Visualizations of Relational Capital for Shared Vision

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Abstract
In today’s digital non-linear global business environment, innovation initiatives are influenced by inter-organizational, political, economic, environmental, technological systems, as well as by decisions made individually by key actors in these systems. Network-based structures emerge from social linkages and collaborations among various actors, creating innovation ecosystems, complex adaptive systems in which entities co-create value. A shared vision of value co-creation allows people operating individually to arrive together at the same future. Yet, relationships are difficult to see, continually changing and challenging to manage. The Innovation Ecosystem Transformation Framework construct includes three core components to make innovation relationships visible and articulate networks of relational capital for the wellbeing, sustainability and business success of innovation ecosystems: data-driven visualizations, storytelling and shared vision. Access to data facilitates building evidence-based visualizations using relational data. This has dramatically altered the way leaders can use data-driven analysis to develop insights and provide ongoing feedback needed to orchestrate relational capital and build shared vision for high quality decisions about innovation. Enabled by a shared vision, relational capital can guide decisions that catalyze, support and sustain an ecosystemic milieu conducive to innovation for business growth.

Keywords
Ecosystem, Relational capital, Innovation, Network orchestration, Shared vision, IETF

1. INTRODUCTION

We are in the midst of a “perfect storm,” a term used to describe multiple converging, unstoppable forces that have the potential to create dramatic disruption. The world economy is in transition from a material-oriented industrial economy to a knowledge-based economy, which is being energized by the emergence of the creative economy. For example, Las Vegas now boasts a thriving new business culture, seeded and nurtured by the creative culture of Zappos, Inc., which re-located its headquarters to Old Las Vegas (location of City Hall, outside the casino cluster) and jump started an entrepreneurial community on themes of customer service (Michelli, 2012). New trends in the emergence of innovation hot spots, shifting demographics, global sustainability challenges, technology convergence, and massive quantities of data are converging to disrupt the location-based innovation culture and practice that was celebrated before the turn of the century (Russell and Still, 1999). These trends are dramatically changing how we cooperate to share innovation’s risks and benefits, allowing us to focus on sustainable development. Innovation 4.0 is the perfect storm, an event in which a rare combination of circumstances drastically aggravates a situation.
In this rapidly changing business environment, regional innovation organizations can serve as catalysts - with practical assistance to local companies, investors and funding organizations. These catalysts are themselves innovating - to aggregate their knowledge assets and synchronize their participation in global innovation ecosystems (Russell et al., 2015b). The EIT ICT program, for example, initially created with a Euro-centric perspective, recently opened a node in San Francisco (EIT, 2014). Change strategists want to know which systemic factors may produce -networked business and what time is required to see a lasting impact on their ecosystems. Community leaders want insights on how policies and programmatic interventions can be orchestrated to accelerate the transformation of their business communities.

Regional policies, targeted strategies and investments are needed to help regional areas build on their distinct and concentrated assets. National policies and programs are needed to help regions and metropolitan areas (Katz et al., 2010). Innovation program managers feel a sense of urgency to find effective methods and techniques to understand and manage the complexity of their business ecosystems (Adner, 2012) in the rapidly changing business environment, fast produce cycles, and decreasing average life expectancy of today’s companies.

Stakeholders and their relationships are assets for technology-based economic development; they can also be liabilities. The advantages and limitations of relationships have been examined in the work of many scholars, who have explored their importance from the perspective of knowledge spillovers due to regional clustering (Marshall, 1920), specialized activity clusters (Schumpeter, 1942; Porter, 1990), and the interrelations of organizational structures in a paradox of simultaneous competition and cooperation networks across different community organizations and institutions (Ouchi and Wilkins, 1985; Smilor and Wakelin, 1990). The roles of key opinion leaders and influencers in information dissemination were initially explored in small, heterogeneous agricultural communities (Rogers, 1965; Oreszczyn et al., 2010). More recent economic development studies have focused on the synergistic advantages within the regional cluster (Saxenian, 1994; Gibson and Butler, 2014), the role of financing relationships as infrastructure (Huhtamäki et al., 2011) and the importance of culture as an enabler (Florida, 2012). The globalization of business relations, coupled with the concept of open innovation (Chesbrough, 2003) and the renewed focus on system-level effects (Hwang and Horowitt, 2012) have now turned the spotlight to relational capital (Still et al., 2014a).

In both regional and metropolitan areas, successful local and regional development frequently includes actors from the community and civil society and other non-profit organizations, as well business and financing organizations. The age-old adage, “It’s not what you know but who you know,” applies to deals, alliances and partnerships, in spite of considerable confusion over exactly what outcomes are actually attributable to relationships. Though there is agreement that the evaluation of relationships is complex (Cropper et al., 2008), shows how a relationship focus has been largely missing from city innovation indicators and rankings. None of the 162 indicators includes the word “relationship” (2ThinkNow, 2014).

To upgrade innovation capability, it is crucial to build cooperative networks among innovation actors and collaborators: Higher Education Institutes, Research Institutes, Industry Associations, governments, and Financing Organizations. These are all essential to create a milieu in which innovation flourishes. However, individual people – working together smartly - make it happen. They do so through large, medium and small enterprises, through relationships between individuals and across organizations. These individuals, their coalitions and their solutions provide the energy and commitment to reach their shared vision of the future.

The enduring paradox of R&D consortia and technology transfer initiatives at continues to be that the very organizations set up to create and transfer technology often set up very effective barriers to doing so. Advanced technology will not cause institutions, organizations and people to become more collaborative, cooperative or synergistic. Advanced technology is merely an additional tool that can facilitate or exacerbate the process. The real challenges are behavioral and managerial.

It is incumbent on catalyst organizations to continually change and reinvent in order to accommodate rapid changes in the relationships on which our ecosystems depend. In order to move forward, both the architects and the engines of change are needed. The critical question: Are we moving forward – fast enough? Accordingly, we use a framework to support the understanding of complexities in innovation ecosystems (Russell et al., 2011). In this paper, we illuminate its deployment with the analysis of its three core components: relationship visibility, storytelling and shared vision.

2. BACKGROUND

Personal and interpersonal communications are the basis of the exchanges through which knowledge transfers take
place (Gibson and Rogers, 1994). In order to create business value, new knowledge must be transferred several times — over and over again — on its way to product development, organizational acceptance, adoption by the end user, and marketing success. Knowledge transfer moves through a spiral of innovative expression, adaptation, articulation, and standardization; this model has been formalized as the SECI model (Nonaka and Konno, 1998). Emergent organizations in which knowledge is continually being applied and exchanged are characterized by rapid spirals. Slow spirals characterize well-established and highly bureaucratized organizations (National Research Council, 1998). Continuous innovation requires continuous change.

With the complexity of product and service development and with markets now becoming increasingly disintegrated vertically and horizontally, leaders must conceptualize interfirm innovation relationships (Iansiti and Levien, 2004) and identify relationship networks (Svendsen, et al., 2001) and decision pathways (Russell et al., 2015b) for business success. Networks and alliances allow firms to share risks in development and obtain access to synergetic knowledge (Eisenhardt and Schoonhoven, 1996; Adner, 2012). Interfirm networks can improve firm performance, speed of innovation, and organizational learning (Ahuja, 2000; Gulati et al., 2000). Multiple, independent paths enhance the agility of organizations in transferring (Moody and White, 2003; Kajigawa et al., 2010) and converting resources.

2.1 Innovation Ecosystems

Adapted from the biological sciences, an ecosystem perspective offers insights on the relationship dimensions of innovation — the education, experience, creativity, economic strength, values, goals, and shared vision of the players. The innovation ecosystem perspective is based on the premise that communities consist of a heterogeneous and continuously evolving set of constituents that are interconnected through a complex, global network of relationships. These constituents co-create value and are interdependent for survival (Moore, 1996; Iansiti and Levien, 2004; Basole and Rouse, 2008; Russell et al., 2011).

The construct of innovation ecosystem grows out of concepts of business ecosystems, which represent an offshoot of interfirm networks (Basole and Rouse, 2008; Doughterty and Dunne, 2011). The complex networked systems approach has been used to study value networks and ecosystems in a variety of industries (Adner, 2012; Rosenkopf and Schilling, 2008).

This view combines both the resource-dependency and the coalition perspective; it suggests that innovation ecosystems are complex systems characterized by co-evolving actors engaged in collaboration, co-opetition (Basole et al., 2015) and collective invention (Powell and Giannella, 2010).

While it is early in the process of the innovation ecosystem perspective obtaining differentiation as an intellectual construct (Oh et al., 2016; Russell et al., 2016), the recognition of concurrent competing forces and non-linear development processes are among its characteristics that allow people from multiple backgrounds to engage dialogues about current conditions and shared futures. A dynamic innovation ecosystem is characterized by synergistic networks that promote growth, decline and equilibrium in a system that is ever changing. Growth is enhanced by fast knowledge transfer cycles, active engagement and agile relationship realignment. Knowledge, capital and other vital resources flow through these relationships in response to changing internal and external forces (Russell et al., 2011).

2.2 Relational Capital

The internal and external activities that create knowledge help to fuel the continuous innovation needed for competitive advantage. A clear step forward to understanding the importance of relationship dynamics in innovation ecosystems can be found in the newest version of the Oslo Manual. It provides guidelines for collecting and interpreting innovation data. It includes a recommendation on how to measure the linkages, as “each linkage connects the innovating enterprise to other actors in the innovation system: government laboratories, universities, policy departments, regulators, competitors, suppliers and customers” (OECD, Oslo Manual 2005, p. 76). Accordingly, new metrics for relational capital are evolving (Russell et al., 2015a).

Relational capital can be used to infer shared vision, resource flow, and — to some extent — risk tolerance at various levels of innovation ecosystems. Indirect relationships, such as the institutional affiliation or alumni status (Rubens et al., 2011) of a key individual on the boards of two different firms, shown as board interlocks (Davis, 1996), may influence decisions and behavior. Toward understanding and measuring the relational capital, the process of making the complexities of relationships visible can support the comprehension of hierarchical nesting of clusters (Moody and White, 2003) and help develop alternative pathways for programs and activities (Kajigawa et al., 2010).
2.3 System Leadership Requires Network Orchestration

Innovation concerns more than developing new technologies and finding adopters for them. Today we think about co-creation of both technologies and their application as systemic, integrated and interdependent processes (Vargo et al., 2008). In Vargo’s concept of co-creation, Koestler’s perspectives on bi-association (1964) and Konno and Nonaka’s concept of “ba,” knowledge creation spaces (1998) revolve around relationships among people. Creating a fertile environment in which such complex relationships can emerge and thrive is the primary opportunity for technology-based regional economic development. Development organizations are charged with making this happen. Experience and research (Gibson and Rogers, 1994) have shown that for optimal effectiveness, these mechanisms need to be targeted to all levels of an organization – the individual, the program or project consortia, alliance or business partnerships, top management, and shareholders.

Technology transfer involves serendipitous interactions as well as deliberate intervention strategies. Technology transfer, the application of knowledge, relies on the exchange of knowledge between two entities (Gibson and Rogers, 1994). The knowledge that is being exchanged may not be a fully formed idea. Or it may be a fully formed idea that is not yet ready for application. It may be tacit know-how – associated with subjective, simultaneous practice and not easily expressible. It may be explicit knowledge – objective, easily processed, transmitted and stored, rational, sequential and digital.

Internet-based tools have opened new networks for catalyzing and managing the information resources necessary for technology transfer. The nonlinear flow of information over these networks, open and immediate access to information, and the ability to make information globally available have had profound impacts on the way people use information (Breese, 1999). Former conceptions of technology transfer as linear information flows from R&D through Development through Engineering through Marketing through Sales and to the Customer have been replaced with concepts that acknowledge the random, sporadic, episodic, eclectic, evanescent, anywhere origination of knowledge that can be effectively captured, codified, catalogued and distributed in order to become a usable knowledge resource (House and Price, 2009).

2.4 IETF - An Action-oriented, Design-thinking Research Construct

The Innovation Ecosystems Network Framework (IETF) construct, already documented as a means for understanding the complexities related to innovation ecosystems, integrates individual and organizational level concepts and emphasizes shared vision developed through relationships (Figure 1) as the driver for knowledge transfer, technology dissemination, and organizational change (Russell et al., 2011; Still et al., 2014b; Russell et al., 2015). This method has roots in action research (Avison et al., 1999) and leverages multiview contingent systems development (Avison and Wood-Harper, 1990). These models are contemporized with design thinking approaches in the Ostinato method (Huhtamäki et al., 2017).

The IETF recognizes that value is co-created and progress is realized through events, their impacts over time, and through coalitions of relationships. All of these can be measured and tracked. Through relationships that co-create a shared vision of the future, interaction and feedback enable people involved in change to transform the ecosystem. These coalitions provide the network’s structure; changes in the actors and changes in their relationships reveal modifications in the coalitions. Over time, changes in these coalitions can be tracked, measured and visualized to reveal, anticipate and orchestrate transformations. IETF has been successfully used to track, measure and visualize snapshots of innovation ecosystems at regional (Russell, 1995) and transnational levels (Still et al., 2014b).

3. ILLUMINATING THE INNOVATION ECOSYSTEM TRANSFORMATION FRAMEWORK

Under enhanced globalization and global proliferation of
information technologies, the innovation process has taken on an interdependent and continual nature. These forces move regions, sectors and systems from the linear development typical for industrial societies to linear, concurrently competitive and cooperative development, typical for the post-industrial, or knowledge-based world. Non-linear development relies on horizontal (non-hierarchical) linkages between different institutional actors, becoming dispersed, diffused and decentralized (Russell et al., 2016). Knowledge, capital and other vital resources flow through social and economic relationships in response to changing internal and external forces (Russell et al., 2011). Evolving networks, continually re-aligning to optimize shared vision, provide concurrent platforms for both stability and transformation. Transformation, seen in economic growth, is enhanced by fast knowledge transfer cycles and agile relationship realignment that accommodate change and promote growth in the system.

Three key elements of the Innovation Ecosystems Network Framework —, visualizations, storytelling and shared vision — are illustrated in the following examples that focus on relationships as infrastructure for innovation ecosystems.

### 3.1 Core Component of Relationship Visibility Through Visualizations

Visualizations are integral to the IETF in that they create common ground on which shared vision can be developed, to support storytelling.

There is a growing recognition of the potential value of visualization in business, strategy and innovation communities (Tegarden, 1999; Wright, 1997; Soukup and Davidson, 2002; Huhtamäki et al., 2012). Visualizations enable decision makers to see patterns, spot trends, identify outliers and thereby improve comprehension, memory and decision making (Tufte and Graves-Morris 1983). Visualizations leverage the human visual system to support cognition and the process of sensemaking, in which information is collected, organized, and analyzed to generate knowledge and inform action (Heer and Shneiderman, 2012).

The introduction of the network perspective of social structures (Wasserman and Faust, 1994) as the defining characteristic of innovation ecosystem provides visual aids for exploring innovation ecosystems, clusters of knowledge assets, unique actors and unique reciprocity links (Chandler and Vargo, 2011). Network visualizations enable researchers and other stakeholders to ‘see’ the structural context and the scalable influence of the context within the market structures (Freeman 2000; Chandler and Vargo, 2011). They can reveal the connections of individual nodes, organizations or the network at large (Basole et al., 2013; Russell et al., 2015b). Being able to dissect various layers in an ecosystem offers advantages in addressing the inherent complexities of innovation (Still et al., 2013; Russell et al., 2015a). Network visualizations can be used to quantitatively and qualitatively analyze, understand and communicate the complexities of innovation ecosystems and illuminate opportunities for the development of shared vision through interventions and network orchestration.

Network metrics can be used to reveal existing relationships and distinct patterns of business ecosystem structure and provide insights on the engagement, agility, social cohesion, vitality, linking factors, and embeddedness of metropolitan areas, as relational constructs for spatially defined innovation. They can make the abstract concept of relational capital visible — to stakeholders and decision makers (Russell et al., 2015a). Network graphs using regional or industry-level aggregate metrics constructed from established KPIs (Still et al., 2012) provide a multidimensional artifact for innovation ecosystem analytics, integrating technological, information, and social dimensions (Lee et al., 2015).

In the highly complex information environment of big data, network visualizations can contribute to the seasoned judgment of experienced leaders. Visualizations leverage the human visual system to support cognition and the process of sensemaking. They provide executive decision makers with data-driven analysis that can be backgrounded by context or which can serve to frame an issue for decision making.

A balance between detail, abstraction, accuracy, efficiency, perceptual tension, and aesthetics in network visualizations (Segel and Heer, 2010), is essential for shared vision and decision making. The literacy of decision makers in visual analytics and network metrics is just beginning to emerge. Many managers are not accustomed to reading network visualizations, and the metrics behind them are not yet common knowledge. Especially for non-technical stakeholders, the amount of information captured and presented can be overwhelming to the end-user. An iterative co-creation process (Huhtamäki et al., 2015) can support the collaboration of researchers and decision makers by using context to guide selection of data and using sensemaking to refine analytics. For policy makers, business executives or the general public, a co-creation process might involve integrating data across levels, as in Case Finland (Still et al., 2013) or filtering the data to highlight patterns in relationships that inform evidence-based decisions, as in the case of EIT ICT Labs (Still et al., 2014b).
Examples: Network Visualizations of Innovation Ecosystems

The visualizations in Figures 2, 3, and 4 exemplify several alternative views of innovation ecosystems, following a standard convention in data visualization idiom design and interpretation (Bendoly, 2016). The three graphs illustrate snapshot, point-in-time relationships.

Figure 2 shows a distribution of roles in the Finnish innovation ecosystem (Still et al., 2013), revealing relative proportions of leadership and investment relationships involved in building capacity among startups and growth companies in Finland. Finnish innovation stakeholders were actively involved with the research team in setting boundary conditions for the data, iterating meaning in the sense-making process, and extracting insights for policy development.

Figure 3 shows geographic distribution of board interlocks and funding relationships across companies in the ICT sector that are located in the six original co-location sites of the EIT ICT KIC program; the visualization adds a hypothetical 7th site, California’s Bay Area (Still et al., 2014b). Insights from the planning process that included this visualization were instrumental in justifying an expansion of the European program to a location in the US.

Figure 4 shows the similarity and boundedness of innovation relationships in the mobile device sector - two mobile phone manufacturers, Apple and Samsung (Basole et al., 2015). Using the bi-centric ecosystem layout method, the direct and indirect relationships with ecosystem partners of two
companies are shown in this image. Deal and alliance relationships are depicted, enabling insights about Apple and Samsung’s outsourcing approaches to their ecosystem, which overlap in several second order networks, through very few first order relationships exist.

Other types of visual representations could be used to show change and change dynamics. For example, changes in an ecosystem could be shown as movement (change in location), growth (change in size, volume or other measures of magnitude), combination (an explicit combination of one element with another), and transformation (change in the state or form of an element.) With additional complexity, visualizations of change dynamics can be used in attempts to explain why changes take place and the processes by which changes emerge – simultaneity, causality, sequence, and cycle (including feedback mechanisms).

3.2 Core Component of Storytelling

Homo sapiens have been called homo narratives. We are “wired” for human relationships (Reeves and Nass, 1996), and we are wired for story (Haven, 2007). Stories have been the basis for human communication since primitive cave wall drawings. A storyteller builds context around characters and actions; and this permits values, attitudes and ambiguities to be communicated along with the details. The listener receives the elements of the story, interprets those elements in light of his or her own values and experiences, and then reassembles the story reflecting personal perspectives.

The shared vision of a dynamic ecosystem relies on the
Deals and alliances create the connections between actors, as well as resource flows. Events such as key events can describe activities and innovations stories, such as CapDigital in Paris (Russell et al., 2015b). Organizations with shared visions and values are occasionally featured as agents in innovation ecosystems. Leaders who have the reputation, resources and commitment to lead new initiatives, leaders who champion new initiatives within their own organizations, and champions who encourage new approaches — such as Michael Dell in Austin, Texas or William C. Norris in Minneapolis, Minnesota (Russell et al., 2015a). Key story agents are sometimes local entrepreneurs who have built successful companies, as well as those who haven’t been successful but are willing to share what they learned from their experiences. Organizations with shared visions and values are occasionally featured as agents in innovation stories, such as CapDigital in Paris (Russell et al., 2015b).

Stories about a shared vision for innovation ecosystems also include key events. These events can describe activities and their engagement, as well as resource flows. Events such as deals and alliances create the connections between actors, as well as resource flows. Sensemaking and storytelling support the process of developing a shared vision. Repetitions of the narrative contribute to shared vision by both evoking a perception of stability and by hinting at opportunities for change (Dailey and Browning, 2014). Storytelling is an integral stepping-stone toward shared understanding, which is a prerequisite for innovation ecosystem transformation. The power of alignment for achieving collective action (Labovitz and Rosansky, 1997) is especially important in contexts with significant uncertainty. In order to align purpose and motivate participation, stories must be carefully chosen to match the situation, the scenario and organizational objectives (Denning, 2006).

The stories of innovation ecosystems include agents, events, impact, and coalitions — in context. Agents in these stories are companies — large and small — and the organizations that interface with them, such as the companies acquired by Google (Basole et al., 2015). Agents are also individuals in those organizations — people who are inventors, founders, entrepreneurs, service providers (law, intellectual property, consulting, real estate, marketing, etc.), and key employees acquired in corporate acquisitions; story details range from who and how many agents exist, to patterns of serial entrepreneurship, to volume and quality of talent in the labor pool. Agents also include support organizations, such as the Finnish accelerators, incubators and other boundary spanning organizations, and resource agents (capital providers, educational institutions and other sources of innovative ideas, discoveries and inventions) (Still et al., 2013).

Agents also include leaders and role models. Stories often include leaders who have the reputation, resources and commitment to lead new initiatives, leaders who champion new initiatives within their own organizations, and champions who encourage new approaches — such as Michael Dell in Austin, Texas or William C. Norris in Minneapolis, Minnesota (Russell et al., 2015a). Key story agents are sometimes local entrepreneurs who have built successful companies, as well as those who haven’t been successful but are willing to share what they learned from their experiences. Organizations with shared visions and values are occasionally featured as agents in innovation stories, such as CapDigital in Paris (Russell et al., 2015b).

Stories about a shared vision for innovation ecosystems also include key events. These events can describe activities and their engagement, as well as resource flows. Events such as deals and alliances create the connections between actors, as well as resource flows. Stories about the activities of an innovation ecosystem recount how people collaborate with each other, which activities generate interest and “buzz” to drive participation in the community. They are stories about what people are doing to stimulate innovation and entrepreneurship. About where, when and how stakeholders interact — how the ecosystem leverages veterans and new talent, and how partners communicate. The event elements of ecosystem stories feature the availability of knowledge, advising, mentorship, and services such as cloud hosting, etc. for aspiring entrepreneurs.

Over time, changes in the actors and events show impact through overcoming obstacles — often the highest point in the story arc. New entrepreneurs, service providers and support organizations emerge. Additional capital or capital providers appear. New participants appear in the innovation ecosystem. Over time changes in the actors and connections show impact — such as those of the EIT ICT Labs’ program in Paris, Berlin, Helsinki, Stockholm, Eindhoven, and Trento (Still et al., 2014b).

These key factors — agents, events and impact — converge in emergence of new or modified coalitions, social networks — formal or informal. New coalitions reflect changes in the working relationships among innovation agencies and catalysts, across emerging industry sectors, and between support organizations. Media organizations and communication vehicles play leading roles in announcing and confirming new coalitions. Deals, alliance, mergers and acquisitions also reflect changes in the structure of the relationship networks through which innovation ecosystems operate.

All this takes place in context, which is also a key element of ecosystem storytelling. Changes in the role of government, the addition or removal of legal or bureaucratic barriers, or tax policy incentives, etc., modify the environment in which the story takes place. The community labor or financial capacity may fluctuate, or the social norms surrounding the innovation ecosystem may change. Modifications in the quality of the physical infrastructure — wireless connectivity, physical transportation, cost of housing - may also contribute dynamic influences to the innovation story. Additionally, cultural shifts — migrations, value systems, perspectives on urgency, uncertainty, risk, and failure — influence the color of the story.

**Example: UCAID**

A single new technology can cascade into multiple sectors and produce disruptive change. The consortium of organizations engaged in developing know-how for advanced net-
works, University Corporation for Advanced Internet Development (UCAID), offers an example. UCAID was formed in 1997 to develop and implement advanced networking technologies. The driving force that catalyzed UCAID’s development and advanced networking technologies grew out of the development of IPv6 as the new Internet protocol, initially developed by the Internet Engineering Task Force in 1994. New applications such as multicast routing, mobile internetworking, scalable addressing, and support for multimedia applications over the Internet have been made possible by IPv6. IPv6 permits more addressable nodes (expanded routing and addressing capabilities), quality-of-service capabilities (the labeling of packets belonging to particular traffic flows for which the sender requests special handling, such as non-default quality of service or real-time service), and novel authentication, data integrity, and confidentiality capabilities - through new header extensions (Hinden, 1996).

UCAID’s collaborators met several times a year to exchange information and narratives about the future. These meetings and stories built relationships among people working at the Giga POP’s (network operation centers that provided expertise and access to this experimental network), development teams working on application demonstrations that required use of the advanced networks of the service of the GigaPops, and people (in test, primary and secondary markets) who were eager to deploy the applications being developed. The complement of tacit and explicit knowledge and the processes of exchanging knowledge among the participating entities were fundamental to the technology transfer process.

IPv6 has ushered in a new era of HTML5, as many expected. UCAID’s success can be seen in the current state of the high-bandwidth network that spans the globe, creating – in one sense - the global brain (GLIF, 2014). It has opened frontiers for new remote collaboration tools, as we anticipated. It has enabled the next wave of disruption to emerge – ubiquitous sensing and “smart” systems. Machine to machine communication is now embedded in many systems, with automated data and systems providing the infrastructure for the emerging platform economy, multi-sided business systems focused on knowledge that outsources production by allowing many businesses to connect to a core set of services.

3.3 Core Component of Shared Vision

Across the constituents of an innovation ecosystem, many critical decisions must be made individually and independently. The speed of change requires zero-time strategies and tactics (Yeh et al., 2000); it argues against a committee review for every decision point or referendum vote for every decision. It argues for a shared vision that enables flexible sense-making and alignment across stakeholders’ independent decisions in order to synergize change and transform the present into a shared future.

Many networks are intentionally “orchestrated” or “engineered” by an organizational actor who recruits network members and shapes their interactions, corresponding to phases of innovation ecosystem building and management (Ritala et al., 2013). Network orchestration, the ability to connect and manage competences across a broad network of relationships, has been recognized as one of the most important meta-capabilities for a networked world (Wind et al., 2008). Recognition of the interdependencies and flexibility of actors in the network (Rizova, 2006) enables practical coordination of the innovation network and recognition of the innovation output (Dhanaraj and Parkhe, 2006). Network orchestration speaks to a “discrete influence” in the ecosystem. Decision-making tools that leverage the knowledge assets of an organization for network orchestration must be appropriate to the context of the decision, the mindset of the decision makers, and the data available to the organization.

To build a shared vision, the leader must choose a lens through which the innovation ecosystem story can told. A snapshot approach captures the ecosystem at one point in time. It describes, for instance, the relationships that Finnish startup companies in the ICT sector have with financial and technology development organizations (Still et al., 2013). A dynamic view reveals changes over time or the impact of changes in conditions, such as the impact of EIT ICT Labs’ programs on vitality in affiliated cluster cities (Still et al., 2014b).

Ecosystems are complex. Architecting the vision requires deciding which considerations will be assumed as givens and which facets will be considered changeable.

Example: Hewlett-Packard

Legends about successful Stanford alumni abound. The story of Hewlett-Packard is often told as an example of Silicon Valley magic; and there are many stories like this one. Bill Hewlett and David Packard were students in Stanford EE course taught by Professor and Dean, Fred Terman. With a loan of roughly US$500, a professor gave two students an opportunity to take a risk to do something that had never before been done. They enjoyed success, and the HP company that bears their name was the world’s leading PC manufacturer from 2007 to 2013.
(Gartner, 2014). Many of the buildings on Stanford’s campus bear the names of successful alumni who gave generous amounts of money to Stanford University. The names of buildings read like a “Who’s Who” of modern technology.

Where is the HP building located? It does not exist. Stanford has a William Hewlett building, and Stanford has a David Packard building. Why, you might ask, are they separate? The answer is straightforward—and relevant to network orchestration. Most large gifts to universities come from the family estates of successful alumni. Though they worked together to create a successful enterprise, Mr. Hewlett and Mr. Packard took home separate pay, to their individual families, who made independent decisions about their investments and expenditures. And this is similar to the way in which individual, independent decisions are made by technology leaders, economic leaders and community leaders—and their families. These leaders arrive to the future together because they share a vision of the future they want to create, in their independent and interdependent activities.

The history of R&D collaborations has demonstrated that advanced technology will not in and of itself cause organizations and people to be collaborative or become productive (Gibson and Rogers, 1994). Interorganizational alliances do not in and of themselves produce synergy. While technology challenges are not insignificant, the behavioral, organizational and managerial challenges are often the most critical.

4. DISCUSSION AND SUMMARY

The ambiguity and popularity of the term “innovation ecosystem” has been critically addressed by Oh et al., calling “for researchers to bring rigorous meaning and practical usefulness to the innovation ecosystem concept” (2016, p.5). In this paper, we answer the call with the practical construct of IETF, which has been created to support innovation ecosystem development and has been used to understand and guide transformations. IETF acknowledges that ecosystems are constructs in which change takes place. Hence, it conceptualizes change as interrelated states in the development or growth of an organization (Van de Ven and Poole, 2005). Analysis of states at single points in time provide snapshots of progress—or lack thereof. Comparison of changes over time—time series or animations—can show impact. Accordingly, metrics reveal insights about the relational capital and identify the new coalitions and the shared vision through which transformation can be orchestrated. For analysis, as well as for the subsequent insights, storytelling—communication with sense-making—is needed.

We see that over time, stories related to the complexities of innovation ecosystem are shared—told and retold—and interpreted through the mindset and experience elements of many actors. Shared understanding develops. And out of this, a shared vision of the future develops. In this shared vision, community members understand how their futures are connected, how they will collaborate with each other, how the community will engage with external or global partners, how it will encourage and recruit new constituents. Personal goals and professional hierarchies become nested in a collective view of how ideas, talent and capital come together toward a future in which all want to participate.

Through this shared mental model, agents make individual decisions that contribute toward the shared vision of the future. New structural patterns emerge in the existing ecosystem; these new links in ecosystemic networks connect new entities each other and with existing entities. The volume and velocity of deal flows increase. The internal and external identity of a region is transformed.

The sensemaking step completes the cycle, using spatial descriptions, regional business history, and collateral metrics of the three metropolitan areas to provide context for the relational capital revealed in the networks of the innovation ecosystems. Storytelling is deployed to provide context for interpreting the quantitative results of the analysis across relational indicators at multiple levels of ecosystems.

An appreciation of the complex system-level factors influencing innovation development is essential for carrying out high impact regional development programs. Values and relationships that constrain and enable change are very real forces, yet often difficult to articulate, and pose huge challenges for measuring change. Visualizations of complex knowledge assets held by organizations help to create shared objects around which a mutual understanding of current state and desired change can be developed.

Our future depends on making the most of all sources of human ingenuity to reconcile inclusive development with social justice, poverty eradication and environmental sustainability. These are the stakes of the new global development agenda that initiatives for “smart” Cities, Regions, States, and Nations are shaping. For this, we also need smart people to make smart decisions.

While the investment in innovation has expanded globally
over the last decades, the pressures of global issues such as climate change and social inequity have been intensified. To sustain quality of life for the 9 billion inhabitants of Earth in 2050, we urgently need to craft new solutions that utilize the creativity of all societies and make the most of science, technology and innovation. This will only happen if investment resources are complemented with additional relational capital, through which we can build stronger relationships for cooperation, networking and smart decisions.

Successful networking strategies aspire to create alliances between locally-related conventional industry and high-tech industry. These strategies must be complemented with shared vision for the transformation of conventional industry to new sectors that bring high-value industries, such as information technology, biotechnology, and nanotechnology, into alliances and partnerships with the humanities and social sectors. In this era of abundant opportunity, the new vision of prosperity has the potential to resolve economic disparity, promote balanced growth of both developed and developing countries, and ensure that all members of the global community can share in the economic growth that will create the future global community.

Exponential opportunities are exploding as the Internet of Things, the platform economy and smart cities converge. The resource most urgently needed is smart people who can make smart decisions about a future that we all will share. Perhaps in the future, the turning points in the IPV6 story, the regional development stories, and the multinational collaboration stories will be in how we met the global challenge of educating the future work force brought business and government leaders together to harness technology for the good of all people.

As mentioned earlier — it is incumbent on those of us responsible for catalyst organizations to continually change them, to reinvent them — in order to accommodate rapid changes in the relationships on which our ecosystems depend. Change is an imperative. Change is continual. In order to move forward, we must be both the architects and the engineers of change. The question before us is: Are we moving forward — and, are we doing so fast enough?

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