Sustainable Future: Building on the Study of Natural Systems[1]

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Introduction

In the past years Sustainable Development has become the primary goal of the developed countries. On the one hand, the dominant socio-economic sustainability remains questionable in many ways, on the other hand, the natural ecosystems demonstrated their sustainability with their long history. Although both systems exhibit examples of competition and cooperation, social systems may have much to learn from natural systems. During my research I will attempt to identify characteristics that can ensure long-term sustainability of natural systems and communities.

Within the alternative economic science, *Bionomics* is based on the careful study of the laws of natural systems aiming to support their survival. The word still pops up from time to time, but this interpretation is not yet widespread. Modern trends of ecological economics, the Blue Economy and CSR (Corporate Social Responsibility) are considered related theories. (Capra–Pauli 1995; Burt 1992; Bell–Morse 2008).

To reach the goal of a "new economy" we should change the pillars of "economism" with "state of the art" values: 1. equilibrium despite growth; 2. cooperation despite competition; 3. potentiality despite effectivity (Pál–Tóth 2009).

1. Goals and objectives

Within my research I am revising the current adjudication of *competition.* Competition is *"the activity or condition of striving to gain or win something by defeating or establishing superiority over others".* Public surveys say, that " 74% of EU citizens consider competition has positive impact on them". On the other hand, we should accept that: *cooperation* is a basic pillar of the formation of life, the process of evolution and long-term development.

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My aim is to work out a more precise model and find the right balance between the two phenomena. My hypothesis is that the right – sustainable – level of cooperation can be identified from natural systems by analysing different organisational levels, different species and cooperation strategies.

2. Understanding the evolution of cooperation

From the past to present, the evolution of cooperation can be found in the literature. Scientific examination of *natural systems* and the levels of cooperation significantly determined the development of the evolution theory in the past years. It is a shocking fact that 99% of ever existed 150 million species are now extinct. Among the successful strategies, cooperation is present and underlines the importance of social values (Hamilton 1964).

Charles Darwin's work *On the Origin of Species*… explains that organisms form groups in which individuals act for the "common good" (Darwin 1859). It seems odd that fitness is defined as a key to survival of the individual. The book itself has come up with some explanation: natural selection is motivated by altruistic behaviour among the relatives of the family since in that case, the reproductive capacity increases (Gaston 1978).

The "selfish gene" evolution theory of Richard Dawkins is well known: to preserve and reproduce the selfish molecules can be considered "survival machines" (Dawkins 1989). On the other hand, multilevel selection theory (group selection) is outlined, i.e. the unit of selection is not possible for each gene; and also not possible for a community of genes (cells), a community of cells (animals), a community of individuals (population), and a group of populations (metapopulation) or even entire communities (ecosystems) (Wilson 2002; Krause–Ruxton 2002).

In the field of *economics,* the basics of the evolutionary approach has been defined by Adam Smith (1723–1790) some 80 years before the appearance of Darwin's major work (Smith 1863). The famous "invisible hand" principle ensures that if everyone acts in its own interests it also serves the common good. Cooperation between companies is created for many reasons: long-term cooperation aims profit maximisation, cost efficiency, or resource efficiency. On the other hand, competition potential is one of the key elements of business strategies. Which strategy is the most effective and which is sustainable in the long run? Qualitative and quantitative analysis of both systems will follow, since the evolution of economic actors is still ongoing (Pennisi 2005).

The appearance of cooperation exists in both fields, now let us understand how can we approach the two systems.

3. The identification of units for the research

To make this happen, as a first step I took literature review and summarised the basic elements of ecology to identify the appropriate units to be able to compare the two systems. From the literature I summarised the organisational levels where cooperation and competition can be identified. Cooperation can be found at all levels of biological organisms: genes

cooperate in genomes, organelles cooperate to form eukaryotic cells, cells cooperate to make multicellular organisms, bacterial parasites cooperate to overcome host defences, animals breed cooperatively, and humans and insects cooperate to build societies (Csányi 1999; West–Griffin–Gardner 2007). My visual interpretation of the ecological units is summarised in Figure 1. On the figure we can substitute the existence of cooperation below and above the individual level.

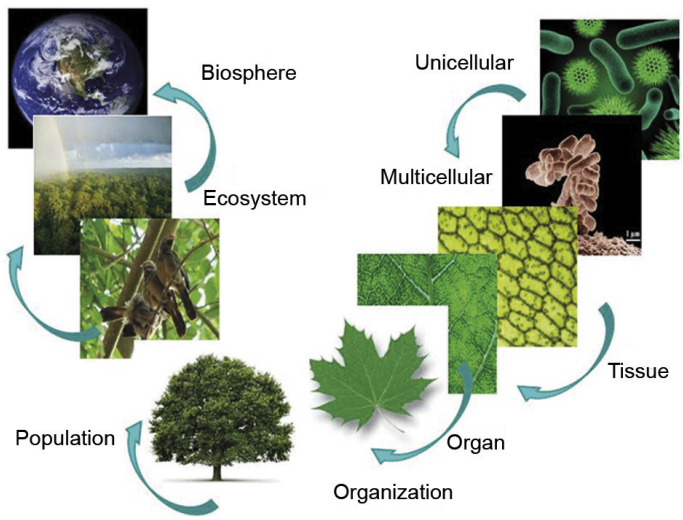

Figure 1.
Cooperation levels of ecology

Source: Szűcs 2014

Using the patterns of the natural system I am aiming to work out and develop a method to analyse present and future sustainability of companies, by observing their attitude regarding cooperation. In order to reach this goal, I outlined the same units in the economic field, to be able to compare the levels of the two systems. My visual interpretation of the economic units is summarised in Figure 2.

Using the same number of elements in the two figures, we can easily find that the unit of "organisation" – level 5 – is the most suitable to compare the two systems. Since I arrived at this result I am currently listing different cooperation strategies of different species from the literature review of ethology. Individuals in many animal species are strongly motivated to form close social bonds and to attend to the social interactions of others (Dugatkin 1997; Török 2009). Each animal – including humans – that cooperates have their limit regarding the group sizes (Dunbar 1992; Reiczigel et al. 2008). In some cases cooperation is relevant in other cases competition and aggression helps to reach the goal of equilibrium (Lorenz 1963). Overall, I listed in the table below the literature results from the field of ethology that summarises the possible elements; these should be considered possible factors for the research.

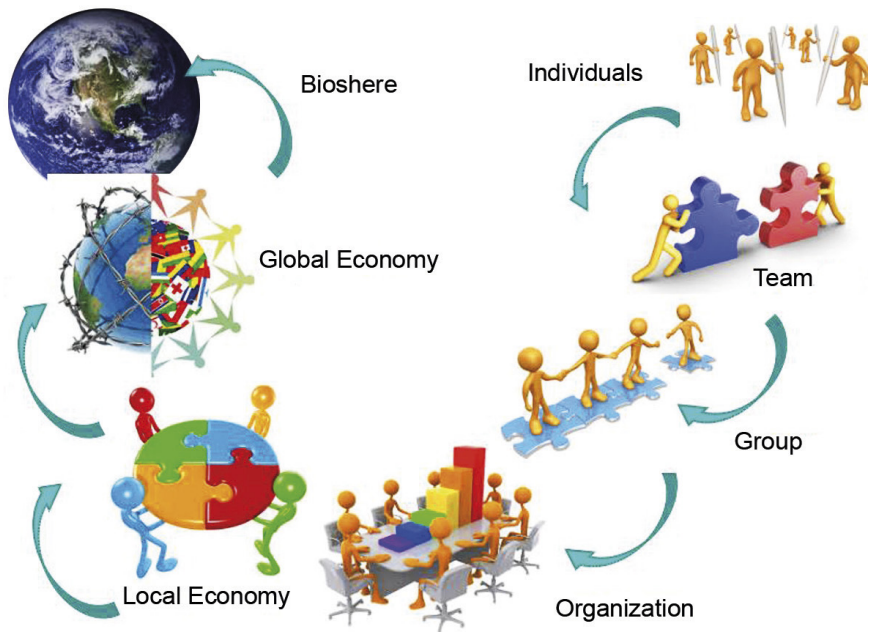

Figure 2.
Cooperation levels of economy

Source: SZŰCS 2014

Table 1.
Possible factors determining cooperative behaviour

Cooperation	Competition
resources – food (1) protection from predators (2) protection of resources (3) brood nursing (4) food sharing (5) giving help (6) altruism (7)	resources – food territory female

Source: Compiled by the author.

As next steps of the research, I have evaluated the results of available domestic and international research in the field of behavioural biology for secondary data. I have rated the

species below (Table 2). These characteristics are to be used as a benchmark to search economic analogies in a later study.

The cooperation factors are listed in Table 1.

Table 2.
Cooperation factors of animal groups

Phylium	Highest levels of cooperation factors	Species	Listed cooperation factors (Table 1)	Group size (dependent on resources)
Anthropoda	Eusociality	Hymenoptera, Apoidea, Isoptera, Vespoidea	1–8	1,000+
Ungulata	Living in group without giving help	Equus, Bison	1, 2, 3, 4	30–40
Aves	Living in group, brood nursing	Aptenodytes patagonicus, Ploceus cucullatus, Malurus melanocephalus, Manorina melanocephala	1, 2, 3, 4	10–1,000
Primates	Food sharing, giving help	Hominidae, Bonobo, Macaca	1–8	5–15
Carnivores	Food sharing	Panthera leo, Canis lupus, Chiroptera	1, 2, 3, 5	8–10
Fishes	Brood nursing	Characiformes, Poecilia reticulata, Cichlasoma	4	50–1,000

Source: Compiled by the author.

4. Planned work methodology – next steps

Next steps of the research:

- *Review and analyse cooperation levels* within economy, find cooperation factors based on the patterns of the natural system (Table 2).
- *Examine the impact of cooperation* both from internal and external environment point of view. Define and compare cooperative behaviour in terms of positive and negative effects on the ecosystem/economy.

The results are going to be analysed using statistical methods, t-test or ANOVA for non-normal distribution and the Mann–Whitney U test in other cases, based on comparison of median values of data. To create models that link together economy and ecology, the Evolutionary Game Theory models would be used. That approach (EGT) is useful in this context by defining a framework of contests, strategies and analytics into which Darwinian competition can be modelled (Nowak–Sigmund 2004).

5. Summary

Within my future work I seek analogies from nature to apply in economics (bionomics) and plan to work out some modules for a new economic theory, satisfying the conditions of sustainable development (human economics). The cooperation features appearing in natural systems have valuable consequences concerning the sustainability of the economy. Assuming that, economy appears to corporate entities like groups in the animal kingdom – fighting for the same resources, at the same time and in the same area (market); in the struggle for survival, the comparison of the patterns can forecast certain economic processes.

Concepts of competition and cooperation appear in both ecological and economic (human) systems. The two concepts are inseparable, their existence is equal and necessary to achieve sustainable operation. Nature-based cooperation as a successful strategy can make valuable findings about the sustainability of the economy.

In the new economy, observing the "operation" of these units, it is necessary to define the "boundaries" of cooperating and competing behaviour. Starting from the fact that corporate organisations, like the groups appearing in the animal kingdom, struggle for the same resources at the same time and in the same field (market), and by comparing the patterns certain economic processes can be predicted.

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