

SELF ORGANISATION AS A TOOL FOR DIAGNOSIS OF INNOVATIVE ECOSYSTEM

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ABSTRACT

Several studies have been conducted to identify innovative mechanisms for the successful development of various innovative regions. The scope of the current research is to shed light on this issue, taking into account the theory of self-organized systems and the principal properties of free-scale networks. Using Silicon Valley as an example, the author demonstrated the majority of self-organized systems, thus determining what traits, working principles and laws should be available for use in innovative system. **Self-organization** as a key characteristic of an innovation ecosystem coupled with prerequisites, supports the growth of Silicon Valley and would be recommended as a model to be utilised in countries and regions across the world.

Key-words: Innovative mechanisms; Self-organized systems; Innovative system.

1 INTRODUCTION

There is a current interest in innovation worldwide. Innovation has become a key advantage for countries, regions, and all type of companies. To facilitate the innovation development, governments, local authorities and executives of corporations try to stimulate innovation in products, process and in business itself to profit on it. In the effort to create and commercialize innovation, one of the approaches is to integrate and create links between science and businesses, by forming National (Regional, or Sectorial, etc.) Innovation Systems (NIS).

NIS functions include the following:

- development of special institutes, which provide regulatory functions;
- creation of innovative infrastructure;
- government work;
- coordinating educational and scientific activity by providing finance etc.

Usually state supports NIS by:

- preferential taxation
- direct financing
- allowance of loans
- creation of venture funds
- facilitating the process of the venture funds' creation etc.

Looking at the practice of stimulating innovation systems, government efforts occasionally lead to the consolidation of such systems, e. g. Finland and Israel. However, this is not always the case, e. g., Sophia Antipolis - France. In the case of Silicon Valley, however, the state didn't plan to create a NIS, or a RIS, but the system where innovation was naturally stimulated was nurtured and grew more steadily. Thus, there is no obvious single formula for building innovation systems, and is dependent upon the set of special conditions and prerequisites that allow innovation systems to work successfully.

So, the core idea of this paper could be stated as:

- whether NIS is the best mean for innovation development
- which stakeholders make a region innovative and attract new enterprises
- if NIS fails to stimulate the region's innovativeness, or if the state fails to create a NIS (RIS), despite other innovations being successful in a region, which principles and laws regulate the process of prosperous innovation development?

2 THEORETICAL FRAMEWORK

NIS is currently an effective method of research. While the debate over this topic appears to gain popularity, certain vital aspects of NIS are omitted. The research in the problem area was undertaken by separate scholars, but the term “NIS” was coined by Freeman (1987, p. 1), who defined it as “...the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies”. Consequently, experts on this issue, such as Lundvall (1992) and Metcalfe (1995), extended the term by the submission of more advanced definitions: “...the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state” (Lundvall, 1992, p. 2).

...that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies” (Metcalfe, 1995, p. 285).

Following on from the definition, both authors included in the definition the “use of new, and economically useful, knowledge... inside the borders of a nation state” (Lundvall, 1992, p. 2), giving more precise information about the government role to “form and implement policies to influence the innovation process” (Metcalfe, 1995, p. 285).

Previously, we considered theoretical aspects of NIS in Yakovleva (2009). Therefore, we now summarize them. Relating to the creation of NIS's **top-down** approach, used to form such a system: in our minds, this approach does not entirely satisfy the needs of all innovation system agents - it can not

consider in detail all aspects of element activity. To permit the innovation process in a country, region etc., we should alter the angle of approach a little.

Recently, the opposite approach, **bottom-up**, became wide-spread among practitioners. Innovation ecosystem, such as a resultant category of **bottom-up** approach is also widespread in innovating communities.

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

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

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

Another direction of research ecosystems in economy is presented by Briscoe and De Wilde (2009). Their field of study was digital ecosystems. Said authors define the term "**ecosystems**" as:

novel optimisation technique where the optimisation works at two levels: a first optimisation, migration of agents (representing services) which are distributed in a decentralised peer-to-peer network, operating continuously in time; this process feeds a second optimisation based on evolutionary computing that operates locally on single peers and is aimed at finding solutions to satisfy locally relevant constraints (p. 1).

A noteworthy approach to innovation ecosystem is proposed by the Japanese researchers Fukuda and Watanabe (2008), who considered innovation ecosystem at a macro-level. Figure 1 below shows a model for a national innovation ecosystem.

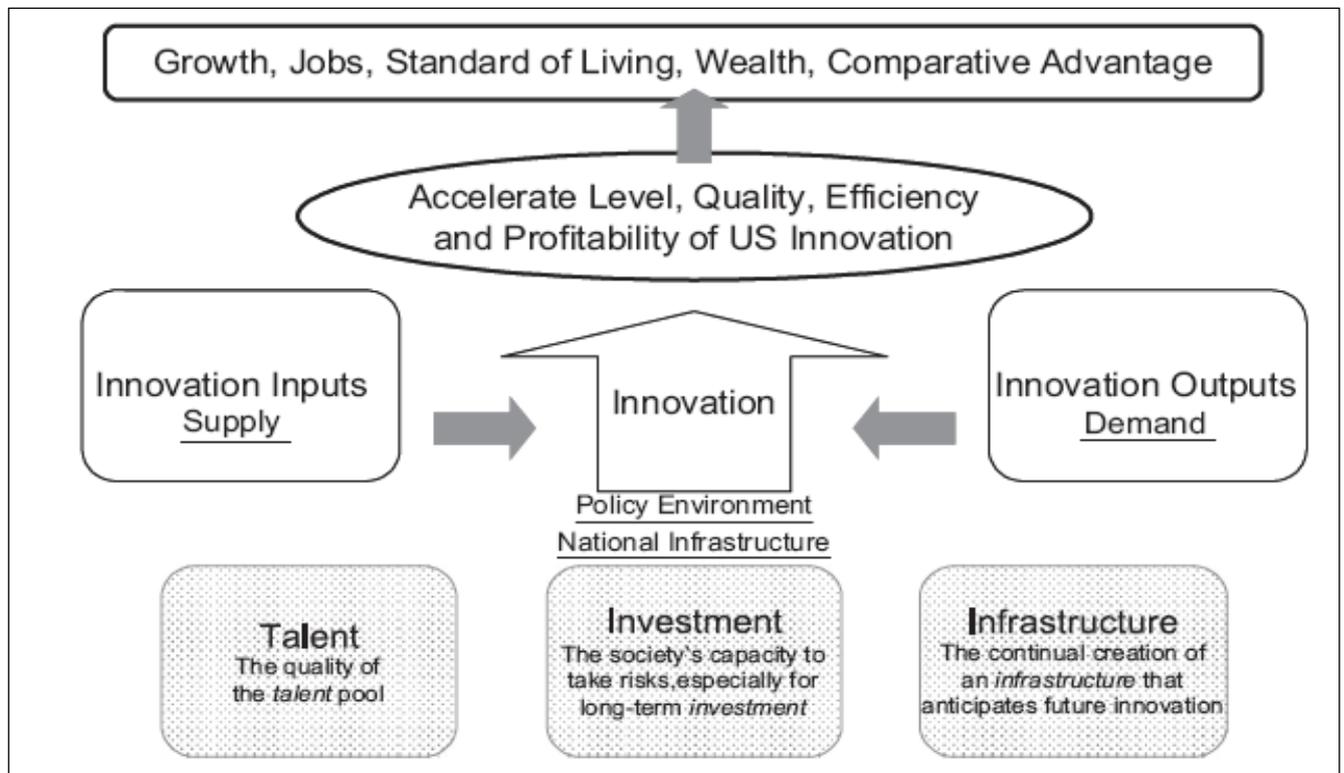


Figure 1 - Scheme of a National Innovation Ecosystem
Source: Fukuda e Watanabe (2008)

The last mention of category **innovation ecosystem** refers to companies such as Google (Google, 2010) and Microsoft (Microsoft, 2010). Both of them, being large agents of innovation network, are noteworthy examples of the development of innovation ecosystems, in and around their environment, and their products. However, this approach appears to be, at least theoretically, challenged by the following fact; it fails to distinguish the essence of natural ecosystems when compared to innovation ecosystems.

The issue in question is that topology of biological ecosystem, haven't got core element in trophic chain. There is a vast number of organisms, though few are key elements responsible for the changes (despite being few, they are not alone). Thus, it is wrongful to affirm that Google and Microsoft create their own ecosystems, and produce projects to expand them. Obviously, in this case

innovation ecosystem is considered a metaphor and has nothing to do with the theoretical research of what innovation ecosystem is.

In regards to Russian scholars, to summarize, the Russian scientific community does not concern itself with categorizing innovation ecosystem. This term is used by practitioners involved in the process of creating and transferring innovation to the market. The elements of innovation ecosystem, the emerging conditions and possibilities of innovation ecosystem are considered by Kopeykina (2008), Kritov (2008), Rodionov (2010). Said authors declare that the term **innovation ecosystem** relates to conditions and a set of elements, necessary to drive the mechanisms of the innovation process. However, their perspective is very limited in its nature, i.e. it only applies to the synthesis of professional knowledge and experience, which deal with the creation of start-ups and transfer innovation into practice.

Unfortunately, research in the category **innovation ecosystem** is neither analyzed nor discussed by the scientific community. Evolutionary approach is presented by Kudrin (1998) and his school of science. Kudrin worked out so called technetic approach, uniting dissipative systems, synergetics, fractality, self-organization, chaos, global evolutionism etc.

According to this approach, many scientific phenomena are considered as analogy of biological cenosis. Kudrin (1998) calls some technological objects (plants, fabrics etc.) as technical cenosis (technocenosis). His followers developed the idea of technological cenosis, consequently separating it into several spheres: business, linguistic, sociology etc (Fufaev, 2006).

Technocenosis is a complex of products and machinery of a certain workshop. Technocenosis involves identifying individuals who belong to a population. There are weak interconnections between the individuals in technocenosis.

One of the principal characteristics of such systems emergence is self-organization. It means, that there is no elements or subsystem which control others or no elements or subsystem which are controlled by other.

Notable is how the process of self-organization occurs. To begin, we shall shed light on the definition and its properties.

Self-organized system appears without any external pressure. Such a system can be stable during both short and/or long periods. The basic problems are the conditions which influence the change of the system's form; the elements in such systems organize themselves in evolving systems, which gain hierarchy of new properties.

Mechanism of self-organization consists of the following. Random or intended alterations can provoke self-organization, which permit a system to find new states. Said states are unstable, because of disturbances and make a system move towards new attractors (stance). Subsequent progress of the self-organized system can finally reach the optimum stance.

Self-organized system includes a list of features, characterizing such a system. Below, we present Table 1, including a list of said properties coupled with a short description.

#	Properties	Description
1	Autonomy	Absence of external control
2	Dynamics	Evolution and development during the time
3	Fluctuations	Search of the various parameters and noise
4	Symmetry emergence	Loosing of liberty and diversity appearance transition from chaos to order
5	Global order	Emergence from local interactions
6	Dispersion	Energy use/ non-equilibrium processes
7	Instability	Nonlinearity/self enforced effects
8	Several states of equilibrium	Various types/forms of attractors
9	Criticality	Edge effect/ Phase transition
10	System stability	Insensibility to the damages
11	Complexity	Simultaneous presence of various criteria and purposes
12	Self determination	Recovery/mechanisms of reproduction
13	Adaptibility	(functionality/ dependence on external changes)
14	Hierarchy	The many levels of self-organization
15	Fractality	A fractal is "a rough or fragmented geometric shape that can be split into parts, each of which is (at least approximately) a reduced-size copy of the whole," ¹ (a property called self-similarity).
16	Correlation	Emergence of interdependencies between the elements which were previously independent
17	Self motion of the system between attractors	
18	Evolution of the system in organizing form without any external influence	

Table 1 - Properties of self organized systems
Source: Heylighen (2001).

¹ Mandelbrot, B. B. (1982). *The fractal geometry of nature*. New York: W. H. Freeman.

A further significant characteristic of the self-organized system is the power law distribution. Using mathematics, it demonstrates the elements of the system according to the rate of definite indicated amount. Calculus is performed using the following formula:

$$N(s) = s^{-t}, \quad (1)$$

Where:

$N(s)$ = quantity of events of the amount s ,
 t = characteristic exponent.

The origins of self-organized systems are widely reviewed by Ball (2004), who presented a detailed survey of self-organization's history. His conclusions were based upon a thorough analysis of books and articles dedicated to politics, sociology and physics. The book provides a wide range of multidisciplinary studies, which, in turn, are vital for self-organization research. The history of the social physics and multidisciplinary studies give an account behind the reasons why laws of certain specific phenomena can be transmitted to various sciences, and why it helps to develop science as a whole.

One of the issues explored by Ball (2004) is the World Wide Web. Ball refers to deep analysis, which was carried out by Barabasi (2003). Barabasi considered the limitations concerning self-organization based on the example of a number of social links, the internet, protein chains in cells etc.

His research was undertaken through initiating a theory of mathematical graphs, declaring that not all graphics are random; he believes that there are many networks where new nodes do not join old nodes randomly. Barabasi established regularity of the nodes behavior. He revealed that, contingent upon stochastic motion of the nodes, the newest nodes cannot choose which nodes to join. If not, in certain networks, nodes prefer to join other nodes which have the largest quantity of links, called **hubs**. However the problem with such behavior is that new nodes will never excel **hubs** in quantity of links. In reality, Barabasi refuted this hypothesis, illustrating his argument over the internet. If we consider web site search engines, it is widely-known the original was AltaVista. Thus, if we imagine the topology of internet sites, it is clear that AltaVista became the hub among most web sites.

However, in 1998, Google was established: step by step it became the principal search engine on the internet. Consequently, the fact users consciously choose the best search engine denies the fact that the network is random. Google put its foot in the door and rapidly became successful. Google subsequently proceeded to topple the original search engine, AltaVista, which had previously been credited as the most popular. The results of Barabasi's investigation allowed him to introduce the term **free-scale network**. Its core characteristic was defined as self-organization. Moreover, free-scale networks are resistant and robust because hubs are connective elements. New nodes join such a network following two principals:

- joining the nodes having the highest number of links;
- joining the nodes which have **preferential attachment** (i.e. special property of the node which makes it more attractive to others).

The ideas of Barabasi (2003) were developed and applied by American sociologist Ferrary and Granovetter (2009), who discovered the innovation network of Silicon Valley as a network including definite hubs. Their role is played by venture capitalists; the most important participants of the innovation process. According to Ferrary and Granovetter (2009, p. 329), venture capitalists are “the source of robustness of the innovative complex network of Silicon Valley”.

Besides venture capitalists, innovation network of Silicon Valley may include other elements shown in Figure 2.

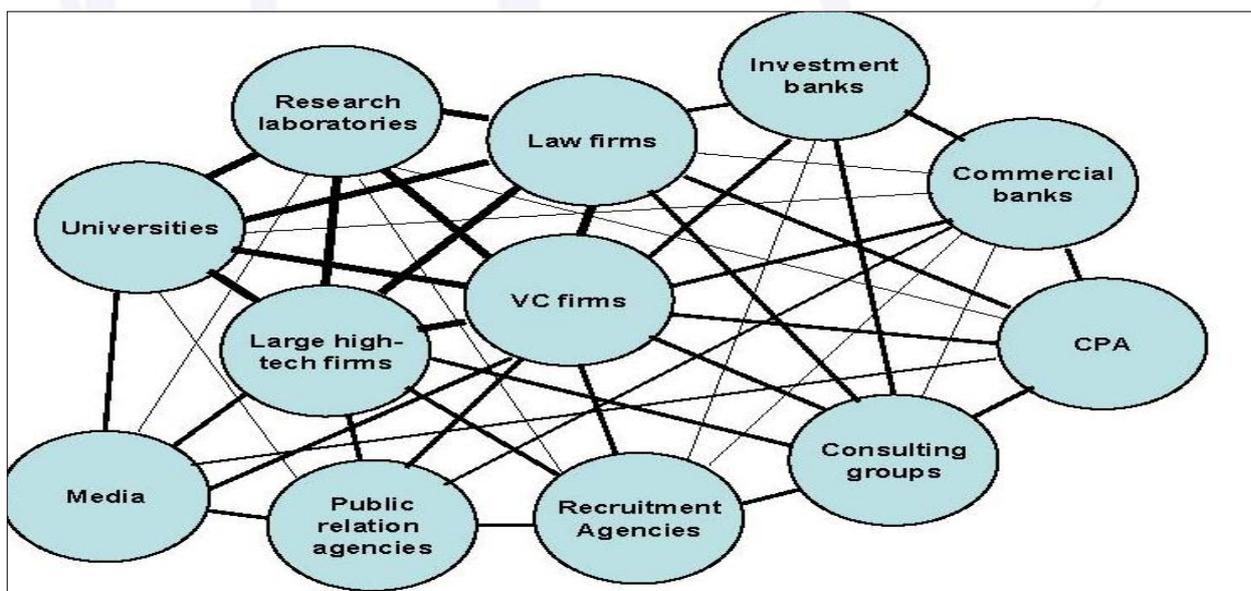


Figure 2 - Innovation Network of Silicon Valley
Source: Ferrary and Granovetter (2009)

In our opinion, this scheme can be used as a model of innovation ecosystem. However, we find it not wholly sufficient for the explanation of the Silicon Valley phenomena. We believe the aforementioned model must include two further elements:

1. Start-up – a company, resultant from the interactions between innovation network agents.
2. Consumer (as a wider sense) – end-user buyers, large corporations, startups. Nowadays, large corporations generally acquire small, innovative companies which present perspective technologies. In turn, startups provide goods and services from time to time, which can be consumed by end-user buyers, large corporations and by the startups themselves.

Having done the theoretical background survey, we can conclude, that theory of self-organized system has interdisciplinary character. That's why this scientific approach can be applied next to two aspects of innovation ecosystem study.

- Self-organized system properties are inherent to innovation ecosystems and can be revealed through innovation region analysis, where such systems can take place.
- Self-organized system properties can help identify such a system, but do not provide an understanding of an innovation ecosystem's presence. Hence, in our opinion, it is necessary to investigate a definite region and its innovation processes; only then is it possible to speak about innovation ecosystem in the studied region.

Further we will consider our assumptions (hypothesis) in case study.

3 CASE STUDY

To conduct a thorough investigation of the aforementioned issues, we chose Silicon Valley as the most innovative region in the world.

We initially provided correspondence between properties of self-organized systems and characteristics of Silicon Valley's innovation process. The characteristics and the financial data (capital investments) can be seen in Table 2 and Figure 3.

№	Property	Description of the property using Silicon Valley as an example
1	Evolution of the system in organizing form without any external influence	According to the history of Silicon Valley, the government's role is not so pivotal, the exemption is program SBIR (Small Business Innovation Research ²) and R&D in the military industry.
2	Self motion of the system between attractors	The system actors tend to move to new favorable conditions of the activity. Each of them and all together make a system to change its stances. In biology, development by the change of diversity of species provides attractors shift. By analogy, evolution of different kinds of activity let the system in a new stance.
3	Emergence of correlation in time and space between parameters, which were independent previously (correlation)	When the quantity of elements is increasing, there is an increase in quality interactions between them (if there is a necessity).
4	Absence of external control (autonomy)	The state doesn't control Silicon Valley's innovation activity. Interactions with authority occur in the form of taxation, company registration fees or in the court. Thus, the governmental influence is indirect. SBIR being an exception, the acquisition of land around Stanford University, program of purchasing innovation created in civil sector by the Ministry of Defence within the program "Commercials-off-the-shelf" ³ (COTS) ³ , presence of NASA in Santa Clara.
5	Dynamics (evolution and development during the time)	These properties belong to the majority of dynamic systems. There is hierarchy too - all system elements interconnect with each other tightly – by means of hubs and centralities.
6	Fluctuation (Search of the different parameters and noise)	
7	Hierarchy (many levels of self-organization)	
8	Symmetry emergence (transition from chaos to order)	At the definite moment, by the time when critical mass is reached, the growth of a system starts.
9	Global order (emergence from local interactions)	Silicon Valley emerged in this vein. Local interactions between Stanford University and Bay Area companies led to the creation of the Research park, which became a center seen as attractive to other scientists and entrepreneurs. Thus people and firms approached this region.
10	Dispersion (energy usage/ non-equilibrium processes)	Most natural and physical self-organized systems have this property, hence, we cannot consider this in respect of Silicon Valley's innovation ecosystem..
11	Instability (nonlinear/self enforced effects)	Perpetual internal development in the IT industry occurs due to permanent relocation of elements. It is dependent upon market conditions, business climate etc. allowing the work force to migrate to more perspective jobs. Occasionally, engineers become CTOs, even venture capitalists. IT industry directions die out and new ones take their place, due to new products and innovative technological ideas.
12	Several states of equilibrium (Various types/forms of	Different stages of the development region are defined by certain directions because of IT-industry activity. For example, the creation of

² www.sbir.ru

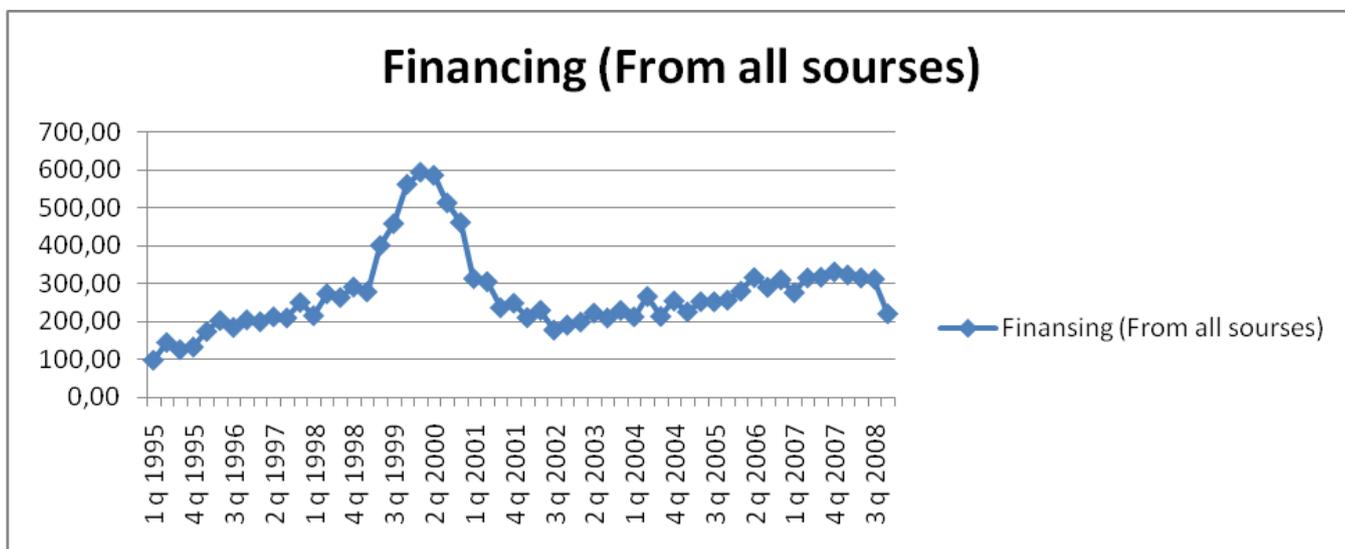
³ http://en.wikipedia.org/wiki/Commercial_off-the-shelf

	attractors)	computer chips, to a large extent ,provoked the emergence of many different companies and marked their modus operandi. The World Wide Web played a similar role in this process. Many new industries appeared because of this innovation; web-design, web-services, security, communications etc.
13	Criticality (edge effect/ Phase transition)	This property displays coupled with the change of other system characteristics. For example, it ensues when certain types of activity become less attractive and perspective or critical moments appear (the Internet Bubble or dotcom crash). Creation of radical innovations or exhaustion of existing technologies has the same change.
14	Redundancy Insensibility to damages	If an element dies out, the system will continue to function. A common situation in this line of work is that many innovative companies can fold on a frequent basis.. For example, traditionally venture capitalist's invest in a portfolio of projects; (s)he choose approximately fifty projects. Ten of which are invested, of which 7 of those fail, two reach breakeven point and one is very successful. Consequently, if the project fails, the team will seek another project; lost investment is compensated by consequent successful projects.
15	Self determination (Recovery/mechanisms of reproduction)	The best example was the crisis in 2001, or the so-called "Internet Bubble"; volume of financing was fastidiously shortened in 2001 (see Fig.2 "Financing in Silicon Valley"). It is possible to observe that shock was the cause of all elements in the system, i.e. it led to a lack of funds, many technical specialists remained without a job, companies closed etc. As a result, venture capitalists became more cautious when choosing projects. After the crisis the region revived and in this current period of uncertainty remains successful. Remarkably, it happened without any external intervention.
16	Adaptability (functionality/ dependence on external changes)	Independent adaptability to changing conditions of the external environment. For example, financing for venture investments come not only from successful projects, but from the economy too. Thus, if the flow of financing is exaggerated, less investment filters its way to the venture capital industry. It is not always a bad result; the strongest projects survive and their level increases. We would also like to mention that macroeconomic factors take place here.
17	Complexity (Simultaneous presence of different criteria and purposes)	Silicon Valley's stakeholders have various purposes relating to their existence. Sometimes these aims can be just the opposite (For example, venture capitalist prefer to change management of a company where the founder is CEO at the current moment. At the same time a founder would like to run a company in the future. Both of them have opposite interests). Their commonality manifests itself by being completely interdependent: if no financing is in place, the engineers cannot put the project into practice. And even in case the project is excellent, but venture capitalists refused in financing, there is rather small probability that the idea will be put in practice. Consequently, elements of the system can have completely separate criteria from their activity, but they seek for points of contact to coexist in equilibrium.
18	Fractality	Fractality function is undertaken by several elements or organizations, which have similar principles to that of Silicon Valley. If we take into consideration the connection between science and business and implemented this in this region, the stakeholders, who have similar functions, act as fractal units. For instance, commercial or university business incubators ("Plug&Play" presented the primary type of incubator, Stanford Business School, the second). Their activity is directed to provide a special service (consultancy, access to the internet etc.) for small companies, or their participation in special events primarily dedicated to initiating connections between start-ups and

 venture capital investors.

Table 2 - Properties of self-organized systems at Silicon Valley

Source: PricewaterhouseCoopers

Figure 3 -Capital Investments in Silicon Valley

Source: PricewaterhouseCoopers

Based on the correlation between the properties inherent in self-organized systems, we studied whether Silicon Valley, seen as the most innovative region in the world, can be defined as such a system. As we can see from Table 2, almost all of Silicon Valley's factors can be explained from the position of self-organization (15 of 18). Therefore, we can conclude that according to a quantitative description of the object, a hypothesis of whether Silicon Valley can be considered as a self-organized system is carried out.

In our mind, qualitative analysis is the flip side of the coin. As aforementioned, that one of principal mathematician characteristics of self organized system is power law distribution of definite property frequency display. The problem stems from how data should be recorded to evaluate and diagnose the law's presence. Concerning this, we would like to refer to two aforementioned scholars; Kudrin (1998) and Barabasi (2003). Kudrin (1998) discusses the power law distribution applied to the diversity of species, believing that individuals can be classified by the species initially, and ranked after that. This procedure answers the rate of diversity in definite biological or other type of cenosis.

Barabasi (2003) looks at two core points:

- the data related to connections between the elements

- the possibility of revealing and assessment the stakeholders with the largest quantity of connections.

As a result, the data obtained must be presented on the definite curve. The parameters of the formula, which describe this curve, can shed light on a number of issues. For example, Barabasi (2003), after conducting an abundant amount of research, declared that when indicator S in formula (1) belongs to the range $[2 < S < 3]$, the exponential growth of the system's elements begins. This output can illustrate one of the self-organized system properties: symmetry.

Symmetry emergence occurs when, at the definite moment, by the time of critical mass accumulation, the exponential growth of a system initiates. The description of this property strongly corresponds to Barabasi's statement. After the elements of the system (or nodes of a free-scale network, according to Barabasi, 2003) accrue sufficient connections, new elements will join the system at an exponential rate.

We believe the above-mentioned property is worthwhile - it concerns the combination of phenomena diagnosed in the creation of innovation regions. Naturally, this is not the sole indicator of innovation ecosystem in a definite region of the world. Previously, we had undertaken research of factors or conditions which make Silicon Valley so attractive to people and to venture capital. Above all, these factors can be considered necessary prerequisites for the emergence of innovation ecosystem. We interviewed residents of Silicon Valley, asking various questions (see Appendix 1). As a result we noted several conditions that nearly all the interviewees mentioned. In Yakovleva (2009-1) we have already extensively discussed these conditions. We classified the factors into two groups: basic and additional conditions. These factors are again presented in Table 3 - they are essential for the current research.

Basic conditions	Additional conditions
Venture industry and all innovation network participants : - Large Universities - Venture capitalists - highly educated workforce etc.	Cultural aspects: - people diversity - multicultural - possibility of interesting leisure - liberal lifestyle - professional communities, networking
Infrastructure (physical and human)	Climate
-	Geographic location
Time	
Vicinity of all innovation network participants	Small business support
Entrepreneurship:	Large corporations

- environment, climate, culture, attitude to companies failure	
The system of material incentives for workers	World center of Product Management
Critical mass of talented people	Authority in the world
“Success stories”	
Market demand	
Concentration on the advantages	
Low and taxation	
Free entrepreneurship and low state financial help	

Table 3 - Basic and additional conditions for the emergence of innovation ecosystem

Source: Yakovleva (2010)

To conclude this study, we would like to define the possible directions of self-organization application. Hence, we present our findings below.

4 RESULTS AND CONCLUSIONS

The beginning of this study defined various hypothesis relating to self-organization, the impossibility of NIS to satisfy the needs of all the system elements. As an alternative, we mentioned innovation ecosystem as a bottom-up organized system, whose principal feature is self-organization. Therefore, we conclude self-organization as a key feature, and can be utilized as follows:

1. We established the properties inherent in self-organized systems. By describing these characteristics using the example of Silicon Valley, we can assert that if these properties correspond to a definite region, it is possible that self-organized system's can emerge. Within the framework of this article self-organized system is oriented towards innovation process. In this case we can make a mention of innovation ecosystem – a category which is defined by a self-organized system, where due to interaction between its elements directed to exchange of information, financial and other kinds of resources the aim of creation and commercialization of innovations and also sustainable development of present system is attained.
2. Besides the presence of properties defining self-organized systems, there are certain core factors which allow a region to be an innovative ecosystem. These factors were divided into two groups: basic and additional conditions. Moreover, it must not be forgotten the fact that ecosystem is characterized by its connections. Therefore, there must not only exist all the necessary elements

in the system, but they must also be connected among themselves. By accumulating a critical mass of the connections, the exponential growth of the elements in the system begins.

3. Studying the laws of self-organization and revealing a list of the conditions required for such system emergence, can help to decide such a problem as the possibility of diagnosis, and possible creation of innovation ecosystem in a definite region of the world. The process of allowing the growth of innovation ecosystem includes the choice of two alternatives:
4. expecting the moment when the conditions form and emerge;
5. facilitation of the conditions' creation.
6. The presence of special conditions, and what that brings to the emergence of an innovation ecosystem. This system permits the venture capital industry to grow: merge all the necessary elements; Universities, venture capitalists, service providers, HR agencies, consulting companies, media, research laboratories, start-ups etc. These interconnections empower the venture capital industry to function as an assembly line. In turn, it creates perpetual demand for innovations, and consequently, the will to commercialize innovation.

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AUTO-ORGANIZAÇÃO COMO FERRAMENTA PARA DIAGNOSE EM ECOSISTEMAS INOVADORES

RESUMO

Vários estudos tem sido realizados para identificar mecanismos inovadores de desenvolvimento com êxito de diferentes regiões inovadoras. O objetivo da presente pesquisa é dar contribuições ao entendimento deste problema considerando a teoria da auto-organização de sistemas e as principais propriedades de redes livres. Usando o exemplo do Silicon Valley (USA), pode-se estudá-lo como um sistema auto-organizado, e assim determinar que peculiaridades, princípios de funcionamento e leis deveriam estar disponíveis para uso em ecossistemas inovadores. A auto-organização como característica principal de ecossistemas inovadores junto com os pré-requisitos para a inovação suporta o crescimento do Silicon Valley e poderia ser recomendado como um arquétipo para ser usado em diferentes países e regiões do mundo.

Palavras chave: Mecanismos inovadores; Auto-organização de sistemas; Ecossistemas inovadores.

Data do recebimento do artigo: 15/07/2010

Data do aceite de publicação: 25/09/2010