants at the foundation of Israel (1948) to almost nine million today, forging an extremely open culture led by pioneers.

It has been said that the whole process of State-building was entrepreneurial itself, being the collective farms (kibbutzim) a clearer expression of this entrepreneurial spirit and a cornerstone for social capital development. At that time, Israel's economic structure was characterized by a large agricultural base combined with a growing manufacturing traditional sector, particularly during the post-II World War period.

Some decades after this initial phase of the pioneers, a crucial event occurred after the Yom Kippur war. A Jewish engineer who had been one of the first employees at Intel in Silicon Valley convinced the company to set up an innovation center in Israel under his leadership (Senor and Singer 2011). This center was vital to Intel's technological development globally. The feasibility of this process showed that the country could become a platform to welcome other international tech companies as from 1990. Despite the ongoing conflict in the region, this process took place amidst the tech revolution acceleration.

Thus, Intel's experience may be seen as emblematic. It showed that some actors had a pivotal role in opening paths in the ecosystems, in this case, towards other international tech companies. It also showed the proactive Jewish diaspora protagonism. From a more general perspective, some talents helped place some building stones in the emergence and development of the new ecosystem (from the foundation of the collective farms or kibbutzim to the setup of firms' technology centers).

The hyperactive role of an "entrepreneurial state" (Mazzucato 2015) was also vital to build the science and technology platform (Avnimelech and Teubal 2004). The Israeli Army also contributed to the generation of technological knowledge and entrepreneurial skills. In fact, one of the first successful waves of start-ups in the 1980's can be attributed to entrepreneurs coming from the elite military school (Talpiot) and from the intelligence unit of the Army technology development area (Nitzan and Bichler 2002). The most salient examples are the

tech companies Comverse, DSCP and Libit founded in the 1980's or Checkpoint in the early 1990's (Senor and Singer 2011; Avnimelech and Teubal 2004). Their founders are also thought to have founded some thirty start-ups in the so-called infant phase of this ecosystem.

However, the development of entrepreneurial skills in the army has not been restricted to elites. During their two or three years of military service, youngsters develop useful competencies - in one of the most effective "schools for entrepreneurs". Individuals learn hands-on how to lead teams, assume responsibilities, run risks, solve problems, face challenges, and so on. Since Israeli citizens are taken for a period of reserve duty every year, the Army becomes also a potent source of contacts in their lifetime that help them build social networks.

After a relatively short period of adolescence, the system reached maturity after two significant moves. One was the need to face the challenge posed by an increasing wave of Jewish migrating from the former Soviet Union with broad scientific and engineering background. This led to the creation of the state/public incubators programs at the early 90's. At the same time, these human resources would become an important feed for the technology move in the start-ups or were hired by already settled firms. The State financed the installation of these organizations that were usually created by municipalities and universities. The aim was to contribute to transforming R&D efforts into market solutions with technology.

The second move was the creation of the Yozma fund, one of the most successful international initiatives that fostered the venture capital industry. The State came to be an example of proactive institutional entrepreneurship in the context of a public-private alliance (Mazzucato 2015). This initiative allowed for the system growth towards a new phase when it multiplied the venture capital offer and accelerated the increase of start-ups.

At the beginning of the 2000's, the ecosystem was guided to a new stage where incubators were reconverted to be led by private actors, strongly levered with public subsidies allocated to innovative entrepreneurial projects. The previous development of the ecosystem enabled investors, enterprises and former entrepreneurs to develop capabilities and to take over the incubators and to engage with high-risk new companies based on their previous experience. This allows them to see better where to invest and channel the resources in the next phases. In turn, the State partially recover the investment through royalties.

A second moment of this “privatization” phase of the incubators occurred when the licensing system to run them was institutionalized and multinational companies were invited to join in. Thus, a pool of venture investors, former entrepreneurs and large international firms came to be the head of the incubators. Recently, a current flow of investments in technology firms has also played a pivotal role by setting up their innovation centres and profiting from the innovative capacity of the ecosystem.

Over time, the ecosystem has become a “manufacturer of start-ups and innovations” with high rates of start-ups and exits. We can identify salient features in this ecosystem trajectory led by the State strategic vision, aimed at transforming the economy through technology and innovation. Some opportunities and challenges emerged on the road and the State capitalized them with high pragmatism, flexibility and learning capacity. The State, as a dynamic entrepreneur, has learned to change with time and provided the conditions for creating an ecosystem from very early stages leveraging on existing pre-conditions and building what was left. Over time, it handed the leadership over to the private sector when the development and the dynamics were gaining momentum and business incentives were in place, but it never dropped its leading role, as incubator franchisor, pre-seed/seed capital provider, infant industries promoter, and so forth.

Santiago de Chile

Since the 70s, Chile experienced important transformations being Santiago the core of its economic organization. The openness of the economy challenged the leading role that the manufacturing sector have had in the previous decades being the new dynamic sectors agriculture, food and beverages and mining (De Mattos 1999). At that time was born, as a rare case, Sonda- an ICT firm born in the mid-70s being today the largest Latin-American ICT solutions provider.

During the 90s a new wave of reforms led to a modernisation of the entire economic structure, being the services (specially the financial services) the new dominant sector in the city economy. In turn, this stimulate the emergence of some related software service activities. The economic performance, even today, both at the local and at the national level, relies on large companies exploiting natural resources from mining, the agribusiness and some services, which results in a highly concentrated economy (De Mattos 1999).

In addition, Santiago continued (and still continues) to have a great social inequality, with a relatively large proportion of wealthy individuals and a narrow middle-class, with closed social circles rising important barriers to access to social capital of qualified networks. Access to higher education is also a sort of 'privilege' positively associated with income levels, what reinforces the previous comments.

Within this framework, the first available information about today's Santiago innovation and entrepreneurship ecosystem dates to 1992 when the first Chilean incubator was created under the umbrella of Santiago Innova with the support of the Municipality of Santiago and the participation of several universities and representatives from the private sector. Six years later, Endeavor settled in Chile, but the experience did not meet the expectations and decided

to close. The lack of deal flow due to the almost inexistence of an ecosystem was behind this failure.

In the late 1990's, the Chilean Government launched some regulatory initiatives to foster the investment activity. With the Multilateral Investment Fund of the Inter-American Development Bank, it created a pilot fund managed by an American company due to the absence of capabilities needed in this sector. Then, the first financing lines to develop the private VC industry were introduced. The funding tool was a long-term loan considered as a quasi-capital which would be paid back only if results were positive. However, results were disappointing.

At that moment, the diagnosis, showed that there was not an ongoing flow of innovative projects (Rivas 2014). Shortly afterward, in the early 2000's, the Corporacion de Fomento (CORFO) -the main State agency fostering innovation and entrepreneurship-, decided to address these gaps with two programs; seed capital and incubators. This period could be characterized as the early phase of the nascent ecosystem. Since then, the different versions of these programs have contributed to "structure" the activities and resources, shaping the institutional architecture of the ecosystem.

Some new more sophisticated instruments, like supporting angel investors' networks or the spin-offs platform, were introduced later but they did not meet the expectations. At the bottom line, the limited private sector's response to CORFO's incentives seemed to show the ecosystem immaturity (Rivas 2014).

By the end of the last decade, CORFO carried out several studies that showed, on the one hand, that supported entrepreneurs exhibited a low capacity to internationalize their ventures as well as to raise external capital. On the other hand, they pointed out some deficiencies of the incubators such as closedowns, limited capabilities, low quality services, and the lack of a

clear incentive scheme based on new firms' performance (Innova Chile 2010). Another study showed the relative absence of spin-offs or innovative new business trying to capture demands from the main economic activities (e.g. mining, forestry, agribusiness) (Kantis and Diaz 2008).

These conclusions triggered a second phase of public policy. Although they were not a part of a masterplan, the main central issues were: (i) the redesign of the Seed Capital program, (ii) the implementation of new incentives to incubators and (iii) the launch of Start-Up Chile.

In the first case, the reform of the seed capital program was aimed at gaining agility and flexibility by decentralizing in the incubators part of the selection of the projects and the administration of the funds. Besides, new incentives were adopted to align incubators behaviour with new firms' performance (Navarro 2014). Within this framework, a new generation of incubators was born. Many of them have profited from CORFO's flexible funding, and advanced towards becoming more like accelerators or have already become ones. Besides university incubators some private organizations have started to operate their incubators.

Another key step in the evolution of the ecosystem was Start-Up Chile, a program designed to invigorate the entrepreneurial environment by attracting foreign entrepreneurs to set up their businesses in Chile giving them a visa for half a year and seed capital. Start-Up Chile put Santiago's ecosystem on the radar of entrepreneurship at a global level and seemed to have strengthen Chilean entrepreneur's competencies by the contact with foreign entrepreneurs (Leatherbee and Eesley 2014).³

³ After five years of operation, more than 1,000 entrepreneurs from more than 75 countries went through the program. However, only a very small proportion of them remain in Chile as the original design expected (Endeavor insight, 2016).

At about the same time, new private players also came up: Wayra (Telefónica's accelerator), Emprende Claro and MasisaLabs. Other examples are 3M's entrepreneurial program and innovation center, and Telefonica's international R+D Center (an alliance between Telefónica and Universidad del Desarrollo, also supported by CORFO). A recent study shows that Chile occupies the second place in Latin America as regards the number of corporate venturing initiatives, even surpassing México (Kantis 2018).

After the change of government in 2014, a new policy of dynamic entrepreneurship was announced aimed at scaling up the Chilean ecosystem. The initiatives were: i) incentives to venture capital funds at the early stage to foster private industry development; ii) a new fund SCALE was set up to follow-on the promising projects from the Start Up Chile in order to increase the rate of business created in Chile by foreign entrepreneurs; iii) a scale fund for Chilean entrepreneurs; iv) a mentoring networks program aimed at enhancing the support services to entrepreneurs and iv) incentives to the creation of co-working spaces.

As a result of all these efforts, Santiago shows today a growing ecosystem. About 1000 projects are supported every year and more than 160 young firms were created during the last five years in the ICT, media and technology activities (Endeavor insight 2016). Some "fruits" seem to have been harvested in the last two years such as the important investments received by some new firms such as The Cornershop, bought by Wall Mart; and Notco, invested by Jeff Bezos. However, the same report from Endeavor highlights that there are not so many scale-ups in Santiago (Endeavor insight 2016). So, the main challenges are still scalability and the involvement of the private sector. In fact, the evolution of the Santiago ecosystem shows that it is an unevenly developed ecosystem mainly focusing on start-ups rather than scale ups, being much more advanced at the institutional level than at the entrepreneur and investors level and still relying mainly on public resources.

Buenos Aires

Buenos Aires' city ecosystem has emerged and evolved over time based on a set of positive initial conditions, such as the significant role played by the middle class, the economies of agglomeration typical in major urban areas and a cultural diversity showing the traces of successive immigration waves. Precisely, the local culture is one of its main differentials. Rooted in the European tradition, Buenos Aires has been throughout its history, a sort of "piece of modernization" in the country. Mirroring what happen in the main western cities, the cultural scene of Buenos Aires and its inhabitants have been always in the vanguard, willing to take new ideas and developments. This fact has contributed to forging an open, tolerant and creative atmosphere. In addition, there is a horizontal and informal culture in the city which facilitates the development of social capital and networks.

Other positive initial condition is the level of education of its population, thanks to the prevalence of a tuition-free public university system which allows the continuous formation of talented people and a knowledge platform in basic science and technology. Most of the pioneering entrepreneurs in the software and biotech sectors that showed up in the city around the 90s, belong to this tradition of public education and basic research.

The economic structure of the city also reflects subsequent phases of modernization registered throughout its history. First, since it is inception the city was linked to its harbour and the commercial activities. Associated with the primary exporting activities, many industries (e.g. tanneries, slaughterers) started to be located at the southern bank of the city. Then, when the European immigrants came at the turn of the twentieth century, they gave birth to many small and middle-sized companies (SMEs) many of which are still alive nowadays. Nevertheless, during the last decades and particularly since the mid-70s, the manufacturing sector in the city

started to lose its importance, giving room to a structure where SMEs coexist with domestic and foreign large firms and where retail and service sectors (banks, consultancy and insurance companies) tend to prevail.

Against this background, we could trace back the first steps of the current entrepreneurial ecosystem to 1990's. At that time, some large software companies, such as Microsoft, SAP, Oracle, Symantec and others, settled in the country. An early group of new IT service providers seized the opportunities given by such big companies in the banking and insurance sectors, giving birth to a new wave of new firms.

The internet wave brought some successful cases at the regional level, i.e., Patagon.com (Wenceslao Casares) and Officenet (Andy Freire and Santiago Bilinkins), that caught the attention of the investment community, attracting the first foreign venture capital funds.

Even after the burst of the dotcom companies bubble, some high impact ventures kept on emerging such as the Argentinean unicorns Mercado Libre, Despegar, and Globant, among others. They have become iconic, role models and the symbol of a new wave of entrepreneurs who would feed the dynamics of an incipient IT sector (Endeavor 2016).

With respect to biotech, the seeds were sowed during the 80s, when two companies, Biosidus and Grupo Chemo, were created, laying the foundations of a sector which would start gaining momentum two decades later built from the collaboration of pharmaceutical companies and universities. These firms have played a pivotal role as sources of entrepreneurs (by means of spin-offs), investments and opportunities, whereas universities have provided their research findings and knowledge (Endeavor 2016; Gutman, Lavarello, and Grossi 2006).

An important period in the history of the country was 2001-2002 economic turmoil. This crisis affected in different ways. Many mature and new companies closed down but, when the macro economy was stabilized, they generated the platform for a new generation of resilient

entrepreneurs that lead the economic recovery first and the economic expansion later, when the crisis was over, boosting the creation of new companies in most sectors, especially in the software industry and biotechnology. The robust economic recovery after the strong 2001-2002 crisis and some public policy initiatives, like the Software Law and the Sectorial Fund FONSOFT (Software Sector Act) provided specific incentives and improved the entrepreneurial development in this industry. ICT entrepreneurs managed to seize opportunities offered in the local market and by the growing trend towards worldwide outsourcing. In this way, it became one of the most dynamic vertical drivers in the Buenos Aires ecosystem and contributed to the significant increase of the number of companies and jobs during that decade.

On the institutional dimension, a snapshot of the ecosystem taken early in the first decade of the 21st century showed UNCTAD's Empretec program and a few entrepreneurial centres and private universities stood alone, such as Instituto de Altos Ejecutivos de Empresa de la Universidad Austral (IAE Business School), the Instituto Tecnológico de Buenos Aires (Buenos Aires Technological Institute, ITBA) or the Universidad de San Andrés (San Andrés University). In addition, the Endeavor Foundation, came to Buenos Aires at the end of the 90s being a relevant player since then.

At this time, the Buenos Aires City Government opened the Centro Metropolitano de Diseño (CMD- Metropolitan Center for Design), and it created Incuba, the public incubator for design, media and tourism industries, which catalysed all the creative entrepreneurial energies around these sectors. Shortly afterward, the Government gave birth to Baitec –a technology-based incubator. By the same time, The Facultad de Ciencias Exactas y Naturales de la Universidad de Buenos Aires (Faculty of Exact and Natural Sciences - University of Buenos Aires) also launched its business incubator.

In 2003, the government of the City of Buenos Aires launched Buenos Aires Emprende (BAE-Buenos Aires Starts up) which was a crucial milestone in the development of the ecosystem's institutional dimension. This program not only offered seed capital for entrepreneurs but also it contributed to the strengthening of the institutional platform by giving them some resources in exchange of their support for start-ups. It also helped expand the ecosystem organizational capillarity through intermediaries. Several institutions operating today started working under this program that overcame successive governments until 2011.

The new decade witnessed the arrival of some new actors from the private sector. First, some seed accelerators started their activities like Wayra from Telefónica Group or NXTP Labs, an independent accelerator founded by former successful entrepreneurs inspired on Y Combinator model. Other example of such 'entrepreneurial recycling' was the creation of Kaszek Ventures Fund by two former Mercado Libre co-founders. Furthermore, new actors joined the financing arena of the EE - the MELI Fund created by Mercado Libre, Nazca Ventures, Lyon Ventures and 54 Ventures. Despite this situation, the availability of financing, particularly in the early phases, is still embryonic and mainly biased towards the ICT sector.

In 2014, the Government revised the strategy and reoriented Buenos Aires Emprende program. It became a tool to co-finance the operation of a reduced number of accelerators, using subsidies in exchange for their commitment to invest with the State as a co-investor in their ventures. The organizations in the ecosystem had to re-engineer in a new scenario when the Government decided to leave its role as an activator. The institutional platform has downsized.

More recently, when the national government changed in 2015, a new phase in the national level entrepreneurship policy started. A cornerstone in this evolution has been the Ley Fomento del capital emprendedor (Venture Capital and Entrepreneurship Act) which created

incentives for accelerators and venture capital funds to boost the development of this industry. As a result, six new accelerators were created in the city in the last two years, joining the existing Wayra and NXTP. As well, two additional VC Funds started operations thanks to the incentives provided by the new Entrepreneurial Act. Interestingly, this new Law had an active contribution of the newly created National Association for Entrepreneurs, whose creation was led by some early blockbuster entrepreneurs.

All in all, the dynamic and governance of the ecosystem has evolved. Now the leadership is more spread on co-work spaces and accelerators, the private sector and the entrepreneurs' side, with some support from the national level government.

Discussion

Once we described the historical path followed by each of the cases, it is interesting to identify whether there are some common patterns among them and to discuss some contrasts. This discussion would allow us to gain some insights into the main drivers and determinants of EE evolution, particularly between EE with different levels of development.

In Silicon Valley, an open and creative culture, former R+D Centers, Stanford University's strategy and Terman's leading role as an institutional entrepreneur contributed to set the basis of an initial phase of the EE. During these early decades, research centres provided a favourable context for new technologies development, matching Public Procurement Contracts demands (Defense and Airspace Authorities). This institutional dynamic produced a first wave of start-ups and spin-offs which, fed and renewed the existing business structure. This entrepreneurial dynamic was reinforced later by attracting other firms, once the science park was created. This process was catalysed some decades later by the SBIC initiative fostering the emergence of venture capital industry. From that moment up to now the

evolution of the Silicon Valley has been under the leadership of a vibrant entrepreneurial/investors driving force that actively interact with universities and tech companies. Mentors and dealmakers became also key players in the ecosystem bridging the entrepreneurial, business and investors dimensions. Since mid-2000's, some institutional innovations, such as the accelerators, have taken place in the context of the new wave of digital technologies. However, this historical process took place without an explicit, collective leadership or a deliberate shared and devised strategy. The evolution was the result of the confluence of different forces and actors and their interaction with the opportunities and resources existing in the broader national context.

In the Israeli case there were in place several intangible assets such as the culture and social capital, the entrepreneurial capacities moulded by the Army, the technological and the scientific platform of universities and the finance provided by government R+D grants, which could be identified as preconditions that sparked the entrepreneurial dynamism of the EE. This could explain a first wave of start-ups during the 80s.

However, throughout the evolution of this EE the State has played a significant and explicit entrepreneurial role as part of a deliberate strategy aimed at transforming Israel in a tech economy. The State was essential in the creation of the VC industry by means of the Yozma Fund but also it was critical to develop the institutional dimension (the technological incubators) trying to profit for a serendipitous event, like the Russian migration. Most of these interventions from the public sector were at the origin of the EE we witnessed today. Since VC industry development first and the "privatization" of the business incubators later the role played by private actors has been growing in the Israeli EE but without erasing the leading role of the State.

In the developing Latin American EE, some important structural differences among them could be identified besides some similarities with respect to the role of government. The open and not- so hierarchical culture of Buenos Aires, rooted in the successive waves of European migrants, has facilitated the development of social capital more than in Santiago. Furthermore, the existence of public tuition-free universities that contribute to a broader skilled population and the presence of a wider middle-class segment fostered the emergence of entrepreneurs that throughout the years nurtured a more diversified business structure, especially in the tech sector where some unicorns emerged. However, it was not until the City government decided to intervene after the big economic crisis (2003) that the EE moved forward. This impulse nurtured some previous and embryonic institutional setting, creating new support institutions that enrich the stock of existing incubators, and providing seed capital. But as time goes by, and the local public policies started to decline as a result of the change of government, the strength of the institutional platform slowed down.

Investors have been scarce until the new Law has been approved in 2016 as the expression of a renewed stimulus of the Government, at the national level in this case, but also a result of new institutional actors fostered by serial and ‘recycled’ entrepreneurs like the Association of Entrepreneurs, co-works spaces, accelerators and also early-stage funds.

Santiago’s EE stands out by a significant institutional and political stability and the proactive role of the national government agency (CORFO). CORFO has been the cornerstone of the EE whose evolution followed to a great extent the changes in CORFO’s programmes. Arguably, because of the structural weaknesses of much of the framework conditions (social conditions, culture, social capital, STI platform) that made up the initial configuration of the EE, its development was more dependent on the active role of the national government.

In the last years, a scale up of the Chilean EE appears associated with new public instruments but also with the emergence of new players such as some large firms' supporting entrepreneurs through open innovation processes and some private incubators/accelerators and investors. Therefore, the current ecosystem is much more diverse, nourished and sophisticated than before. However, the Government's leading role is still vital to allocate resources.

In sum, the evolution of four different EE analysed in this article allow us to identify different drivers and leaderships among these EE and how the strength and relative relevance of each driver changes over time. We could also evidence the importance of some structural pre-conditions for the emergence and development of the EE. This fact helps us to identify different levels of development in the four studied cases as well as the differences in the relative weight of the institutional and governmental level in the evolution of the EE *vis a vis* the role of existing business and investors. In more developed ecosystems, business incentives are crucial in understanding private actors' behaviour. Clearly, the quality and size of the deal flow (i.e. entrepreneurs) in such EE constitutes a strong incentive for the involvement of the private sector and the existence of a deep and complete financing offer (from seed capital and early-stage funds up to the IPO) altogether with incubators and other vertically-specialised services providers (Kantis 2018). On the contrary, in the developing ecosystems, the government's incentives are still more relevant as moulding entrepreneurs' and institutions' behaviours and incubators and services providers are more generic. Some recent 'entrepreneurial recycling' processes and the emergence of large companies supporting entrepreneurs in the analysed Latin American cases may evidence a growing role of the

private sector. Clearly, the level of development of each EE would be determined by the relative balance between the different actors and factors involved.

Corollary: Towards a dynamic model of EE evolution

Based on previous cases and discussion we propose a novel interpretative model to understand EE evolution, paying special attention to the drivers that are relevant to explain the development process in the EE trajectory and the differences between developed and developing EE.

First, we should define what EE evolution means. We describe evolution in terms of emergence and development. Both phenomena are intrinsically associated. It is not possible to trace back a precise moment in time when the EE begins – a sort of big bang – just as it is not possible to identify a moment when the origin finishes, and the development starts. EE are neither natural nor accidental. They are the result of a process of social construction (Roundy 2016).

What we could certainly identify are some roots, that is, a series of factors, actors and situations which define the initial conditions from where an EE starts to emerge and develop. To discover these roots and the current stage of development of an EE is always an analytical challenge for the researchers. However, at every moment and space, there is a specific configuration of actors and factors upon which some dynamics and relations start to take place defining a trajectory of development of an EE.

In the Silicon Valley, Stanford University's strategy and Terman's leading role as an intra-entrepreneur together with an open and horizontal culture, the R+D centres and the Public Procurement contracts, set up these initial conditions. In the Israeli case there were a rich social capital base, a culture that rewarded the individual initiative, a sound scientific platform

built by the public R+D grants and the role played by the Army and the military service. In the Latin-American cases the initial conditions were less favourable. Nevertheless, some differences could be observed. Buenos Aires stand out because its cultural and social capital conditions and a wider middle-class segment (relative to other Latin-American countries) whereas Santiago showed a more stable and institutional and political setting and a proactive role of the national government.

We could label this configuration as *framework conditions*. As the reviewed cases show, these framework conditions include the educational system, the culture and social conditions, the social capital, the knowledge platform (science and technology), business sector (diversity and density), demand conditions and the institutional system. All these variables may be considered as space-specific idiosyncratic ‘assets’ that influence the potential surge of would-be entrepreneurs and the size and wide of the opportunity space for the emergence of new ventures (Acs et al. 2016; Kantis, Federico, and Ibarra García 2018). The degree of development of each of these framework conditions and their relations define the configuration of the EE at any moment.

The second component of our model are five dynamics or sources of “energy” (drivers). EE evolution is, hence, conceptualized as the result of the interaction between the configuration of framework conditions these dynamics (Kantis 2018). These five *dynamics* are:

Entrepreneurial dynamic: Conceptually, this is the core of the EE and its strength constitutes a sign of its energy and vitality, as many previously reviewed models stated. It encompasses not only the entrepreneurial process of newly born firms (start-ups) but also the growth of existing young firms (scale-ups). The multiplication of high-growth firms and blockbusters is one of the expected results of this dynamic. But there are other manifestations that include the organic growth of the remainder businesses and the surge of spin-offs, serial entrepreneurs

and the ‘entrepreneurial recycling’, which constitute the self-reinforcing drivers of the entrepreneurial dynamics. All these outputs contribute directly to the densification of the productive structure and the emergence of new activities and sectors. The existence and development of *institutional entrepreneurship* is also a key result from this dynamic that links and could activate the institutional dynamic explained below.

Institutional dynamic: It includes the initiatives of organizations such as incubators, accelerators, mentoring networks, coworking spaces and others supporting entrepreneurship. As well, this category refers to the general institutional dynamic comprised by the initiatives led by universities and other educational and science and technology institutions, chambers of commerce, and the emergent phenomenon of entrepreneurial associations. The institutional dynamic is influenced by the business dynamic (i.e.: providing mentors); the government dynamic (i.e. by means of direct incentives and entrepreneurship policy) and the entrepreneurial dynamic (i.e. providing institutional entrepreneurs as a result of the entrepreneurial recycling).

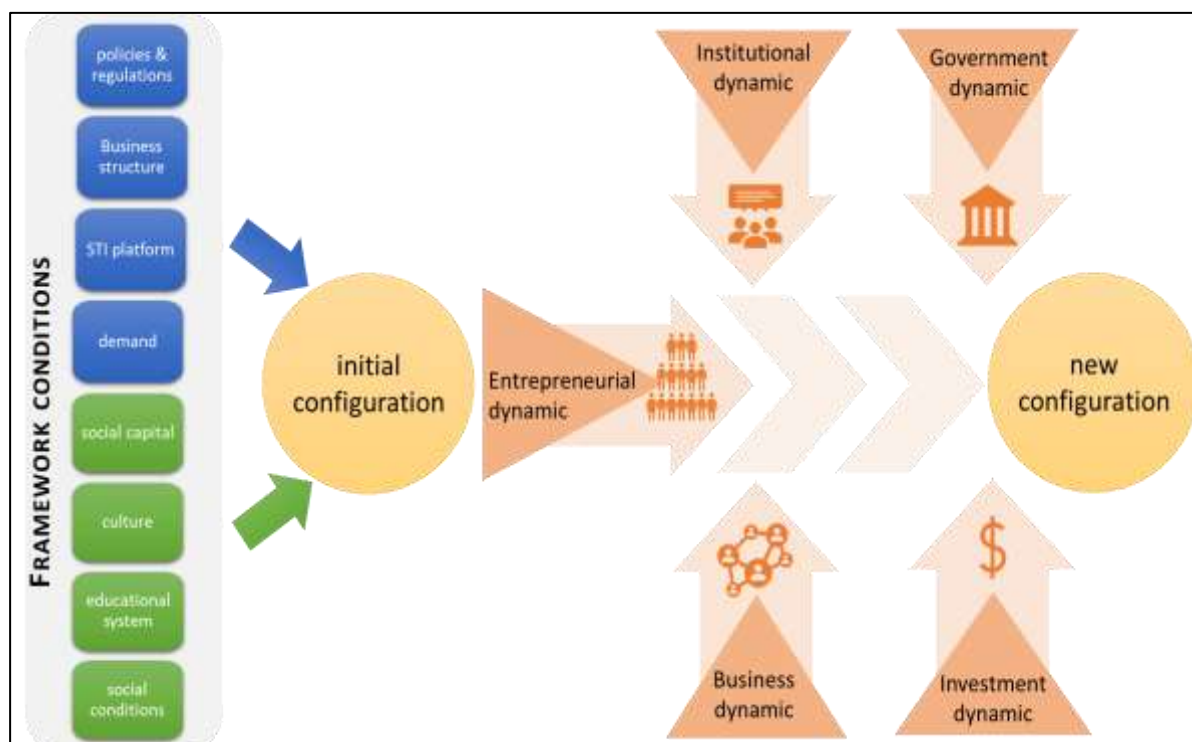
Business dynamic: This refers to the role played by the existing firms located in the EE, particularly the large companies and their initiatives towards entrepreneurship (for instance, open innovation, investments in start-ups, and so forth). It is also the source of spin-offs, potential mentors, and dealmakers, fuelling other dynamics of the EE such as the already mentioned entrepreneurial dynamic but also the institutional dynamic (by providing mentors for support institution) and the investment dynamic (by means of corporate venture capital funds), which will be explained bellow.

Investment dynamic: This involves the role played by different funding sources ranging from banks, business angels and their networks, seed funds, early stages funds, venture capitalists to other actors that directly or indirectly influence the availability of deals and investments

(capitalists, lawyers, dealmakers). This investment dynamic contributes to the ecosystem by feeding the entrepreneurial dynamic with financing. At the same time, it is influenced by the entrepreneurial recycling and business dynamic, as it was seen above and by the institutional and government dynamic, explained below.

Government dynamic: On the one hand, it encompasses all the deliberated interventions made by the government to support entrepreneurs and young firms. But on the other hand, it includes all the changes in regulations that influence the development of start-ups and young firms (entry regulations, taxes, bankruptcy, etc) as well as those that may affect the demand conditions (public procurements) and the investment dynamic (financial regulations, incentives, direct investments or co-investments). This dynamic includes government intervention at different levels, national and subnational.

Figure 1. The interaction between framework conditions and driving forces



Source: Authors' own elaboration

So defined, our model is composed by two ontologically different levels of variables: the framework conditions on the one hand, and the dynamics or drivers on the other. The former influence the latter, which in turn transform the previous configuration of framework conditions into new configuration.

Based on this interactive process between framework conditions and driving forces, our model conceptualizes evolution as a self-reinforcing process, resembling the one proposed by Stam and Van de Ven (2018). Hence, we could formulate the following proposition:

Proposition 1: EE evolution is defined as the result of the self-reinforcing interaction at any moment in time between a configuration of framework conditions and the dynamic of five driving forces: entrepreneurs, existing firms, investors, institutions and governments.

In some models of EE evolution, it is defined as the transition from initial phases towards maturity, assuming some archetype of how a mature ecosystem would look like (Mack and Mayer 2016; Brown and Mason 2017). In our understanding, evolution is explained in terms of ‘quantum leaps’ which do not follow a unique pattern. We can hypothesize two possible extreme cases. In the first one, EE evolution is defined as a cumulative process where framework conditions and drivers interact over the same trajectory. Therefore, small but incremental quantitative changes are accumulated over time achieving then a qualitative change. This pattern of EE evolution would be illustrated by the phenomenon of the water which is transformed into vapour once it reaches its boiling point.

As well, EE evolution could take place by means of certain (internal or external) factors and/or actors which produce by itself a qualitative transformation of the existing configuration into a new one. In this case, we refer to this pattern as catalysation and the above-mentioned factors and/or actors would be the catalysers.

Furthermore, it is possible to identify combinations of the two patterns. For instance, some EE would exhibit some periods of accumulation that will generate certain ‘geological layers’ of actors and factors which in turn will be qualitatively changed by the intervention of some catalysers, whose transformative effect would not be possible without the previous accumulation.

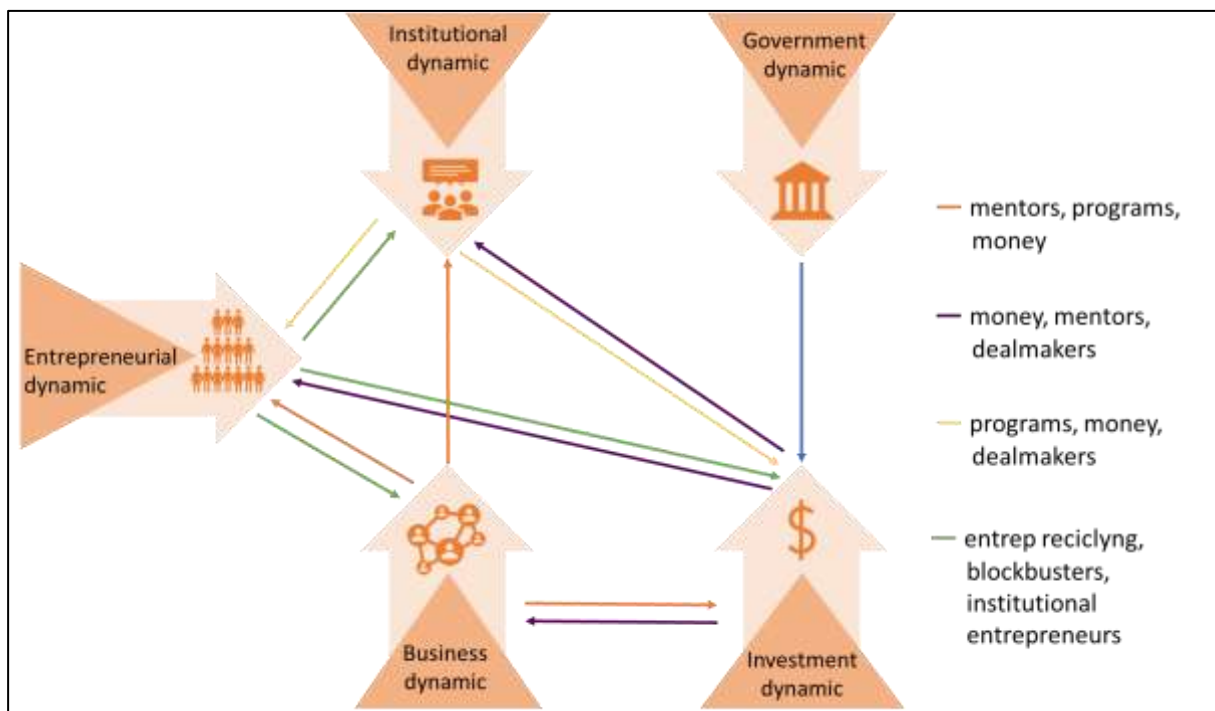
In the analysed cases, in Silicon Valley there were accumulative processes of start-ups until SBICs initiative led to a superior stage of development with the creation of VC industry. The same could be said about Yozma initiative in Israel or the “privatization” of incubators. In both cases the strength of the drivers could be identified in its capacity to trigger more diversified drivers and actors (i.e. entrepreneurial, investment) and in the output of start-ups and scale ups. On the contrary, in the developing ecosystems the government seemed to have played this role of catalyser, but it was not enough to activate in the same manner the entrepreneurial dynamic, giving the less favourable framework conditions. These arguments led us to state the following proposition:

Proposition 2: EE evolution could take place as the result of two types processes: a) accumulative processes over the same trajectory which sometimes could reach certain momentum and generate a new configuration, and/or b) processes led by factors/actors which transform itself the previous configuration in a more radical way, “catalysing” the accumulated conditions.

In the context of such evolution, the different dynamics (or driving forces) co-evolve and interact each other by means of economic incentives (public or private), institutional projects and missions and the motivations and engagements from actors such as entrepreneurs, deal makers, investors mentors, institutional entrepreneurs and policy makers as Figure 2 illustrates. Some of these connections are explicit and deliberate, while others have been the

result of emergent strategies. In this vein, serendipity plays an important role in the EE dynamic and evolution but as all our cases show the role of the framework conditions and the driving forces, particularly, public policy is crucial.

Figure 2. Interrelations within the driving forces



Source: Authors' own elaboration.

The interaction between these driving forces would lead to non-linear dynamics and feedback effects (Roundy et al. 2018). Precisely, the amount and strength of these interdependencies between the different driving forces, will explain the different trajectories of evolution that an EE could follow. In the analysed cases some differences on the trajectories could be identified, such as the relative role of the public and private sector as the EE evolve; the sources of motivations and incentives of the different actors; the level of deal flow and specialization of the organizations and providers of services. These contrasts are the result of different initial configurations and drivers along the time. The differences between the most developed EE illustrate this situation. The more explicit role and influence of the government

in Israel (government dynamic) *vis a vis* the relative power of the not so planned role of mentors and spin-offs (business dynamic) in the Silicon Valley may explain the contrast between them. Based on the above commented we will state proposition 3.

Proposition 3: The different dynamics are interdependently and intertemporally related by a myriad of economic incentives and personal engagements, resulting from deliberated and emergent strategies. The strength of these forces and its connections will explain the different possible trajectories of the EE evolution.

In addition, EE are open systems and they are multi-scalar in nature (Brown and Mason 2017; Roundy et al. 2018). This means that the external (to the territory) actors and factors may influence the evolution of a single driving force and the EE as a whole. In other words, EE evolution would be also the result of the ability of the local driving forces to successfully accommodate these external influences and leverage from them. The cases show the influence of national and local forces, altogether situated in an increasingly global context. In particular, the developed EE show how they were capable to profit from external influences, i.e. the decline in the military contracts in the Silicon Valley and the Russian migration in Israel.

Proposition 4: EE evolution is also influenced by the presence of external (to the territory) factors and actors that may affect the framework conditions and/or the driving forces and their interactions.

By means of this process of evolution, EE are constructed and developed over time, resulting from the co-evolution of framework conditions and driving forces. Consequently, EE evolution and EE development are intimately associated, moulded by its initial conditions and the relative importance of each of the driving forces and the interaction process between dynamics and framework conditions. A positive sign of EE development is the existence of certain balance between the relative importance of each of the driving forces without which

the results of the EE in terms of the quantity and quality of the firms generated and scaled will not be fully realized. The examples of Silicon Valley and Israel showed that despite the leading role of the ecosystem may varied throughout the time, there has always been a tendency towards some balance. On the contrary, in the less developed ecosystems, some degree of unbalance is still evident, especially in the Chilean case. So, we propose the following proposition:

Proposition 5: The level of development of each ecosystem will associated with the framework conditions and the strength and balance of its dynamics (or driving forces) and their interrelations.

Summarizing, the present article tries to contribute to the on-going debate about EE evolution from a systemic perspective. Based on the examination of four different EE, we propose a novel interpretative model of EE evolution with an emphasis on EE with different levels of development.

This model and its five constitutive propositions will surely open new dialogues and research agendas. In addition, it has several political implications, starting from the most basic one referring to the idiosyncratic nature of the EE and the consequently discouragement of any replication attempt. The second most fundamental recommendation is to take into consideration the structural and framework conditions. This would help to understand not only the current situation of the EE but also its future possibilities given their influence over the driving forces of the EE. As well, to intervene in the EE promotion implies the recognition of the complex nature of the interdependencies among the different dynamics that constitute the driving forces that help explaining the evolution of the EE. Hence, policy making must be systemic itself, considering not only the effects over the direct beneficiaries (the entrepreneurs) but also over the broader context of the remaining actors and factors. Finally, a

closer look into the entrepreneurial dynamics invite to widening the focus on the output, to embrace other manifestations of it such as young firms' growth, spinoffs and institutional entrepreneurs.

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References

- Acs, Zoltan, David Audretsch, Erik Lehmann, and George Licht. 2016. "National systems of entrepreneurship." *Small Business Economics* 46 (4): 527-535.
- Acs, Zoltan, Erik Stam, David Audretsch, and Allan O'Connor. 2017. "The lineages of the entrepreneurial ecosystem approach." *Small Business Economics* 49 (1): 1-10.
- Álvarez Martínez, Paola, Sabrina Ibarra García, Cecilia Menéndez, Juan Federico, and Hugo Kantis. 2016. "El ecosistema emprendedor de la Ciudad Autónoma de Buenos Aires. Una mirada exploratoria." *Revista Pymes, Innovación y Desarrollo* 4 (1): 146-174.
- Alvedalen, Janna, and Ron Boschma. 2017. "A critical review of entrepreneurial ecosystems research: towards a future research agenda." *European Planning Studies* 25 (6): 887-903.
- Auerswald, Phillip, and Lokesh Dani. 2017. "The adaptive life cycle of entrepreneurial ecosystems: the biotechnology cluster." *Small Business Economics* 49 (1): 97-117.
- Avnimelech, Gil, and Morris Teubal. 2004. "Venture capital start-up co-evolution and the emergence and development of Israel's new high-tech cluster: Part 1: Macro-background and industry analysis." *Economics of innovation and new technology* 13 (1): 33-60.
- Blank, Steve. 2008. *A Secret History of Silicon Valley*. Mountain View: Computer History Museum.
- Brown, Ross, and Colin Mason. 2017. "Looking inside the spiky bits: a critical review and conceptualisation of entrepreneurial ecosystems." *Small Business Economics* 49 (1): 11-30.
- Cavallo, Angelo, Antonio Ghezzi, and Raffaello Balocco. 2018. "Entrepreneurial ecosystem research: present debates and future directions." *International Entrepreneurship and Management Journal*, 1-31.

- Colombelli, Alessandra, Emilio Paolucci, and Elisa Ughetto. 2017. "Hierarchical and relational governance and the life cycle of entrepreneurial ecosystems." *Small Business Economics*, 1-17. <https://doi.org/10.1007/s11187-017-9957-4>
- De Mattos, Carlos. 1999. "Santiago de Chile, globalización y expansión metropolitana: lo que existía sigue existiendo." *Eure*, XXV (76).
- Díaz, Sandra, and Hugo Kantis. 2017. "¿Quién es quién en Santiago de Chile?" *Dossier III. Serie Brief Prodem N° 1*. Accessed September 16, 2019. <http://www.prodem.ungs.edu.ar>
- Eisenhardt, Kathleen, and Melissa Graebner. 2007. "Theory building from cases: Opportunities and challenges." *Academy of management journal* 50 (1): 25-32.
- Endeavor 2016. "El crecimiento del emprendedorismo en Biotecnología en Buenos Aires." Accessed September 16, 2019. <http://www.mapeoba.com/ElCrecimientoDeBABiotec.pdf>
- Endeavor Insight 2016. "El ecosistema del sector tech en Santiago." Accessed September 16, 2019. <http://www.mapeosantiago.com/wp-content/uploads/2016/05/EcosistemaDelSectorTechEnSantiago.pdf>
- Federico, Juan, and Paola Álvarez Martínez. 2017. "¿Quién es quién en la Ciudad de Buenos Aires?" *Dossier IV. Serie Brief Prodem N° 1*. Accessed September 16, 2019. <http://www.prodem.ungs.edu.ar>.
- Innova Chile. 2010. *Datos Emprendimiento Innovador*. Unpublished internal report. Santiago de Chile: CORFO.
- Isenberg, Daniel. 2010. "How to start an entrepreneurial revolution." *Harvard Business Review* 88 (6): 40-50.
- Kantis Hugo. 2018. "Ecosistemas maduros y en desarrollo. El juego de las diferencias." *Documento de trabajo de Prodem*, 1/2018. Accessed September 16, 2019. <http://www.prodem.ungs.edu.ar>.
- Kantis, Hugo, and Sandra Díaz. 2008. *Estudio de Buenas Prácticas: Innovación y Emprendimiento en Chile: una radiografía de los emprendedores dinámicos y de sus prácticas empresariales*. Santiago: Endeavor Chile.
- Kantis, Hugo, Juan Federico, and Sabrina Ibarra García. 2018 *Opening the black box of ecosystem diversity around the globe. The index of dynamic entrepreneurship*. Buenos Aires: Prodem and Global Entrepreneurship Network.
- Kaplan, David. 2000. *The Silicon boys: And their valley of dreams*. New York: Harper Collins.
- Gutman, Graciela, Pablo Lavarello, and Julia Cajal Grossi. 2006. "La biotecnología y las Industrias de Ingredientes Alimentarios en Argentina." *Journal of Technology Management & Innovation* 1 (3): 121-130.

- Leatherbee, Michael, and Charles Eesley. 2014. "Boulevard of Broken Behaviours: Socio-Psychological Mechanisms of Entrepreneurship Policies." *SSRN*, (August 15, 2014) <https://ssrn.com/abstract=2488712> or <http://dx.doi.org/10.2139/ssrn.2488712>
- Levie, Jonathan, and Benyamin Lichtenstein. 2010. "A terminal assessment of stages theory: Introducing a dynamic states approach to entrepreneurship." *Entrepreneurship Theory and practice* 34 (2): 317-350.
- Mack, Elizabeth, and Heike Mayer. 2016. "The evolutionary dynamics of entrepreneurial ecosystems." *Urban Studies* 53 (10): 2118-2133.
- Martin, Ron, and Peter Sunley. 2011. "Conceptualizing cluster evolution: beyond the life cycle model?" *Regional Studies* 45 (10): 1299-1318.
- Mason, Colin, and Richard Harrison. 2006. "After the exit: Acquisitions, entrepreneurial recycling and regional economic development." *Regional Studies* 40 (1): 55-73.
- Mazzucato, Mariana. 2015. *The entrepreneurial state: Debunking public vs. private sector myths*. New York: Anthem Press.
- Napier, Glenda, and Camila Hansen. 2011. *Ecosystems for young scalable firms*. Copenhagen: FORA Group.
- Navarro, Lucas. 2014. "Entrepreneurship Policy and Firm Performance: Chile's CORFO Seed Capital Program." *Interamerican Development Bank Policy Brief No IDB-PB-230*. Accessed August 28, 2019. <https://publications.iadb.org/en/entrepreneurship-policy-and-firm-performance-chiles-corfo-seed-capital-program>
- Nitzan, Jonathan, and Shimshon Bichler. 2002. *The global political economy of Israel: From war profits to peace dividends*. London: Pluto Press.
- Rivas, Gonzalo. 2014. *El fomento al emprendimiento dinámico en países del Cono Sur de América Latina: Análisis de experiencias y lecciones de política*. Inter-American Development Bank.
- Roundy, Phillip. 2016. "Start-up community narratives: The discursive construction of entrepreneurial ecosystems." *The Journal of Entrepreneurship* 25 (2): 232-248.
- Roundy, Phillip, Mike Bradshaw, and Beverly Brockman. 2018. "The emergence of entrepreneurial ecosystems: A complex adaptive systems approach." *Journal of Business Research* 86:1-10.
- Saxenian, AnnaLee. 1996. *Regional advantage*. Cambridge: Harvard University Press.
- Senor, Dan, and Saul Singer. 2011. *Start-up nation: The story of Israel's economic miracle*. Random House Digital, Inc.
- Spigel, Ben. 2017. "The relational organization of entrepreneurial ecosystems." *Entrepreneurship Theory and Practice* 41 (1): 49-72.

- Stam, Erik. 2015. 'Entrepreneurial ecosystems and regional policy: a sympathetic critique.' *European Planning Studies* 23 (9): 1759-1769.
- Stam, Erik, and Andrew Van de Ven. 2018. "Entrepreneurial Ecosystems: A Systems Perspective." *U.S.E. Research Institute, Working Paper Series 18-06*, Utrecht University.
- Startup Genome. 2017. *Global startup ecosystem report 2017*. San Francisco: Startup Genome.
- Yin, Robert. 1989. *Case study research: Design and methods*. Newbury Park: Sage Publications.

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