Building Knowledge Economy through Innovation Ecosystem: The Role of Innovation Hubs

Draft Analytical Compendium

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Is there a 3% Solution?

This complexity of innovation means that numerical targets for research expenditures must be accompanied by policies and actions that focus on incentives and intermediating institutions designed to focus researchers’ attention more on problems needing science-based solutions rather than on science for its own sake.

In the understandable desire to encourage innovation, and demonstrate a commitment to competitiveness, the European Council’s Barcelona Declaration set an ambitious objective of increasing the Union’s global research expenditure to approach three percent of Gross Domestic Product by 2010 with the specific goal of achieving greater firm growth and innovation. Yet questions about the efficacy of this approach are widespread. One difficulty is that some European countries, like Sweden, already have high R&D expenditure as a percent of GDP with very limited new firm growth or innovation (outside large firms) to show for the high R&D expenditures. The case of Sweden strongly suggests that there is no correlation, must less causality, between levels of input expenditures on R&D and desired levels of innovation-led growth.

It is important to keep in mind that Europe is one of the world’s foremost centers for research. The quality of European research is not in question. The problem facing many European countries relates more to how they may capitalize on the existing R&D investments. While the three percent target, described by some as a political goal, has the virtue of focusing public attention on the need for innovation, its actual import has been limited at best. The practical challenge is for policymakers to focus on creating better incentives for researchers in companies and universities to encourage them to convert their ideas into innovations and, eventually, into promising products for the global market. Promoting a better understanding among policymakers of the realities of the innovation process is a major and necessary step in facilitating innovation while providing the opportunity to generate measurable returns on incremental R&D investments.  

(Entrepreneurship and the Innovation Ecosystem: Policy Lessons from the United States, pg. 7)

Innovation Hubs

Innovation hubs can be viewed as mechanisms for the mediation of knowledge and the facilitation of its use for purposes of innovation. The mediation process involves creating new or strengthening old networks that enable the various actors in the innovation process to communicate and learn, not only from the hub, but from one another. One of the hallmarks of such a hub is that it spans the boundaries of individual institutions and organisations, accumulating mediating functions that foster the exchange of tacit as well as codified knowledge (Youtie and Shapira 2008). Although the aim of a hub as a means of advancing innovations in a country or region has fairly wide acceptance, what constitutes a hub is less clear. It can be an incubator, a science park, a technology centre, a specially created public sector body, or an existing institution, such as a major university. In analysing innovation hubs, some scholars have focused on a particular organisation, while others have used network analysis to identify the major actors and confirm the existence of one or more hubs.

Hubs can be focused on implementing radical innovation in mature firms (Leiffer et al. 2001, strengthening the technical competence of SMEs (Tidd et al. 1997), or simply to ‘make innovation flourish’ (Ruiz 2010). Universities have had a special role as innovation hubs. Stanford University incubated the Silicon Valley, Massachusetts Institute of Technology (MIT) played a role in the growth of Route 128 in Boston, and Imperial and Cambridge Universities created science parks in the UK. The circumstances of the US especially in the 1990s including the role of the defence industry investment and existence of venture capital firms make it unique and hence not easily generalized for other contexts. Studies in US and UK (Roberts, 1991; Oakley, 1995) suggest that contextual factors are more responsible for the success of the innovation hubs than the concept itself. They suggest that individual skills and disposition
of the entrepreneurs and the market characteristics are responsible for innovation. This view is supported by Mel, McKenzie and Woodruff (2009). *(Innovation Hubs and Small and Medium Enterprises in Africa, pg 5)*

We use the term “innovation ecosystem” to refer to the inter-organizational, political, economic, environmental and technological systems of innovation through which a milieu conducive to business growth is catalyzed, sustained and supported. An innovation ecosystem is a network of relationships through which information and talent flow through systems of sustained value co-creation.

The systems approach has been used to describe the multifaceted nature of innovation at various levels - national, regional, technological, and sectors – and to describe the processes by which research capabilities build knowledge, then transfer the knowledge to support business development in the context of the Triple Helix of business, government and academic interaction (Etzkowitz and Leydesdorff, 2000). The systems approach recognizes the interaction among the many actors and other “determinants of innovation processes… that influence the development and diffusion of innovations” (Russell and Still, 1999). The ecosystem metaphor enriches the systems model with value and culture.

Transformation of an ecosystem is characterized by a continual realignment of synergistic relationships of people, knowledge and resources for both incremental and transformational value co-creation. Through relationships, value co-creation networks evolve from mutually beneficial relationships between people, companies and investment organizations. A continual realignment of synergistic relationships of people, knowledge and resources is required for vitality of the ecosystem. Requirements for responsiveness to changing internal and external forces make co-creation an essential force in a dynamic innovation ecosystem. *(Transforming Innovation Ecosystems through Shared Vision and Network Orchestration, pg. 5)*

According to open innovation mode and business ecosystem structure, open innovation process is embedded into business ecosystem framework. Then, a theory model of open innovation based on business ecosystem is built which is shown below:

**Open Innovation Model Based on Business Ecosystem**

![Open Innovation Model Based on Business Ecosystem](image-url)
Under open innovation scenario based on business ecosystem, managers and employees of internal enterprise and external users, suppliers, partners, et al. are important innovation resources and participants. They play important roles in innovation. This model contains multiple main innovators such as producers, users, suppliers, partners and external environment, etc. It reflects the open innovation process of business ecosystem formed by many subject.

- **Innovation sources** Innovative ideas can be from managers and employees within enterprise and also from users, suppliers, partners, and et al. of business ecosystem to increase the channels of creative sources. They can be beneficial to obtaining more thought and increase choices margin.

- **Ideas recognition** Creative identification can be completed by enterprise itself and also made by with the other members of ecosystem together; they together screen out immature undesirable innovative ideas to improve innovative feasibility.

- **Innovation concepts** Originality forms innovative concept through identification process, and users, suppliers, et al., of business ecosystem participations help to accelerate maturity and stereotypes of innovative concept.

- **Analysis and design** After the formation of innovative concepts, users, suppliers, et al. will provide analytical thinking according to its own technology and market capacity; information exchange in ecosystem helps core enterprise to make decision on their own research and development. It offers to other members of business ecosystem according to the direction of eco-development.

- **Research and development** Other members in business ecosystem participate in research and development stage which is particularly critical; user participation can ensure product direction and experience goodness, and suppliers can provide a variety of technology support; on the premise that ecosystem stability is ensured, innovation activities are jointly led by core enterprise, suppliers, partners, et al.

- **Trial of production** In trial process, the suppliers and partners of system members can provide good technology platform and essential trial service to lower huge cost required by alone trial of core enterprise.

- **Pilot perfection** Experiments on product can be made in users, suppliers and peers of ecosystem, and product quality is improved, which will increase the innovation success rate according to pilot condition.

- **Promotion** Members of ecosystem jointly improve technology platform, interface and product according to pilot condition, make optimized products quickly marketed to gain income and achieve exaltation of innovation performance.

(Interaction of Open Innovation and Business Ecosystem, pg. 5)

There are many ways to characterize innovation. When the term innovation is applied to technological change, it is often conceived of as a change to a product or service—e.g. a higher yielding seed or a more efficient delivery system. However, for the purposes of this paper, the sphere of innovation is defined in broader terms, encompassing significant improvements to goods and services, as well as to operational processes and business models. Furthermore, to facilitate our analysis, we describe innovation in terms of both innovation activities and the innovation ecosystem that supports those activities.
Since innovation is a dynamic, unpredictable and uncertain process, it depends critically on creating the right conditions, especially from a policy perspective. Hence, a robust treatment of innovation requires an understanding of the innovation “ecosystem” and its absorptive capacity.

The concept of an innovation ecosystem reflects the individuals and organizations acting and interacting in political, economic and technological systems to catalyze and sustain innovation activity. Its boundaries are amorphous and impossible to control; its interactions are multiple and subject to constant realignment, of a diverse nature, and often intangible. It depends heavily on the effective circulation and communication of knowledge. Innovation to the ecosystem itself is also possible, and can constitute one of the most valuable forms of innovation.

An innovation ecosystem comprises three elements: Actors, organizations (and their facilities), and enabling conditions (formed by the political, economic and technological systems). Actors include the researchers, entrepreneurs, financiers and other individuals doing innovation. Organizations include the universities, research institutions, businesses, knowledge networks, etc. that organize the actors and supporting resources toward specific innovation activities. Cross-organizational enabling conditions include education and training support, direct public funding for innovation, a sufficient legal framework to allow innovators to benefit from their activity, infrastructure (e.g. the internet), and supply-demand mechanisms that communicate economic and social value. Critical to these enabling conditions is how well they link and align incentives of the innovation actors and organizations, and their activities—for example, the robustness of links between research universities and entrepreneurs to inform the direction of the former and feed commercialization opportunities to the latter.

There is no definitive model for an optimal innovation ecosystem, and it depends on both the level of development and the nature of broader political, economic and social systems. However, all countries
that have successfully harnessed innovation for growth have had the full set of actors, organizations and enabling conditions. While organizations may be either public or private and vary greatly across countries, the enabling conditions – such as the policy and regulatory context, as well as market operations - are closely dependent on government action. Moreover, these enabling conditions are set almost entirely by national - or subnational-level governments, with the global innovation ecosystem forced to work across (or as a supplement to) them. For developing countries in particular, the robustness of its innovation ecosystem determines its “absorptive” capacity—its ability to adopt, adapt and successfully implement innovation

*(Green Growth Innovation: New Pathways for International Cooperation, pg. 4)*

This new collaboration is rooted in support for capacity building for innovation. It would further strengthen capacity while providing impact through new R&D by supporting scaled-up knowledge creation via a competitive grant program. Entrepreneurship support would broaden the coverage of national business incubators, working through universities, research institutes, nonprofit organizations and start-ups to reach individual researchers, students, and budding entrepreneurs. This would in turn be complemented by a set of funds to deploy risk capital for the diffusion of technologies that have been proven at the demonstration stage. As a network these collaborative mechanisms would provide full financial, technical and business support to researchers, developers, business people and financiers along the RDD&D continuum.

Of course, the launch of new international arrangements with such a broad mandate runs the risk of creating unnecessary bureaucracy and slowing progress if not properly designed and executed. Building on existing institutions and bilateral arrangements by creating a consortium of actors with a coordinating mechanism could ensure low transaction costs while streamlining access to international finance, and consolidating brokerage and intermediary services.

*(Green Growth Innovation: New Pathways for International Cooperation, pg. 34)*
A slightly different approach, but one that capture important nuance, is to understand the economy as a national innovation ecosystem. This approach can help us understand, first, that the system is not fixed but evolutionary, growing and evolving according to new needs and new circumstances and, second, that this system is susceptible to change as a result of new policy initiatives. The ecosystems approach highlights the complex inter-linkages among a variety of participants in an innovation economy (including individual entrepreneurs, as well as corporate actors such as large businesses and universities) and the importance of the incentives the various actors encounter as they push towards an “innovation friendly environment”. Innovation, like regional competitiveness, will not be achieved by fiat but rather through a combination of public and private initiatives.

*(Entrepreneurship and the Innovation Ecosystem: Policy Lessons from the United States, pg. 3)*

<table>
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<tr>
<th>Actors</th>
<th>Function in Innovation ecosystem</th>
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<tr>
<td>Businesses</td>
<td>• Conceive of radical innovations in anticipation of market demand.</td>
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<td></td>
<td>• Identify innovation opportunities in response to market demands.</td>
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<td>• Signal interest in innovation to their customers or suppliers.</td>
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<td>• Innovate by themselves and in cooperation with others.</td>
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<td>• Recruit / retain a cadre of professionals / creatives in order to innovate.</td>
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<td></td>
<td>• Generate or otherwise source the funds necessary to innovate.</td>
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<td></td>
<td>• Secure any external know-how or technology required.</td>
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<td>Banks and Financial Services Organisations</td>
<td>• Provide the investment funds businesses may need in order to innovate.</td>
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<td></td>
<td>• Provide the very much larger investment funds (risk money) businesses need for new products or services (or whole businesses) to go to scale.</td>
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<td>Knowledge Intensive, Business Services Organisations</td>
<td>• Provide specialist services, from designing user interfaces for new products and services through to researching market entry strategies or prior art searches.</td>
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<td>• Provide access to specialist people and facilities (from interim CEOs to product testing / accreditation).</td>
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<td>• Provide a conduit for knowledge flows between science and industry, facilitating knowledge spillovers.</td>
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<td>Intermediary Bodies</td>
<td>• Aggregate and represent sectoral interests to other actors in the innovation ecosystem.</td>
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<td>• Share the cost of developing generic solutions / innovations.</td>
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<td>• Facilitate the diffusion of innovations through new codes and standards.</td>
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<td>• Aggregate and codify good practice, career structures and CPD frameworks.</td>
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<td></td>
<td>• Provide CPD and other training to keep people abreast of wider innovation.</td>
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<td>Higher Education Institutes which includes Public Research Organisations</td>
<td>• Provide a source of graduates and postgraduates.</td>
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<td>• Offer a portal to the global pool of academics and stock of knowledge.</td>
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<td>• Provide a source of partners for proprietary innovation projects.</td>
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<td></td>
<td>• Offer a source of IP, consulting know-how, large-scale facilities and research equipment.</td>
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<td>• Partners for increasing the innovative capacity of firms through human capital, problem solving and new knowledge.</td>
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<td>National and Regional Innovation Support Agencies</td>
<td>• Create and maintain a policy framework for innovation.</td>
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<td>• Administer the innovation budget efficiently and effectively.</td>
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<td>• Implement innovation-support programmes of many kinds, from</td>
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grants for R&D to knowledge transfer networks to access to finance.
• Implement various tax incentives and reliefs, from business expansion and seed funds to R&D tax credits.
• Support / launch topical working groups that come together to articulate innovation challenge.
• Administer the national science budget and support universities and research institutes with their third stream.
• Identifying and supporting the development of new technologies and new markets.

<table>
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<th>Policy makers and regulators</th>
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<td>• Persuade government of the value of public support for innovation.</td>
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<td>• Define public research and innovation budgets, and determine policy priorities and balance of funding for innovation support.</td>
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<td>• Set wider framework conditions for innovators, from education policy to fiscal rules and tax reliefs to intellectual property.</td>
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<td>• Define or implement regulations, such as those governing environmental protection, with short term impacts (e.g. compliance costs) and positive longer term effects on innovativeness.</td>
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(Leveraging the Innovation Ecosystem for Business Advantage: A Cross-Border Study, pg. 12)

It is difficult to evaluate the extraordinary importance of Moore’s (1997) contribution to studying the competition under the strategic management view. Moore was the first scholar to coin the term ecosystem and apply it to the economy. His core idea was alteration the way of traditional competition head-on for coexistence. He insists that cooperation will help a company compete effectively and procure new markets. The stages of entrepreneurial ecosystem were also illustrated by a case study for Wal-Mart.

Before Moore’s study, the transfer of biological laws was completed by supporters of neoevolutionary theory in economy (Arthur, 1989, 1994; David, 1985; Hayek, 1992; Nelson, 1993). Said scholars researched the similarities between biology and economy, and defined that many economic phenomena follow biological laws, i.e. mutation, coexistence, adaptation, diversity of species etc.

Speaking about the usage of ecosystem as a term in economy, we should make a mention of Van der Bergh (2003) and Ayres (2004). The former investigated the commonality between mutation, genetic clones, competition, adaptation etc. in biology and economy. The latter studied common features between the two sciences. However, their field of research also included enterprise activity, concerning similarities amongst patterns of life of certain biological organisms. As with Ayres (2004), Moore (1997) considered ecosystem in economy, yet his research dealt with the creation of innovation ecosystem as a kind of platform for innovative production, including new items and its complements.

A noteworthy approach to innovation ecosystem is proposed by the Japanese researchers Fukuda and Watanabe (2008), who considered innovation ecosystem at a macro-level. Figure 1 below shows a model for a national innovation ecosystem.
The Scope of an Innovation Ecosystem Aimed at Solving Problems

Many of the problems that threaten social sustainability are faced not only by Japan, but also the world as a whole. As shown in Figure 2, an innovation ecosystem aimed at solving problems exists not only at national level, but also at regional and global levels. The constituent actors include scientists, the public sector, industry, think tanks, and NGOs/NPOs. Each actor plays a role in creating innovation. Scientists who are affiliated with universities and research institutes generate scientific knowledge, and large corporations, small and medium-sized companies, and venture companies in various industries produce goods and services. New value from their creations is then enjoyed by society. At this point, society signals scientists and firms what it wants by purposefully selecting products. The government and administrative agencies including funding agencies support the creation of scientific knowledge and goods and services. To set up an environment or system enabling society to enjoy new value, they also develop necessary institutions and distribute funds. Think tanks provide advice so that each actor plays a role effectively; NGOs/NPOs assist the interactions between actors and society. Scientists and industry pursue collaboration and cooperation mutually as well as internally to effectively create value enjoyed by society. Also, society, scientists, and industry have requirements for the activities of the public sector, think tanks, and NGOs/NPOs. In this manner, information is exchanged, as shown in Figure 3, between the various actors and between the actors and society. As a result, new economic and social value is created, contributing to solving problems that threaten social sustainability and thus sustainable development.
Starting with the concept of ‘innovation hubs’ as urban creative places, we can identify seven important dimensions of analysis of the phenomenon: governance, connectivity, clustering environment, talent environment, built environment, cultural environment and natural environment.

- Governance refers to the coordination of actors – public and private – involved in the management of the innovation habitats. We are speaking not only about urban public policies and programmes but also of the degree of participation of the community in the project development.
- Connectivity is related to physical accessibility, such as transport networks, as well as to digital infrastructures and flows. The strategic partnerships between the innovation hub and other creative spaces and urban and regional cooperation processes are also included in this dimension.

- Clustering Environment is associated with the business climate and knowledge infrastructure of the innovation hub and with the interactions between universities and other research institutions and companies. The level of entrepreneurship and the intensity of the creation of startups is also an important factor in the dynamics of the territorial system.

- Talent and Social Environment concerns the human capital component, comprising the level of qualifications, mobility and diversity of the residents and workers in the innovative community. The degree of social equity is another relevant element in this dimension.

- Built Environment includes aspects related to the physical dimension (namely urban design) of the innovation hub and includes land use, urban grid, architecture, public spaces and urban art. The prevalence of a mixed-use strategy is an important factor in the evaluation of this environment.

- Cultural Environment comprises cultural and entertainment amenities located in the creative hub as well as public attendance of cultural events and visits to historical sites (heritage). Other important elements can be identified: the presence of restaurants, bars or coffee shops and other facilities promoting a vibrant and diverse night life.

- Natural Environment is related to the natural system of the area (waterfront, green spaces, etc.) in addition to the environmental quality (water, air, soil, etc.), weather, climate and energy, namely the use of renewable sources.

The ‘governance component’ is the nucleus of the model and the basis for the interaction between different environments: clustering, talent, built, cultural and natural, oriented towards developing a creative, distinctive and sustainable urban hub. Additionally, ‘connectivity’ is a prerequisite condition for the success of innovative habitats since it fosters cooperation between people, objects and places.

Each dimension of analysis can be evaluated with the help of a specific system of indicators that can be quantified or qualified based on the information collected through the empirical work. This uniform and homogeneous methodology aids in the development of benchmarking exercises comparing the case studies and in extracting global characteristics and best practices.
“If you and I swap a dollar, you and I still each have a dollar. If you and I swap an idea, you and I have two ideas” (Gloor, 2006). Sharing ideas in an open environment creates a common output that is greater than adding up individual collaborations of each discrete member. This definition is basically referring to the concept of synergy. When companies innovate through collaborative networks, they build value that no solo enterprise would be able to achieve by itself. These advantages of innovating through collaborative networks should be extensive to all partners included within the ecosystem, where relationships should be always on a win-win basis.

One could see that all benefits gain through innovation ecosystems are directly related with the forces driving the decision to belong to one. In other words, if a company is able to cope with a specific internal or external force driving cooperative alliances, then it will reach a given advantage. In that order of ideas, advantages can be classified in external and internal. External meaning benefits that give the company new tools to face the new economy business arena, and internal meaning benefits reflected in the firm’s well-being.

It has been found that belonging to an ecosystem is a way of accelerating the co-development of a sustainable innovation, and remove the burden of resources and time-pressure from the shoulders of a single partner (Traitler, Watzke and Saguy, 2011). Thus, this kind of alliances is a mean of sharing not only development and rewards, but also market uncertainty and risks. Likewise, it accrues new means of creating and exploiting new markets while accelerating innovation and increasing market speed. It is important to recognize that this kind of alliances have a great impact on sharing human resources which will ultimately lead to create a sense of cultural openness.

Similarly, the firm can internally benefit from this type of networks and leverage some of those benefits into their assets. As pointed by Traitler, Watzke and Saguy (2011), sharing resources and postponing out-of-pocket investment until the project is launched has a significant impact on reducing upfront costs.  

(Orchestrating innovation ecosystems: a case study of a telco wholesaler growing into a global hub for cross-innovation, pg. 15)

The Innovation Hub Framework

The study was operationalized using the Hub concepts™ Innovation Hub Framework, which illustrates the key regional innovation ecosystem elements that are necessary for building up a successful regional innovation hub (see figure on the following page). It is noted that each element (layer or driver) represents a significant development task of its own, but only in combination can they produce the true ecosystem which can rise to the globalization challenge and take its place in the value network context. Accordingly, the core management organizations should be able to plan, organize, manage and develop further the regional ecosystem as a complete set of interconnected elements where interplay and complementarities between the layers gives the ecosystem its soul and strength. It is argued that the developed Innovation Hub Framework (with its firm theoretical foundations and advanced extensions) is an appropriate tool to analyze regional innovation ecosystems. The framework describes thoroughly the core elements (layers) needed for systemic ecosystem development and defines their key characteristics in advancing the globalization of ecosystems. It is considered useful in guiding and framing the related discussions of regional innovation policies, collaborative actions for joint IP creation and coordination of the local management processes.
The hub firm role

Hub firms are defined as the one that possesses prominence and power gained through individual attributes and a central position in the network structure and that uses its prominence and power to perform a leadership role in pulling together the dispersed resources and capabilities of network members (Dhanaraj and Parkhe, 2006). In other words, these firms are triggering entities, central decision makers, which are strategically located at the center of the network to perform a leadership role in leveraging both innovation design and network design. They are also responsible for performing the orchestration tasks (deliberately and purposefully) that will create value (enlarge their industry) and extract value (share a greater portion of it), in their market place.

Although each partner keeps a considerable amount of autonomy regarding their individual contributions, the hub firm remains as the central decision maker in the network. Moreover, two important assumptions are made. The first one is that all network players will actively pursue their own self-interest (Dhanaraj and Parkhe, 2006), as this context set the basis for making orchestration an essential activity. Second assumption is that hub firms may influence the network through their recruitment activities (Dhanaraj and Parkhe, 2006). This strategic choice of partner should gave them the power to change the network membership (meaning size and diversity of partners), and similarly, change the network structure (meaning density and autonomy of partners). Assuming a hub form hold this power, they should be able to control their network position and maintain centrality and status.
Furthermore, a hub firm may play two main different roles in different projects. It may act as an innovation integrator that primarily focuses on envisioning the core innovation and integrating partners’ contributions to create the final product or offering (Nambisan and Sawhney, 2011). Within this role, their main objective would rely on integrating technological assets of partners involved in the development of the new service. On the other hand, it may take the role of a platform leader, who focuses on defining and developing the core innovation (platform) and facilitating partners’ complementary innovations that expand its reach and range (Nambisan and Sawhney, 2011). Their main objective as platform leaders would be to support partners in the creation of the complementary services that enhance the scope of the main innovation. (Orchestrating innovation ecosystems: a case study of a telco wholesaler growing into a global hub for cross-innovation, pg. 21)

While there is no consensus on one single definition of a national innovation system, there is a wide agreement on the following stylized facts:

- A model of an innovation system identifies key actors, activities, relations and institutions as well as starting points for systematic innovation and technology promotion.
- It helps to explain and stimulate innovation processes at different levels: the national, regional and sectoral level.
- Interactions between different actors in the models can be distinguished in terms of “knowledge/innovation producers” and “knowledge/innovation appliers” in the public and private sectors.

(Innovation – An Imperative for Competitiveness & Sustainable Development, pg. 6)

Different ways to stimulate an Innovation System

(Innovation – An Imperative for Competitiveness & Sustainable Development, pg. 9)
Cluster Management Organizations: Enablers of Cluster Collaborations

A cluster management organization facilitates collaboration within a cluster by providing a variety of services. These cluster management organizations consist of different participating cluster actors, the industry and research sector included, in order to e.g. mediate contact, to support the identification and initiation of projects etc. The following table presents the main categories of services offered with examples of services:

<table>
<thead>
<tr>
<th>Categories of services</th>
<th>Examples of services</th>
</tr>
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</table>
| Acquisition of thirdparty funding for projects (public funds) | • Acquisition of R&D and non-R&D projects on behalf of cluster members  
• Distribution of information about funding programs |
| Collaborative technology development, technology transfer and R&D projects | • Organization of tasks forces/working groups  
• Management of projects on behalf of cluster members  
• Legal advice, e.g. on IPR |
| Internal networking among cluster members           | • Regular meetings, get-togethers, thematic events/workshops for cluster members  
• Internal newsletter, databases etc. |
| Development of human resources                      | • Participation in the development and implementation of vocational training or study courses together with external partners such as universities  
• Training courses for cluster members |
| Development of entrepreneurship                      | • Consulting and coaching  
• Acquisition of financing (e.g. venture capital, banks, public funds) on behalf of entrepreneurs |
| Matchmaking and networking with External partners/promotion of the cluster location | • Information material, website, press releases, publications  
• Presentation of the cluster and its members on trade fairs or conferences  
• Events/workshops to present the cluster  
• Matchmaking/partnering events |
| Internationalization of the cluster                 | • Presentation of the cluster and its members on trade fairs or conferences, networking visits, study tours  
• Offices or other permanent representations abroad  
• Cooperation with export promotion agencies |

From a policy perspective, it is not a specific service which determines the innovative success of a cluster. It is the mix of services which is important. Beside other benefits for the businesses, clusters increase productivity and in many cases they play a significant role for the rate and success of innovation activities (Porter 1998). The "cross-pollination" of ideas and innovation was the main driver for the achievements of the Silicon Valley model (Saxenian (1994) in European Commission Staff Working Document, 2008). (Innovation – An Imperative for Competitiveness & Sustainable Development, pg. 16)

The concept of an innovation ecosystem is prevalent in the literature related to innovation. An innovation ecosystem is most often contained within a geographical region and houses the components essential to innovation. These ecosystems consist of two major parts: a research component propelled by R&D institutes, and a commercial sector driven by the marketplace. The two are co-dependent because the research side of the ecosystem receives a large percentage of its funding from profits made by the commercial side. For a better understanding, it can be helpful to compare an innovation ecosystem to a biological ecosystem. In a biological ecosystem, living organisms and their surroundings must exist with some degree of equilibrium in order to be considered functioning. This equilibrium is measured using the energy exchange that takes place in transfers such as 'prey to predator' or 'plant to soil' (Jackson, N.D.).
This energy transfer is intricate and interwoven, making it so that each piece of the ecosystem has some impact on, and is impacted by, other pieces of the system as a whole. An innovation ecosystem is analogous to this – tracing the economic dynamics rather than the energy of the system. The innovation ecosystem is populated by students, faculty, staff, and researchers (representing the plants and animals) who are connected through entities including universities, business firms, venture capitalists and research institutes (Jackson, N.D.). Similar to a biological ecosystem, the success of an innovation ecosystem often relies heavily on the quality, timing and proximity of exchanges between resources and participants.  
(Evaluating the Feasability of a Visual Representation of Wellington’s Innovation Ecosystem, pg. 9)

Interestingly, the strength of this region is not based in the development of the cluster that has formed. Businesses have adopted the philosophy of Ed McCracken, the former CEO of Silicon Graphics, who said, "some secrets are more valuable when shared" (Lee et al., 2000, p. 10). While almost all businesses and suppliers have relocated there to create an epicenter of these suppliers, the strength of Silicon Valley is in the overreaching business support and connection. Despite being competitors and constantly working to get the upper hand, companies in Silicon Valley have come to realize that the benefits of sharing some ideas with competitors far outweigh the benefits of sitting on their secrets. In the 1980s, this philosophy led to a huge jump in collaboration, which increased the information sharing horizontally from company to company. In addition to this open flow of communication, many of the major players in the Silicon Valley ecosystem have connections that extend beyond their current business partners. Many of them went to the same universities, or worked in the same companies at some point in their lives. These personal associations continued even once they became heads of competing companies.  
(Evaluating the Feasability of a Visual Representation of Wellington’s Innovation Ecosystem, pg. 15)

Communitech (2011: 9) explains that a thriving innovation ecosystem is characterized by knowledge creation, enabling organizations, an entrepreneurial culture, technology, entrepreneurs, government, and financing expertise. An innovation ecosystem is sustainable when it provides the assets and resources necessary for building relationships between partners, promoting the growth and responsiveness of the system to changing internal and external catalysts, and translating knowledge generated by research organizations to industry investors (Jackson, 2011; TECNA, 2011). These assets include entrepreneurial capacity, business acumen, risk capital, R&D enterprise, technology commercialization, human capital, physical infrastructure, an industrial base, global linkages, networking opportunities, a culture that is supportive of innovation and a community mindset, supportive government policies and quality of life (TECNA, 2011).

The list of resources needed by academic and private sector entrepreneurs within an innovation ecosystem can be grouped into six broad categories: networking – achieved by attending events/conferences designed to assist entrepreneurs in connecting to other innovation ecosystem actors; capital – includes providing direct funding to entrepreneurs and facilitating connections to funding providers; representation – ensures that the entrepreneur’s interests are communicated through lobbying activities; knowledge – gained through participation in seminars, webinars, programs and courses, web resources and print media, etc; services – includes the provision of an incubator, CEO in Residence, mentors/coaches/counselors, peer-to-peer groups, web services, etc; and support – includes the promotion of innovation and commercialization, publicity and recognition, workforce development, etc.  
(Growing Innovation Ecosystems, pg. 51)

Innovation Agencies

Innovation agencies are in most cases public bodies with a mission to promote economic and social development through the creation and growth of new business. The conduct of this mission is determined by the political governance of the agency, and may change with changing national governments. Individuals working for the agency are expected to show strong integrity, committed to the creation of public good, and capable of understanding and adapting to a shifting and complex multi-stakeholder structure. The leaders of the agency have a pivotal role in strategic and operational decision making and in securing the organisation’s good performance. This criterion focuses on organisational procedures to
ensure that Leadership is conducted in a manner likely to support the agency’s success. For assessment of innovation agencies, the initial priority should be in setting a clear direction and a strategic focus. Ensuring that a controlling system is in place to monitor the performance of the agency is a part of leadership, as well as participating in regular dialogue with all key stakeholder groups. (EFQM Framework Innovation Agencies, pg. 9)

The state of the five aggregate behaviours governs the effectiveness of the innovation ecosystem in fostering and sustaining firm innovation, and ultimately generating impact. It follows that the state of the entire ecosystem, or regional and sectoral ecosystems, can be assessed by examining indicators of the five aggregate behaviours of the firm-centric innovation ecosystem. The firm-centric innovation ecosystem is an approach to assessment, rather than to measurement.

- **Knowledge generation** – Created in universities, colleges, public research organizations, governments, and firms, and codified in the forms of publications/patents/products or embodied in human capital, knowledge represents the ideas from which novel products and processes emerge.
- **Innovation facilitation** – The enabling of innovation is often performed by innovation intermediaries, through financial support, networking capabilities, and mentoring/advice.
- **Policy-making** – Six types of government policies and regulation can influence the health of an innovation ecosystem: competition policy; trade policy; intellectual property; sector-specific regulations; good governance, transparency, and corruption; and public innovation platforms.
- **Demand** – This behaviour is a reflection of the needs and preferences of market customers, other end users, and governments.
- **Firm innovation** – This is the central behaviour of the innovation ecosystem with firms playing the principal role in translating ideas into innovation by using the resources of the ecosystem.

(Innovation Impacts: Measurement and Assessment, pg. xiv)

(2) **Challenges**

Open Innovation Risk

Open innovation breaks organization boundary, pays attention to the use of internal and external resources, and stresses labor division and cooperation. Because open innovation is implemented in relatively open environment and is a loose, flexible innovative mode. Although more new ideas and innovative thinking can be brought in, the difficulty and cost of management are also increased at the same time. In open innovation mode, enterprise can obtain necessary technology through outside world to reduce costs and improve product quality so that competitiveness can be improved. However, if it excessively relies on suppliers and partners, the technical health state itself may be affected.

- **External technology dependent**
  For external environment of open innovation, enterprise can more easily obtain advanced knowledge and technology from suppliers, partners or research institutions. Therefore, enterprise independent innovation or motivation in search of other cooperation will be weakened. If enterprise excessively relies on specific suppliers. When problem appear in cooperation, there is also no substitute or other partners, which will likely lead to the collapse of original system and formation of technological dependence.

- **Complex process management**
  Open innovation eliminates the organizational boundary. The increase of innovation subject, difference of technology, management and resource capabilities and extension of innovation process increase the difficulty of process control and management complexity. Therefore, so various conflicts are produced among innovation subject and uncooperative phenomenon can occur at any moment.
• **Difficulties in intellectual property protection**
  Open innovation has contributed to the rapid diffusion of knowledge among service providers, suppliers and partners. However, this may lead to that part of innovation subject loses control of knowledge ownership. Under present intellectual property protection condition, as corresponding laws and regulations is not healthy, when enterprises use open innovation mode, the core technology may be difficult to be protected. Therefore, it will be difficult to produce the advantages of open innovation.

• **Market information leakage**
  For enterprise borders open, disclosures of core knowledge and business secrets maybe occur for project cooperation and information exchange in innovation process. Theft of product and user information by service providers and market strategic information caught by suppliers may occur in cooperation process. Information leakage and other things occur during users participate in innovation process.

• **Resource capacities are mismatched**
  In open innovation mode, the resources and capacity of each subject are uneven and mismatched which will often create obstacles on some key nodes of innovation activity. They affect the overall innovation process, which will be transferred to external subject of innovation.

• **Other risks**
  Target predicted by innovation has uncertainty, and each subject has inconsistent understanding for innovation goals. Other factors such as the sharing degree of technology and information, heterogeneity of corporate culture, complementary effect of technical resources and so on. They will all lead to the risk of open innovation.

  *(Interaction of Open Innovation and Business Ecosystem, pg. 4)*

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**Regional Innovation Agencies (RIA)** established throughout the OECD regions are exposed to the following common pitfalls:

- **Unclear mandate**: when RIAs mandates are not explicit, or too vaguely defined, the risk is that the effectiveness of their mission cannot be assessed, and that conflicting priorities might undermine the agencies’ operation. Unclear mandates also enhance the risk of dispersion into multiple projects to find financial resources, at the expense of overall goal compliance.

- **Lack of impact evaluation**: absence or weaknesses of monitoring and evaluation tools and practices generate a high risk of sub-optimal performance. In addition, legitimacy of RIAs may be undermined by a lack of goals achievement demonstration.

- **Difficulty to find and retain qualified staff (due to unstable funding)**: when RIAs’ funding sources are too uncertain, the agencies experience high staff turnover and a difficulty to attract senior level advisers, and to capitalise on in-house expertise.

- **Public status and absence of competition induce lack of performance incentives**.

- **Inward-looking perspective constrained by administrative boundaries and lack of vertical co-ordination**: in cases where RIAs’ territories of action are too restricted to institutional borders, opportunities for effective innovation support will be missed through lack of openness to external sources of innovation, and unnecessary competition with other regions might take place.

  *(Regional innovation agencies, pg. 5)*

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Edquist (2005) also discusses the three weakness of the systems approach. Firstly, the concept of institution has ambiguity in definitions. Nelson and Rosenberg (1993) use institutions as different kind of organizations, but according to Lundvall (1992) the term refers to rules of the game.(Edquist,2005:186) Second weakness of the innovation systems is that its boundaries are not well defined. There is no clear guide what should be included on the system and what should be excluded. Thirdly, innovation systems are not formal theories because they do not suggest causal relationships among components.

*(Components of Innovation Ecosystems: A Cross-Country Study, pg. 3)*
University-Industry Collaboration

The traditional function of universities is providing qualified labor for private and public sectors. Thus, increasing human capital and teaching are understood as role of universities in innovation process. Leading by universities in United States, universities have been adapting research and development skills besides teaching skills. Etzkowitz (2003) uses triple helix concept to describe role of universities in the innovation process. Three components of the helix are university, government and industry. A DNA molecule has a dual helix but DNA of innovation has a triple helix. According to triple helix approach, industry is the component in which productive activities happen, on the other hand government guarantees stable interactions and exchange relations through setting the rules of contracts. Mission of university in the triple helix is improving new knowledge and technology that are inputs of a knowledge society. University industry collaboration and innovation output are positively correlated. (Components of Innovation Ecosystems: A Cross-Country Study, pg. 7)

Culture to Innovate

Besides of natural, structural and organizational factors culture or components of culture influence the use of nature, social etiquette, technology development and the organization of knowledge. The cultural effects transmit economy and innovative activity, respectively. Culture influences economy at least three ways. Firstly, economic systems are legal, moral and morphological formations which prevail customs and traditions. Second, culture in a narrower sense directly influences the acceptance of the economic order. It is assumed that functioning and stability of an economy derives from the congruence between the implemented structural and economic order prevailing in a society. Organizational formations and cultural environment must be compatible. Thirdly, particular elements in a culture accelerate economic progress. (Hölscher, 2006:65-66) Cultural factors play an important role innovation making. Openness of the culture contributes to innovation making. Social model, combined with specific features of businesses, manifests itself as a “culture of an organization”. (Components of Innovation Ecosystems: A Cross-Country Study, pg. 8)

An important feature of an innovation ecosystem is that the resources available to the knowledge economy are coupled to the resources generated by the commercial economy, usually as some fraction of the profits in the commercial economy. Another feature is that the ecosystem is usually strategically developed around a specific technology. Two high profile examples of focused ecosystems are the Department of Energy’s Innovation Ecosystem Development Initiative which is focused on speeding up the adoption of energy innovations and the European Innovation Initiative’s Digital Ecosystem Technologies. These national level strategic initiatives are just two examples; clearly innovation ecosystems can be structured around almost any subject matter. The Engineering Research Centers (ERC) program at the National Science Foundation is an example of smaller scale innovation ecosystems developed to push selected technology niches which are centered around transformative engineering systems. This program, originated more than 25 years ago within the NSF’s Engineering Directorate, has been very effective at initiating and maturing ecosystems that are stable enough for the ERCs to continue operating after NSF funding sunsets at the end of 10 years. The current success rate for graduated ERCs is 82%. (What is an Innovation Ecosystem, pg. 3)

The Role of Leadership in Developing Culture

All of the constituents interviewed, regardless of their affiliation (venture capital, industry, institutions, etc.), independently provided input that consistently echoed certain themes:

- Finding ways to increase innovation is only one element of an effort to create a regional environment that will attract the resources (capital and people) needed for successful commercialization of new technologies.
- Champions for collaboration are required throughout the ecosystem. In many instances, it is industry leaders who drive the culture shift because of their need for new innovation to sustain their businesses. Their stature as leaders of tax-generating businesses is also important for
developing local and statewide political champions, who then are able to develop programs and initiatives at the state level.

- The most successful ecosystems have clear financial and other resource commitments from leaders at multiple institutions. The leaders come from:
  - Large, profitable businesses (sales over $100M annually)
  - Successful entrepreneurs and venture capitalists
  - Universities
  - Research institutions
  - Media outlets
  - Economic development organizations
  - State and local governments

- The leaders “walk the talk”. They state their vision and implement programs, either internally or across the partnership, that are specifically designed to foster an innovative culture.
- Beyond working individually as leaders, they typically either create a separate organization to coordinate their efforts, or institute a formalized meeting/communication process to ensure coordination across their region to maximize effectiveness.

(External Innovation Ecosystem Analysis, pg. 7)

Companies looking forward to engage and innovate through partnerships, should also be aware of the obstacles they may encounter in their way to success. This sense of consciousness about possible problems is especially true for companies orchestrating the ecosystem. In fact, codevelopment alliance managers need to overcome obstacles and to operate through novel configurations in order to succeed.

Depending on others for your personal accomplishments implies having important changes on your strategy. Yet one of the main obstacles is overall confusion. Starting from the misunderstanding over what innovation actually is the one being launched: Who has control? Who and how can members profit from the initiative? What happens to intellectual property rights? (Corkill, 2007). Intellectual property is a tricky issue here: partners may be reluctant to share their insights and remain overprotective with IP sharing. Possible reasons for this are relational problems and lack of confidence between members, then again, another complication to networks. Besides this, there may be more confusion over the management methods needed to deliver continuous value. An uncoordinated partnership which is poorly aligned with peer functions (such as accounts, procurement, sales, etc) will create conflict messages to current and potential partners, presenting an obstacle to innovation (Corkill, 2007). Additionally, the absence of an innovation plan can hide where critical bottlenecks reside, consequently affecting timing of the overall project. (Orchestrating innovation ecosystems: a case study of a telco wholesaler growing into a global hub for cross-innovation, pg. 17)

Second, Fisher (1996) pointed out that although some failures may be attributed to changes in business conditions, a number of them are triggered by inappropriate partner selection. Differences in organizational cultures, mindsets, expectations, and behavior can make building relational capital and managing alliances extremely costly (Emden, Calantone and Droge, 2006). Likewise, having an undifferentiated value proposition for network partners, for instance, relying on money as the only deal driver leaves a company without advantage over competitors (Corkill, 2007).

As a third theme, some authors may also argue that one of the most important strategic factors affected is the risk assessment and management. For some companies the attempt at ecosystem innovation has been a costly failure because they overlooked that along with new opportunities, innovation ecosystems also presents a new set of risks (Adner, 2006). Initiative, interdependence and integration risks should be carefully treated upfront.

One final obstacle may reside on the costs associated with those network-types of practices. Specifically, upfront investment in human resources required for assessing selecting and negotiating with external innovation contributors, or in some cases the paramount organizational changes required for implementation (Traitler and others, 2011). (Orchestrating innovation ecosystems: a case study of a telco wholesaler growing into a global hub for cross-innovation, pg. 18)
‘Cultural Divide’ Between University and Industry

One of the key challenges to university-industry collaboration is conflicting views of the purpose of research. University researchers tend to select topics that are viewed by their peers as interesting and valuable and that they can publish through the peer review process. In contrast, firms are interested in developing new products and services and tend to see the long-term orientation of university research, potential conflicts over intellectual property, and rules and regulations imposed by universities or governments as the key barriers to collaboration. The collision of these two different world-views, or attitude orientations, can lead to insurmountable conflict during research partnerships leading to an inability to pursue research collaborations fully. Firms and universities are managed with different logics and objectives and while market efficiency is the key driver for firms, higher education institutions have a focus on the provision of knowledge and training. Many firms, especially those without knowledge and technology transfer activities, assume that their R&D questions would not be of interest to academics, while many academics operate under the assumption that the research interests of universities do not correspond to the presumably more application-oriented interests of business (Arvanitis et al., 2005, 12). Similarly, Pavitt (2003) discusses “organizational cultural differences” as a major problem complicating university-industry collaborations, and reports that because the natural pace of activity tends to be slower for universities, managers often complain that universities operate on extended time lines and demonstrate little regard for the urgent deadline of business, which acts as a deterrent especially to smaller entrepreneurial firms unused to such arrangements. (Growing Innovation Ecosystems, pg. 17)

(3) Good practice cases

UK Research Partnership Investment Fund – encouraging university partnerships with businesses and charities. Some of the first projects to benefit include:

- A £60 million partnership between the University of Birmingham and Rolls-Royce for a world-leading research centre for high temperature metallurgy and associated processes for components including turbine blades. This will ensure a more effective translations of fundamental research to production and train engineers from apprenticeships to postdoctoral fellows;
- A £92 million partnership between the University of Warwick, Jaguar Land Rover (JLR) and Tata Motors European Technical Centre (TMETC) for a new National Automotive Innovation Campus. This will develop new technologies to reduce our dependency on fossil fuels. It will also address a shortage of skilled R&D staff in the automotive supply chain; and
- A £138 million partnership of the University of Oxford and a consortium including Synergy Health, Cancer Research UK, Roche Diagnostics, GE Healthcare and the Oxford University Hospitals NHS Trust, to establish a new world-leading centre for targeted cancer research. This will take an all-encompassing approach to patients with early stage cancer, to develop, test and implement personalized minimally invasive treatments, combined with targeted diagnosis, imaging and therapy.

(Innovation, Research and Growth, pg. 59)

Collaboration is a key element of a successful innovation ecosystem. An Innovation and Knowledge Centre (IKC) creates a fertile, knowledge-rich environment in which business can collaborate with academics and other businesses to create the next generation of technology as it emerges from the science base. Led by an academic institution, and funded for at least five years, IKCs are intended to accelerate the commercialisation of world class science and emerging technologies into new products, processes or service.
What distinguishes the Silicon Valley from any other innovation hub, even today, is the well evolved ecosystem to foster innovation.

What are the components of this ecosystem? Startups, entrepreneurs, technologists, attorneys and big tech companies that are potential buyers, not to mention VCs and angels. More intangible, but as valuable, is the risk-taking culture that has been inculcated owing to the tremendous success seen by Valley entrepreneurs over the years. It was believed for long that it would be impossible to replicate this environment elsewhere as it required a coming together of so many factors.

However, Bangalore, often dubbed the Silicon Valley of India, has managed to simulate the environment quite successfully. Some reasons attributed to Bangalore’s success are the presence of numerous R&D centers of global MNCs, support of organizations such as TiE and Nasscom, influx of VCs and prevalence of entrepreneurial climate (in part owing to the creation of wealth from the success of the IT services industry and from Bangalore being the preferred destination for Indian technologists returning from the US, especially the Valley). In fact, today Bangalore and Silicon Valley are quite interconnected, with numerous startups working with a cross border operating model.

The role of academic institutes in fostering innovation needs to be emphasized. The IITs in India have played a very important role in nurturing and incubating ideas that have today become successful commercial products. Prof Jhunjhunwala, IITChennai, has contributed greatly to the success of companies such as Midas Communications. The alumni of IIT, especially those that have tasted success as entrepreneurs, have created forums for facilitating interactions within the community - a good example is Proto.in, which according to the website, is a platform for entrepreneurs to express their visions and showcase their imagination, with a working prototype, for the world to see. It’s about increasing partnership, collaboration and mindshare among a distinguished, qualified and well-connected audience. Proto.in provides a unique platform for promising startup talent to communicate their creativity and innovation potential. As a meeting place for the smartest entrepreneurs, venture capitalists and professionals, Proto.in stands true to its mantra “Create, Contribute, Collaborate.” In addition to IIT, management institutes such as the IIMs and ISB also have incubation centers to nurture ideas with potential.

Companies such as Microsoft also have ongoing initiatives for identifying and assisting innovative technology companies. Microsoft is also planning to set up a first of its kind Innovation Triangle Park in Pune this year. Last, Nasscom too has done many different things to foster a climate of innovation. Their award for the Most Innovative Technology Company of the Year is now much sought after.

The development of China into an emerging innovation hub traces a slightly different path. The creation of the much needed ecosystem is being virtually managed step by step, by the government. One of the main goals of the economic reform process, started in 1978 by Deng Xiaoping, was to raise China’s indigenous technological capabilities. In fact, China adopted a dual strategy for economic development - industrialization and informatization.

Israel in many ways has emulated the Silicon Valley experience owing, in part, to its strong links with the US and also because of the strong entrepreneurial culture and high quality of technically trained people available. The government also has played an important role in nurturing the high tech industry which, as mentioned earlier, is the main driver of the country’s economy and exports.

From the beginning, the country has sought to differentiate itself as an intellectual powerhouse, to make up for its lack of size and natural resources. Altogether, Israel spends about $300 million annually on academic research, with most of the money coming from the government. In addition, grants are available for research projects, to the tune of $100M, that support thousands of projects.
University research and development foundations, the first of which were established in 1952, are responsible for the interaction between researchers and the world of industry; they facilitate the commercialization of innovative ideas. A recent study shows that universities are Israel’s leading patentees at home and abroad, and that the relative size of their patenting activity far exceeds that of higher education sectors in other countries.

The Israeli government also established an office of the Chief Scientist to encourage the growth of R&D based industries. Each Chief Scientist acts as advisor to the minister on matters of industrial R&D and implements government and ministerial decisions in this area. The chief scientist is also responsible for providing financial aid to worthy R&D projects, as well as guidance and training to new enterprises and funding for industrial and technological incubators. The chief scientist promotes cooperation with foreign countries to advance bi-national activities and tries to generate risk capital in Israel and abroad for the development of innovative technology. 

(21st Century Innovation Hubs, pg. 4)

What is often left out of European discussion of the US innovation system are its systemic aspects – i.e., the environment for innovation. In the United States, the environment for innovation is shaped by policies concerning areas such as taxation, capital markets, intellectual property, as well as a host of regulations – often critical for new firms – concerning market entry, labor standards, and of course bankruptcy. Such policies and regulations define the risk-reward ratio for aspiring entrepreneurs. Together, they condition the willingness of entrepreneurs to take on the risk of firm creation. They can also condition the willingness of investors to support entrepreneurs as they move an idea from the laboratory to the marketplace. The generally supportive nature of these policies (buttressed by accommodating social and cultural attitudes) is one of the defining features of the US innovation system.

Policy incentives for local heroes:
- Innovation grants provide seed capital for entrepreneurs to start new firms;
- Competitively reviewed awards create information for markets, encouraging private capital investment in early-stage development;
- Intellectual property rights encourage invention by securing the fruits of invention;
- Non-confiscatory tax policies preserve the rewards of entrepreneurship, and hence motivate entrepreneurship;
- Labor flexibility provides firms the confidence to hire new workers – firms that can’t fire won’t hire;
- Gentle bankruptcy laws that enable entrepreneurs to assume the risk of a start-up without betting their homes and their futures.

(Entrepreneurship and the Innovation Ecosystem: Policy Lessons from the United States, pg. 13)

Small Business Innovation Research Program (SBIR)

Created in 1982 and renewed in 1992 and 2001 SBIR requires agencies with extramural research and development budget of more than 100 million USD to set aside 2.5 percent of this budget for innovation awards to small businesses. The program is structured in three phases:
- Phase I is essentially a feasibility study in which award winners undertake a limited amount of research aimed at establishing an idea’s scientific and commercial promise. Today, the legislation anticipates Phase I grants as high as 100,000 USD. The program is highly competitive, with less than 15 percent of applicants receiving awards.
- Phase II grants are larger – normally 750,000 USD – and fund more extensive R&D to further develop the scientific and technical merit and the feasibility of research ideas; about half of the Phase I awardees receive Phase II funding.
- Phase III. This phase normally does not involve SBIR funds, but is the stage at which grant recipients should be obtaining additional funds either from a procurement program at the agency that made the award, from private investors, or from capital markets. The objective of this phase
is to move the technology to the prototype stage and into the commercial marketplace or
government procurement, depending on the product.

(Entrepreneurship and the Innovation Ecosystem: Policy Lessons from the United States, pg. 15)

The Enabling Role of Universities

Research universities are a key component of the US innovation ecosystem. Their role as focal points in
the innovation system has evolved tremendously over the last twenty years. More than ever before,
industry depends on university research for new ideas for improved products and processes, while
university researchers frequently draw ideas from commercial trends to explore new veins of scientific
inquiry.

The university role in the regional economy has also undergone significant change. Universities are
increasingly recognized not only as centers of learning but also as poles of regional growth and
employment. It is important to note that the distribution of university contributions to local economies is by
no means even. There is significant variation across states and regions in the United States, with some
universities such as MIT and Stanford now recognized as global centers of innovation, while others are
much less attractive and less effective in commercializing new technologies. The contribution of US
universities to innovation and growth is, nevertheless, widespread. In Pittsburgh, Pennsylvania, for
example, the University of Pittsburgh and Carnegie-Mellon University have become the largest employers
in the region and are spurring the creation of innovative new firms, helping to replace the reliance of
the regional economy on the steel industry.

(Entrepreneurship and the Innovation Ecosystem: Policy Lessons from the United States, pg. 17)

When the Small Business Innovation Research program was created in the early 1980s, universities
strongly objected to the program, seeing it as a source of competition for federal R&D funds. In the
course of the decade of the 1990s, this perception of the program significantly evolved. In the
commercialization-sensitive environment SBIR awards were increasingly seen as a source of early-stage
financial support for promising ideas.

The role of SBIR in encouraging professors to found companies based on their research appears to be
growing in importance. Importantly, the availability of the awards and the fact that a professor can apply
for an SBIR award without actually having a firm, encourages applications from academics who would not
otherwise be likely to commercialize directly their own technologies. Initial National Academy of Sciences
research has shown that SBIR awards directly cause the creation of new firms, with positive benefits in
employment and growth in the local economy.

Contrary to what one might expect, the awards generally do not seem to detract from the teaching role of
the university professor. On the contrary, the real life application of research with the attendant
recognition in academic, technical, and financial terms can serve as a source of inspiration for students to
pursue the real-world applications of their studies.

(Entrepreneurship and the Innovation Ecosystem: Policy Lessons from the United States, pg. 18)

Convergence technologies are thriving in Southern California thanks to synergies that take place across
clusters and also to state support for the region’s four California Innovation Hubs (iHubs) that stimulate
partnerships in wireless health, biofuels and energy storage. Technologies boosted by iHubs will include
clean energy, smart grid, intelligent transportation, energy storage/batteries, biofuels, action sports
combining with wireless, cleantech or material science innovation, wireless health, robotics and more.
Regional Innovation Agencies can be established as brand new organisations, or emerge from a specialisation process of existing economic development agencies, formerly providing basic industrial support. The emergence of RIAs is a relatively recent phenomenon, which has accelerated in the last two decades. There is a diversity of models of RIAs as they appear in practice, with a number of key dimensions around which they differ: size, ownership, missions, activities, funding structure, etc.

Examples of such Agencies illustrating this diversity are: Scottish Development Agency (a central agency in charge of a broad regional development mission, funded by the regional government); IWT in Flanders (a large dedicated innovation agency, in charge of innovation promotion through R&D and technology, distributing funds for industrial R&D in public and private sectors, and co-ordinating intermediaries network); the US Manufacturing Extension Partnerships (a decentralised and flexible network of business advisory services, funded equally by national, state and private money, with a focus shifting from problem-solving towards innovation promotion); and the Dutch Regional Development Companies (the regional arms of the Ministry of Economy for its regional development and innovation policies, in charge of support to innovation, amongst other economic promotion goals).

Steps for implementing RIAs in given regional environments involve taking decisions on several strategic questions:

1. The governance and ownership question needs to be determined. The model adopted will differ between two extremes, with nationally-led agencies, to regionally autonomous agencies. In practice, many agencies are co-funded and respond to several layers of government.
2. There is the definition of the agency’s mission, as it could choose to be an innovation specialist only or have a much broader regional development mission.

3. The territory that it covers needs to be determined, as while agencies typically service an area that maps to a particular administrative region, this does not always serve the needs of innovation actors.

4. A key decision to take relates to the choice between a networked model (relying on existing service providers and intermediaries) versus one-stop shop model.

5. The nature and extent of the RIAs services portfolio require a definition of the scope of intervention and the nature of market and other failures that need to be addressed. A list of typical services offered by RIAs appears below.

6. The choice of a funding structure will determine in part the nature of the services it will provide as well as the accountability mechanisms. Performance-based funding models increase the chance of efficient service activities, but may lead to structural instability, while the reverse is true with permanent funding schemes.

7. Finally, there is a conscious choice to be made in terms of the frequency and nature of evaluation tools to address agency effectiveness, and of the consequences of these evaluations.

*(Regional innovation agencies, pg. 2)*

In Africa, building innovation ecosystems has become an imperative for governments and business communities. And, in a few places, such ecosystems are beginning to take shape. Nairobi, Kenya, has gained a reputation as the startup capital of Africa. A half dozen small innovation hubs and incubators have been launched in the past three years, and the city seems to be crawling with entrepreneurs. The first and foremost of the tech hubs, iHub, provides a model for other organizations around Africa that want to plant the seeds for innovation and entrepreneurship.

You can think of iHub as an attempt at creating an innovation ecosystem in a box. The facility, occupying four floors in a building in downtown Nairobi, is run by the local startup community rather than the government or a corporation, though it has backing from nonprofits and tech companies. iHub’s programs include startup meetings and contests, interactions with venture capitalists, a business incubation space, a supercomputer provided by Google and Intel, and a coffee bar where people meet informally. The iHub organizers look for gaps in the local business ecosystem and try to fill them. An example is iHub Research, which facilitates scientific research collaborations.

*(Building Africa’s innovation ecosystems, pg. 3)*

**Moving Toward a New Model Led by Virtually Connected Innovation Hubs**

Cisco IBSG believes there is an urgent need to update the cluster model and shift the focus toward more globally oriented innovation hubs. Few clusters have exploited all the opportunities of the digital economy in terms of collaboration, partnerships, virtualization, and resource sharing. Most of the industrial sites located within cluster zones have regarded technology as an industry to be attracted or supported, rather than as a catalyst for their own innovation and growth. Consequently, this huge potential for innovation and growth remains untapped.

It is therefore important to replace the notion of the traditional cluster — typically a closed-space run on conventional working methodology — with innovation hubs that are open to global opportunity, free of geographic restrictions, and embrace the full potential of technology. This new paradigm calls for three fundamental shifts:

- From geography-based to community-driven
- From locally processed innovation to open, borderless innovation
- From technology-driven to technology-enabled
From Geography-Based to Community-Driven

Instead of viewing innovation hubs as defined geographies, they should be characterized as digital communities of interest, cohering through close intellectual proximity, and not solely through geographic proximity. It is important to comprehend the growing power of online social networks and collaboration tools in the business sphere. In our global world, collaboration and teamwork cannot be limited to geographies; as the sun sets on one innovation hub, it is rising on another, allowing workers dispersed across different time zones to continue work and optimize productivity every hour of the day.

(Next-Generation Clusters: Creating Innovation Hubs To Boost Economic Growth, pg. 8)

The Korea Advanced Institute of Science and Technology (KAIST) is actively promoting cross-field interdisciplinary research, regarding it as an important field of study needed for the future development of society. KAIST has eight research centers for eight high-priority research themes and engages in research and development and provides training. For each research theme two methods are used to set up concrete topics for research and development. One is a top-down approach in which a task force team set up for each theme comes up with topics for research and development through discussions with specialists, and the other is a bottom-up approach in which idea contests are held to invite the submission of proposals for ideas that are highly creative and are free from existing concepts or technologies. Topics with high feasibility and a great potential impact on society are selected, and projects aimed at practical application and productization are designed. Researchers participating in each project come from various academic disciplines and are evaluated on their contribution to interdisciplinary research rather than on the number of research papers they produce.

/Framework for an Innovation Ecosystem Aimed at Solving Problems, pg. 19)

The 'Innovation Hub' Initial Concept

For our purpose, innovation hubs (iHubs) are tools of urban policy oriented towards developing creative places within the cities, such as in their historical centres or in old industrial or logistical areas (the so called “inner-city”). The main idea behind this concept is that we can use science, technology and engineering (as well as design, arts, culture and media) as driving forces of urban regeneration and redevelopment. They will contribute to reinforce the conjecture of Hall (2001): the cities of the future will be a creative conjunction of technology, arts and community.

Thus, we are talking about “cities within cities” as breeding places in an experimental phase (Modder and Saris, 2005). These are “fusion places” where different uses coexist, such as business/entrepreneurial, research and development, education and learning, shopping and entertainment or community functions. In fact, iHubs foster a wide variety of interactions and the appearance of mixed-use environments, blurring the boundaries between physical, digital, economic, social and cultural spaces. Multidisciplinarity is the main feature of these creative communities, where we can find a high density of knowledge intensive workers, who look for quality of life, inclusive environments, social and cultural diversity and digital and physical connectivity. In other words, they are good places to work, live, learn and play.

(Creative Urban Regeneration: The Case of ‘Innovation Hubs’, pg. 3)
‘Innovation Hub’ Concept

Examples of iHubs can be found in several parts of the world: 22@bcn in Barcelona/Spain, "Milla Digital" in Saragoza/Spain, “Dubai Knowledge Village” in Dubai, “Crossroads Copenhagen” in Copenhagen/Denmark or “Avenue of the Arts” in Philadelphia/USA.

*(Creative Urban Regeneration: The Case of ‘Innovation Hubs’, pg. 3)*

**Good Practices for Urban Design and Planning of Innovation Hubs**

Although there are relevant differences between the political, economic and social contexts of the countries and the regions/cities analysed, a comparison of the case studies (added to a general review of other international examples of iHubs) can be fruitful in identifying best practices for the planning and urban design of these creative places. It is worthwhile to note that a model is always a simplification or an artificial representation of reality, and this constitutes a limitation of our research. Moreover, each case has institutional specificities which would make it difficult to imitate and transpose, as is, into other environments.

Strong leadership is a key element for the success of an innovation hub. It is usually based on public-private partnerships, and comprises innovative urban policies and redevelopment strategies and flexible, non-continuous development phasing. Good physical and virtual connectivity is also essential for social, institutional and territorial interaction within the area, fostering its integration into the city and the overall city-region. First-class digital infrastructures and bridging elements are two of the distinctive features of these creative places.

Interaction among the different environments – clustering, talent, built, cultural and natural – stimulates the dynamics of the zone. Best practices point to the presence of good knowledge infrastructures (education and science and technology institutions) in cooperation with companies of creative or soft industries. A culture of entrepreneurship is also important. Besides the presence of knowledge and creative workers, the environment tends to be diverse, multicultural and vibrant, with the presence of foreign talents.
A mixed-use environment combining residential, working, learning, shopping and entertainment functions is one of the main characteristics of these hubs, fostering the emergence of a good place to live, work, learn and play. Other relevant factors are related to the existence of cultural amenities, good environmental quality, a dynamic and iconic spatial concept, distinctive landscape and architectural features along with a specific unique identity.

**Innovation Hub Success Factors**

(Creative Urban Regeneration: The Case of ‘Innovation Hubs’, pg. 8)

**Technology Venture Development Office at the University of Utah**

The Technology Venture Development Office ("Tech Ventures") at the University of Utah is dedicated to technology commercialization and driving economic development for the state. They accomplish this by licensing faculty inventions, building partnerships, supporting the community, and educating students. This center is headed by Jack Brittain, who leads commercialization activities across the campus, including the Pierre Lassonde Entrepreneur Center, the Technology Commercialization Office (TCO), and all commercial-sponsored research.

The Technology Commercialization Office (TCO) is a recognized leader in transforming new ideas into practical, commercially viable products and services. The TCO provides process support services to university spin-outs and outside company “spin-ins” to help them successfully commercialize their intellectual property. They believe that providing these services will facilitate the growth of resources and deals in such a way that it will create a hub of creative commercialization for the city, state and region.

Their programs include:

- **Venture Bench** – an accelerator that provides a suite of services for the university's technology-based companies, including grant and investment funding, entrepreneur-in-residence program, establishing a corporate structure, market assessment, business plan development, logo/brand creation, web hosting and development, and accounting services. It also helps provide access to research labs and office space.

- **TCO Accelerator**: a rapid prototyping facility, focused on accelerating product development and market launch for early stage medical and life science companies and technologies. This facility provides the infrastructure, resources and services for startups and existing companies looking to relocate.
• Software Development Center: formed to create a clear distribution channel for university software projects, developing state of the art entrepreneurial applications, and training students to become professional software developers.

• Energy Commercialization Center: formed to address the problem of discoverability of energy commercialization resources and engage their partner network to drive research energy technologies to the next stage of validation via rapid prototyping, pilot development or commercial-scale deployment.

• Start-Up Center for Students (StaC): helps students execute on their business ideas by assisting with strategy, funding, implementation and mentoring. StaC’s expertise is building companies around ideas that are scalable and have an intellectual property component.

• Entrepreneur Faculty Scholars: provides help identifying funding to explore new ideas, protecting intellectual property, applying for a patent, creating a business plan, or determining if fundamental research is, or should be, on the commercialization path.

(External Innovation Ecosystem Analysis, pg. 25)

German Innovation System as a “Role Model”

Many developing countries and emerging economies consider the German national system of innovation as a role model for the development of their own national systems of innovation. The mere look at the statistics is indeed impressive:

- In 2010, Germany spent 2.82% of its Gross Domestic Product (GDP) on research and development (R&D), out of which the private sector accounts for the largest share (1.9% of GDP) (Eurostat 2013).
- Germany is a top-performer when it comes to patent applications, not only in terms of absolute numbers of patent applications to the European Patent Office, but also in proportion to GDP and per million inhabitants.
- 65.1% of German enterprises are “innovative companies”, meaning that they are active in product and/or process innovation.

This impressive R&D and innovation performance is based on a national system of innovation that is composed of a wide array of research organizations, higher education institutions, training institutions and companies. They are supported by government agencies through hundreds of different programs in the fields of research, education, vocational training and economic development. Collaboration between the science sector and industry is the order of the day, which contributes to the innovation-based strength and competitiveness of German companies on the global market. Innovation enjoyed high political priority for quite a long time, which is evidenced by the “High-Tech Strategy”, adopted in 2006 and spearheaded by the Ministry for Education and Research, which consists of the following three main pillars:

1. Promotion of innovation in four selected priority areas (so-called ’needs areas’, namely: health, climate protection/protection of natural resources/energy, mobility, security) and related key technologies (such as biotechnology, nanotechnology etc.);
2. Promotion of cooperation between science and the private sector, and
3. Improving the framework conditions for innovation.

In addition to the federal government, the states are also involved in promoting innovation, but their programmes are not part of the “High-Tech Strategy”. In contrast to many other European countries that have created specialized, independent agencies for the implementation of innovation policy and programmes, in Germany, this is managed by a diverse set of research organisations, associations and companies, the ‘Projektträger’, or project executing agency (European Commission 2009).

(Innovation – An Imperative for Competitiveness & Sustainable Development, pg. 10)

Finland in particular is internationally recognised as a leader among R&D intensive countries; knowledge transfer between business and universities has been one of the key factors in Finland’s innovation and
economic success. This success has been largely attributed to the supply of highly trained graduates in R&D intensive sectors and the development of institutions that support knowledge exchange to sustain the Finnish innovation ecosystem (World Economic Forum, 2011). To further this effort, in 2010 Finland established another post-secondary institution called Aalto University; this new “innovation university” is a merger between three Finnish universities: The Helsinki School of Economics, Helsinki University of Technology and The University of Art and Design Helsinki. The university is designed to provide strong multidisciplinary education and research and encourage linkages between industry in sectors of strategic advantage, which would ultimately have economic and social spill-over effects. In general, the Finnish innovation ecosystem is enriched by its local universities which provide the local economy with a highly trained workforce, and in particular, a significant number of science and engineering graduates to further bolster its strong innovation capacity in ICT. (Growing Innovation Ecosystems, pg. 53)

National Science Foundation (NSF) established programs

Engineering Research Centers (ERCs): The ERC program supports interdisciplinary teams and infrastructure that strategically join discovery with research that advances enabling systems technology in partnership with industry. Center education activities serve pre-college students and teachers through practicing engineers. Centers funded since 2008 have become more directly focused on bridging the innovation gap through partnerships with small firms and groups dedicated to entrepreneurship. (Other NSF center approaches, including NSECs, MRSECs, and STCs, have similar structures and results.) To date, 54 ERCS have formed, with 15 current ERCS operating within a 10-year window of NSF support. ERC awards spur translation of fundamental research, encourage university–industry collaboration, and educate faculty and students to innovate.

Industry/University Cooperative Research Centers (I/UCRCs): The I/UCRC program engages small interdisciplinary groups of faculty and students to perform research on industry-relevant and mutually agreed-upon topics, with industry and other stakeholders providing the majority of financial support (7 to 8 times the NSF investment). I/UCRCs spur translation of fundamental research and encourage university–industry collaboration.

Grant Opportunities for Academic Liaison with Industry (GOALI): This program promotes university–industry collaboration by supporting academic fellowships/traineeships in industry, industrial practitioners on campus, and industry–university team research. GOALI awards spur translation of fundamental research, encourage university–industry collaboration, and educate faculty and students to innovate.

Partnerships for Innovation (PFI): The PFI program promotes partnerships between academe, the private sector, and government in order to: generate new ideas through collaborative research; transform new ideas into goods, businesses, or services to society; build infrastructure to enable innovation; and educate people to foster innovation. PFI outputs include knowledge and technology transfer, product commercialization, startup formation, workforce development, and education in the innovation enterprise in academia at all levels and in industry. PFI awards spur translation of fundamental research, encourage university–industry collaboration, and educate faculty and students to innovate. (The Role of the National Science Foundation in the Innovation Ecosystem, pg. 8)

Pilot activities

Industry-defined Fundamental Research: In this pilot program, the Industrial Research Institute has invited its own members, professional society members, and university partners to examine possible research thrusts that are fundamental and that could have a transformative economic impact on an industry or sector. These research areas will then inform relevant research programs within ENG. These naturally can lead into any one of the above-referenced programs as a follow-up to the pilot program. This project will spur translation of fundamental research and encourage university–industry collaboration.
**Industry Postdoctoral Fellows:** Through an award to the American Society for Engineering Education, the NSF has provided 40 grants to postdoctoral students for innovation-focused work in industry, the costs of which are shared between industry and NSF. An expansion of this fellowship into NSF-supported small businesses (through SBIRs/STTRs) will be a natural follow-on program. This investment will **encourage university-industry collaboration** and **educate faculty and students to innovate**.

**Innovation Fellows:** This activity will support cohorts of engineering undergraduates in an innovation-focused Ph.D. graduate program that includes summer internships in industry. This investment will **spur translation of fundamental research, encourage university-industry collaboration**, and **educate faculty and students to innovate**.

**Translational Research in the Academic Community (TRAC):** TRAC supplements provide targeted resources to academic researchers to begin the translation of results from NSF GOALI fundamental research into potential commercial applications. Funds support prototyping, proof-of-concept tests, and/or scale-up. TRAC supplements **spur translation of fundamental research** and **educate faculty and students to innovate**.

**Accelerating Innovation Research (AIR):** The AIR pilot involves two related, new activities. The first will encourage the translation of technologically promising, fundamental discoveries made by NSF researchers, while drawing upon and building entrepreneurship in researchers and students. The second activity will foster connections between existing NSF research centers and other institutions, whose complementary foci will spur the development of discoveries into innovative technologies through collaboration. AIR awards will **spur translation of fundamental research, encourage university-industry collaboration**, and **educate faculty and students to innovate**.

**Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR):** Recently, NSF partnered with the Economic Development Administration and the National Institutes of Health to launch the i6 Challenge, a competition that encourages technology commercialization and entrepreneurship.9 NSF has also explicitly linked SBIRs with the ERCs and the I/UCRCs. SBIR and STTR grants **spur translation of fundamental research** and **encourage university–industry collaboration.** *(The Role of the National Science Foundation in the Innovation Ecosystem, pg. 9)*

**New concepts**

**University–Industry Collaboration to Advance Discovery:** Modeled after the GOALI program, this program would accelerate innovation based on the transformational research already funded by the ENG Office of Emerging Frontiers in Research and Innovation (EFRI) by providing incentives to industry researchers to partner with EFRI grantees. As a first attempt to implement this idea, the FY 2010 EFRI solicitation allows industry researchers to serve as co-PIs on a research project. This investment will **spur translation of fundamental research and encourage university–industry collaboration**.

**Economic Development Stimulation in Rural Areas:** A program sharing many features of the ERCs could be established for universities in rural areas that have a history of working effectively with local or national industries. Such a program would provide students, faculty, and the region with the positive effects of ERCs: opportunities to participate in large-scale research projects; new curricula and pedagogical tools; building a culture of innovation through outreach and collaboration with other universities and industry. These awards would **spur translation of fundamental research, encourage university–industry collaboration**, and **educate faculty and students to innovate**.

**National Network for Technology Integration (NNTI):** Technology integration and scale-up are critical components of technology translation and often neglected as discoveries are matured towards commercial products. The NNTI would address this issue by providing a network of technology-specific flexible user facilities that provide access to state-of-the-art instruments and services for technology integration and for scale-up and manufacturing research, and they would offer training and education opportunities. The NNTI would connect to regional innovation hubs to facilitate collaboration with industry. These awards would **spur translation of fundamental research, encourage university–industry collaboration**.
Orchestration is a key process for maintaining effective innovation ecosystems. Once actors are able to find each other, communicate effectively, and understand each other’s questions, interests, and needs, trust and mutual respect can grow. Collaborative learning becomes possible, and the investment of time, effort and attention participants need to make in order for collaboration to be successful can begin to pay off. Support infrastructure – methodologies, technologies, tools, activities, and shared spaces – both physical and virtual meeting and co-working spaces – are important to facilitate communication and to build shared understanding.

Changing mindsets is often an important and difficult aspect of the innovation process, but it is essential both on an individual and a collective level. Thinking in outcomes and impact, not outputs, is the basic principle in regional innovation ecosystems. Moving from proprietary ownership to open innovation, from personal to partnership, from following to initiating, from risk-aversion to experimentation – these are building blocks of the culture of innovation Europe is looking for, and which the Horizon 2020 program hopes to achieve. They mark shifts in deep understanding, which are necessary in order to create value in society.

Beyond this, the right attitude is required, and diverse skill-sets are needed for pioneering and discovery. Discovery skills form part of the creative intelligence of innovative entrepreneurs. These skills work together to create what the authors call “the innovator’s DNA” (Dyer, Gregersen & Christensen 2011). This idea was used for designing the original Aalto Camp for Societal Innovation (ACSI) concept, and has been taken over in developing ACSI-style interventions for the EUE program. Two additional aspects were added to the original five, creating the concept of an innovation dynamo to guide the mentality of EUE participants to focus and strive for the regional impact.

The Innovation Dynamo (see the core in above figure) harnesses the five discovery skills to two aspects of the innovation process essential to realizing innovation in practice: Implementing and Creating Impact (Markkula & Kune 2013):

- **Associating** is the ability to make connections, linking seemingly unrelated issues and ideas in new fruitful combinations.
• Questioning leverages the power of provocative questions to create new perspectives and modes of thinking.
• Observing is the key to understanding how things in the world work, and why people behave as they do.
• Experimenting means going with best guesses and not being afraid of failing your way forward. It is an essential skill of innovators.
• Networking allows us to tap into the collective and distributed intelligence for insight, explanation, expertise, and inspiration, as well as critical thinking.
• Implementing is the litmus test for innovators—realizing a good idea in practice.
• Creating Impact—and Celebrating it. This is the proof of the pudding: does a new product, service or realized idea actually create value for its users—and for the ecosystem. If it does, then we should celebrate it, making it clear to all those involved that this innovation works.

This is how the Innovation Dynamo generates innovation power and the energy required to maintain the ecosystem. Working with these skills, pioneering innovation regions are able to leverage their potential to create societal impact. (*The Knowledge Triangle: Re-Inventing the Future*, pg. 29)

**Ontario Innovation Investment Programs**

<table>
<thead>
<tr>
<th>Aggregate Behaviour</th>
<th>Program Type</th>
<th>Investment Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Generation</td>
<td>Direct academic support</td>
<td>Ontario Research Fund (Research Excellence and Research Infrastructure) Early Researchers Award Post-doctoral Fellowship International Strategic Opportunities Program OMAFRA University of Guelph Research Partnership</td>
</tr>
<tr>
<td></td>
<td>Public and not-for-profit research organizations</td>
<td>Ontario Institute for Cancer Research Ontario Brain Institute Perimeter Institute for Theoretical Physics Agricultural Research Institute of Ontario Ontario Forest Research Institute</td>
</tr>
<tr>
<td>Innovation Facilitation</td>
<td>Innovation intermediaries</td>
<td>Ontario Network of Excellence • Ontario Centres of Excellence • MaRS • Regional Innovation Centres Business Ecosystem Support Fund Health Technology Exchange Agri-Technology Commercialization Centre Centre for Research and Innovation in the Bio-economy Water Technologies Acceleration Project</td>
</tr>
<tr>
<td></td>
<td>Indirect business support</td>
<td>Ontario Innovation Tax Credit Ontario Business Research Institute Tax Credit Ontario Research and Development Tax Credit Ontario Interactive Digital Media Tax Credit Ontario Tax Exemption for Commercialization</td>
</tr>
<tr>
<td>Policy-making</td>
<td>n/a</td>
<td></td>
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<tr>
<td>Demand</td>
<td>Public procurement</td>
<td>Green Focus on Innovation and Technology Green Schools Pilot Initiative</td>
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(*Innovation Impacts: Measurement and Assessment*, pg. 70)
MIT’s success arises from a well-developed innovation ecosystem consisting of a network of well-funded and highperforming offices that mutually support entrepreneurship within the university and with MIT’s industrial partners.

These include:

- Technology Licensing Office - grants licenses to both existing and startup companies that demonstrate the technical and financial capacities to develop MIT’s early-stage technology into commercially-successful products.
- Deshpande Centre for Technological Innovation - reduces technology and market risk by funding early-stage research and facilitates connections between researchers and the business/venture capital community.
- MIT Entrepreneurship Centre – fosters entrepreneurship through education programs and builds industry-technology partnerships and networks with the entrepreneurial community.
- Venture Mentoring Service - supports innovation and entrepreneurial activity throughout the MIT community by matching prospective entrepreneurs with experienced volunteer alumni mentors.
- Industry Liaison Program - creates and strengthens mutually beneficial partnerships between MIT researchers and global corporations.
- Student groups and innovation prizes – foster entrepreneurial activity as an integral part of the student experience.

(\textit{Canada's Innovation Ecosystem}, pg. 6)

\section*{(4) Recommendations}

Just as the orchestration required of a symphony orchestra is different from that required for a jazz quartet, ecosystems of people and companies that produce a product, service, or other outcome often require some orchestration that is suited to their objectives. The vitality and success of an innovation ecosystem depends upon the objectives around which it is organized, as well as its capacity to engage its members and attract new ones. According to Wind et al. (2008), this ability to connect and manage competencies across a broad network of relationships is one of the most important meta-capabilities for a networked world. Across the triple helix of interrelationships among business, education and government organizations, a variety of catalyst organizations enable network orchestration.

The primary roles of network orchestration are related to the focus, management, and value creation of the ecosystem and its entities. With the objective of transforming the innovation ecosystem, we argue that the network orchestrator for technology-based regional development includes several roles:

- Focus on the network: Networks compete against networks. With a perspective on the network, orchestrators must help entities in the ecosystem understand their roles in the network and collaborate for integrated synergy;
- Lead through empowerment: Network orchestration relies on a combination of empowerment and trust, to motivate entities to respond with agile entrepreneurial synergy;
Co-create value through boundary spanning: In an innovation ecosystem, value comes from integration, bridging borders and leveraging the capacity for co-creation across the network.

*(Transforming Innovation Ecosystems through Shared Vision and Network Orchestration, pg. 16)*

Focus innovation programs on the individual entrepreneur
After all, countries don’t innovate; firms do. Industry initiation and management of projects is essential. Providing broad solicitations to attract a variety of approaches towards achieving a given government mission is one of the SBIR program’s strengths.

Limiting the government’s participation
Ensuring that government funds are granted on a competitive basis, with real and transparent competitions, is essential. Requiring industry cost share, and limiting public commitments in funds and time are important to maintain the entrepreneur’s commitment to a successful commercial outcome and to identifying technical failure early in the development cycle.

Improving markets by encouraging private initiative
Government innovation awards such as SBIR do not replace the market. They can improve imperfect investment markets by creating new information about the quality of an innovation (through government and private review) and the commercial potential (by government interest and/or implicit endorsement) of the product. Another one of SBIR’s major advantages is its bottom-up approach, relying on self-initiation by entrepreneurs with ideas for technologies applicable to government needs or commercial markets.

Match policies to market realities
SBIR focuses on market processes – the environment where real entrepreneurs make real decisions – rather than on policy inputs – the realm of economists and their models of innovation. Without attention to market processes, more inputs into the innovation process (such as the European Commission’s 3 percent solution for innovation-led growth) will not necessarily deliver better results.

Take advantage of Constructive Confusion
While a harmonized policy looks well ordered from the policymaker’s point of view, it often fails to make sense from the entrepreneur’s perspective and can easily understated the diverse public needs and institutional processes. Policies that provide points of coordination for multiple and localized industry initiated efforts, by contrast, can exploit the richness of diversity in a nation’s innovation ecosystem. A strength of the SBIR program is that it is administered flexibly, allowing the program to adapt to the various agency missions, scientific opportunities, and commercial imperatives. A centrally managed system with the attendant bureaucratic procedures and controls could well stifle the program.

Foster a culture for innovation
Fostering a culture of innovation requires a change in the incentives facing entrepreneurs and others in the innovation ecosystem. Encouraging more professors to start new companies to commercialize their research ideas, for example, will come about only when the university supports and rewards such behavior in one form or another. This need for a change in university culture is often easier to recognize than to effect. One way to address this is to encourage parallel research institutions that encourage and reward cooperation on research relevant to industry needs.

*(Entrepreneurship and the Innovation Ecosystem: Policy Lessons from the United States, pg. 18)*

There is no one-size-fits-all successful model for Regional Innovation Agencies (RIA), valid across all types of regional environments. Several models can be adopted, but a number of characteristics of efficient RIAs can be identified:

- RIAs should act as system facilitator based on a systems failure rationale: helping to solve systems bottlenecks and increase knowledge flows in the regional environment. RIAs’ mission should be defined so as to avoid unfair competition with private services. While acting on the system dynamics, RIAs need to focus on enterprises and people as key engines of innovation.
• RIAIs need to work under an “open” territory definition given the frequent mismatch between administrative borders and the footprint of the innovation ecosystem.

• RIAIs should include in their mission a focus on “constructing regional advantages”: capitalising on existing regional strengths and supporting the development of higher value-added, innovative activities. Meeting this success condition depends heavily on the quality of human resources in the RIAIs (professionalism, specialisation, complementarity of expertise).

• Funding authorities (in most cases, regional authorities, but often also higher level authorities and a series of co-funding partners from the private sector) should display a sound and long-term commitment towards these RIAIs.

• RIAIs also need to consider in their portfolio a smart mix of instruments and be capable of ensuring policy co-ordination in order to enhance synergies and avoid gaps and duplications in the use of programmes, subsidies, advisory schemes, etc.

• Finally, RIAIs should be equipped with strategic intelligence tools and methods for evaluating the effectiveness of their actions. These evaluations should use, and feed mechanisms for the enhancement of performance. They also should feed back to the future definition of activities and missions of the RIAIs, based on an understanding of past achievements and shortcomings, and on identification of new emerging needs. (Regional innovation agencies, pg. 4)

Recommendations for creating successful innovation ecosystems:

Policymakers should:
• Increase cross-border collaboration;
• Build innovation centres (as opposed to research facilities which typically lack commercial focus) that facilitate the innovations of others;
• Create places where young people feel they have ‘cultural self-confidence’ and where they can meet face to face, as experts say that is when successful innovations emerge;
• Ensure a friendly regulatory environment;
• Lower barriers to innovation by encouraging ‘balanced risk-taking’ and providing financial incentives to entrepreneurialism (such as matching private investment in start-ups’ research and development and providing tax incentives for funding start-ups);
• Reform education policies to keep pace with the knowledge and skills required for young people to participate in the emerging ‘third-wave industrial revolution’;
• Promote the successes of domestic entrepreneurs to foster an entrepreneurial culture;
• Recognise which start-ups are more likely to succeed and channel the resources to them instead of trying to support as many start-ups as possible.

Business leaders and entrepreneurs should:
• Combine financing with commercial mentorship;
• Support the government in creating a modern workforce for the future;
• Take advantage of opportunities in developing countries, instead of focusing too much on trying to solve ‘first-world’ problems.

(Innovation ecosystems: Empowering entrepreneurs and powering economies, pg. 17)

However, it is not just laboratories and universities that are required to work together to spur innovation. There were five key requirements that emerged from our research:

1. A collaborative culture is required for launching innovation, and it requires champions. Although industry champions were the primary drivers, it also requires champions from labs, universities, state and local government, and the media to drive the culture both internally within their organizations and collectively as a region. This culture change requires a long-term commitment to make it happen,
therefore emphasizing the need to have industry champions who remain consistent throughout changing administrations in publicly funded institutions.

2. Resources for building and maintaining a **supportive ecosystem** must be integrated throughout the entire value chain (from idea generation to venture launch and growth), with special emphasis on industry involvement at the idea generation stage. It also requires constant communication and cooperation between all ecosystem players. Many areas focus on core competencies (clusters).

3. Various pools of **capital** are necessary throughout the different stages of the lifecycle and should be implemented in small amounts with short time frames and milestones geared toward commercialization. This capital pool is critical for attracting venture funding.

4. A region must develop its own **entrepreneurial talent** because it is too difficult and expensive to attract talent, especially if the culture, ecosystem, and capital resources are not yet robust. The educational effort should start as early as the K-12 school system, and the entire ecosystem should be included. Mentor networks are especially important.

5. Tech transfer offices must find ways to make it easier to access **intellectual property** (IP)

None of these are short-term endeavors. All of them require a long-term investment/commitment before rewards can materialize.

*(External Innovation Ecosystem Analysis, pg. 4)*

**Reinforcement – Strengthening Key Actors in the Innovation System**

One way to improve the innovation system is to improve the capacities of the different actors, such as companies, vocational training institutions, applied research institutions, universities, R&D in firms etc. The following offers some examples of starting points for reinforcement:

- A high-quality education system that produces skilled personnel for R&D and for implementing innovations in the private sector is highly important for the creation of sufficient human capital.
- The creation of an increased capacity for research by improving the quantity and quality of basic as well as applied research with relevance to the private sector. Hence, firm-relevant research is offered and can be used to the advantage of companies.
- Improving innovation-oriented private/governmental service offers.
- Introduction of innovation management in SMEs.
- Improvement of supply of private consulting services for innovations and innovation management as well as for business start-ups and the creation of networks.
- Foster entrepreneurial thinking at universities.

*(Innovation – An Imperative for Competitiveness & Sustainable Development, pg. 8)*

**Bridging – Strengthening Cooperation between Actors**

Interaction, cooperation and networks within and between the different actors of the innovation system, between knowledge producers and users, are crucial for bringing about commercially successful innovations. Institutions (Business Incubators, Consulting Services connected to Universities, Innovation agencies, Promotion institutions, Cluster and competency networks) which connect actors of “knowledge appliers” and “knowledge producers” as well as the public and private sector are necessary. For companies, it is important to collaborate with others, e.g. with their suppliers, with research institutions, within a network of companies etc., in order to generate new ideas and innovations, especially as it is thinking “outside the box” that leads to innovations.

More concrete, bridging means e.g.:
- Strengthening innovation networks through intermediaries as e.g. business incubators or consultancies.
- Advice on the development of cluster strategies.
- Advice on models of technology transfer.
- Improvement of the structures and mechanisms for knowledge and technology transfer of universities and research institutes. Here, possible ways are: To clearly define the roles of all participants in the innovation system, organizational development, action plans and best practices for the promotion of spin-offs etc.

*(Innovation – An Imperative for Competitiveness & Sustainable Development, pg. 8)*

**Frameworks – Supporting an Enabling Environment**

Strengthening the individual actors of the innovation system and promoting interaction amongst them needs to be complemented by continuous improvement of the overarching framework conditions that shape the behaviour and opportunities of the individual actors. This usually has to be done by local/regional/national governments. Issues such as intellectual property rights, availability of information and communication technologies, the legal framework for company start-ups and bankruptcies, the existence and functioning of quality infrastructure, the fiscal system and access to finance, amongst others, all form part of framework conditions affecting innovation capability and activities. A few starting points could be:

- Advice on national innovation policies and their coherence as well as the coherence of instruments, analysis and M&E-tools.
- Promote inter-ministerial cooperation and policy coherence.
- Awareness raising on the importance of innovation.
- Building regional dialogue platforms and expert networks.
- The training of policy and decision-makers.
- Advice on reforms of public financial sources: transparency, effectiveness and efficiency.
- Advice for the implementation and use of analytical tools (innovation scoreboard).

*(Innovation – An Imperative for Competitiveness & Sustainable Development, pg. 8)*

**Venture Funding**

Finally, successful university-industry knowledge transfer, particularly in the form of entrepreneurial start-ups, requires access to early stage funding. While venture capitalists make critical contributions to supporting local university-industry linkages by providing important sources of financial support and expertise, most tend to be more interested in short-terms gain on an investment and few are willing to take on the risk of investing at the embryonic research stage. Nordfors et al, (2003: 13) contend that today's venture capitalists have become too risk averse, tending to focus on the later stages of technology development which has resulted in a "widening and deepening of the ‘Valley of Death’ between public funded long-range basic research and industry-financed product development." As a result, a steady stream of predictable and sustainable government funding programs and incentives, especially for specialist early-stage capital or seed funding, is needed to fill this crucial gap (Apax Partners 2011; Rasmussen et al, 2006). Government funding mechanisms bridge the structural financing gap at the heart of university technology transfer, and these mechanisms are particularly important due to the propensity for larger venture capital firms to avoid making investments in early-stage research (Apax Partners 2011). According to the OECD (2007), incentives that include long-term core funding as well as additional strategic funding schemes are critical for supporting successful local university-industry linkages in the form of joint research with firms, the provision of services to SMEs and the promotion of enterprise formation, and funding linked to regional priorities that support collaborative research should be made available. *(Growing Innovation Ecosystems, pg. 16)*

**Stimulate co-creation and a learning mind set among innovation actors**

- A more open and diversity stimulating recruitment policy in public administrations and in private enterprises will deliver positive results and stimulate innovations in the longer term. Creativity, initiative and experimentation, transparency and stakeholder collaboration need to be rewarded through innovations in human resources management.
In the short term, executive development efforts must be made primarily in public administrations to foster understanding of the impact of new technologies, of (incremental and radical) innovations in all sectors of the European economy involving cross-fertilisation and inter-sector developments. Special capabilities are required for coaching innovation in the age of digitalization of the whole economy and society.

Companies, the principal partner for public authorities for competitiveness and employment, should mirror the effort in the public sector, to include public policy challenges in their strategy development and to investigate their public value, in order to bring a more cooperative and aligned business-government interaction and culture.

**Achieve alignment between market and policy actors**

- There is often little synchrony between business strategies aimed at global markets and policy cycles aimed at national elections. While these dissynchronies are inevitable in democratic market economies, they can constitute a systemic weakness for long-term investments in research and innovation. Some of Europe’s competitors, operating with different government models and in different cycles, do not face such difficulties to the same extent. It is therefore important to explore the bottlenecks for R&D&I upfront, for each sector and inter-sector.

*(Inspiring and Completing European Innovation Ecosystems, pg. 21)*

**1. Adoption of systemic ecosystem-level master plans**

First, it is strongly advocated that regional decision makers should begin to address the innovation ecosystem development challenge in a more holistic manner and start systematic ecosystem-level development processes in close collaboration with key private sector actors. It is recommended that regional actors start a systemic regional master planning process, where all related ecosystem elements are addressed concurrently. This process should embrace an extensive dialogue between the key parties to identify real potential for mutually beneficial practices and their interpretation in practice for setting up an attractive environment for accomplishing long-term innovation creation targets. The master plans should include guidelines and criteria for developing the basic municipal infrastructure (connectivity, transportation, energy, zoning, sewerage etc.), the institutional structures (educational facilities, research facilities, incubation centers, joint development platforms, living labs, co-creation environments etc.) and solutions for true virtual connectivity (Internet/ broadband access, telecommunication networks, information systems platforms etc.). It should be noted that these plans must also include the ‘softer’ ecosystem elements (comprehensive service structures, facilitating mechanisms, coordination functions etc.) to address the parallel ease of use and functionality concerns, which have a direct impact on potential, shared, ecosystem-level activities and ultimate results.

The practical innovation ecosystem planning and management challenge is in combining the parallel interests of the company driven, the public sector driven and the public-private partnership driven innovation processes. All key decision makers in both the public and private sectors must be brought together to design a shared future vision for regional development in a wider global context. These key parties should, then, agree on their reciprocal roles and responsibilities in implementing that shared vision and the related, joint policy and targets for necessary investments. It is argued that Case Shanghai (Zhangjiang Hi-Tech Park, Pudong) and Case East Coast USA (The Research Triangle Park, North Carolina) are the most representative cases applying this approach in practice, and consequently, have been able to accelerate their respective ecosystem development processes to meet the tough globalization challenge and create complete, locally optimized value systems for swiftly globalizing industry clusters. *(The Global Best Practice in STP Development: Case Study Research for Developing the Next Generation Innovation Hubs, pg. 6)*
2. Use of empowered core hub organizations

Second, it is highly recommended that a separate regional management organization (a hub core) would be established to take over the key responsibilities to facilitate, direct and manage the local collaborative processes. It is advocated that the core hub organization should be given overall responsibility for the key management functions in ecosystem-level coordination, program planning and management, value network development and maintenance, and securing and upgrading the required human resource (HR) pool for global engagements. In doing so, the hub management team could support the other members of the ecosystem in their drive for joint innovation activities and extensive, mutually reciprocal collaboration. It is argued that the core hub organization is needed for channeling the inter-organizational information and resource flows and patching up the possible, systemic gaps in related innovation creation processes.

It is argued that Case France (Sophia Antipolis), Case United Kingdom (Cambridge) and Case South-Korea (Daedeok Innopolis, Daejeon City) are the most representative cases applying this approach in practice, and consequently, have been able to bring the majority of local actors within a common institutional framework/setting for a truly functional, shared innovation creation process. This is especially true in the case of Côte d’Azur, France, where the local collaborative mechanisms and organizational structures were totally reorganized in 2008, and seem to be working for everyone’s benefit, improving the dynamism of the overall Sophia Antipolis/Côte d’Azur ecosystem in an unprecedented way. (The Global Best Practice in STP Development: Case Study Research for Developing the Next Generation Innovation Hubs, pg. 7)

3. Management of advanced public-private partnerships

Third, it is argued that, in most ecosystems, the toughest development challenges seem to be related to the orchestrated, mutually beneficial matching of varying stakeholder interests around the middle layers of the framework. The public investments and services are put in place to induce and advance regional collaboration for the common good and to improve the effective use of specific, combinatory talent and resources throughout the ecosystem (for IPR generation and commercialization), while private interests seek for proprietary competitive advantages and better odds for improved business profitability. On the other hand, it is common that both parties openly acknowledge the potential benefits of coordinated actions and, consequently, seek for partnerships across domains. These practical realities call for a concerted approach in managing the public-private partnerships.

Subsequently, it is highly recommended that ecosystem developers put extra effort into planning and implementing advanced mechanisms for regional networking, communication and joint activities. This translates into setting up open forums for facilitated meetings, planning for flexible service structures for first-class intermediary support (KIBS providers, transfer offices, incubators etc.) and launching open platforms for coordinated actions (co-creation environments, living labs, business labs etc.). These common sites bring together local actors to learn from each other, to exchange specialized information on particular topics, and to set up mutually complementing value systems for practical business endeavor. It should be noted that the authors also advocate coordinated efforts for joint business platform creation as they provide the right set up and incentives for private business participation. These platforms can be especially beneficial for SMEs, which have limited resources to engage in broader, value system level development processes on their own.

In most advanced cases, these partnerships can lead to a completely new system integration business model, where resident anchor companies (or similarly active lead actors) and their networking partners decide to reorganize the entire value system from within and build an intraecosystem, integrated business model. In this case, specialized actors will integrate their core competencies on common platforms for aggregated product/service/solution provision, and cluster for credibility, impact and reach. The partnership can offer all involved maximized intra-ecosystem added value and, if managed properly, higher return on investments (public or private). It is argued that Case West Coast USA (Silicon Valley, California), Case France (Sophia Antipolis) and Case United Kingdom (Cambridge) are the most representative cases applying this approach in practice. In the USA, these advanced partnerships are often managed by private venture capitalists who specialize in orchestrating value system efficiencies – for the highest possible added value and maximized profits. As a result, Silicon Valley has become world-renowned for its ability to create world-class business platforms (especially in the ICT sector), which often
determine the status and success of complete industrial clusters. In case of France and the UK, the focus has been more on orchestrated coordination of multi-disciplinary collaboration and advanced technology partnerships, which have led to better optimized, industry-specific support schemes and improved collaborative processes. (*The Global Best Practice in STP Development: Case Study Research for Developing the Next Generation Innovation Hubs*, pg. 7)

4. Extensions of strategic alliances

Fourth, it is argued that inter-ecosystem collaboration has huge potential in leveraging specialized regional advantages across broader national or global settings. The resident technology and industry portfolios can be complemented across allying networks to improve commercialization options and to build up comprehensive service provision for broader markets. This helps minimize the impact of associated specialization and diversification trade-offs that each ecosystem has to face in determining its focal development areas and key promotional sales points. Moreover, ecosystems can complement each other’s competence areas improving prospects for productive knowledge combinations. They can expand outwards, rotating human resources with partnering ecosystems, and support the national and global operations of growth companies through strategic alliances.

At the same time, independent ecosystems can aim at filling in their own competence gaps through alliances, introducing external talent to the local system. This can be done with direct knowledge acquisition, hiring global experts to the key roles within the system, and/or engaging in the active outsourcing of product, process and service know-how. In either case, the local innovation ecosystem will grow stronger and improve its attractiveness to external parties as an active network developer in broader contexts.

It is also rather self-evident that some ecosystems cannot reach global benchmark levels on their own. Therefore, it is advisable to connect the internationally recognized, front-runner ecosystems to the up-and-coming challengers and plan joint programs to embrace both the ecosystem-to-ecosystem linkages and intense global collaboration. In this way, aspiring regions could capitalize on their proprietary resources and talent while developing virtuous global relationships. Later on, these gradually emerging networks could be transformed into global alliances of like-minded ecosystems with shared vision, joint practices and complementing service structures. The future collaboration could include development of open co-creation environments, reciprocal incubation platforms and/or associated programs (adjusted to particular cultural contexts). It is argued that Case West Coast USA (Silicon Valley, California), Case Shanghai (Zhangjiang Hi-Tech Park, Pudong) and Case France (Sophia Antipolis) are the most representative cases applying this approach in practice, and consequently, enjoy the gradually aggregating benefits of complementing ecosystem dynamism. Strong strategic alliances with multiple overseas actors work for their benefit in improving regional capacities for knowledge transfer and providing access to expanding global markets. (*The Global Best Practice in STP Development: Case Study Research for Developing the Next Generation Innovation Hubs*, pg. 8)

**We recommend that the university commit to the following areas of investment and reform across Johns Hopkins University:**

**A network of industry/regulatory experts**

The university needs to cultivate a deeper and unified mentorship network that includes key partners in industry and the investments community. There are now a number of different groups that reach out to industry, including the Johns Hopkins Alliance and the Whiting Technology Commercialization Network. A formal and more institutionalized effort to bring these resources together in one powerful tool for faculty to access will create a more robust method for tapping into invaluable resources across the commercial–regulatory–reimbursement continuum. These individuals could serve any or all of mentoring/counseling, educational and investment roles. A diverse range of voices from the investment, biotech, pharma, device, information technology and other private sectors will be essential to identifying assistance for the
wide range of Johns Hopkins University technologies and know-how, and creating and promoting the most helpful connections between our community and entrepreneurship opportunities.

Entrepreneurs-in-residence (EIR)

The university should hire entrepreneurs-in-residence for relevant verticals (information technologies, medical devices, diagnostics, biotech/pharma, services) to help our scientists as needed, and at their request, with market assessment, business plan drafting, financial modeling, identifying sources of funding, and other needs of start-up businesses. A number of other universities, including Columbia University, Boston University, University of Michigan, and the University of Washington have run successful EIR programs for more than 5 years and have identified best practices.

Ease of access to commercialization services

As noted, the fragmentation of the university’s tech transfer services cannot help but undermine the impulse of our faculty to engage in commercialization activities. It is beyond the scope of this paper to set out precisely how the university should address this problem, but however solved, the university needs to find a way to integrate and streamline these offices, and reduce the barriers that separate these services. This will create a consumer-oriented, “concierge” like ease of access to commercialization functions. The university should also consider a number of related reforms in this area, including: additional research and writing support for grant opportunities that provide seed funding; standardized licensing contracts and processes to allay the need to reinvent each time, so opportunities can be pursued quickly; more tech transfer personnel embedded in the day to day experience of the schools, with more regular interaction with faculty; a directory of external resources available widely to the community; and a heavier reliance on surveys and related mechanisms to measure satisfaction with tech transfer services.

(Report of the Committee on the Innovation Ecosystem, pg. 24)

Educational opportunities

The university should develop a more extensive cadre of educational offerings on entrepreneurship that are available across the university. The university should consider a variety of different forms for these offerings to meet the needs of various components of the university community: summer boot camps, interdisciplinary courses, one day workshops, and so on.

Policy reforms

We recommend that the Provost of the University convene the appropriate individuals to explore changes to tenure and promotion policies in order to create stronger incentives for translational and commercialization activities. We also believe the university should undertake a review of other university policies with which our entrepreneurship activities come into contact – including questions involving institutional review boards, use of name policies, and intellectual property – and in particular whether there are opportunities to simplify or clarify the intent of these policies. One additional, specific area of potential reform involves permitting greater flexibility in the recovery of costs from new start-ups until such time as they are generating revenue.

Preserving our legacy of promoting global health throughout the world

In 2011, the university convened a Study Group to assess the ways in which our technology transfer policies influence global access to our discoveries and inventions. The group emerged with a set of recommendations that touched on a variety of topics, including approaches to improving health-related technology transfer to developing countries, and the inclusion in licensing agreements of provisions that aim to protect the safety and health of patients. We recommend that within a period of twelve months following the publication of this report, the Provost and the Office of Technology Transfer should undertake a review of our compliance with the recommendations of the Study Group.
Protecting the integrity of our research

As noted, it is imperative that as the university expands its partnerships with outside organizations, it increases in lockstep its vigilance in preserving the values and the ethics that are essential to our groundbreaking research. According to the 2011 Study Group, one of the “most important ways the University can continue to promote health among the citizens of developing countries is to “uphold the highest ethical standards of research conduct, informed consent, and scientific rigor, and to urge its partners to do so as well.” Policies relating to the integrity of research are set out and administered in each of the schools. We recommend that the Provost use the occasion of the creation of this hub to undertake a review of our policies in this area to ensure that we are adhering to the above mandate, and to identify any areas of needed improvement in the substance or the process of these policies. (Report of the Committee on the Innovation Ecosystem, pg. 25)

Cores, accelerators, and competitions

Other areas of potential investment include: the enhancement of existing cores and the definition of new core facilities to provide support for early (and potentially mid-) stages of translational development; encouraging new cores to locate in the new physical space and move existing cores there when possible; and coordinating and hosting organizations and initiatives that can stimulate business creation, ranging from external accelerators (such as the DreamIt Ventures accelerator recently brought to campus) to business plan competitions. (Report of the Committee on the Innovation Ecosystem, pg. 26)

Institutional innovations provide better ways to focus investments already being made. R&D, supply chain, or training expenditures can become more productive by ensuring that resources do not disappear into potholes between institutional silos. Collaboration is sometimes thought of as unwieldy, but it can produce efficiencies and multiplier effects.

Leaders should encourage policy-makers to target resources in focused, strategic ways that fill gaps between institutions and provide more fertile environments for jobs to grow into inclusive prosperity.

That agenda includes a commitment to:

- Invest in foundational institutions that are sources of enduring strength, including centers of knowledge creation, incubators, apprenticeships, and high quality education adaptable to changing job skills.
- Facilitate collaborations and resource-sharing, whether in collaborative research, innovation zones with live/work spaces, supply chain resource pooling, or education-employer collaborations.
- Seek integrated solutions that link institutions, by directing resources to regional coalitions and public-private partnerships with coherent strategies.
- Identify and reward excellence. Rather than sprinkling resources everywhere, invest in the best ideas and then spread institutional innovations.

(Enriching the Ecosystem: Forging the Missing Links between Innovation, Enterprises, and Jobs, pg. 12)

Recommendations for regional actors and EU policymakers

Recommendations for regional actors in Europe

1. Regions in Europe need to develop Local Digital Agendas and Regional Innovation Strategies (RIS3) to increase their economic growth potential and to implement EU policy on the ground.
2. Regions in Europe need to move on to a ‘Quadruple Helix model’ of innovation.
3. Regions in Europe should call for ‘Territorial Pacts’ within National Reform Programmes to implement Europe 2020 targets on the ground.
4. Regions in Europe need to develop Regional Innovation Strategies (RIS3), based on smart specialisation, in order to secure innovation funding from EU budgets post-2014.
5. Regions in Europe should strive for societal innovation, through Living Labs, test beds and open innovation methods in regional innovation policymaking, taking the citizens on board.
6. Regions in Europe should build on dialogue, collaboration and co-creativity to learn from best-practice and exit the economic crisis together.
7. Regions in Europe should foster a new innovation mindset, towards demand and problem-driven innovation, strengthened entrepreneurship, education and bridging the digital divide in society.

Recommendations for EU-level policymaking

8. EU-level policymaking should increase research and innovation budgets across all spending areas with specific reference to Horizon 2020 and cohesion policy.
9. EU-level policymaking should put a stronger focus on bottom up policies and regional innovation ecosystems development.
10. EU-level policymaking should increase the quality of support and guidance for regions to access European funding.
11. EU-level policymaking should increase assistance for regions to run pilots and demonstration projects including more support for open innovation strategies.
12. EU-level policymaking should increase budgets for entrepreneurial education to advance in
13. Innovation cultures at the regional level through education at secondary school and university level.
14. EU-level policymaking should develop new forms for high-level regional and territorial leadership in research and innovation strategies.
15. EU-level policymaking should focus on innovative procurement development including more training to improve regional competences and simplification of procedures.
16. EU-level policymaking should stress the importance of European-wide collaboration and transnational cooperation projects between regions building on innovation support and smart specialisation strategies.

(Open Innovation, pg. 88)

Awareness raising

Awareness rising among policy makers, policy practitioners, cluster organisations as well as their member companies is needed to increase cluster involvement in User Driven Innovation. Several activities can be undertaken:

- Clusters can use show-cases to illustrate what User Driven Innovation can mean in a variety of industries
- Clusters can organise peer-to-peer meetings where cluster organisations and member companies can meet and learn from each other on all topics directly (e.g methods and tools) or indirectly (convince management, convince member companies,...) related to User Driven Innovation.
- Policy makers/practitioners should use ECA (European Cluster Alliance) for communication
- Policy can provide support (financial) to awareness raising activities of clusters
- Policy makers and practitioners should spread clear messages on the importance of User Driven Innovation at occasions gathering a broad audience on the topic of innovation (conference, local innovation events, ...)

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**Mapping of existing assets to be able to valorize these assets**

Several existing platforms made efforts to map existing UDI assets. Mapping of available infrastructure in clusters in general was done by European Cluster Collaboration Platform see [http://www.clustercollaboration.eu/](http://www.clustercollaboration.eu/) or more specific UDI related mappings as within the European Network of Living Labs ([http://www.openlivinglabs.eu/](http://www.openlivinglabs.eu/)).

- Clusters need to be encouraged to register in these platforms and to promote their own infrastructure or to search for infrastructure for their member companies with UDI projects.
- Policy practitioners can stimulate memberships to these existing platforms (e.g. membership required to get local financial support)
- A methodology to map open innovation environments was developed and tested in Sweden. This method can be used by other regions/countries. Dissemination of regional/national mappings should be done in collaboration with existing platforms (ECO...)

**Procurement as driver for innovation (for public Users)**

Innovative Public Procurement is proposed to find innovative solutions to societal problems. In these new areas, government needs to assist in bringing all stakeholders together (cluster creation) in order to:

- Formulate a detailed description of the societal problem and possible innovative solutions
- Create a common roadmap how to develop the required innovative solutions
- Support collaboration between companies and research institutes to work out technological aspects
- Create a momentum in the project that generates commitment from stakeholders to spent time and efforts in the project

("Fostering User-Driven Innovation through clusters, pg. 29")