Business Angels and Investment Organizations as Networked Co-creators of the Finnish Innovation Ecosystem

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1 Introduction

In the world of startups globally, two main types of actors facilitate and accelerate the co-creation of new companies and business: venture capital investors and a group of well-connected individuals, often referred as business angels or serial entrepreneurs.

In this article, we present a visual snapshot of a network of institutional venture capital investors and a group of well-connected individuals together creating and co-creating parts of the Finnish innovation ecosystem. The concept of ecosystem is here used as metaphoric reference for value co-creation in a network-centric mindset (cf. Russell et al., 2011). The analysis is based on a

socially constructed dataset that can be explored to provide value to researchers as well as ecosystem facilitators and other agents of change as shown in the paper.

The analysis concentrates on two complementary means of co-creation: a) investments of venture capital, which in Finland have been oriented to early equity phase financing of high-tech start-ups and b) business angels investing their time, knowledge, connections and other resources to new startups. A total, all-inclusive analysis of the Finnish system is outside of the scope of this article, but the visualization snapshot of the ecosystem at the moment, interestingly, on the verge of possibly the largest structural change that the Finnish high tech sector has ever witnessed will serve as a starting point to stimulate the development of insights relevant to innovation experts, analysts and decision makers within the context of the Finnish innovation ecosystem.

2 State-of-the-art

There is an increasing interest towards the concept of co-creation both in research literature (Seppä and Tanev, 2011) and in social media activities in general (cf. http://ominvoimin.com). Recently, the concept has been redefined to reach beyond explaining the emerging relationships between customers and the companies through which they are jointly creating value to an emerging business and innovation paradigm that leads to the need of "changing the very nature of engagement and relationship between the institution of management and its employees, and between them and co-creators of value - customers, stakeholders, partners and other employees" (Ramaswamy, 2009).

Strategic value-creation networks, an important example of co-creation, can be observed through network analysis of small, medium, and large enterprises as well as investors and individuals contributing to them. Chesbrough (2003) states that a leading idea in open innovation is that, because valuable knowledge and other resources exist outside of an individual organization, companies purposively co-create value networks through vendor-supplier relationships and collaborative service offerings that are specific to market segments. Interfirm relationships created by the participation of executives and board members in two or more enterprises with related missions, markets, products or social responsibility is additionally a potentially powerful force for value co-creation (Davis, 1996). Business angels and serial entrepreneurs have a similar kind of role in serving their knowledge, connections and resources to catalyze the creation of new startups, effectively acting as venture-to-capital (V2C) players (Seppä and Näsi, 2001). In a similar way, startups and enterprises receiving investment resources from the same financial source may share complementary visions of the future, complementary benefits from new technologies, and synergistic market development.

Seppä and Näsi (2001) differentiate the role of different venture-to-capital players: angel investors, incubators, advisors as well as corporate investments in bridging the gap between seed

funding of prospective companies and capital infusion into investable companies. While all these types of financial resources may be available for business investment in a region, the role and proportion may vary. Investors' ultimate objective is for a new company to undergo a major liquidity event that allows it to become listed on a stock exchange. An ecosystem including both experiential and financial resources is needed to co-create successful journeys across the gap from a prospective to a listable company.

Business ecosystems are comprised of the aggregate of relationships among individuals and groups of individuals in clusters of companies. The competitive advantage of clusters accrues from the linkages and the synergy between activities (Porter, 2000). Co-creation is an essential force in a dynamic innovation ecosystem because a continual realignment of synergistic relationships of people, knowledge, and resources is required for growth of the system and responsiveness to changing internal and external forces (Rubens, Still, Huhtamäki and Russell, 2011).

On one hand, venture capital, the "independent, professionally managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high growth companies" (Gompers and Lerner, 2001), has specific termination objectives that drive investments. On the other hand, government development agencies are often framed around capacity building missions – building markets, standards, supply chains, and technical and managerial talent. The investment strategies of development agencies vary in outcome and objectives, as well as in time frame and financial objectives. For examples, differences in the "cultivation vs. harvesting" strategies evidenced by investments into and out of China have been described (Rubens, Still, Huhtamäki and Russell, 2011).

The Finnish national innovation system has been described as a network of various actors, with education, research, product development, and knowledge-intensive business and industry at its core. Regarding the flows of investments into this system, it has been noted that "because of the importance of the public venture capital/private equity organizations, the Finnish venture capital system can be described as dual one in which some private venture capital funds have been initiated by public intervention" (Luukkonen, 2006). Furthermore, special characteristics have been noted: i) due to the small markets in Finland, the growth expectations oftentimes have been limited, which has impacted non-Finnish investors' perceptions of the attractiveness of investment in Finnish companies; ii) these existing public investors many times have been passive; and iii) that there are very few corporate venture capitalists in Finland (Luukkonen, 2006).

Huhtamäki, Russell, Still and Rubens (2011) revealed structural connections between Finnish technology-based companies and their investment organizations. It was shown that a significant proportion of Finnish companies in the high-tech sector have not received funding from

investment organizations in recent years. For those Finnish companies that have received funding, 63% received either first or second-round funding from a government-owned Finnish Industry Investment. A handful of investment organizations (some Finnish and some not) was found to provide modest diversification to the Finnish funding landscape, which according to the findings shows a pattern similar to that of scale-free networks. (Huhtamäki, Russell, Still and Rubens, 2011.)

Scale-free networks are networks of actors without a scale, characterized by a very small number of nodes that are highly connected and many nodes with a small amount of connections (Barabási and Bonabeau, 2003). In scale-free networks, growth patterns that show preference for attaching to highly connected nodes are typical and generally lead to the development of hubs (i.e., nodes with an enormous number of links) in a rich-get-richer manner. Scale-free networks tend to be “robust against accidental failures but vulnerable to coordinated attacks” (Barabási and Bonabeau, 2003).

In this article, we take a network-centric approach to look into the Finnish innovation ecosystem landscape to see the co-creation patterns between different actors including business angels and organizational investors. Does this kind of analysis support revealing the relationships and resource flows, both of which are intended outcomes of Finnish innovation policies?

3 Methodology

We agree with Ramaswamy and Gouillart (2010) in that "In co-creation, strategy formulation involves imagining a new value chain that benefits all players in the ecosystem." Further, we see that imagining such value chains or value networks is more concrete and intuitive when graphical representations of an ecosystem are available.

We draw our findings on basis of data-driven visual mining of Innovation Ecosystems Network (IEN) Dataset (Rubens, Still, Huhtamäki and Russell, 2010), a quarterly updated collection of over 140,000 records built by web-crawling English language, socially constructed data about technology-oriented companies. As of June 2011, it includes data about 65,000 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.

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).

The analysis is conducted with a network-centric mindset. We see visual network analysis as a powerful method enabling the investigator to gain insight into the structure of social networks under study and to communicate the findings to others (cf. Freeman, 2009). The visualisation of the overall structure of the network under investigation, the different characteristics of the network, the roles of the network actors and the nuances of their interaction are of interest in many fields of research. Networks may, for example, be characterized by their overall structure as random, small world and scale free (Barabási and Bonabeau, 2003) and have actors in roles including authorities, hubs, connectors (Barabási, 2003; Kleinberg, 1998) transferring information within the network (cf. Molka-Danielsen et al., 2007).

Due to the availability of state-of-the-art network analysis tools and platforms such as NodeXL (Hansen, Shneiderman and Smith, 2010) and Gephi (Bastian, Heymann and Jacomy, 2009), social media data can be turned into graphical images and even animations or movies representing various phenomena. As Basole (2009) and Rubens et al. (2011), for example, demonstrate, network analysis is a particularly suitable method for investigating phenomena that, essentially, are networks. Further, Giuliani and Bell (2008) show that SNA metrics are useful also in measuring more subtle phenomena such as homophily, reciprocity and transitivity in between corporations.

Precise quantitative SNA metrics can be calculated both for a network as a whole and for its actors. Whereas simple metrics such as nodal degree representing the number of connections of a node are a good starting point to support visual network analysis, more complex metrics such as betweenness centrality, prestige (Wasserman and Faust, 1994), page rank (Page, Brin, Motwani and Winograd, 1999), and measures of hubs and authority (Kleinberg, 1998) have their role in the quantitative analysis processes.

4 Findings and interpretation

In the sample of 247 high-tech companies that have their primary office in Finland constructed for this study, there are 298 individuals whose connection to one of the companies has been mentioned in the press. A total of 120 investments for the companies in the sample were announced from 64 investors, made in 77 rounds between 2005 and 2011. The total amount of investment is USD 437 million. The first investment was issued in 2005 when BioFund Management, Sitra Ventures, Varma Mutual Pension Insurance Company and Finnish Industry Investment co-invested in Ipsat Therapies and the most recent investment in the sample is game developer Supercell securing an investment of USD 12 million from Accel Partners in May 2011.

As this paper is also demonstrating the process of network analysis of innovation ecosystems on basis of social media data we refer to as Ecosystem Network Analysis, we next discuss some of the more technical details of the analysis process. The web crawling-based process used to construct the IEN Dataset is, however, outside the scope of this article; see Rubens, Still, Russell and Huhtamäki (2010) for details. More close to innovation ecosystem network analysis, we use Gephi, an open interactive visualization and exploration platform for networks (Bastian, Heymann and Jacomy, 2009) for graph metrics, visualization and layout. To present the individuals and investors co-creating companies within the Finnish innovation ecosystem, we processed the network layout in two stages: (1) cluster-based stage, (2) relation-based compacting stage. In the cluster-based stage we use OpenOrd layout algorithm (Martin, Brown, Klavans, and Boyack, 2011) since it produces a layout that allows us to better distinguishing clusters based on the interconnections between the nodes. We then apply Force Atlas (Bastian, Heymann and Jacomy, 2009) to compact the graph (nodes that are connected to each other are pulled closer together) and to make the representation aesthetically more pleasing. The network visualizations are embedded in the document by using vector graphics so it is possible to look at network details by zooming in.

Figure 1 presents an overview of the network. There are three kinds of nodes in the network: red nodes represent companies, green nodes represent the investors - individual people, companies and financial organizations that have invested to at least one Finnish company and blue nodes represent people that have a press worthy relationship to a company. The relationships vary from CEO and board membership to positions on research and development activities.

The resulting network is a directed one with connections pointing from co-creators towards companies. Most importantly, this modeling decision enables us to fine-tune the constructed visualization. In this case, the size of each node is defined on basis of the outdegree of the node (Wasserman and Faust, 1994), i.e. the number of the nodes that a node has contributed to. Contributions include investments made to companies as well as a person having been affiliated with a company in a noticeable fashion.

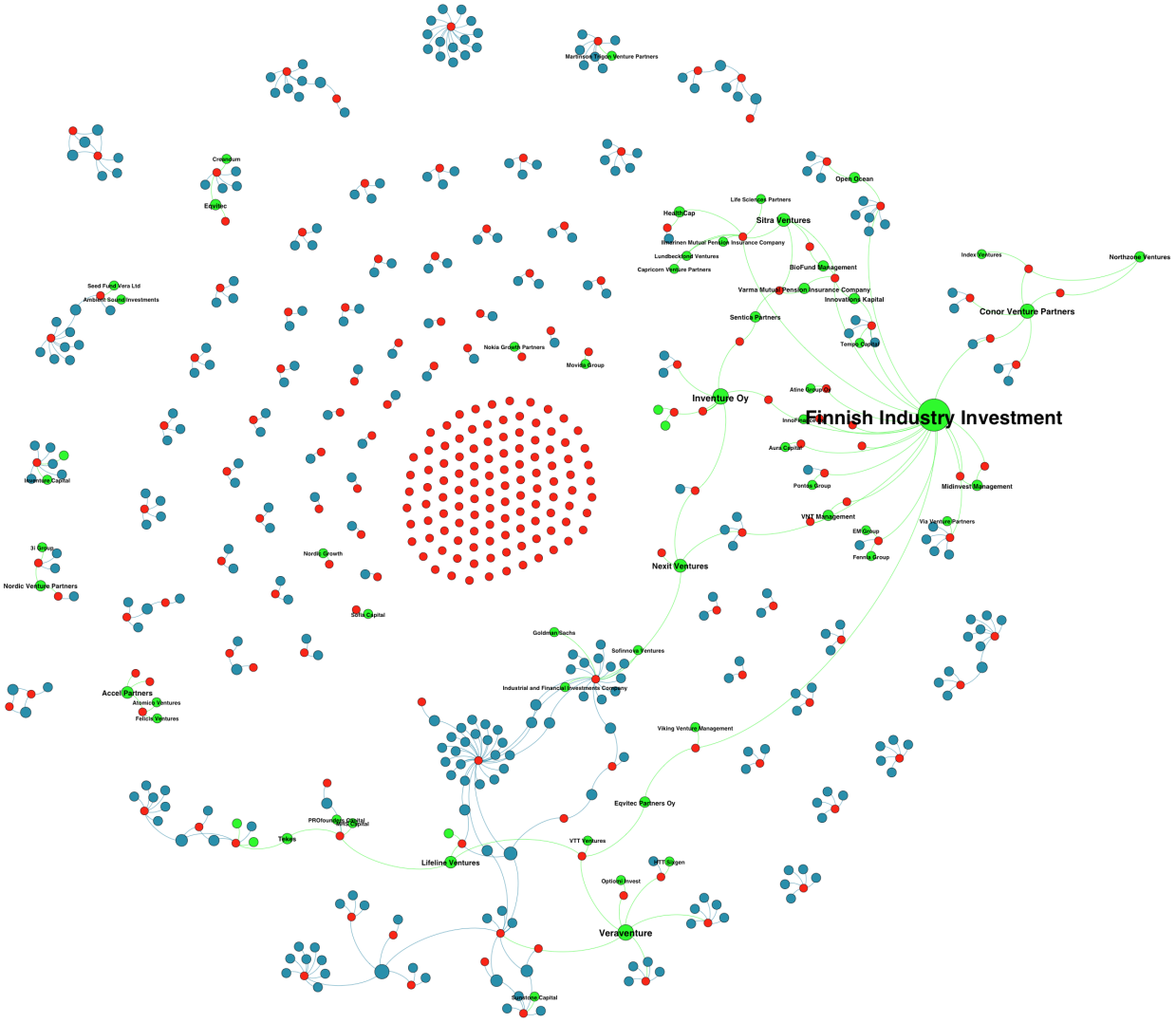

Figure 1. Overview of the co-creators of the Finnish innovation ecosystem: red nodes represent companies, green nodes represent the investors and blue nodes represent individual people.

Due to the modeling of the network and the design of the data collection process, the resulting network is not a connected one. Instead, it is composed of a set of network components. The main component of the network includes a group of companies connected through both investors and individual people. In the middle of the network lies a herd of companies that, according to the data, have neither yet received any investments nor connected to any employees or business angels in a press worthy manner. Whereas one could criticize the inclusion of companies with no connections to the network, we see that their existence very much reflects the situation in the ecosystem: there are interesting startups looking forward their opportunity to moving their venture to capital.

A government-owned Finnish Industry Investment is the node with the largest amount of connections to companies with an outdegree of 19, i.e. Finnish Industry investment has invested into 19 different companies in the sample. As Huhtamäki, Russell, Still and Rubens (2011) showed, Finnish Industry Investment often co-invest into companies together with both Finnish and foreign investment organizations.

When compared to the findings of Huhtamäki, Russell, Still and Rubens (2011), the role of a Finnish giant Nokia is more significant now when the individual people are included in the analysis: a previous or current relationship with Nokia characterizes many individuals who are active in various startups. It will be interesting to see how the role of Nokia evolves in the near future if the scenarios of Nokia releasing some of its research and development personnel come true (cf. "Pekkarinen: Government Help for Nokia", 2010).

An overview to the graph hints that oftentimes when major investors are present, the amount of connected individuals is low and vice versa. This suggests that individuals are investing their own resources, monetary, knowledge, and experience into the companies instead of acting as venture-to-capital players moving companies towards organizational investors.

The main business angel-driven cluster in the network is a group of social media startups, emerging around social media companies and, in particular, an early Finnish social networking site IRC-Galleria (Finnish for IRC gallery). The individual connecting the different companies has an outdegree of 5 indicating that, according to the sample, the person has a previous or an connection to five companies with a primary office in Finland. A cluster of startups folds around Nokia including a person with an outdegree of 4 (second largest in the sample) and several people with a connection to Nokia and another company: some of the people have made their way from Nokia to startups while others support and invest to startups while still holding a position at Nokia. Venture capital is also present in the cluster in addition to the individual people.

In their article on scale-free networks, Barabási and Bonabeau (2003) list a variety of domains and phenomena from biology to social networks where scale-free structures have been discovered. After the publication of the article and a related book (Barabási, 2003), scale-free network structures have been of interest to many. To show how the network under investigation here looks like from this viewpoint, we created a visualization of the distribution of node connections. For clarity, however, we want to state that the sample size here does not allow general conclusions on the network structure.

As Figure 2 shows, the distribution of the degree value for individual people seems to follow a power law: a majority of people have a connection to only one company and only a few people are connected to many companies.

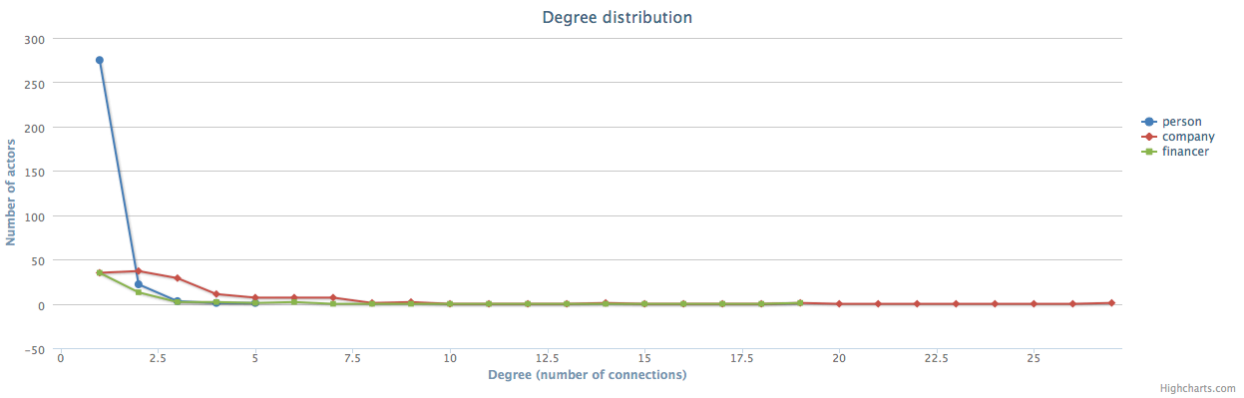

Figure 2. Degree distribution for different types of actors

The degree distribution in Figure 3 is plotted on a double logarithmic scale. If a network is scale-free, the result of this kind of a plot is a straight line (Barabási and Bonabeu, 2003). The distribution of people on a log-log plot in Figure 3 comes close to a straight line, suggesting that at least in the sample, the structure of business angel network follow the universal scale-free structure. Moreover, the closer investigation of the results show that with the help of outdegree and its distribution for individual actors, we can pinpoint to potential serial entrepreneurs and business angels with a good precision.

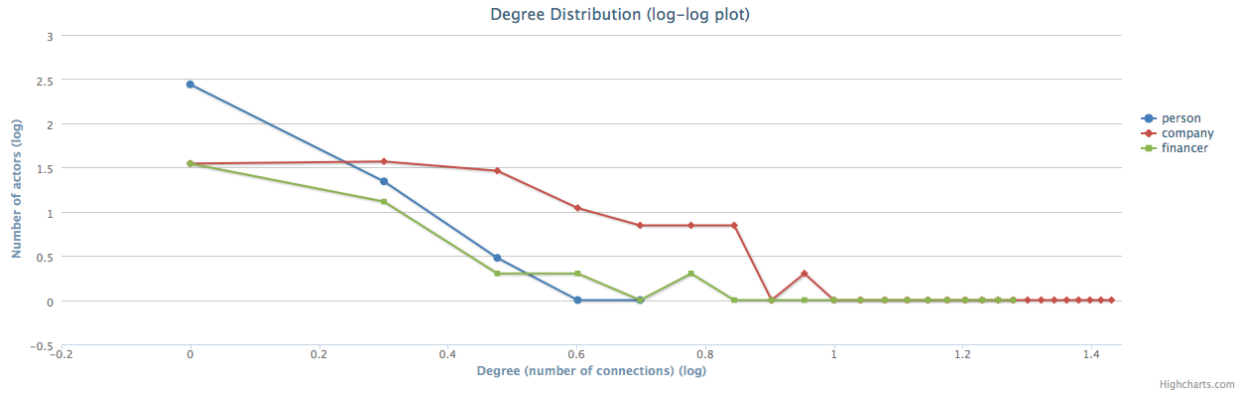

Figure 3. Degree distribution for different types of actors on a double-logarithmic scale (cf. Barabási and Bonabeau, 2003)

As a final step of the analysis, we look into the titles of the five individuals with outdegree value three, four or five - all possible candidates for business angels. The titles in Figure 4 are inflated according to the times their appear in the list of titles of business angel candidates: CEO appears four times, board member three times, and director, founder, CTO, and co-founder are all mentioned two times. A browser-based text visualization tool Wordle (http://www.wordle.net) was used to create the word cloud representing the titles of the top-outdegree individuals. The clouds give greater prominence to words that appear more frequently in the source text. McNaught and Lam (2010) for example demonstrated that Wordle can be used as a supplemental

research tool for preliminary analysis, quickly highlighting main differences and possible points of interest, and a validation tool to further confirm findings and interpretations of findings.

Figure 4 The titles of the individuals with an outdegree value of three, four or five

While the snapshot-based approach is able to reveal the macro-level structure of the ecosystem under investigation, it is not alone able to attach attention to small changes, possible weak signals emerging in the ecosystem. The results of the recent attention that the Finnish game industry has gained after Rovio Mobile (http://www.rovio.com) first publishing their popular puzzle video game Angry birds and receiving a major investment from an investor group led by Accel Partners in March 2011, soon followed by another investment from Accel Partners to another Finnish game developer Supercell can be pinpointed from the network but revealing such steps of development directly through the visualization insist on applying methods of time-varying network analysis (cf. Santoro et al., 2010; Molka-Danielsen et al., 2007).

5 Conclusions

On basis of discussions and informal interviews with actors that have an interest in catalyzing the development of the Finnish innovation ecosystem, we can conclude that by using social media data together with the method demonstrated in this paper we refer to as Ecosystem Network Analysis, we are able to support gaining insight on the co-creation patterns between both

individuals and investment organizations from the beginning of the venture to IPO or other liquidity event and beyond. With the help of the visualizations, the stories found through investigations may be shared with those that are interested in an intuitive manner.

As mentioned before, this study is primary demonstrating the potential of both social media data as the source of innovation ecosystem research as well as visual network-centric ecosystem analysis as a method. A very concrete example of the visualizations is the support they provide for validating the existing data in social media sources and, more importantly, the feedback mechanism they introduce for the actors in the startup industry helping to make their existence more visible in social media. We are, namely, sure that this kind of an approach is (to be) used in the evaluation of the development of innovation ecosystems as well as even in attempts trying to steer the startup ecosystems (cf. Liu, Slotine and Barabási, 2011).

6 Policy implications and directions for further research

In this article, we have used socially created data to reveal structures and patterning of the interplay of business angels, serial entrepreneurs and organizational investors in co-creation of the Finnish innovation ecosystem. At the same time, we acknowledge the fact that in Finland, governmental funding resources are available through Finnish National Technology Agency (Tekes), the Finnish Fund for Research and Development (Sitra), the Ministry of Trade and Industry and the TE (Labour and Economic Development) Centres, all of which have a major role in co-creating the Finnish innovation ecosystem, all with a global mindset. In the future, we are going to seek means to tap into additional data sources that help us to investigate their role in the Finnish innovation ecosystem funding and co-creation.

Further, we join with the wishes of open data enthusiasts to release more governmental data for analysis; we see this as an important catalyst for open innovation processes and the emergence of an even more active innovation ecosystem in Finland. Thus, more specifically, we suggest that actors such as New Factory (http://www.uusitehdas.fi/en), EIT ICT Labs (http://eit.ictlabs.eu) and others operating in Finland, Europe and around the world make their best to ensure their visibility in socially constructed data. As we have shown, social media data and, similarly, open linked data (http://linkeddata.org) promotes the visibility of early-phase startups.

In order to perform a more rigorous analysis of the influence of individuals in drawing the attention of organizational investors, for example, we do need to collect temporal data on the flow of investments and the mobility of individual people between companies. Additional future challenges rising from the results of this article include, for example, finding means to locate the origins of business angels and serial entrepreneurs: Do they come from large enterprises or startups that have completed a successful exit? Do the angels have some other common denominator; perhaps their education?

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