APRIL 2019

MIT REAP
Regional Entrepreneurship Acceleration Program

MIT's Stakeholder Framework for Building & Accelerating Innovation Ecosystems

Dr. Phil Budden
MIT Sloan School of Management

Prof. Dame Fiona Murray
MIT Sloan School of Management

MIT's Stakeholder Framework for Building & Accelerating Innovation Ecosystems

Dr. Phil Budden
Senior Lecturer, Technological Innovation, Entrepreneurship, and Strategic Management
MIT Sloan School of Management

Prof. Dame Fiona Murray
William Porter Professor of Entrepreneurship
Associate Dean for Innovation, MIT Sloan
Co-Director, MIT Innovation Initiative
Faculty Director, Legatum Center
MIT Sloan School of Management

Working Paper

April 2019

Originally Published by MIT's Laboratory for Innovation Science & Policy

MIT's Stakeholder Framework for Building & Accelerating Innovation Ecosystems

Generating 'innovation' and 'entrepreneurship' - especially in the form of innovation-driven start-up enterprises (which we refer to as innovation-driven enterprises (IDEs)) - has emerged as a critical priority in the global innovation economy. The challenge is, as observation confirms, that the world today - far from being 'flat' – has remained remarkably uneven, especially in terms of innovation-driven entrepreneurship. We refer to densely concentrated hubs of innovation-driven enterprises as 'innovation ecosystems'. While Silicon Valley remains the archetypical and iconic such iEcosytem, others are emerging around the globe from London to Lagos, Shenzhen to Sydney.

The puzzle for policy-makers, or others interested in a specific 'place' or region, is that this phenomenon – especially of 'innovation-driven entrepreneurship' – is not only highly concentrated but also seems to be characterized by a positive reinforcing cycle of growth, once IDEs reach a particular concentration (Audrestch & Feldman 2004). The systems-like behavior of these places has knock-on consequences, both for the regions in which it takes place, but also for those localities that have not crossed the threshold for accelerated growth (or at least not at the same rate). The logic of 'co-location', with growing networks of exchange and the consequent 'network effects,' means that the successful regions (and nations) may end up continually doing better, while those less successful ones get left further and further behind. As Audrestch & Feldman described, "geography has been found to provide a platform upon which new knowledge can be produced, harnessed and commercialized into innovations" (2004, p.31).

MIT's study of these phenomena tries to address this puzzle, and provide advice and options for those who wish to optimize innovation-driven entrepreneurship in their specific regions, and who seek to build a vibrant innovation ecosystem in their locality. A key to MIT's approach is a Stakeholder Framework (which will be the subject of this Working Paper), but it is important to first place this in context.

'Innovation' is an observable phenomenon around the world, and may be assessed with a variety of input measures, such as R&D spend (often as a % of GDP), as well as outputs including publications, patents filed (per capita), etc. Interestingly, such innovation appears to be increasingly localized in 'hotspot' regions that have become known as hubs of innovation, such as Seoul, Switzerland, Silicon Valley, and Greater Boston.

On the other hand, 'entrepreneurship' is another, separate, observable phenomenon, captured in measures such as new business enterprise start-ups, the jobs created by

'young' (ie less than 5 years old) enterprises, venture capital (VC) funding (also often measured as a % of GDP), and 'exits' such as IPOs or acquisitions. Entrepreneurship in this sense is in some ways a more widespread phenomenon, although regions with successful high-growth IDEs (rather than just more traditional SMEs, ie small and medium-sized enterprises) are themselves rare and highly concentrated, such as we see in London, Berlin, Silicon Valley, and Israel. At the core of these most productive regions is what we call an 'innovation ecosystem' – with the choice of this world from biology being deliberate, used to capture the organic, inter-dependent and evolving nature of the phenomenon.

We describe such an ecosystem as being characterized by a network of connected and interdependent actors who have a range of ties – from formal to informal, and from weak to strong, within a geographically proximate area (Schrank & Witford 2011, Sorenson 2018). Such ecosystems also have, at times, a hierarchical structure that denotes different power dynamics and differential resources, although these dynamics often need to be overcome for collective action to enable a stronger, more densely connected network and more resource sharing. But most importantly, the successful innovation ecosystems have a form of social cohesion that drives and is driven by collective action (Owen-Smith & Powell 2006).

As a consequence, such networks enable a range of formal and informal norms and institutional practices that support the types of resource exchange that are the life blood of innovation ecosystems. Owen-Smith and Powell describe the advantages, especially to IDE formation and growth, of membership in these loosely connected networks as arising from "coherent network topology [that] imparts significant advantages to firms in knowledge-intensive industries" (2004 p.6). Such advantage lies in the ability to combine resources and ideas in novel ways, but also from the ability to move from one possible collection of resources, people and ideas to another if that particular project is deemed to be a "failed" experiment (Sorenson 2018). And it is the reaction of the various actors in the ecosystem to such successes and 'failures' that drives network trajectories and topology, and the changing role of various actors, that over time drives the entire ecosystem (Dedehayir, Makinen & Ortt 2016).

By studying these iconic 'innovation ecosystems', we can discern how they evolved – which was often without an overarching plan, or even a concerted bottom-up series of efforts – and how stakeholders have sustained their success. This then provides insights into the roles played by core stakeholders in these ecosystems.

As with all our other Working Papers, we put this work out to be of use now, and invite comments and suggestions.

A framework for understanding stakeholders in innovation ecosystems

While few regions aim to replicate Silicon Valley or even Greater Boston, many aspire to build their own innovation ecosystem to support the creation and growth of new enterprises (especially 'IDEs') with the social and economic benefits that arise when such firms grow to serve as the engine of the innovation economy. Those wishing to build, develop or accelerate their innovation ecosystem can draw general lessons – if not a precise roadmap - from historical, iconic ecosystems to chart their own path.

The most famous ecosystems did not arise from highly orchestrated stakeholder strategies, nor did they emerge from the requisite engagement of all the critical stakeholders from the outset. However, the dynamics of stakeholder engagement do still remain salient and serve as the source of useful lessons.

For example, Silicon Valley evolved from a confluence of actions, accidents and subsequently increasing returns over a period of many decades that led to its formation and growth. Greater Boston, especially the recent rise of its biotech-led ecosystem, presents only a slightly more strategically-oriented example, while Israel's 'Start-Up Nation' is not characterized exclusively by deliberate actions. Each of these examples, however, involves important and shifting roles for certain stakeholder groups in their evolution and success.

Understanding those stakeholders' systemic roles – and aiming off for self-promotion by some, and understatement by others – is crucial to getting more accurate and nuanced perspectives on their contributions. Building on these examples (and on insights into the role of involved stakeholders), those seeking a more purposeful (and accelerated) approach to ecosystem-building today can assume that, by taking a more mindful and systematic approach, they might shift the odds more swiftly and more clearly in favour of success for their region.

This of course begs several questions: which stakeholders must be at the table to ensure effective ecosystem change? Who are the most effective leaders to drive such ecosystem efforts, and under what circumstances? How can diverse stakeholders be brought together effectively? What are the fault lines that characterize the tensions in their interactions, and does it matter if some stakeholders are missing?

Which Stakeholders are required for building Innovation Ecosystems?

Practitioners and scholars have proposed a variety of perspectives on the question of which stakeholders are required to boost a local economy, or today to build an innovation ecosystem. In early works, there was a general agreement on a bilateral axis (or 'dyad') of 'industry' and 'government', as appeared to have dominated the industrial economy, with conceptions ranging from the 'military-industrial complex' to more general perspectives on industry-government relations. With the rise of the knowledge economy in the late twentieth century, a third stakeholder was admitted – namely the 'entrepreneurial university' - resulting in the "Triple Helix" of 'industry-government-university' relationships (as outlined by Etzkowitz (1993) and with Leydedorff (1996)).

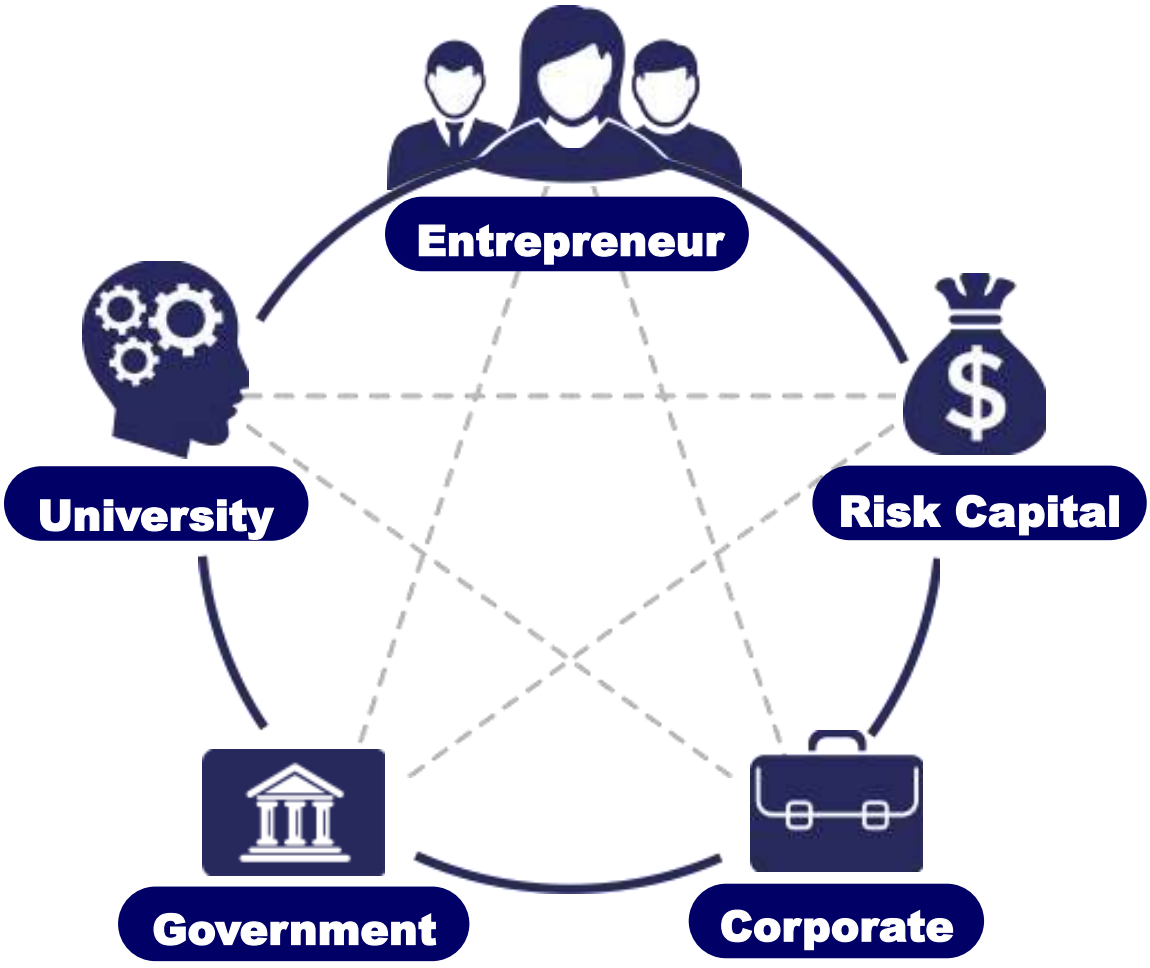
Now in the twenty-first century, reality has shifted (not least with the rise of digital technologies) and the debate on which stakeholders are key to the innovation ecosystem has started to move on: for example, in his book "Boulevard of Broken Dreams," Lerner (2012) argued that, while the government can "set the table" and create the conditions for successful innovation-driven growth, it cannot lead such efforts. Brad Feld in his "Start-Up Communities" (2012) book suggested an alternative "Boulder Hypothesis" arguing that entrepreneurs are the only individuals who can meaningfully lead ecosystem-building, because they are the leaders (and not 'feeders') on the frontlines. More recently, Mazzucato in the "Entrepreneurial State" (2015) has posited a strong and central role for Governments and policy-makers.

In yet other streams of thought and guidance, universities are posited as the most natural organizations to drive ecosystem change – a perspective driven in part by the critical role of Stanford and MIT in Silicon Valley and Greater Boston respectively (see Kenney & von Burg 1999), and driven by analyses of the emergence of biotech clusters in the United States and Europe (Casper 2008). And finally, we have observed that in practice there is a strongly held belief that risk capital providers (especially venture capitalist (VC) firms) see themselves as necessary (and sometimes solely sufficient) to any effective ecosystem and so are critical actors to be brought to the table to lead change and growth (Feld 2012).

Our MIT perspective is based partly on our historical analyses of the world's most iconic innovation ecosystems – from Greater Boston's ecosystem on our doorstep, to many others, from Silicon Valley, through London and Israel, to Singapore and Shenzhen. But it is also founded on a wide range of global innovation ecosystems, at various stages of development, with which we have had opportunities to work through our various MIT classes and a key MIT global program, namely MIT REAP.

From our MIT research, we argue that there are five key stakeholders critical to the success of most efforts at innovation ecosystem creation, and to the subsequent growth and acceleration of innovation-driven entrepreneurship in the ecosystem. This goes beyond the 'triple helix' to reflect the twenty-first century's realities. (There are of course many other actors in any socio-economic/political system – ranging from trades unions to law firms, the general public to the media – but, for the purposes of advancing innovation-driven entrepreneurship ecosystems, the same five kept showing up around the world as the necessary stakeholders.)

The five stakeholders in innovation-driven entrepreneurship ecosystems are as follows:



MIT's five stakeholders in an Innovation Ecosystem

Entrepreneurs: entrepreneurs and entrepreneurship are both widespread phenomena, but - in the types of innovation ecosystems that characterize Greater Boston, Silicon Valley, Israel, London, Shenzhen and beyond - we emphasize the particular types that harness innovation, and thereby found and grow a particular type of start-up enterprise: the innovation-driven enterprise (IDE). In contrast to most 'small and medium-sized enterprises' ('SMEs'), these IDE start-ups are formed with the explicit intent to build competitive advantage based on new innovations (that can have their origins in scientific insights, technical change, new business models, supply chains, etc), to grow quickly and scale well beyond local markets, and aspire to significant growth.

With general entrepreneurship being so globally widespread, it is clear that the subset of innovation-driven entrepreneurs derives particular benefit from being in resource-rich innovation ecosystems. Entrepreneurs around the world may be no less driven or entrepreneurial, but they lack the dense networks of resources and people which those IDE entrepreneurs may take for granted in the regions in which they reside: they benefit from network crucial to driving start-up success and overcoming the lack of any founder resources (Powell and Grodal 2006, Sorenson 2018).

Given the IDE entrepreneurs' central role in the innovation ecosystem, their voice is critical to ecosystem building. Without this voice from the frontline of innovation, ecosystem-building efforts may be undertaken in a vacuum, and not actually provide the support needed to accelerate IDEs: instead, efforts may simply provide what other stakeholders *imagine* that an IDE entrepreneur needs. A case in point is the development of a large 'Biopolis' in Singapore which was a government-led effort built to support an innovation ecosystem in the life sciences. Yet, by emphasizing a large building and large corporations rather than the needs and wants of the sorts of life science entrepreneurs behind successful ecosystems elsewhere, the project failed to jump start the cluster as expected. In other instances, a narrow focus on providing risk capital (eg VC) as a solution might also fail to recognize the specific needs of local IDE entrepreneurs and thus meet with less success than anticipated.

Instead, we have found, for example in our MIT work with Scotland on their innovation ecosystem, that when present at the table, current entrepreneurs, as well as successful entrepreneurs willing to give back to their ecosystem, share their views and represent (informally) the perspectives of a wider entrepreneurial community. Likewise, in Greater Boston, successful entrepreneurs such as 'Desh' Deshpande have supported programs to build the innovation ecosystem (e.g. MassChallenge), served as mentors to many aspiring young entrepreneurs and supported MIT in its own entrepreneurial activities.

Risk Capital: like entrepreneurs, providers of risk capital (which we define as going beyond just VC) are necessary, but not sufficient, stakeholders in the innovation ecosystem. Therefore, it is essential to have them participate in innovation ecosystem-building activities, though it is critical to emphasize that their engagement must be more than simply a measure of their presence in the ecosystem as funders.

For example, they can provide an especially important window into the factors that may be limiting risk capital resources. Conversely, innovation ecosystems are especially salient to risk capital providers: they provide an efficient, geographically localized context for the identification of new ideas, teams and IDEs. And the deep social networks provide important sources of referrals and endorsements to investors with many investment choices and only limited time and investment capital.

In ecosystem-building activities, it is also worth avoiding the common trap of assuming that venture capital (VC) is the only essential form of risk capital for innovation ecosystems. Even though many ecosystem-ranking exercises consider VC funding to be the only measure of such capital, this form of risk capital is highly optimized for IDEs in software and other start-ups where learning and scaling can take place rapidly with relatively small capital outlays. More recent experience in clean tech (e.g. the PRIME Impact Fund and Breakthrough Energy Ventures), in tough tech (via the new 'Engine'), and 'deeptech' (with SGInnovate) suggests that critical non-VC 'patient capital' might be available in other sectors, or that crowd-funding can be another key source.

The lesson for ecosystem-building is to explore the spectrum of risk capital resources (eg angel investors and their syndicates), to ask IDE entrepreneurs about their own experiences of fund-raising, and to engage more closely the full range of both traditional and new risk capital providers.

As an example, during its work on building its innovation ecosystem (and especially when focusing on building its entrepreneurial capacity), Singapore has brought several risk capital stakeholders to the table including Infocomm Investments, Joyful Frog's risk capital fund (and accelerator), and DBS Singapore (a bank which plays a key role in supporting risk capital especially for more traditional SMEs across the ecosystem).

Universities: certain universities play an iconic role in the development of some of the most powerful innovation ecosystems. For example, MIT and Harvard have played a critical, and complementary, role in the emergence of the Greater Boston ecosystem. As is widely documented, Stanford has, of course, played a central role in the emergence of Silicon Valley. Even in locations where initially the universities were slightly less prominent players – such as in Israel, London, New York or Singapore – the university is still a critical stakeholder. And yet, strong universities are not deterministic of strong innovation ecosystems (Taylor 2016).

While represented as a single stakeholder, universities vary widely and provide a range of different activities and insights for the innovation ecosystem and must play, as Florida has argued, a multi-faceted role (2014) providing: novel science-based ideas, technical and scientific training, entrepreneurship education, sophisticated facilities, etc. Of course, like other large organizations, universities have a range of different touch-points with the innovation ecosystem.

Engagement with the university must include a range of these internal individuals – everywhere from the Office of the President, through individual faculty and their labs, to the Technology Licensing/Transfer Office and the leadership of the Entrepreneurship Centers and Programs. While universities such as MIT are iconic for playing such a role (Roberts, Murray & Kim 2015), others like Waterloo in Canada also play a less widely celebrated but nonetheless critical role (Bramwell & Wolfe 2008).

Beyond engaging with a variety of actors within a single university, it can also be critical to interact with a range of universities in an ecosystem, especially when these are very distinctive in their comparative advantage in research, in their focus on education versus research, or in their interaction with corporations for different purposes.

For example in London, ecosystem-building – especially focused on the intersection of technology and design - has expanded to include Imperial College (especially with its move to the West London White City Campus), Kings College London (expanding in Central London to an Entrepreneurship Center in Bush House), University College London (moving east to Olympic Park's Here East), and the University of the Arts London (which has consolidated a range of arts and design programs, training and expertise).

Large corporations: large corporate enterprises have increasingly seen themselves as being 'global' or 'multi-national' and less deeply connected to specific regions, including local innovation ecosystems. Traditionally, only those Corporates that have regarded themselves as a national anchor have played a role in their region but, even in that role, the emergence of the innovation ecosystem has not necessarily been at the core of their activity. However, global corporations, as well as those who are national champions, have become increasingly interested in their role in tapping into innovation ecosystems.

A case in point is Greater Boston where almost all the major global pharmaceutical companies have a presence to tap into and contribute to the local ecosystem. Much as with other ecosystem stakeholders, large corporations have a role to play within, and benefit from, a dense network of connections. Their role as strategic alliance partners has often been highlighted (Owen-Smith & Powell 2006), but more recently their contributions have been considered in a broader light.

It is important to recognize the powerful role that such large corporations can play in ecosystem-building, including their activities in 'on-the-job' talent development, their contributions to risk capital through their 'corporate venture capital' (CVC) arm, their facilities (eg space, testbeds and labs) that support innovation infrastructure in the region, and their convening power.

Of course, not all large corporations will be equal players in any ecosystem but, depending upon the comparative advantage that a region has or is aiming to build, specific corporations are likely to be key stakeholders that need to be included in ecosystem development.

For example, in their ecosystem-building in Chile, the MIT REAP Team focused on using mining expertise as a source of comparative advantage (and as a testbed for innovation-driven entrepreneurial activities). Ecosystem leadership engaged representatives from mining associations of Corporate, such as Codelco and Alta Ley, as well as the global corporation, BHP. itself. Similarly, in Morocco, OCP as a national champion and a key industrial player in the economy, was the fulcrum in shaping that Team's innovation ecosystem efforts.

Government: notwithstanding that governments are often controversial in their role in ecosystem-building (particularly in the minds of entrepreneurs!), their engagement in deliberate ecosystem development is critical. To put it another way, governments must be engaged in ecosystem-building even though they may not necessarily be the leaders of such activities. And while governments have not been widely regarded as key nodes in the social networks of innovation ecosystems, their presence and ongoing interaction with different organizations and individuals can be critical in shaping appropriate rules and norms within ecosystem networks.

One of the key challenges and factors to recognize is that government consists of key different levels: eg national level government, regional level government and also city level government, and it is important to differentiate among places where the power or leadership reside with different levels of government agencies.

For example, in our work with Madrid, we found that the region's REAP Team must engage both with the City of Madrid government (including its Mayor) as well as the *Comunidad de Madrid* (one of the 17 autonomous communities of Spain). In our work with Scotland, the team included representatives from the Scotland-wide Scottish Enterprise agency as well as the local Highlands and Islands Enterprise organization. In Central Denmark, the team coming together around ecosystem building must manage changing political boundaries that put some parts of the region in or out of scope for government representatives.

Beyond a focus on the levels of government, innovation ecosystem builders also have to be aware that 'government' representatives can come from a number of different government departments or agencies at each level (as responsibility for innovation and entrepreneurship is widely distributed across business/commerce, education, treasury, trade etc); as well as from a more 'political' side (eg ministers, advisers or members of parliament) or a more 'official' side (eg career civil/public servants).

Other Key Players: based on our research, the MIT stakeholder framework is a heuristic, intended to capture core insights about the key players in ecosystems in which innovation-driven entrepreneurship seems to best thrive. As such, it cannot map the real world on a 1:1 ratio, nor cover all the possible players within all ecosystems everywhere. Having identified the five primary stakeholders in an innovation ecosystem, it is useful to identify a variety of other actors which play a role within the complex ecosystem, just as in the natural world, and which might usefully be involved in ecosystem building.

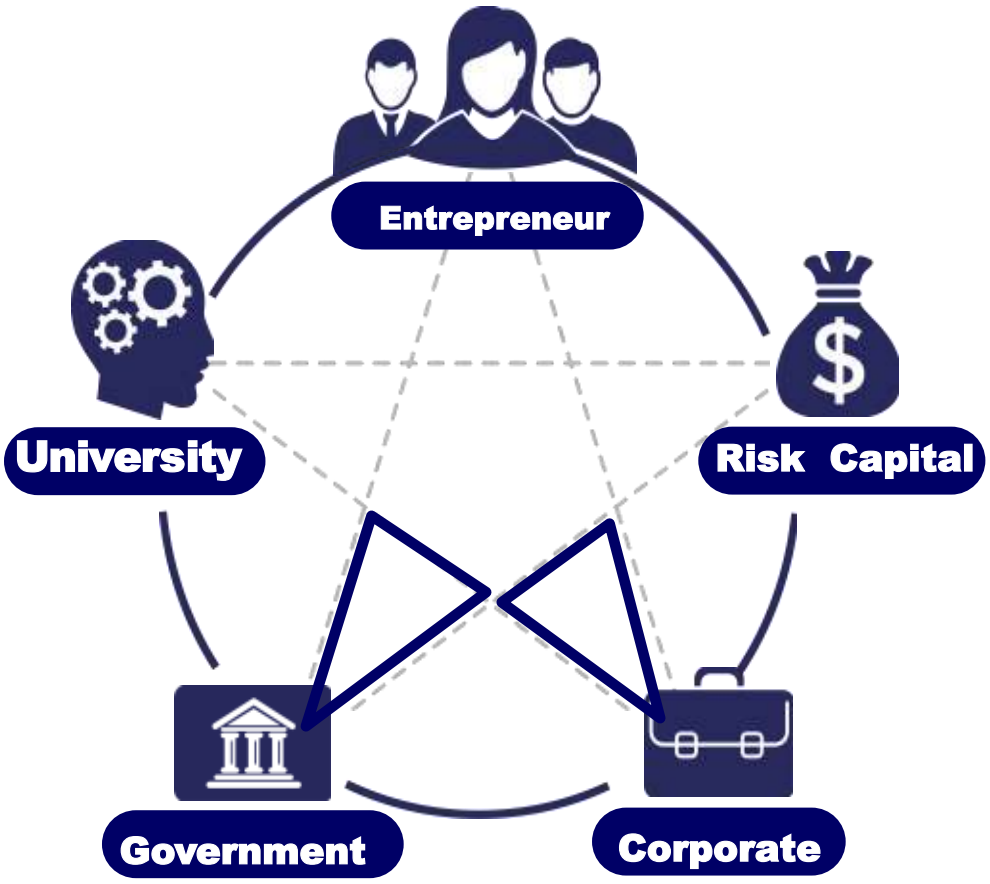
These do not warrant being among the Framework's five essential Stakeholders, but they can be included within it (see below), depending on the region's particular circumstances: these could include:

- Specialised 'service providers' like lawyers, accountants and consultants helping start-ups add value to an existing ecosystem: as such, we would place them – with other incorporated organisations – close to the Corporate stakeholder, just inside the circle (in the space represented below, by the triangle on the right hand side).

- Non-governmental organisations (NGOs) and 'quasi-governmental organisations' ('quangos') can also be seen as playing a supportive if sometimes secondary roles: in the space represented by another of the triangles above, they may include varieties of players which aim to participate in Government, namely political parties.

- Some Corporates – such as banks and other financial institutions – can play a hybrid role, where they are both a large Corporate and a Risk Capital provider: these can be powerful contributors (or obstacles) to an innovation ecosystem, and could engage and in some ways represent both Stakeholder groups (although do not represent the totality of either all corporates risk capital providers).

- Other actors in the ecosystem – like accelerators, co-working spaces or 'sandboxes' – can be placed within the circle, but they are often sponsored by one (or more) of the five key stakeholders, so should be placed close to them. For example, a state-funded accelerator might be placed close to the Government stakeholder, but just inside the circle, to respect its semi-autonomy and the fact that it is intended to engage a variety of other stakeholders within the circle of the ecosystem.



The innovation ecosystem itself is embedded within a much wider political, social and economic context. Many individuals exist within that community, with many interests that encompass, but lie well-beyond, innovation. Within society, these individuals may have political interests which they express in a variety of ways, such as through political parties or interest groups whose activities shape policy and are the domain of Government. As such, the Government stakeholder acts as a proxy for this process of representation while, in some contexts, represents its own particular state views of the needs of the population, if no such representation exists. It is thus worth recognizing that innovation ecosystems can emerge under systems that are not fully democratic.

On the economic side, individuals may also have needs as consumers, and as such represent a significant aspect of market consumption. Within the MIT framework, the innovation ecosystem is embedded within these many market and consumer interests, which find proxy representations in a number of the Stakeholders, such as Corporates serving the market, Entrepreneurs seeking new opportunities to meet consumer needs, and Governments enacting economic policies (eg to regulate competition, consumer safety, enterprise-formation, etc).

Can Ecosystem Leadership be undertaken by different Stakeholders?

All five primary stakeholders are critical to effective innovation ecosystem-building, but it remains a challenge to bring these five together and to develop a sense of collective leadership. One key question that arises is whether there is one stakeholder who might serve as the best leader for ecosystem development.

In contrast to some of the earlier literature above, our experience is that any one of the five stakeholders can take a leadership role. The most important characteristic of any ecosystem leaders is that they remain committed over a long period to the task at hand, and follow a stakeholder engagement approach that makes the entire group of stakeholders feel included and heard.

As such, there are examples of different stakeholders taking a leading role, in different regions and at different times: together, these examples provide a chance to explore the opportunities and challenges of different leadership approaches.

Entrepreneurs and Risk Capital as Leaders

Entrepreneurs and risk capital providers have led the creation and growth of a handful of innovation ecosystems – including in a number of U.S. cities such as Boulder, Colorado (Brad Feld) and Las Vegas, Nevada (Tony Hsieh). Entrepreneurs as ecosystem leaders have often deployed their personal wealth and used it as the foundation of a vision to build an innovation ecosystem in places that have particular importance to them, and perhaps have been less successful in innovation and entrepreneurship than these individuals find desirable.

For Brad Feld, his 'Boulder Hypothesis' was that he could build a community of start-up entrepreneurs on the foundations of a beautiful location (in the Colorado mountains) to attract many individuals from all over the world, with a tremendous resource of several extremely strong universities (the University of Colorado Boulder and Colorado School of Mines), as well as several national labs e.g. the National Institute of Standards. In contrast, Tony Hsieh focused on a region of the US with a less obvious university community – Las Vegas – but a strong risk-taking ethos and with the potential for urban redevelopment.

In both cases, the entrepreneurs sought to use their own personal funds as 'angel' risk capital, as well as attracting risk capital from other entrepreneurs and angels in their extended social network. Of course, these two cases take place in the U.S. where the underlying institutional foundations are well constructed, and where (at least in the

case of Boulder) government funding had long supported a strong university presence. It is less clear whether such an approach could jump-start regions with fewer pre-existing resources, but it is clear that the focused and determined attention of experienced and wealthy entrepreneurs can certainly drive the early-stages of change in regions without a strong innovation ecosystem.

University as Leader

Universities have a long tradition of supporting and at times leading their regional economies. Indeed, those universities founded by local and regional governments, or by a local community, often have a regional economic mission embedded in their charter. With their often, large physical footprint (in terms of buildings, land, etc.) and significant number of employees, universities are a major presence in some regions. As such, they are often ideal leaders of regional innovation ecosystem development.

While balancing its global outlook with a regional focus, MIT has played a key role in supporting the Greater Boston innovation ecosystem: in the post-Second World War period, it was a significant player in the development of the regional defense and hardware ecosystem (especially on Rt.128 around Boston). But MIT has not operated alone. Greater Boston has benefited from having over sixty academic institutions, each making unique and distinctive contributions, with some more focused on innovation and translation of research than others. More explicitly, the emergence of the life science ecosystem has benefitted from the concerted and collective leadership efforts of Harvard University, its affiliated hospitals, MIT and other universities in the region.

With their convening power, and opportunity to be an honest broker, universities can be significant drivers of ecosystem acceleration when regions are otherwise declining: Carnegie Mellon and University of Pittsburgh in the city of Pittsburgh and surrounding region played a critical leadership role at a time of economic decline and stagnation. Building on their strengths in computer science and robotics, large local infrastructure and convening power, the universities led and collaborated with the regional community of stakeholders to drive the 'Pittsburgh Renaissance'.

Further afield, in Chile, the *Universidad de Chile* is playing a critical role in supporting the burgeoning innovation ecosystem, especially in its transition for building basic entrepreneurial capacity (through government led 'Start-Up Chile') towards a more innovation-driven approach with an emphasis on mining-oriented challenges e.g. in related aspects of health, water, energy, safety etc. and with a role in convening otherwise complex stakeholder communities.

Universities around the world often play a critical role in their ecosystems. Their strength lies in their openness and convening power; as well as their long-term commitment to their region: many universities contain the name of their region in their licensing charter, eg Massachusetts Institute of Technology, or University of Pittsburgh, so have a special role in the namesake region. Their limitations often arise from a lack of access to significant risk capital funding, the boundaries in their remit to emphasize not-for-profit activities (and only the early research stages of innovation), and their (sometimes limited) engagement with Government (either local or national) that is needed, at least to be an honest broker).

Large Corporate Leaders

Large Corporates are not widely regarded as natural innovation ecosystem leaders. They typically have a wider economic, rather than a regional or local ecosystem, remit, and are therefore necessarily focused on their immediate corporate goals and the demands of their shareholders. Nonetheless, in some regions, large corporations (especially those with an anchor role as a national or regional champion) have played a role in leading ecosystem building.

For example, Morocco's OCP is the world's largest phosphate producer, but - far from being engaged only in the country's primary industry - OCP is playing a central role in establishing an innovation ecosystem. It is taking an enlightened approach to corporate goals, by acknowledging its longer-term interests in innovation arising around the phosphate assets, by working with local entrepreneurs, supporting the creation of a new technical university, and providing risk capital through a corporate venture capital fund. Likewise, Saudi Arabia's Aramco is the country's leading global corporation and it can play a critical anchor role in building the country's innovation ecosystem.

Corporations do not have to be national champions to play a leadership role. In Wales for example, IQE – a major compound semiconductor producer – has stepped up to play a leadership role in the region by collectively imagining and building an entire globally-competitive innovation ecosystem. Drew Nelson, the CEO, mobilized the University of Cardiff to develop a research center on compound semiconductors, and to work collaboratively with others to build a semiconductor academy. Supported by the regional Welsh Government, the national UK Government has created a Compound Semiconductor "Catapult" for translation research in compound semiconductor applications, and there are opportunities for entrepreneurs to build IDEs in a range of application domains.

In Finland, Nokia worked to support and build the local innovation ecosystem, especially in the period 2008-2013 when it was losing ground and many of its employees were having to find other employment alternatives. In China, especially in Shenzhen, Tencent has played a leading role in strengthening innovation ecosystems, by supporting start-ups in their incubators, through accelerators and backed by their funding. They provided entrepreneurship training, co-working space, and seed funding for start-ups.

Corporates such as Nokia, Tencent, and IQE can be extraordinarily effective in leading their ecosystems. However, corporations also have limitations in their role: they have shareholders to satisfy, some of whom might only have a short-term perspective, while the most global ones may shift their strategic direction and therefore their ecosystem commitment, through changing geographic priorities, and may even be less credible as an honest broker in regional leadership.

Government Leadership

Governments are, of course, one of the most obvious leaders in innovation ecosystem building, and many strive to accelerate their ecosystem as part of their mandate in shaping political stability, economic prosperity, and social progress. Perhaps the best-known example is the proactive and at times prescriptive role that Singapore's Government has successfully played in shaping the fortunes of its 'city state'.

The pitfalls of government-led ecosystem development are well known, and yet some governments, especially those which take an ecosystem view, can lead innovation ecosystem development effectively. Singapore has traditionally been effective in building the innovation capacity of the country (eg through R&D), and more recently has taken steps to complement such efforts with matching entrepreneurship activities. More recently, the government of Dubai has started playing a leading role in building its innovation ecosystem - as part of UAE Centennial 2071 – including a focus on building new space (Area 2071), government accelerators, regulation etc.

Each of these efforts is informed by the needs of entrepreneurs, but this is challenging for governments, as entrepreneurship is perceived as less top-down in its needs. This distinct form of engagement is particularly difficult for governments more used to engaging in innovation which can benefit substantially from public R&D spending and yield to simple spending programs and where there is a long record of engagement with the scientific community. Indeed, the focus of Lerner's "Boulevard of Broken Dreams" is precisely on the failures of governments in entrepreneurship-oriented funding policies. Lessons from other governments including Israel and the UK have provided at least a handful of models for more successful government-led intervention on funding.

As an alternative, government leadership needs to emphasize convening, listening to the needs of entrepreneurs, and going with the grain of existing entrepreneurial activity. This is surprisingly challenging and stands in contrast to the desire of many policy-makers to issue edicts about the direction and location of regional entrepreneurship (that might be politically useful but is practically infeasible). One of the features of Singapore's more recent success in building support for IDEs is the willingness to engage the risk capital and entrepreneur communities, to bring them into the conversation (and into key leadership roles), to emphasize the need for policy changes via dialogue (e.g. the policy sandbox), and to recognize that the areas of focus may need to emerge from the community.

Israel also presents a case for government-led ecosystem initiation. While the 'Start-Up Nation' phenomenon has many origins, the role of the government in the earliest stages of ecosystem development is widely agreed to have been critical. As part of its shift from a socialist, kibbutz-based economy to a highly competitive start-up-rich economy, the Government not only invested in public R&D, in links with the US and in building local competitiveness (and self-sustainability in defense), but it also aimed to build entrepreneurial capacity through the provision of several well-designed funding vehicles designed to both jump-start IDEs but also build local venture capital expertise. The Yozma program (to accelerate VC formation) is now well known and widely copied, but was a critical act of the national government, which was then able to step back and allow others (including entrepreneurs) to lead the ecosystem.

Collective stakeholder Leadership

A single stakeholder often leads in the early stages of deliberate and strategic innovation ecosystem development: at other times, we have found that government and another stakeholder might lead jointly, an approach that can provide greater continuity and inclusiveness. Within our REAP program, we have seen several Teams where the leadership has been shared, and strengthened as a result. A good example is Team London, which was sponsored by two Stakeholders - namely Government (in the form of the agency driving UK trade and investment, ie UKTI) and a large Corporate that was also potentially a Risk Capital provider (in the form of RBS's UK banking arm, ie NatWest). This 'co-champion' partnership provided a strong foundation for others, and – in the resulting projects – demonstrated truly distributed leadership.

In other examples, the university has ended up as the anchor Stakeholder, not least because it can take a longer-term perspective about a region (whose name might appear in its charter) than a Corporate (with quarterly reporting requirements) or a Government (whose 'political' members might have their eyes on the electoral cycle).

Enabling Collective Action for Ecosystem Leadership

At the core of innovation ecosystem leadership, regardless of which stakeholder plays a convening role, is collective action: enabling cross-sector collaboration to achieve change and transformation around critical social issues (Kania & Kramer 2011). In the case of innovation ecosystems, this means engaging all stakeholders in the collective task of ecosystem building. This is challenging to accomplish, not least because each of the stakeholders has its own primary goals, purposes and activities, while the health and strength of the ecosystem is important but often only secondary, at least in the short-term.

Ecosystem leaders therefore need to develop and implement expertise in enabling and leading collective action within the ecosystem. Kania and Kramer lay out five conditions for collective action: a common agenda, shared measurement systems, mutually reinforcing activities, continuous communication, and backbone support organizations (2011). While a full exploration of these guiding conditions as they apply and are understood in the context of innovation ecosystems, is beyond the scope of this paper, a few aspects are relevant.

First, collective action requires that all stakeholders can see that it is in their medium- and long-term interests to have a healthy and vibrant ecosystem in other words that the goal of building a strong ecosystem is a shared one (albeit for different reasons). This is typically most straight forward for governments and universities whose past history and present-day remit is locally and geographically bounded. It is more challenging to bring large corporates to the table, and yet (as noted above) their assets and expertise can be of central value to the ecosystem.

It may be that only one or two key corporate actors are necessary to any successful efforts, especially in the early stages. In our experience, it is those corporations with a regional focus or national mandate who are most likely to resonate with the geographically-centered mission and call to action: Nokia felt the need to shape its innovation ecosystem at a time of crisis, OCP feels a responsibility to the country whose resources have led to its striking success, and so on. On the other hand, such corporate champions can be traditional and, at times, slow moving.

In our experience, national or regional banks also maintain a strong sense of responsibility and commitment to their regional ecosystem and as such can undertake a series of reinforcing activities in its role as a corporate anchor: although they might also be considered as risk capital providers, many regional financial institutions see

themselves as corporates first and risk capital providers second, and thus can anchor a corporate point of view. The Royal Bank of Scotland (RBS), as mentioned above, played a key role in anchoring efforts for REAP team London, while Statoil (now Equinor) has played a similar role in Norway.

In other settings, industry associations, with their more collective mandate, can be useful especially in providing a backbone organization (to be adapted to an ecosystem agenda) although they lack the assets, physical infrastructure and financial weight of a true corporate stakeholder.

Beyond banks, corporations and governments its worth exploring how to get entrepreneurs and risk capital providers to commit to collective action given their own immediate interests, and understand the ways in which they might come to the table to support regional development and contribute to reinforcing activities. For the most part, experienced and successful entrepreneurs and investors are more likely to be willing and able to give the time and attention to such activities than those who are new to the ecosystem, or at an early stage of their enterprise's start-up.

In contrast, the more experienced players often feel a sense of willingness to give back and to support the next generation. We see this in the composition of many government panels on entrepreneurship and innovation. One caveat that is worth exploring, however, is that while they have the time and resources to bring to ecosystem building efforts, their perspectives on the needs of the ecosystem may be idiosyncratic.

Given their personal story (and evident success, as they are able to 'give back'), their perspective may involve individual biases about what are the probabilities for being successful, what new entrepreneurs therefore need to do to succeed, and with whom they fancy working. The wider ecosystem may not always be evident to them: as one entrepreneur said – often the start-up entrepreneur is like the goldfish, i.e. the last to realise that it is in water.

Something similar can be true of the entrepreneur (or even the risk capital provider) in a 'resource-rich' ecosystem, where success seems to flow just from individual brilliance, without acknowledging the many benefits of entrepreneur-friendly Government policies, of technologies coming from publicly-funded R&D in university labs, or of enlightened Corporates which were willing to buy their start-up's initial products and provide them a market.

While leaders are critical, it is also important to understand whether and to what extent it matters if some of the stakeholders are missing, as this can have repercussions for ecosystem resilience, especially in times of crisis or in periods of recession. For the most part, as noted above, ecosystem building will likely fail if the voices of entrepreneurs are ignored and not engaged in the process: projects like Bio-XCell in Malaysia, or Skolkovo university in Russia, have been government-mandated with very limited entrepreneurial engagement leading, not surprisingly, to poor outcomes and weak performance.

Ecosystems can sometimes be led without much initial university engagement - as happened at the start of the creation of New York City's ecosystem, or even London's 'Silicon Roundabout' which emerged as bottom-up entrepreneur-led ecosystems. Once scale is increasing, however, the lack of a talented and connected labor force makes university involvement essential. Thus, universities become engaged or, as with New York's new 'CornellTech', are established to support the ecosystem and provide the central voice in defining a shared agenda, continuous communication and even, at times, a backbone organization.

Lastly for collective action, it is useful to characterize the main tensions that we observe in ecosystem building as these can often cause fractures in the cohesion needed for success, and may ultimately sow the seeds for failure. There exist a range of tensions that arise within the various stakeholders and are important to understand:

- Within Government, different levels of government (eg local versus national) or departments (eg Finance versus Business) may disagree over the priorities for the ecosystem, its geographic boundaries (which do not always map to the usual natural or political boundaries), the need to prioritize some sectors over others (especially when money is tight), or the political divisions at different levels.

- Within a 'university', there might be different views among its leadership (eg Presidents, Provosts and Deans), its faculty (tenured and adjunct), its staff and the various interests of students (undergrad, grad, executive and post-doc). Different universities in a region may also have different priorities (often from their founding mission) and different points of emphasis that may lead to challenges for direction setting.

- Among government and corporate stakeholders, there may be differences of perspective on how to support 'innovation-driven enterprise' start-ups which might disrupt the business of established incumbents (and their trade

associations which are effective lobbyists), even though this could be good for the ecosystem and economic health of the wider region.

- Lastly, among entrepreneurs and risk capital providers, there may be a natural tension over the quality of the entrepreneurial ideas requiring funding, the share of equity which founders should give to outside investors, and what the balance of the relationship should be.

While 'within' stakeholder tensions can stifle collective action around ecosystem acceleration, it is the cross-stakeholder tensions that can, at times, actually stop collective action and lead to serious challenges in making progress towards shared goals. While there are obvious tensions between each of the ten possible combinations of stakeholder interactions. But a few are worth noting as they are either particularly common or especially challenging:

- **University-corporate** relations are a critical foundation of many innovation activities for large corporations, and have largely been the source of both hiring/talent management at one end of the spectrum and of sponsored research on the other. A focus on innovation ecosystem building can be complex as it requires new modes of interaction that emphasize whether and how university curricular are fit for purpose for innovators of the future, how corporations may contribute to the university well beyond a narrow sponsorship agreement e.g. around student start-ups, and they challenge corporations to have a more "joined up" approach to university engagement.

- **Corporate-entrepreneur** relations within an ecosystem context can be stifled when corporations move slowly to find ways to engage with start-ups, taking a long time in protracted decision-making regarding funding or partnering. This makes it different to find common ground as corporations in turn find entrepreneurs to be impatient and lacking a solid plan upon which to build their fund-raising approach. In an ecosystem conversation, tensions arise when individual entrepreneurs cannot see how corporations can be of value, or when corporations to not recognize that their most valuable assets are often their sector expertise and infrastructure not their funding.

- **Government-entrepreneur/risk capital** relations are perhaps the most fraught in our ecosystem building context. Governments increasingly recognize the power of risk capital (especially venture capital) to accelerate the growth of ventures in their region, but may not have an adequate appreciation of the factors that

cause investors to come into a region. For example, governments must be educated around the specific incentives that structure these different capital sources and the ways in which capital gains, risk management and other (somewhat esoteric) rules guide investment. Moreover, a recognition that the quality of entrepreneurial teams may in turn shape risk capital availability may come as unwelcome news. Of all the networks, it is the network ties from risk capital and entrepreneurship into government that is likely to be the weakest and one most in need of strengthening e.g. through programs like Entrepreneurs-in-Residence etc., rather than simply quick policy fixes.

Conclusion

The promise of regional innovation ecosystems is manifest: in the unequal world of innovation and entrepreneurship, the returns to strong innovation capacity and strong entrepreneurial capacity – and ways to connect them - are significant. The wealth and prosperity created in successful innovation ecosystems in the US, Europe and beyond are hard to deny. And yet the challenges of reaching a region's full potential are also clear: who should lead, can all stakeholders be brought to the table, how easily can these parties agree on a shared vision of the future and act accordingly?

This short Working Paper serves as a guide to these efforts, drawing on our research, by emphasizing the important role of all actors in this process and reminding us all that 'collective action' among stakeholders is most likely to accelerate the process. We have tried to address the initial puzzle – of why innovation is still so localized, even when the world was supposed to be becoming so flat – and provide advice and options for those who wish to optimize 'innovation-driven entrepreneurship' in their specific regions, and build a vibrant innovation ecosystem in their locality.

References

Audretsch, D. B. and Feldman, M. (2004) “Knowledge Spillovers and the Geography of Innovation.” In V. Henderson and J.F. Thisse (eds.). The Handbook of Urban and Regional Economics, Volume 4. North Holland.

Bramwell, A. and Wolfe, D. (2008) “Universities and regional economic development: The entrepreneurial University of Waterloo.” Research Policy, 37(8), 1175-1187.

Budden, P. and Murray, F. (2018) An MIT Framework for Innovation Ecosystem Policy: Developing policies to support vibrant innovation ecosystems. MIT Lab for Innovation Science and Policy Working Paper.

Casper, S. (2007) “How do technology clusters emerge and become sustainable.” Research Policy, 36(4), 438-455.

Dedehayir, O., Mäkinen, S.J., and Ortt, R.J. (2016) “Roles during innovation ecosystem genesis: A literature review.” Technological Forecasting and Social Change, 136, 18-29.

Etzkowitz, H. (1993). Enterprises from Science: The Origins of Science-based Regional Economic Development, Minerva 31(3): 326-360, 1993.

Etzkowitz, H. and L. Leydesdorff (1996). A Triple Helix of Academic-Industry-Government. Current Science

Feld, B. (2012). StartUp Communities: Building an Entrepreneurial Ecosystem in your City. New Jersey: John Wiley & Sons.

Florida, R. (2014). The Rise of the Creative Class. New York: Basic Books

Kania, J. and M. Kramer. (2011) Collective Impact. Stanford Social Innovation Review, Winter 2011.

Kenney, M. and U. von Burg. (1999). Technology, entrepreneurship and path dependence: industrial clustering in Silicon Valley and Route 128. Industrial and Corporate Change, Volume 8, Issue 1, March 1999, Pages 67–103,

Lerner, J. (2012). Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed – And What to Do About It. Princeton: Princeton University Press.

Mazzucato, M. (2013). The Entrepreneurial State: Debunking Public vs. Private Sector Myths). Anthem Press.

Murray, F. and Budden, P. (2017) A systematic MIT approach for assessing innovation-driven entrepreneurship in ecosystems. MIT Lab for Innovation Science and Policy Working Paper.

Owen-Smith, J. and Powell, W. (2004) “Knowledge Networks as Channels and Conduits.” Organization Science, 15 (1).

Owen-Smith, J. and Powell, W.W. (2006) “Accounting for Emergence and Novelty in Boston and Bay Area Biotechnology.” Braunerhjelm, P. and Feldman, M. (eds) Cluster Genesis: The Emergence of Technology Clusters and their Implication for Government Policies. New York: Oxford University Press

Powell, W. and Grodal, S. (2006) “Networks of Innovators.” Fagerberg, J., Mowery, D.C. and

Nelson, R.R. (eds) The Oxford Handbook of Innovation. New York: Oxford University Press.

Roberts, E.B., Murray, F. and Kim, D.J. (2015) Entrepreneurship and Innovation at MIT: Continuing Global Growth and Impact. Report. MIT Sloan School of Management.

Schrank, A., & Whitford, J. (2011). “The Anatomy of Network Failure.” Sociological Theory, 29(3), 151–177.

Sorenson, O. (2018). "Innovation Policy in a Networked World," Innovation Policy and the Economy. 18: 53-77. https://doi.org/10.1086/694407

Taylor, M. Z. (2016). The Politics of Innovation: Why Some Countries Are Better Than Others at Science and Technology. New York: Oxford University Press.