



## Household as a Participant of an Innovation Ecosystem

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### ABSTRACT

The article shows the results of the investigation in which a household is described as a participant of an ecosystem. A household has appropriate properties that can be considered from both biological and economic point of view. The importance of raising children as future innovators using the techniques of psycho-diagnostics and the abilities of combinatorial economics is demonstrated in the paper. Besides, a hypothesis is provided about the necessity of wider application of analogies with ecology to develop the theory of innovation risks in a household. Household is shown as an ecosystem in which the change of one component condition causes the change in the condition of the other. Analysis of a household as an ecosystem has been insufficiently investigated yet. Its social, economic and environmental components have not been clearly defined and are considerable opportunity for studying using the system approach and the impact on the surrounding society.

**Keywords:** Family Household, Ecosystem, Innovation Ecosystem, Social-ecosystems, Analogy, Risks

**JEL Classifications:** R20, R29, Q16, Q56

### 1. INTRODUCTION

Scholars as well as practitioners have been increasingly illustrating the importance of the innovation ecosystem (IE) metaphor to explain co-evolution and co-specialization (Christensen and Rosenbloom, 1995; Pierce, 2009), value of co-creation and acquisition (Adner and Kapoor, 2010), cooperation and competition between firms (Iansiti and Levien, 2004).

In academic literature, competition in the era of information economy is described as the competition between ecosystems (Moore, 1993), where the participation in an ecosystem is an important way to gain a competitive advantage for each participant and to innovate cooperatively.

Particular interest while presenting the IE is shown to the role of the “ecosystem orchestrator” (Roiykkers et al., 2013) which

plays a key role in the success of ecosystems, participants and firms innovation outcomes interdependency (Adner and Kapoor, 2010) and the role of users in the innovation processes (Lüthje, 2003; Shah and Tripsas 2007).

This paper emphasizes a household role, and its risk through the IE lenses. We pioneer an idea that households can be studied using the laws of economy and ecology. The paper includes the literature review and authors’ opinion supporting this point of view. This review describes the ecosystem structure, highlights the development of the theoretical background of the households structure. Then we describe the financial resources of households and their innovation activities. Later on we give our vision of a household as an IE and explain interconnection between ecosystem, socio-ecosystem and household risks. The paper ends with the further development of the theory of environmental risks and conclusion.

## 2. LITERATURE REVIEW

The term “Ecosystem” introduced into science by the ecologist Tansley in 1935, is a combination of the words “eco” and “system” (Tansley, 1935).

It showed a functional unity of living organisms and their habitats. From biological point of view an ecosystem is considered as organisms interacting with one another and with their environment within a defined area or volume (Miller and Spoolman, 2009). Additionally, development of scientific cooperation processes resulted in the application of ecological analogies and their using perspectives in the literature on management and governance (Hannan and Freeman, 1977; Lewin, 1999). Due to the Darwin’s theory of evolution (Darwin, 1871), biology and economics started to merge and develop together.

Problems of evolutionary economics have been studied by various authors. In Russia, the works of Rothschild, who formulated the basic principles of a new science - Bionomics, were widely known Rothschild (1990). This author measures the efficiency of ecosystems by their survival and states that quite an important distinction between natural and business ecosystems is the rate of changes, which is much faster within economic changes.

Among the scientists investigating the problems of biology and economics on the national level are Jackson, 2012; Yawson, 2009; Metcalfe and Ramlogan, 2008.

Some authors explained that business ecosystems were functioning due to the efficiency and flexibility of the whole system (Iansiti and Levien, 2004; Moore, 1993). IEs are well illustrated through the empirical research of the semi-conductor lithography in the work of Adner and Kapoor (2010). Moreover, the ecosystem technology terminology is associated with the industrial ecosystem introduced by Gawer and Cusumano (2002); Gawer (2009).

While developing the traditional economics, usually took analogies from physics which resulted in creation of econophysics (Mantegna and Stanley, 2000). Many scientists believe in biological approaches as more promising while integrating into the economy. Thus, A. Marshall pointed out that economic biology is more important for an economist than economic mechanics. According to him, biology, unlike physics, allows study economics in a more original perspective, thus generating a more accurate picture of the economic reality and revealing its new unique specificity (Marshall, 2009).

As for households, the general issues of their functioning were investigated by Nerlove (1974), Manser and Brown (1980), Pollak (1985), Thomas (1990). The issues of the household financial management were studied by different scientists (Neary and Roberts, 1980; Bourguignon and Chiappori, 1992).

## 3. METHODOLOGY

To investigate the studied issue more comprehensively, we conducted qualitative research, using a grounded theory method,

we are trying to analyze theoretically the available data about household activities, resources, risks etc. We used the data obtained by experts in different fields, information from theoretical literature and observations of households’ daily life.

The financial resources of households and their innovation activities.

Extensive economic relations of households with the state and the corporate sector, as well as the availability of the budget show the need for specific strategies for forming and using financial resources of these important ecosystems. In Russia these strategies are in most cases characterized by primitivism or non-existence due to low income of many households, nevertheless hazards and risks always accompany them during their operations.

The financial base of the population is significantly affected by the growth of cash income (Table 1).

Financial base of the population is considerably influenced by the increase of monetary income. Between 2008 and 2014 it increased by as much as 8.1%. It is specific that during that period the share of income from entrepreneurial activity decreased from 10.2% to 7.6%, due to low business activity of Russian households.

However, this activity does not apply to the innovation sector. Unfortunately, there is no official statistics about innovations of households (only statistics about companies is available), but we can judge about it by indirect indicators. Thus, the share of small enterprises engaged in technological innovations is about 5% out of their total number in Russia. The share of innovative products and services in the total volume of goods forwarded, work performed and services rendered by small enterprises is about 1.5%. Statistics of individual enterprises in terms of innovation activity has not been kept at all; therefore one can assume that this is because of its small volume.

Due to the increasing role of households in the formation of the financial base of Russia, government and other interested parties should take all measures to reduce the hazards and risks for this important category of market economy functioning. Unfortunately, there are some problems in this area, one of which is the lack of mechanisms to allow households manage risks. This is especially true for innovation risks, which are exacerbated by shortages of scientific research related to such management. Even the category “risk” still remains a sphere of continuing debate in Russia.

**Table 1: Structure of the Russian population income (Rosstat, 2014)**

Year	Total population income in %	Including		
		Wage, including black wage	Income from entrepreneurial activity	State social transfers
2008	100.0	58.4	10.2	13.2
2012	100.0	65.1	9.4	18.4
2014	100.0	66.5	7.6	18.3

We assume that in order to boost the growth of households, it is necessary to research them through an ecosystem lenses. However, households as ecosystems have been considered so far in Russian and foreign literature only fragmentarily.

#### 4. HOUSEHOLD AS AN IE

As households have been considered neither as an ecosystem, nor as an IE in the Russian economic literature, we confine ourselves only to the most vague issues.

Households have many characteristics of ecosystems. First of all, in contrast to depersonalized firms, they are actually biological objects. Like any highly developed organisms, they have lifecycle, starting from birth, then growth, maturity and death. Similar cycles are common in all businesses, products and industries. Households as ecosystems have homeostasis, they are able to minimize the external effects, while maintaining the internal balance. This is partially due to risk management. It is known that the stability of an ecosystem is higher if its size is bigger and its population and species composition is richer and more diverse. This position is fully applicable to households. Households, as well as many living organisms compete for resources; they evolve through adaptation to external conditions.

So from the biological point of view, a household is an organism, but from the economic point of view it is a nanoscale organization. These two concepts can be regarded as a bio-economic pair. According to the general systems theory of L. Von Bertalanffy (1968), a household as an ecosystem is self-organizing, self-regulating and self-developing open system. Therefore, it is described as input and output streams of resources, energy and information (Bertalanffy, 1968).

The following circumstance should be also mentioned. In addition to competition, households realize visible cooperation. The author of the biological evolution theory Darwin underlined "... for those communities, which included the greatest number of the most sympathetic members, would flourish best and rear the greatest number of offspring" (Darwin, 2004).

Russian scientists have not considered a household as an IE. Moreover, Russian academics don't keep to a uniform understanding of the concept "IE." Some researchers consider it as a collection of conditions providing successful creation and development of enterprises (corporations). Others consider such a system on higher levels - regional and national (state level). Those understandings define a list of subjects and functions performed by IE. We believe that IE includes not only these three levels, but also a cross-country level, which is associated with the processes of globalization of the world economy; and the level of households. The latter is a part of innovation community and can do business (mainly the level of small enterprises), or can limit themselves only with routine activities, which, however, assume extensive economic, financial and other relationships both internally and with external world.

Thus, we cannot exclude households (the primary element of the ecosystem) from the number of actors involved in the innovation

process, for example scientists, innovation managers, investors, inventors, entrepreneurs engaged in the commercialization of innovations and other persons named as "stakeholders" by Freeman (1984).

These are households where talents and the most important elements of human capital are formed. Finally, households are consumers of innovative products and services. We should also state that both businesses and governments are derived from the households, because they consist of individuals (or groups of people). These are people as members of households who are the main drivers of innovation processes.

Innovation activities of households as firms of the innovation sphere and as consumers of innovative products, including intangible products (ideas or other information), are not interesting for our statement, since these issues have been adequately studied in science. It is more important to show the role of a traditional households at one of the most important stages of socialization, which is the process of forming a personality, training and mastering by individuals the values, norms, attitudes and behavior inherent to the whole society and in particular to a certain family. This is where the importance of households is demonstrated. They can and should prepare children, as a part of their outputs, to be innovatively thinking individuals.

It is referred to the idea of the necessity for households to create an appropriate internal environment that will be the basis for the development of the future innovator at the before - working stage of socialization, covering the time since a child's birth till he/she enters school and then university. In this case, some scientific adjustments should be made in the structure of the scientific IE, which is usually represented by four components: (a) An idea; (b) an experience of innovative entrepreneurship; (c) sources of financing; (d) a community that is able to unite the actors of the market in a single unit, including early training the basics of innovations.

While planning the training, a household should not run to extremes, because not every child has ability to be an entrepreneur. It is therefore important to perform psycho-diagnostics at the early stage based on special psychological tests to reveal the potential professional interests of a child.

However, it will be useful for each child to obtain knowledge, which develops his/her intellectual, sensory and creative abilities. Parents and teachers set a goal to help the child in the transition from a non-reflexive to the conscious mastering of a sequence of mental operations that make up the intellectual process. We are talking about the formation of combinatorial abilities of children, as a condition for their logical and creative thinking development.

There is a sufficient number of techniques for psycho-diagnostics and for developing combinatorial abilities of children in Russia. However, not every household has the ability to pay for the services of highly qualified teachers, and/or to let a child attend elite kindergartens, where modern techniques for psycho-diagnostics

as well as for developing the younger generation are used. So it is very important to form a financial base for both a household and for its members development, including children, adolescents, young adults and university students.

## 5. ECOSYSTEM, SOCIO-ECOSYSTEM AND HOUSEHOLDS RISKS

Households (families) risks and methods of their management (personal risk management) were studied by a great number of scientists from different countries. There are well-established risk management tools, which are not used in Russia due to an almost general lack of the securities market, designed for individuals, as well as due to a huge number of poverty-stricken people. Russians, who have available cash resources, prefer to keep them on deposit accounts in a bank, as the Russian citizens' deposits are subject to guarantee repayment of 1,400 thousand rubles according to compulsory insurance.

Deposits of the population of Russia are demonstrated in Table 2.

As it is shown in Table 2, considering the fact that the average size of a bank deposit (July 01, 2014) is 104 thousand rubles and the average interest rate is 7.6% (Deposit Insurance Agency, 2014), the market seems not to have any changes in the near future.

A rigorous literature review has shown that scientists do not investigate the risks of households as ecosystems; they do not use the analogies of biological science in the economy applying to households. Diverse financial instruments are described and offered to allow households not only survive, but also prosper. In any case, they give a possibility to households to maintain their monetary system on an acceptable level. Insurance, deposits, bonds and other capital market instruments are used, as well as numerous companies managing finances or giving advices how to operate in the market are involved. There are many forms of supporting innovation activities of households' members. But the ecosystem is not visible! Biological objects, even the most reasonable ones, like dolphin communities, having a distinct intellect, or like anthills undoubtedly effectively running a joint household, do not act within the laws inherent to the human community. It's the law of supply and demand, the law of diminishing returns, which are not applied in the animal kingdom. Of course, it would be interesting to create a symbiosis of economics and biology and apply the analogies of economic laws, let's say, to the animal world. However, they will not be able to understand and to apply the principles of the science in their life due to the lack of the necessary intelligence.

**Table 2: Citizens' deposits in Russian banks, million rubles (Bank of Russia, 2015)**

Year	Total	Including deposits	
		In rubles	In foreign currency
01.01.2012	118,534.89	969,064.0	216,284.9
01.01.2013	142,225.51	117,431.46	247,940.5
01.01.2014	169,383.61	139,852.38	295,312.3
01.01.2015	186,830.77	136,990.86	498,399.1

Our next hypothesis is opposite to the traditional views, but gives an answer to the question "why scientists do not investigate the risks of households as ecosystems?" Despite a large number of analogies inherent in biology (ecology is a part of it), and in economy, almost all of them relate to the catastrophic environmental impact and only partly to biological consequences (such as the onset of the Ice Age). Of course, catastrophe theory is widely used in economics, and in finance, but it is poorly applicable on the nano-level (the household level). In any case, we have not found any publications on this subject online. Therefore, considering the economy and households as ecosystems is an extremely extensive process, simplifying the reality, which does not allow apply the knowledge gained through scientific analogies in the "economy-ecology" to the fullest extent in practice. It's especially true for innovations and inherent risks where the factor of intelligence is extremely high and analogies of wildlife cannot be properly applied.

As a reflection and support of our hypothesis we can mention the appearance of science that studies social-ecological systems (SES) (Berkes et al., 2000; Renaud, 2013). SES is a "bound system of man and nature, which is a complex adaptive system, including the environmental and social components that actively interact through various feedbacks" (Boyd and Folke, 2012).

In our opinion, the subject of the science that studies the SES is much closer to human perception of the world, especially the economy, than the theory of ecosystems. SES as a more specific part of the theory of ecosystems is capable for reflecting more accurately the processes in the economy of households and in their risks management. However, to be absolutely correct, the term "social" in science characterizes living organisms in relation to the population of humans and other animals. It describes some interaction of one organism with another, whether voluntary or involuntary. It is quite possible that the name of this science should be corrected from SES to "human-ecological systems" (HES).

## 6. RESULTS

The issues of households risk management through the lenses of ecosystems are not investigated in Russia. However, it is also relevant to other actors of the market and the whole national ecosystem. These issues are addressed only in the framework of such science as "economics" (and its numerous branches), and the prefix "ecosystem" is only a tribute to the existing scientific tradition.

The objective of our research is not to identify all ecological hazards that can be applied to the economy in the form of analogies, that is the task of biologists and, specifically, ecologists. However, one type of risks is directly applicable to the subject of our study. These are the risks associated with the formation and development of the younger generation. Of course, we are not able to find the absolute analogies in this area. Especially since analogies do not require a complete accordance and this fact allows apply them in the fields where the level of knowledge is insufficient. If such analogies existed, then any two sciences would unavoidably merge into one.

Groups of animals living collectively, in particular, most primates not only thoroughly protect their pups, but also educate them. This is a very complex instinct that helps not only to maintain but also to increase offspring. This instinct of gregarious animals, as a special type of altruism extends beyond the family, covering the whole herd, as the lack of the sense of mutual assistance from members of the community results in the rapid extinction of the herd. Considering predators that exterminate the herd, there is a risk of extinction that can be reduced by unlimited fertility. However, it is not possible due to scarce resources. Thereby, well “educated” cubs often protect their parents, although in most cases they become estranged from their parents, but they do not consider them as their enemies.

Something similar occurs in a family and a household. The head of the family, “ecosystem orchestrator” forming the ecosystem (Roijackers et al., 2013), prefers to have an unlimited number of children. Some of them, as he would like, would be major innovative entrepreneurs, earning abundant revenues for the family. Others would become well-known musicians, doctors, teachers, etc. However, the extents of families are limited, and the growing number of children results in other than concentration risks.

There are cases in a family and in a household, when parents dream that their child grew up, got education and became a major innovator, protecting the family financially. Parents used all possible measures at the pre-work stage (see above) to make their dream come true. However, a child after finishing school and then graduating from a technological university suddenly decides to choose profession that doesn’t bring high income (school teacher, etc.). This family tragedy in economic essence is an accomplished risk of parental goals’ failure, the goals that they defined at the pre-work stage. This risk may be valued in monetary terms and can be attributed to innovative risk (its humanitarian component).

It is in this way, through the biological, ecological analogies, that it is necessary to develop the theory of households’ risk in relation to the ecosystem. This does not deny, but amplifies traditional approaches to the risks undertaken in the frameworks of economic sciences.

## 7. CONCLUSIONS

The study shows the importance of the “ecosystem” concept introduction to theory and practice. This is especially true for the issues of economic development, using analogies of ecology as a part of biology. The importance of studying innovations not only on the level of the state, regions, firms, but also on the global, as well as on the household level (nano-level) has been shown. It is on this level, where citizens who are able to think entrepreneurially are developing. So the activities for early learning the basics of innovations are necessary.

Based on the statistical data we have shown that the income of Russian households is growing steadily, but innovative mechanism does not work on this level. One reason is the existence of a

tradition to invest available cash resources only into bank deposits, ignoring the stock market and investment innovations.

There are a lot of methods to improve and change the situation. The authors argue that the innovation process begins at the humanitarian phase, at the pre-work stage of socialization. Therefore it is extremely important to perform early children psycho-diagnostics to identify their potential labor preferences, as well as to develop combinatorial abilities.

We have proposed to revise the name of the science that studies ecosystems and apply the theory of SES or even HES.

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