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Sustainable economic education: lessons from nature

Introduction

As a rule, ecodestruction processes as a result of human activities and their consequences are pointed out by ecological education. Economic and management sciences are concentrated on economic relations between individual economic agents. As the author is concerned about fatal consequences of ecodestructive activity? he makes the efforts to examine the causal-investigatory connections between different natural processes and to analyse the sources of effective functioning and regulating of natural systems. The author is positive that such kind of knowledge will allow future professionals to answer many questions in ecological and economic spheres which cause difficulties on the way of sustainable development.

1. The principles of ecosystem's organisation

The biosphere of our planet consists of complex interrelated components and can be characterised with systemic properties. They are:

- *self-organisation* (i.e. self-supporting the current metabolism, energy and information exchange process between the system's components);
- *homeostasis* (i.e. the state of dynamic balance of physical and chemical processes);
- *self-regulation* (i.e. amending and tuning the appropriate mechanisms as a reaction on recurring changes);
- *self-development* (i.e. ensuring the conditions for system's improvement).

The properties mentioned above are ensured by a set of mechanisms. The main of which are: *system's hierarchical organisation; interdependence of system components; natural selection; ecological limitations.*

The term **hierarchicness** means the *functional subordination of the elements of the whole (its subsystems) from the interior to the superior.* The biosphere as a whole and the concrete ecosystems as well can have a hierarchical character.

Speaking about the hierarchy of ecosystems we should warn a reader against a possible wrong associative comprehension of the term "hierarchy" by analogy with the commanding structures of the government, let us say, at a production firm. *Hierarchy of the ecosystems differs from the hierarchy of the administrative public structures principally (!).* The subordination in the commanding governing structures goes from the bottom upwards (for example, the executors are subordinate to their brigade – leader. In his turn he is subordinated to a chief of the brigade-leaders, the chief – to the manager of chives. This goes on to a president of the firm). The administration influence is performed in the opposite direction, i.e. from the upper level to the very bottom.

Hierarchy of the ecosystem assumes that the lowest level, i.e. the living organism plays a leading administrative role in the system. One can see it analysing the hierarchical organisation of the ecosystems (Figure 1).

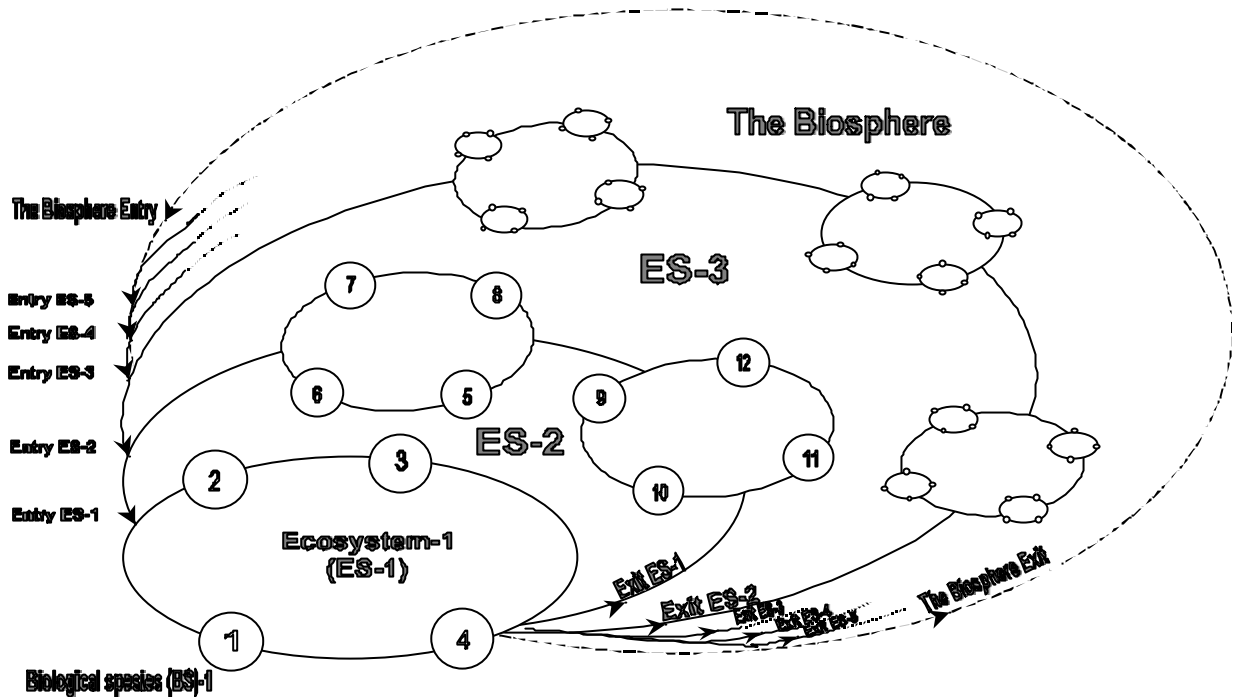


Figure 1. The Hierarchical System Organisation

The ecosystems of the lowest level (ES-1) as the self-organised closed systems are formed as a result of the symbiosis of the living organisms (communities the producers, consumers and reducers). Each ecosystem cooperates with "exit" and "entry" of the other systems of the same level by means of its own "entry" and "exit". In such a way a comparatively closed ecosystem of higher level (ES-2) is formed. So, the ecosystems form level by level (ES-3, ES-4) the common biosphere. This is the highest hierarchic level of the organisation of the eco-systems on the Earth . But we can not say that this is the main or central level of the system because each biological organism can be the centre in the biosphere. The smallest bacterium processing the lion's remains is of no less importance in the process of self-maintaining the life in the ecosystem than the "tsar of all the animals" himself who is an emperor of his own functions. So, the ecosystem has a unique property of bio-centrism. It means that the centre of the system is simultaneously in each biological organism. when each of them can enjoy an honour to be called a "tsar". May be here lies the explanation to one more quality of the Nature -Creator because in accordance with one of the above-given definitions *God is a boundless love* ?!

The hierarchy of the biospherical type managed to solve an important cybernetic task, but the governing structures of the commanding type failed to solve it. The matter is that according to one of the cybernetic principles of management, *the complexity of a managing system must be higher than the complexity of a managed system*. Because an eco system of the lowest level serves as a managing system for the biological species (the managed sub-systems). In its turn an eco-system of a higher level can serve as a managing system of the eco-system of the lowest level etc.

Only the systems organised according to the biospherical principle are able to survive in nature and society. Run ahead we should say that the market "managed" to realise just this principle according to which each consumer can be "a tsar". It is very important to comprehend the meaning of the principle of the ecosystem of any level. It means that the lowest level of the system's hierarchy which determines its life, development and action (the

dynamics) is in the centre of the system. Hierarchic organisation of the biosphere is one information miracle of Nature.

For the biosphere its hierarchical is the entry of the smaller and simpler ecosystems into the larger and more complicated ones in the following line: biogeocoenosis – biocoenological complex – biome – natural belt – sub-sphere of the biosphere of the biosphere (for example, the eco-systems of the land, the ocean, etc.) – the biosphere. The ecosystems each level have their own cycle of elements.

Homeostasis is a state of the dynamic balance. The mobile equilibrium of a natural system is maintained sustained by the even renewal of its main components and by the constant self-regulation in all its links. The self-regulation provides the state homeostasis in a biocoenosis. Self-regulation is a regulation of the number of each species in a biocoenosis as a result of the mutual adaptation of the species when this self-regulation gets disturbed the natural balance in a biocoenosis is upset. This leads to the distraction of this biocoenosis or to the formation of a new one. The state of the dynamic balance itself characterised the should stress that this stable balance has a reserve of durability subcient enough not to be upset easily.

2. Conditions of the system development

The form of system organisation defines its ability to progressive development. the increase in free power performs two functions which sum to be opposite. On the one hand, it is a factor which makes a system stable because free power contributes to the self-regulation of the system and maintains the state of the dynamic balance. On the other hand, the accumulation of surplus free power causes the instability of the system, brings it to the self-excitation. As a result, we can see the transition to the more complicated system which corresponds to the given number of free power more. A person must take into account this phenomenon in his activity connected with the influence on the ecosystems. The artificial simplification of the system reduces a number of free power generated in the system and causes its degradation .

The ability of the animate nature to resist the growth of entropy and accumulate free power for the progressive development was formulated by V. Vernadskij as the first two principles of the animate natures evolution called the biochemical principles(V. Vernadskij, 1978):

- free (biochemical) power tries to attain the maximum performance in the biosphere;
- those organisms which increase free power by their lives survive during the evolution of the species.

Any ecosystem belongs to the group of open stationary system following all their intrinsical principles. Free energy production is the main function of such system This function can be carried out only in the state of homeostasis (dynamic balance). In order to sustain this state a system has to spend a produced free energy (the mechanism of the negative reverse connection). A system remains in the state of homeostasis under the condition when the inflow of a produced free energy will be equal to the outflow of the energy from the system.

As a matter of fact these principles express the proper natural historic law-governed nature of the development of the living organism on our planet. The forms of the public development are not the exception.

3. Distinction between ecosystem and command management structures

Quantitative distinction of two management systems (classic command and the above mentioned ecosystem) could be figured as distinction of their database organisation and management systems.

Information system in the classical command management structures represents the reverse triangle (apex at the bottom, base up). The very top level should has the maximum information content. It must control the whole system behaviour down to the very bottom.

Then, it must have available sufficient information. Ordinary executive units possess minimal information content - they perform commands given by higher levels.

Even if "supreme commander" without going into the root of the matter of down levels will make principal decisions (though Stalin tried to control the production of an each plan, tank, film and even a book), all the same the central level will stock the enormous information content. The activity of each enterprise in the Soviet Union completely was locked by central authorities (Planning Committee, Supply Committee, Pricing Committee, ect.)

But the problem is not the lack of database organisation and management systems. The removal of self organisation conditions including natural selection mechanisms of the most hardy "organisms" of the system is not of the less importance. No one enterprise became bankrupt during the Soviet Union epoch. Perpetual reorganisations in combination with finance injections reanimated lacking vitality economic structures. The majority was represented by the collective and the soviet farms. Khrushchiov felt intuitively those vices brokenly tried to "improve" the directive control: sometimes eliminating ministries and creating territorial institutions of self-governing (sovnarkhozs), sometimes carrying out the reforms of local regional the Party committees (obkoms). Alas, those actions did not conform with wish to solve everything at the top.

In the *ecosystem hierarchies* the most information content is concentrated on the down levels. They are self-organised and must solve all problems of individual and subsystem organisation. Firstly, every biological organism bears an individual genetic code, determining the information behaviour problem. Secondly, the interaction between separate organisms is fixed information - *the organisational order* of given ecosystem, that is to say the original "genome". Thirdly, the *natural selection* works to information improve biological species and correspondingly the whole system. The higher is the hierarchy level the less information content requires its organisation. You see, the system functions in automatic mode ("information triangle" - apex at the top). The classical command structure and the hierarchical self-governing system are like "polar" forms of organisational structures. The public organisations you could meet different combinations of these two principles. For instance, firm command structures could be "soften" by competence delegation to the lower levels. At the state level of economic organisation it worked well to a certain extent in Yugoslavia in Tito's time. On the other hand the behaviour of ecosystems built on the basis of ecosystem principle one can be corrected changing input data of economic agents' activity (e.g. at the expense of tax or credit mechanisms), interfering directly in the firms' affairs.

4. Mechanisms of regulation in social systems: lessons from nature

What lessons can we get to be able to improve the regulation of the socio- economic systems?

Lesson 1. *To be a viable one a system must be self-organising.* The viability of any system is determined by its ability for self-improvement and adaptation to any changes in the environment. On the market model it is this way by which each manufacturer (an enterprise or an individual) independently solves all the problems concerning the organisation of the production, the search for the consumers of the produce (in this aim in view improving it constantly) and the search for the suppliers of saw materials. Thousands of producers and general effectiveness of a system. *A released energy* of the economic system promotes the appearance of the new economic subjects, favours the growth of the system's diversity, and its sophistication. The automatism of functioning and self-organisation of the system makes pre-conditions for its purposeful correction with the help of the economic instruments (taxes, credit mechanisms, payments, etc.).

Lesson 2. *A system can be regulated if an authority is decentralised.* The given analyses reveals a failure of the commanding system because its functioning is completely determined by the higher "centre".

The permanent complication of the contemporary economic systems demands the adequipment of the higher level of regulation. Nowadays databases which are required for the normal regulation of the economics of a small region is estimated by an astronomic

magnitude. In the history of the mankind it is this objective discrepancy of the necessity with the ability of the regulation system (but not the mistakes of separate leaders) that led to the collapse of all commanding economic systems. It is not accidentally that any total regimes gravitate towards the maximal simplification of the social organisation. Because it is easier to govern this way. To be more accurate only having simplified the system maximally it is possible to control it by means of the commanding methods. In the regulation of the regulation of the eco-system type "decentralisation" of power does not mean losing the control over the regulated system. It is just the other way round. When the higher levels get rid of the routine functions of the current and even efficient regulation it "unties hands" of the political management and allows it to concentrate on the strategic tasks. It is not accidentally that the mathematics modelling of the hierarchical structures organised according to the eco-systemal principle, shows that the complexity of regulation and the quantity of entropy (the measure of the chaotic state of the system's behavior or its disorder) diminishes with each hierarchical level (from the foundation to the upper levels) (Kulich, 1998).

Lesson 3. *A system will be effective if it is complicated enough.* In the nature the complication of eco-systems, the growth of their diversity, the appearance of new hierarchical levels is a consequence of the surplus free energy accumulated in the system. Still this is the cause of the increase of free energy because the complication of the system means the beginning of new connections of symbiosis between the biological species which help to increase the effectiveness of the existence of the each separate species and to reduce the correspondent expenditures of energy.

An example

The poor soils of tropical forests. This can be explained the following way. The diversity of the inhabitants of this eco-system practically does not leave any wastes, which are necessary for the formation of the soil. Contrary to this the unbalanced (and what is more important, less closed) character of the steppe biocenosis is a cause of the fertility of soils.

By analogy with this only economic systems with a high degree of variety (the poly-structural economics; different forms of property; the differentiation of sizes of an enterprise, the differentiation of kinds of business, and others) have a chance to achieve a high effectiveness by economic subjects. In its turn it forms preconditions for the progressive development. The economic co-operation is one more important factors. The liberation of trade (international trade including) is one of the conditions for the formation of the economic profit relations; for the deepening of labour division and growth of the effectiveness of the economic system.

Lesson 4. *A system can develop progressively if its "free energy" is preserved.* Even the market model itself does not prevent the economics of a country from degradation and destruction. The excessive burden of taxes, the racket of officials and the criminal sphere can become the factor which "pumps out" the free energy of a system. This can lead to its stagnation or even degradation.

Lesson 5. *A system will perfect itself if the mechanism of "natural selection" functions in it.* Like in the nature, in economic selection of the most effective links is a necessary condition for the perfection of a system in the whole. Absence of the competitions is harmful for the economics. No matter how painful for the Ukraine the opening of the borders was, it is this fact that allowed to raise the effectiveness of the production here during the latest decade. This resulted in the variety of goods which immediately appeared first of all in the counters of provision shops.

Conclusion

It is extremely important to learn these lessons of the nature under the present conditions in Ukraine. Because only in this case we can expect the progressive development of the society and the successful solving of economic, social and ecological problems.

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