

Paper 81.00  
S1.1 History and conditions for success

**Transforming Innovation Ecosystems through  
Shared Vision and Network Orchestration**

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**Transforming Innovation Ecosystems through Shared Vision and Network Orchestration**

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#### **4. Keywords:**

innovation, ecosystem, networks, relationships, orchestration

#### **5. Abstract:**

This paper describes innovation ecosystems as networks of relationships through which information and talent flow for value co-creation. The character and boundaries of the ecosystem are shaped by political, capital, and intellectual environments. In innovation ecosystems, co-creation networks are implemented through business financing and interpersonal linkages. Network analysis is used to visualize these relationships. Through the lens of relationship-based synergy and using examples from UK and France, the network dynamics of two innovation ecosystems are described. An action framework that leverages networks for shared vision is presented as an approach to network orchestration for transformation. Vitality indicators for innovation ecosystems are proposed, and contextual factors are explored.

## INTRODUCTION

Innovation—the ability to create and capture economic value from invention (Hagel and Seely Brown, 2005)—is seen as a critical driver of both the economic prosperity of nations and the shareholder value of corporations (PriceWaterhouseCoopers, 2008.) Innovation has become an imperative for business, academic and governmental organizations in response to environmental and technology-driven changes.

Over the past century, conceptual approaches for understanding and accelerating innovation have evolved. In the early Twentieth century view of manufacturing-driven, technology-push innovation (Schumpeter 1934, 1942, 1950), the role of the entrepreneur was to revolutionize production systems. In the later part of the Twentieth century, the linear view of invention leading to innovation also included respect for the role of lead-end-users (Baldwin and von Hippel, 2009) and environmental factors in the diffusion of innovation (Rogers, 1962). In the 1970's the role of creativity in the coupling process required for innovation was addressed (Freeman 1979; Amabile 1983, 1988, 1996), and innovation was seen as first taking place in the minds of imaginative individuals (sometimes within a group of people) somewhere at the ever changing interface between science, technology, and market. The coupling is “far more than an intuitive flash: it is a continuous creative dialogue over a long period of research, experimental design, and development.” (Freeman 1979, p. 211). For Drucker (1985), innovation was the specific instrument of the entrepreneur. Appreciation developed for the concept of innovation as “a continuous creative dialogue over a long period of research, experimental design, and development” (Freeman 1979, p. 211). In the 1980s, the strategic importance of innovation as a discipline of leadership was emphasized, and innovation (especially concept innovation) was seen as the source of business revolution (Hamel & Prahalad, 1994).

Near the beginning of the twenty first century, Henry Chesbrough (2003) introduced the concept of open innovation. His recognition that monetizable ideas could come from both inside or outside the company repositioned innovation as a nonlinear phenomenon and shifted the locus of innovation away from companies and toward individuals. The meaning of “open innovation” has been elaborated as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation” (Hagel and Seely Brown, 2005). The subsequent rapid growth of individual and open collaborative innovation, assisted by technologies that both enhance the capabilities of individual inventors and support distributed, collaborative design projects (PriceWaterHouseCoopers, 2008), has given way to an appreciation of collaborative innovation networks for production, distribution and marketing (Gloor, 2006) and to the recognition that human resources fuel the systems of innovation (Saxenien, 2006; Wang, 2011).

This paper presents perspectives on the transformational role of innovation ecosystems. These perspectives are based on personal experience with technology-based regional development at the city, state, regional and national levels, as well as programmatic and policy initiatives aimed at redirecting interdisciplinary research initiatives, creating technology-focused human resources, diffusing know-how, and establishing accountability for public and private resources. The senior author's professional assignments with catalyst organizations, public-private partnerships, industry-university technology transfer programs, and technology-based regional development – over several decades, in several countries, and in several technical

domains – have been harvested for foundational insights and unanswered questions compatible with concepts of leading technology and innovation practitioners and scholars.

Timelines for high-impact change often require decades. Yet leaders and funding organizations need validation on an interim basis that catalyst programs are achieving results. They need action-oriented assessments to optimize results and make mid-course corrections. They ask questions that are difficult to answer: What indicators can verify that investments made locally to enable business development for global participation will return benefits to the investors? With the transformation model of the innovation ecosystem, we offer insights on this question.

## **STATE OF THE ART**

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.

Strategic value creation networks have become critically important factors in technology development and social change. They rely on the infrastructure of relationships of people and organizations; they are influenced by the political economy of organizations and governments. Especially in the flat-world economy (Friedman, 2005), relationships are the channels through which resources flow. Relationships in the ecosystem are the capillaries for the flow of resources and information; they are the channels for work flow, business processes and network orchestration (Fung et al., 2008). Value co-creation relationships are influenced by environmental conditions – the cultural context of individualism or collectivism (Hinds et al., 2011), the flow of risk capital and the perception of reward (Huhtamäki et al., 2011). The capacity of public agencies, business organizations and educational institutions depends on their

ability to orchestrate networks of relationships in order to co-create standards and value chains, create and activate technical and managerial talent, and attract and leverage capital.

Companies purposively co-create value networks through relationships among vendors and suppliers as well as with strategic customer networks through collaborative product and service offerings (Basole, 2009). Enterprises receiving investment resources from the same financial resource may share complementary visions of the futures, complementary benefits from new technologies, and synergistic market development (Huhtamäki et al., 2011). In a like manner, enterprises collaborating at board, task force and project team levels across government, academia and business sectors build and share complementary visions of the futures, complementary benefits from new technologies, and synergistic market development. The participation of executives and board members in two or more enterprises with related missions, markets, products or social responsibility is a potentially powerful force for value co-creation.

The social network of innovation ecosystems can be described through such relationships. Through these relationships, shared meaning and dynamic trust develop into performance expectations about a shared future (Hagel and Seely Brown, 2005). The transformative potential of the shared vision for an innovation ecosystem arises from new coalitions and network connections and the relationships on which they are based. Their shared vision is collectively realized and continually updated by the co-creation of events and their impact. The transformative potential of an innovation ecosystem lies in its capacity for continual realignment of synergistic relationships of people, knowledge and resources that promote harmonious growth of the system in agile responsiveness to changing internal and external forces.

## **METHODOLOGY**

### **Transformation Model**

Transformation takes place over a period of time as synergistic relationships of people, knowledge and resources evolve in response to changing internal and external forces. Changes take place through the innovation ecosystem, which can be defined at many different levels of an organization, a community, a region or country. The capacity to continually co-create and maintain value is essential for radical adjustments to disruptive forces (Christenson, 1997) as well as for the harmonious evolution of incremental growth.

Change-making events take place. Independently and individually, decisions are made and actions are taken in the context of existing relationships, practices, finances, policies and culture. Over time changes are observed; these are important impact milestones. More importantly, a shared vision develops among the new coalitions and networks of people who perceive a synergistic future. It is this shared vision that enables people who are making individual and independent decisions to co-create value and accomplish transformation. Shown in Figure 1, the Transformation Model illustrated how transformation evolves from shared vision that is created by the coalitions and networks created from the impact of events. As the impacts of events are measured and tracked, interaction and feedback through the networks refines the shared vision, stimulating the next round of events.

Indicators used to measure and track change in innovation ecosystems have been described by Milberg et al. (2007) in the white paper prepared for the US National Academy of Sciences. Additional refinements and prioritization of the impact of transformations in innovation ecosystems have been proposed by Still et al. (2011). Additionally, organizational and social structures in the innovation ecosystems have been represented as networks (Wellman & Berkowitz, 1988), with nodes (social system members) and links (relationships) connecting the members. Changes occur through this process of transformation, as networks of individuals act independently toward a shared vision of the future.

Transformation can be activated and accelerated through the orchestration of these networks. Catalyzing and optimizing networks of relationships relies on network orchestration through an action model of events, impacts, and coalitions that build a shared vision that empowers the transformation.



Figure 1: Innovation Ecosystems Transformation Framework

### Social Network Analysis

Network analysis has been used to study the interdependence of industries and nations (Yim and Kang, 2008), as well as the dependence of innovation networks on knowledge flows (Owen-Smith and Powell, 2004). In the “cluster” view of the world, in which competitive advantage builds from the linkages between activities (Porter, 2000), the collection of internal, external and quasi-external innovation networks (Wu, Gu, Zhang 2008) creates value through

networks. The network-based view of organizations has grown beyond describing supply chains “that move people, goods, or information from various points to various other points” (Coyne and Dye, 1998). The existence and emergence of strategic value creation networks can be observed through network analysis of small, medium and large enterprises.

This paper uses “social networks” to characterize networked individuals as sources of innovation in ecosystems. Networks are described by connections, or social links (Krackhardt and Hanson, 1993). Through the establishment of mutually beneficial relationships, people, companies and investment organizations provide visibility into the infrastructures for the dynamic flow of innovation resources. The innovation ecosystems in this paper—at local and national levels—are comprised of networks of technology-based businesses. These networks are constructed from relationships between people and their organizations or institutions, making these networks inherently social.

Social network analysis is a research field studying the structure of networks as social actors. The basic idea of network analysis perspective is that social structures can be represented as networks, that is, as sets of nodes (social system members) and sets of ties connecting the members (Wellman & Berkowitz, 1988). It has been used for several decades to study the sociological relationship of people and organization, and its key statistics include centrality (indicating relative importance of a node within the network) and number of components in the networks (indicating how fragmented the network is (Wasserman and Faust, 1994; Welser et al., 2007). With the rise of consumer-generated content, social network analysis has been deployed to analyze communication structures, content and virality in social media (Welser et al., 2007).

The use of graphic images to represent social configurations is important because “[i]t allows investigators to gain new insights into the patterning of social connections, and it helps investigators to communicate their results to others” (Freeman, 2009). We approach social network analysis from data-driven information visualization point of view, thus we refer to data-driven visual social network analysis. The underlying objective of information visualization is to serve as an amplifier of the cognition of a user through expressive views giving insight on a certain phenomena represented by the data (Ware, 2004). Interactive information visualization “allows the user to implicitly form mental models of the correlations and relationships in the data, through recognition of patterns, marking or focusing in on those patterns, forming mental hypotheses and testing them, and so on” (Kosara, Hauser ja Gresh, 2003).

In this era of dynamic technological and social change, timeliness of feedback is extremely important, and the lag-time at which official or administrative data becomes available is unacceptable for anything but historic or academic analyses. The technological capability of web crawlers allows active harvesting of online data, such as press releases, company reports, biographical background of company executives and board members, and investment events.

Data used in this data-driven approach is drawn from the Innovation Ecosystems Network (IEN) Dataset (Rubens et al., 2010), a collection of over 140,000 records built by web-crawling English language, socially constructed data about technology-oriented companies and updated quarterly. As of June 2011, it included data from 66,000 companies (including a high proportion of startup companies), their executives and board personnel (over 76,000 records), investment organizations (over 5,300 records), and financial transactions totaling over US\$ 410

billion. People included in the dataset are the press worthy employees in their respective companies (e.g. founders, executives, lead engineers, etc.), members of boards of advisors, or investors. The dataset further includes data on the background of some of the individuals including the degrees they have received from various educational institutions.

It is important to note that the dataset we use inherits both the advantages and disadvantages of socially constructed data. Some of the advantages are availability, large coverage, timeliness, and community verification of data quality. Some of the disadvantages are potentially erroneous data and public bias (vs. the editorial bias often extant in traditional data settings). Sectors are included: advertising, biotech, cleantech, consulting, ecommerce, enterprise, games & video, hardware, mobile, network hosting, public relations, search, security, semiconductor, software, and finally web. The data reflect a global distribution of companies ranging in size from start-ups to multinationals. The timely on-demand data provides us with new opportunities for nearly real time analysis and utilization of the data.

## **FINDINGS AND INTERPRETATION**

With network analyses of relationships and resources in Birmingham UK and Paris, France, we describe the transformational vitality of three innovation ecosystems. We discuss the application of the Innovation Ecosystem Transformation Framework for measuring and tracking the events, impacts and coalitions catalyzed through program and policy initiatives that orchestrate and accelerate the distributed implementation of progress toward a shared vision.

### **Birmingham Science Park Aston: A Local Catalyst for a Regional Innovation Ecosystem**

Opened in 1983 to overcome the reluctance of London-based firms to invest outside of Southeast England, Aston Science Park is located in Birmingham, UK. It is owned by the Birmingham City Council in collaboration with Lloyds TSB and Aston University, who provide equity capital and launch management support to start firms at the science park. In a transition from a location-based and supply-chain oriented mission to information technology-enabled global outreach, BSPA now provides support to life science and digital enterprises that can revitalize the local economy, left weak by declining productivity in automotive and traditional manufacturing sectors. The regional infrastructure of canals that served Birmingham's manufacturing hub are now tourism attractions and underutilized, as are also the young and older men who worked in the manufacturing facilities.

One hundred fifty companies are members of BSPA, and several dozen of those are co-located at BSPA facilities, where high bandwidth communication, access to telepresence facilities, and gathering places (coffee shop) are available. Roughly half have financing, primarily from local groups. Relationships with universities focus on business internships for students and entrepreneurial seminars given for students by BSPA staff.. Over several decades, a handful of new companies have developed out of relationships with local educational institutions, as well as national regional development programs sponsored by the UK government. These are the events that launched BSPA. Changes in government support, a redefinition of the technical domains, and an emphasis on globalization have led to the redefinition of BSPA's goals.

Using network analysis of Birmingham region's individuals, companies and investors in the IEN Dataset, a series of network visualization were created for the Birmingham Innovation Ecosystem.

Figure 2 shows the relationships among innovation and communication technologies (ICT) sector companies with headquarters in the greater Birmingham area. Companies with locations in the Birmingham area are shown in red; branch offices are shown in pink. People (blue) at the executive, board and founder level are linked to the companies, as are financial organizations (green) that have made investments in the companies. Links between companies, people and financial organizations show that existing relationships provide opportunities for co-creation for only three companies – one small cluster in the lower right with a direct company to company relationship and two small clusters on the left. In the upper right, four companies have relationships with a financial organization. Others appear autonomous with respect to decision making or financial investments.

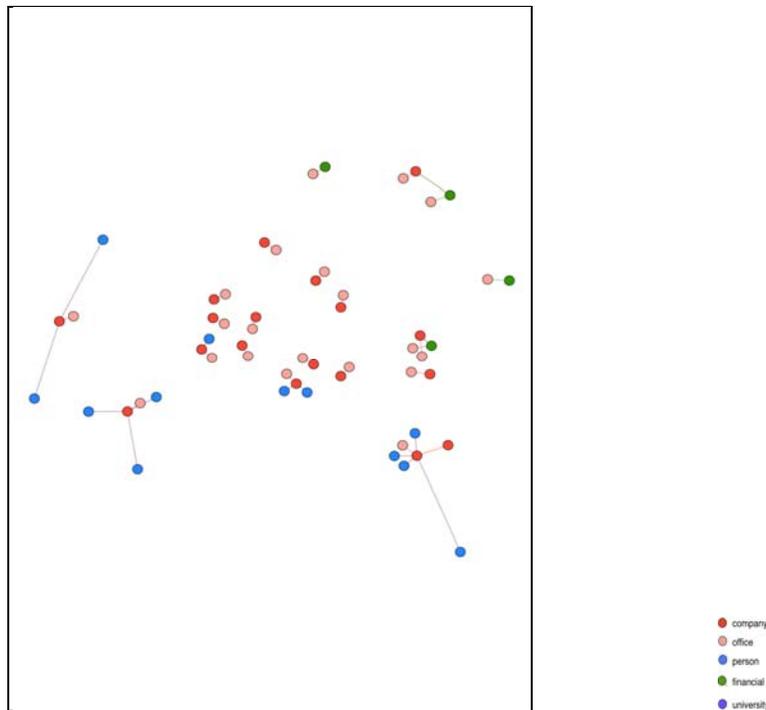


Figure 2: Birmingham ICT Innovation Ecosystem: Executives, Board Members & Investors Connected to Companies and Financial Organizations with Headquarters and Branch Offices in Birmingham

Figure 3 shows the Birmingham ICT innovation ecosystem expanded from the entities shown in Figure 2 to include their relationships with other people, companies and financial organizations. Additionally, educational institutions (purple) with which these people are affiliated are included. Birmingham companies' potential information and financial resources expand modestly with these second level relationships. An additional financial organization appears, and several additional companies are linked into the network.

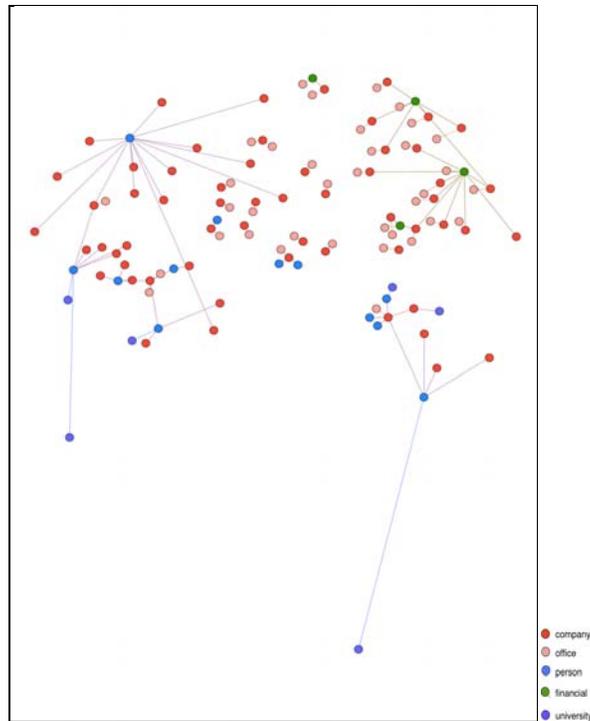


Figure 3: Birmingham ICT Innovation Ecosystem: Two Degree Network Including Universities

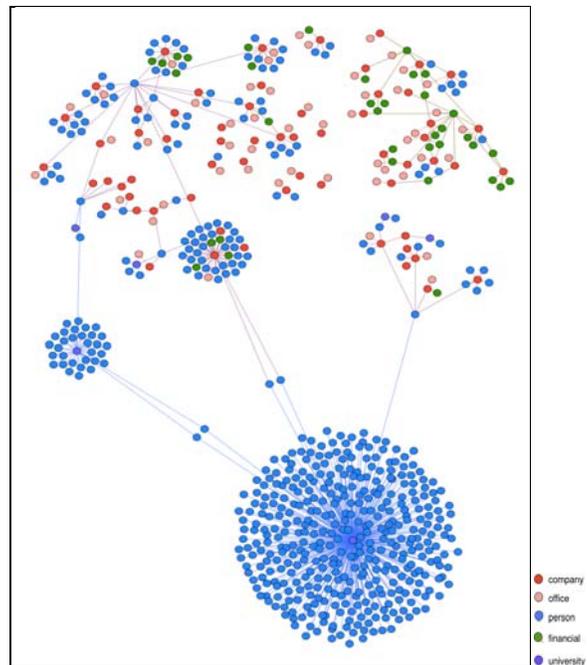


Figure 4: Birmingham ICT Innovation Ecosystem Two Degree Network Expanded from All Entities to Three Degree

In Figure 4 the network is expanded again by adding the next level of entities affiliated with the entities in Figure 3. In this expansion, the ecosystem grows to include more entities and greater connectivity in the network of relationships. Three clusters can be seen. The cluster in the upper left of Figure 4 shows a handful of individuals through which companies, and financial organizations to a lesser extent, are connected. Through two individuals, companies in this cluster have relationship access through their educational institutions – known to be INSEAD and University of Warwick – to two additional clusters of people. The potential of alumni networks to synergize the innovation ecosystem have been documented (Rubens et al., 2011). The second cluster in the upper right is characterized by a higher proportion of relationships with financial organizations; this cluster also shows more density in the interlinkages between entities. The third cluster, on the middle right, is linked by one person; that individual has an affiliation with Stanford University, the large cluster at the bottom of Figure 4.

Several but not all of the companies participating in BSPA are shown in these network graphs of the ICT innovation ecosystem of Birmingham. Start-up companies that have not yet been covered in the press are not included in the IEN dataset. The BSPA life science companies are not shown here. However, the visual representation of Birmingham's ICT companies, their financing organizations, and individuals in leadership positions shows the potential for shared vision through coalitions that exists in transforming Birmingham's innovation ecosystem.

These entities and their existing relationships offer opportunities for network expansion and orchestration. Local universities are not visible as affiliations at the executive level. Few linkages at the board and investment levels likely means that the shared vision of the region promoted by the BSPA may not yet have been activated at the time of this analysis. Programmatic initiatives to accelerate the development of relationships between these companies, people and financing organizations and BSPA's emerging tenant companies are likely to be beneficial to the regional ICT ecosystem.

### **CapDigital, A Sector-Focused Catalyst in a National Innovation Ecosystem**

CapDigital is a catalyst program based in Paris, a non-profit organization under the French *Loi 1901* and founded in 2006 (<http://en.capdigital.com/lassociation/>). Its mission is to catalyze the new digital infrastructure in France with global connections, create an ecosystem to facilitate the relationship between France and global market, and enable Paris to become global region of the market for digital services. CapDigital is a contemporary initiative with a similar economic growth objective, implemented through a virtual rather than physical network (Russell, 1994). Over 650 companies participate in the networking and mentoring programs and in the international trade missions offered by CapDigital.

Network patterns reveal four zones in the Parisian innovation ecosystem: a small segment of unconnected companies, some of which have a single investor; a large segment of French companies, many of which are financed by either French or foreign investors; a large segment of French companies without investors, many of which have branch offices; and a large segment of Paris-located foreign companies, most of the investors for which are foreign. Most CapDigital members are in Zone 2 or Zone 3. Isolates, companies with the fewest links, cluster at the center of the network graph in Zone 1.

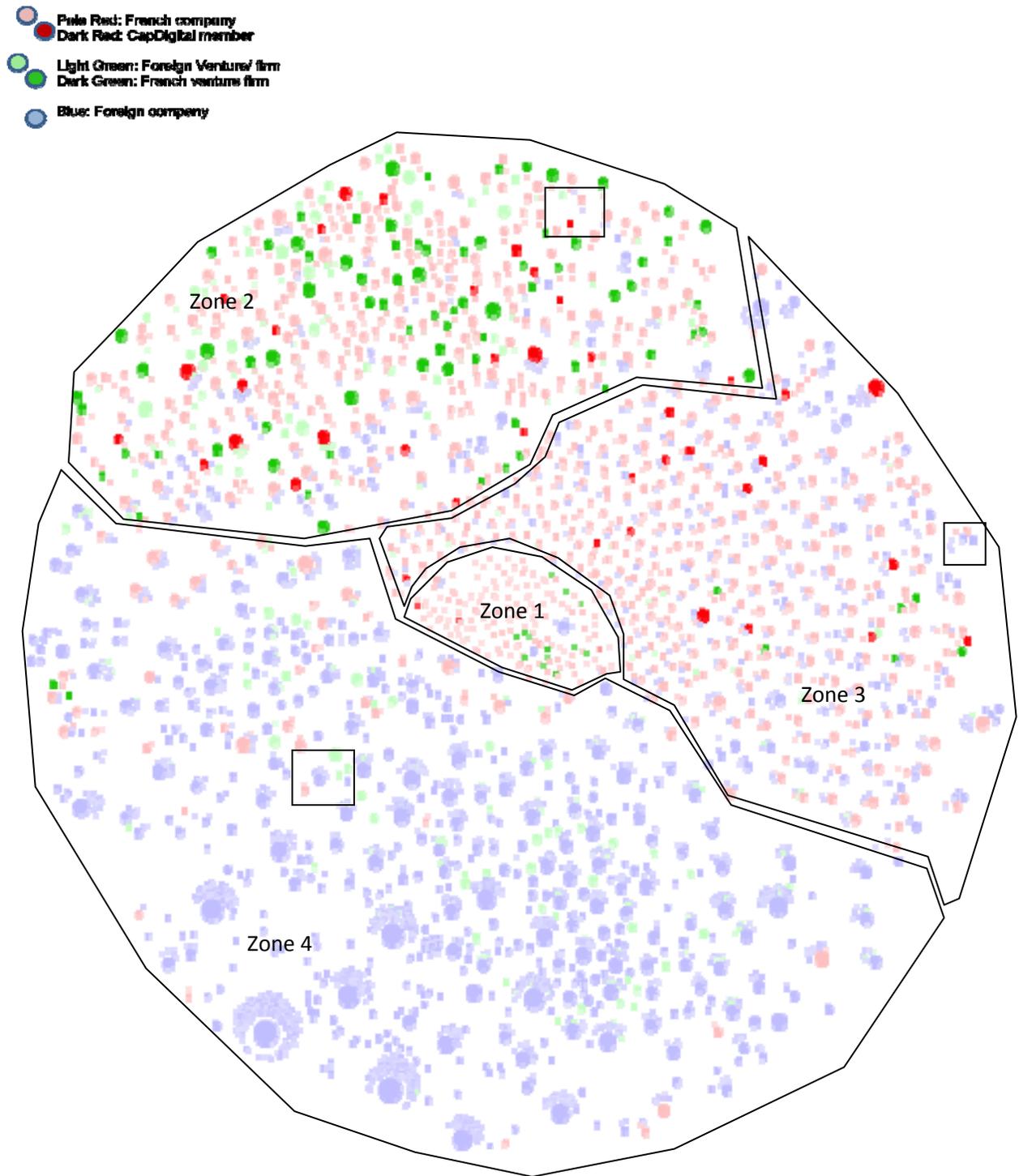


Figure 5: Two Degree Parisian Innovation Ecosystem, Starting from Companies with Headquarters or Branches in Paris, Their Financing Organizations and Individuals.

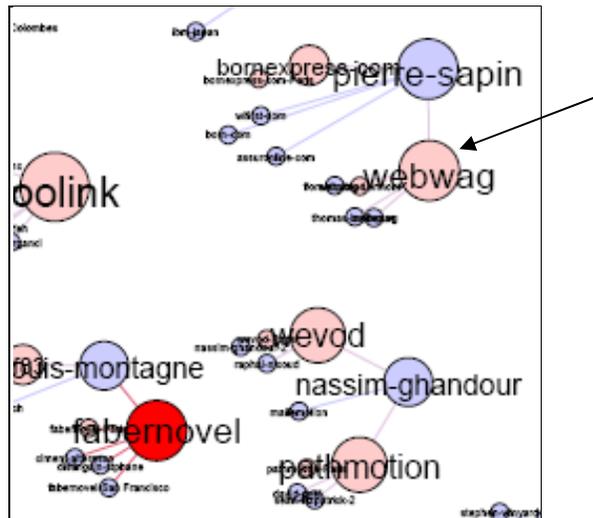


Figure 6: Zone 2 of Parisian Two-Level Innovation Ecosystem

To the right of center in Figure 6, Zone 2 reveals many independent French companies; some have branch offices. The lack of visible relationships with financing organizations in Zone 2 may indicate that this significant group of companies are family businesses or are privately financed. Figure 6 shows an enlargement of one area in Zone 2, in which the companies generally have fewer connections, suggesting consultancies or life-style companies. Interestingly, a two-location pattern is visible in which headquarters are as likely to be in regional France as they are to be in Paris. A few of the companies in Zone 2 already have global relationships, through people or financing organizations.

As an example, Webwag is not yet a CapDigital member but could, with membership, bring its synergistic network of relationships to other CapDigital companies. Webwag publishes Mobile and Web widget convergent solutions, helps users create a personalized home page with data feeds and web 2.0 services that are always accessible from any computer or mobile. Its technologies are made available in white brand to its customers that include network operators, handset and connected devices manufacturers, service owners and media publishers. Webwag already has international relationships. Recruiting companies like Webwag to CapDigital programs could provide synergies through investments in global value chains or mentoring on becoming global.

In Zone 3 shown in Figure 7, many of the companies are connected to a financing organization or through people to other companies. Investment organizations and individual investors are visible in Zone 3, indicating high potential opportunities for funding from French financing organizations, including many in the Paris area. Figure 7 shows that Alto-Invest, a French financing organization, funds several Parisian digital media companies: Decalog, a French company of 45 employees with a capital of €342,000, offers a range of software to meet the needs of professionals in libraries and media centers; Akamedia provides online distribution solutions for broadcast quality content; Dmailer is a software editor that designs, develops,

manufactures, and markets portable backup and synchronization software solutions for mobile devices.

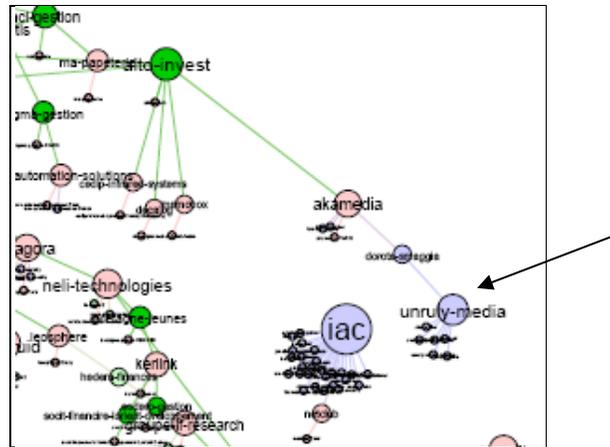


Figure 7: Zone 3 of Parisian Two-Level Innovation Ecosystem

Other companies, some CapDigital members and others not, are funded by non-French organizations. Several French media companies are linked to non-French companies and financing organizations. For example, Unruly Media (headquartered in London) helps agencies and marketers distribute branded content on the social web. Outreach to the French and international investors is a vital component of achieving CapDigital’s objective of helping Parisian media companies establish global business opportunities. Network patterns in Zone 3 suggest additional companies and financing organizations that could be recruited into CapDigital membership and networking programs.

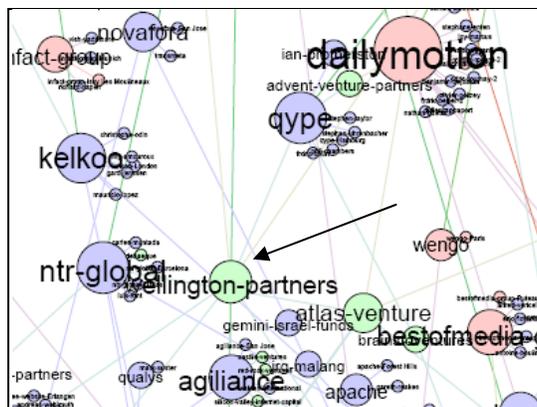


Figure 8: Zone 4 of Parisian Two-Level Innovation Ecosystem

Zone 4 is characterized by a higher proportion of international entities and foreign investment, shown in Figure 8. The French companies, people and financing organizations are the minority in this zone; however, they are present and could provide leverage if linked to entities in Zone 3. Relationships established with these non-French companies, their executives

or financing organizations offer CapDigital opportunities to foster international partnerships for its members. A co-investing partnership in digital media and software companies, such as Wellington Partners has with a French financing organization, could provide relationship access through Wellington Partners' offices in Munich, London, Palo Alto, Zurich.

The network analysis of the Parisian innovation ecosystem indicates the potential benefit of involving people such as Arnaud Fischer, Founder and CEO of Glam and former Director of AOL Search, or Morten Lund, who also invests in companies in the Birmingham region, in CapDigital programs. It highlights current CapDigital members, Metaboli and dibcom, which are both connected to the international community through Intel Capital, which has many such investment relationships to digital media companies around the world.

The visual network analysis of the Parisian innovation ecosystem for digital media reveals co-creation relationships across people, companies, and funding (Still et al., 2011). Opportunities for co-creation can be identified at existing edges and spaces in which small clusters indicate a mindset receptive to new links that could provide synergy. Additionally, the visual network analysis communicates the complexity of innovation ecosystem relationships to constituents, providing a snapshot of today and suggesting opportunities for tomorrow. Importantly, the segmentation of entities in the innovation ecosystem reinforce the benefit of strategic outreach in the CapDigital programs.

CapDigital network has grown over the past few years in response to national initiatives. The involvement of educational institutions has been primarily one of receiving students for business internships. The catalytic impact of new EU ICTLabs initiatives (Paris is one of five clusters) may impact relationships, and dependencies may change. The shared vision may prioritize goals of the EU or develop a new Zone in the ecosystem.

## **CONCLUSIONS**

Value is co-created for the innovation ecosystem through events, impacts and coalitions/networks that emerge from a shared vision of the desired transformations. The people who participate in events create coalitions and networks whose impacts can be measured and tracked with data-driven visualizations of these, revealing the transformations. These changes can be measured and tract as impacts of events of change organizations, such as Birmingham Science Park Aston and CapDigital. The power of shared vision to transform innovation ecosystems through network orchestration gives new meaning to the cluster concept for (Porter, 2998).

The shared vision that is created through the impact of events and relationships, new coalitions and networks transform the innovation ecosystem. Catalyst organizations and their leaders serve as change agents. Network orchestration is a multiplier that increases the reach and effectiveness of the organization.

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. Some, as seen by BSPA and CapDigital perform the role of network orchestrator.

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.

Using visualizations of the social networks of relationships among companies, people and financing organizations, patterns reveal insights that can be used to communicate complexity to co-create vision, identify and empower influential individuals for critical actions, connect components to catalyze the evolution of the ecosystem, develop and implement programs (meetings, funding, initiatives) to foster co-creator networks, and measure and transform an innovation ecosystem.

## **POLICY IMPLICATIONS AND DIRECTIONS FOR FURTHER RESEARCH**

Applied to the presence of links between firms and their human and financial resources, network analysis reveals patterns in innovation ecosystems, allowing observers to see indicators of the broad systems of value co-creation. Through network analysis of relationships identified in socially constructed and federated datasets representing firms and actors as partners and collaborators in co-creating their future ( Huhtamäki et al., 2011), we have observed innovation catalysts, with roots in education, business and government, link entities through innovation objectives. By aligning objectives through shared vision, the potential for co-creation is increased.

The transformation of a region's technology-based business economy depends on the availability, flow and conversion of resources in a network of relationships. These are necessary but not sufficient. Skillful orchestration of the network can accelerate the availability of new resources, optimize the flow of existing resources and leverage complementary resources for synergy.

The urgency of the innovation mandate in business, education and government sectors requires insightful analysis of relationships, resources and the networks of interrelationships to effectively and effectively drive knowledge-based exchanges (Russell and Still, 1999) and investments in innovation systems. Contextual factors such as attitudes toward risk and the “second chance” mindset are important filters for twenty-first century initiatives seeking to transform innovation ecosystems through shared vision and network orchestration.

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