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TRIALECTICS OF SYSTEMS FORMATION AND DEVELOPMENT

Based on the proposed trialectic approach the author explores the interaction of 3 groups of factors, namely materials and energy, information, and synergy in the formation and development of open stationary systems. Characteristics of this phenomenon for economic systems are analyzed.
Keywords: *trialectics; factor; free energy; information; synergy; system development.*

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ТРИАЛЕКТИКА ФОРМУВАННЯ І РОЗВИТКУ СИСТЕМ*

У статті на основі запропонованого автором триалектичного підходу досліджено взаємодію 3 груп чинників (матеріально-енергетичних, інформаційних і синергетичних) у формуванні і розвитку відкритих стаціонарних систем. Проаналізовано особливості прояву даного явища на прикладі економічних систем.
Ключові слова: *триалектика; чинник; вільна енергія; інформація; синергія; розвиток системи.*
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ТРИАЛЕКТИКА ФОРМИРОВАНИЯ И РАЗВИТИЯ СИСТЕМ

В статье на основе предложенного автором триалектического подхода исследовано взаимодействие 3 групп факторов (материально-энергетических, информационных и синергетических) при формировании и развитии открытых стационарных систем. Проанализированы особенности проявления данного явления на примере экономических систем.
Ключевые слова: *триалектика; фактор; свободная энергия; информация; синергия; развитие системы.*

Problem statement. Synergetic approach for studying natural and social systems is gaining scientific importance. Additional opportunities for research also require methodological improvements. Our goal is to use natural science tools for studying economic systems.

Recent research results and literature review. Among recent scientific research results, that significantly improved the economic tools by utilizing natural science approaches, a synergetic theory of economic systems self-organization has gained importance. Scientists investigated many open problems of economic systems management based on feedback mechanisms. In addition, processes of material and information transitions as well as transformations of different forms of capital were analyzed. Evolution of economic systems was also studied. A proposed approach is based on the research of well-known classic authors including V.I. Vernadsky (2013), N.N. Moiseev (1990), S.A. Podolynsky (2000), E. Schrodinger (2009). In this paper we also refer to the results of contemporary authors, namely K. Mainzer (2009), V.N. Tarasevich (2008), I.N. Sotnyk (2012). Main systemic factors were also examined in the author's previous publications (e.g., Melnyk, 2012).

Investigated problems. An internal framework and causality formation of economic systems is still under investigation by different authors.

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Research objective. The purpose of this study is to analyze a three-fold mechanism of interaction of 3 essential natural principles and 3 system components in the formation and development of open stationary systems.

Key research findings. The world consists of *open stationary systems*. They underlie the formation of any natural essence – from elementary particles and massive galaxies to biological organisms and socioeconomic systems. We refer to them as *natural essence*. Formation of natural essence occurs in the *essential origins of nature* and the corresponding system components.

Essential origins of nature are the fundamental forces of nature, i.e., material and energy capacity, information reality, synergetic phenomenon, that determine formation, functioning and development of natural and social systems, including elementary particles, atoms, molecules, cells, organisms, combinations of organisms and social formations.

Hypothetically, it is possible to describe a triune action mechanism of the following system components:

- ***material and energy*** (providing energy capacity movement in natural entities);
- ***information*** (forming implementation of energy towel vector);
- ***synergy*** (combining individual natural entities into a united system).

A mechanism for implementing the essential origins of nature is a fundamental property of nature as well as its mystery.

Material and energy origin generates *material components* of the system and in conjunction with its *information algorithm* (information component) determining the ability of a system to complete work, carrying out metabolic processes of substances, energy and information with external environment, as well as between the elements of the system. ***Information origin*** causes formation of information system characteristics, i.e., fixed memory algorithms for implementation of energy potentials, which provide the capability for system changes or steady-state in space and time according to certain programs. ***Synergy origin*** determines the interaction between components of the system itself; consequently, they start acting as a single entity, forming a united system.

Reproductive phenomenon can be considered as the fourth essential origin that integrates self-reproduction of the above 3 system components into a single system. Thus, reproduction phenomenon provides continuous formation (sustainable renewal of reproduction cycles) of features (properties) in time and space for each natural essence.

We conventionally consider the methodological approach based on a study of interactions of the triune origins of nature as an essential basis for the formation of ***trialectics***.

It can be assumed that the content of triune interactions of essential natural origins in system development processes reflects the nature of Hypostases of Christian Trinity. In other words, process of forming the essential origin of each system is an operating model for realization of the Hypostases of Divine Trinity unity.

A relationship between 3 mentioned origins in the formation of *open stationary systems* needs to be emphasized. In particular, *energy potential* can only be realized if it is ordered by the information algorithm of the system. *Information* is a carrier of characteristic (distinctive) features of natural objects that originates from their differ-

ent motion (energy potency) capabilities. The latter can only become *information* if it is fixed by *memory*.

It should be mentioned that *memory* transforms random movement impulse into sustainably repetitive (reproducible) system potential or a set of energy potentials inherent to that subject or phenomenon. In fact, *memory* creates various objects of nature, i.e., natural essences, from the same "building block" – *movement potency*.

Due to memory of human brain *information reality* has evolved to virtual forms of its manifestation. *Human personality* is capable, firstly, to form information images in relative isolation from objective reality, and, secondly, to learn nature, including its own nature.

By interacting a triad of the mentioned components (and corresponding groups of factors) can form any natural essence (each individual electron, atom, molecule or biological individual) by making its inner contents. After all, for these creatures of nature to exist, they must *reproduce* their distinctive features at every point in space. This creative self-reproduction counteract with entropy forces, i.e., with natural processes of self-destruction that occur simultaneously with self-reproduction.

We conclude that the nature of any system that surrounds us, e.g., molecules, plants or enterprises, is trialectic. First, it is a ***material essence***, second, it is an ***information program***, and third, it is a ***product of coordinated interactions*** of other systems.

As a *material object*, the system can accumulate and consume energy. As an *information program* it is self-organizing and manages the processes of formation, functioning and development. As a *synergistic product* the system is formed through interaction and, hence, via mutual fit and behavioral adjustments of its own subsystems as well as of the system itself.

It is possible to form and destroy the system through impacting each of the mentioned components or the entire three-fold mechanism of system reproduction. It can be illustrated by the examples of different types of systems.

Ecosystem. The following actions can contribute to improving the state of the ecosystem:

- material *quantitative* buildup of plants and animals in the ecosystem;
- *information* improvement of ecosystem (improving quality status of species, ecosystem structure optimization of species);
- *synergetic* improvement (species and interspecies communication);
- improvement of the holistic *self-organization mechanism* of the ecosystem.

Ecosystem will be gradually *degraded* and *destroyed* if the listed actions will be carried out with the negative sign. It means that 1) plants and animals would be destroyed; 2) quality of species would deteriorate due to diseases or other reasons, optimal proportions of ecosystem species composition would be violated; 3) species and interspecies communications would be blocked; 4) self-replication mechanism of the ecosystem would be disrupted.

Enterprise is *created* by forming its main foundations:

- *material* (fixed and working capital);
- *informational* that provide algorithms (technology) for manufacturing and trading activities of an enterprise;
- *synergetic* that provide an implementation of links within and outside an enterprise;

- *holistic* reproductive *potential* of the 3 foundations.

The company would degrade if the processes go in reverse order: 1) wear and tear will be undepreciated, the amount of working capital and the intensity of its turnover would decrease; 2) information and management algorithms would be inadequate for an enterprise in space and time; 3) interaction links on internal and external levels would worsen; 4) self-reproduction mechanism of an enterprise would be blocked.

Speaking about the formation and destruction of systems, it is necessary to pay attention to one feature. There are many ways to *destroy* the system, and each way is "appropriate" in its own way. Some lead to rapid, catastrophic failure of the system. Others are more soft and subtle, they destroy the system slowly and imperceptibly.

If the goal is formation of the system, there is only one way that is most effective among a variety of possible approaches. Any deviation from this path sharply increases operational costs of the system and reduces efficiency of individual processes occurring in the system and possibilities for progressive development.

For ***economic systems*** that would mean an efficiency investment loss of resources and money. For example, it makes no sense for an enterprise to spend money upgrading existing computers (an expensive task) if there is no software to implement the required functionality.

Even if investment is made in improving computer hardware and software, money will be wasted if a company does not have people able to use those computational resources. In this case, information processing system becomes a costly useless toy.

However, even availability of qualified professionals does not completely address the issue. All of the mentioned resources would be unnecessary if a company does not have goals that require computer optimization *information algorithm* for decision-making or its synergetic base (internal or external economic links).

In this context, the law of ***maximum output of triune nature origin*** can be formulated. *A system achieves maximum efficiency when each of the factor groups of system formation triune mechanism (material, information and synergetic) corresponds to the goals and objectives of its functioning.* In this case, ***mutual consistency*** of the 3 essential origins is achieved.

Over million years of evolution, nature has been able to achieve a perfect combination of natural origins in each of its creations. Technological systems created by mankind, in our opinion, are still far from such perfection. One reason for this, which is clearly evident during the industrial society era, is an imperfection of information and synergetic basis of technical and organizational systems. Tremendous energy potential, accumulated by mankind, is virtually redundant and is scattered due to extremely low efficiency of technical systems and due to high transaction frictions between the components of our economic system.

The logic of mankind evolution in its progress towards the informational society has a tendency of improving these "bottlenecks", i.e., *information algorithm* for controlling production and consumption processes (including the systems for setting goals, technological support, motivation etc.), as well as a synergetic framework (including links, communications, relations etc.) of economic systems functioning are improving.

The process of system formation and self-organization is determined by its properties. One of the key properties of the system is *emergent property.* N.F. Reimers gave

the following definition: "The emergent property is when the whole system has special properties that are not inherent to its blocks and subsystems, as well as to the sum of its elements that are not linked by system organization connections. A brief ancient definition of a system is that "the whole is greater than the sum of its parts" (Reimers, 1990).

How can the system acquire this something that is *greater than the sum of its parts?*

Paying tribute to the elegance and conciseness of the *definition* provided by ancient scientists, it should be noted that the definition is not entirely correct. This may create an illusion that a new quality of a system (in contrary to the laws of nature) is emerging from *nowhere*. Meanwhile, it is known that in the material world something new (if it is not imposed from outside) may appear in the system only from its *inner content*, i.e., from parts (components) of the system itself. The misconception of ancient scholars about the occurrence within the system of *something* that is "greater than the sum of its parts" comes from the fact that ancient scientists did not take into account two out of three key components of the system – its *information* and *synergetic* bases. Those are also "parts" of the system, though not material. The two non-material components are the sources of new features and specifications in the system. It can clearly be seen from specific examples.

Contradiction in the definition of the system can be resolved with a small but significant refinement, i.e., if we add a single word to the definition, rewriting it as *the system is a whole, which is greater than the sum of its* ***material*** *parts*.

The influences of *information* and *synergetic* components can be studied on the examples of systems surrounding us.

For example, material parts of which an airplane consists (each of them is heavier than the air) can fly into the sky only under two conditions: first, if they are made in accordance with appropriate specifications governing their shape, size and construction features as well as if they are assembled in a certain order (*information* origin is implemented); secondly, if they begin to interact appropriately, e.g., the motor would start pushing forward the whole structure of the aircraft by creating the lift force (*synergetic* origin is implemented).

Information and synergistic components of any system, acting in close connection with the material component, equally ("equal-in-different") contribute to the formation and "*ordering*" of a holistic entity that represents a certain level of open stationary system. In particular, efficiency in using the *energy potential* is determined by the system information algorithm of the system and the degree of interaction between individual subsystems. Any *information program*, even the most advanced one, cannot be implemented without involving tangible assets (material and energy) and without interaction between individual subsystems. It is meaningless to talk about the *synergetic* basis (in particular, about implementing links between subsystems), if there is no informational algorithm (general rules, languages, communication channels) for interaction between individual parts of the system, or if these parts are absent.

This paper allows us making a number of important **conclusions**:

1. The phenomenon of development can only be applied to *self-organizing open stationary systems*. In other words, only such systems can develop.

2. The amount of *negative entropy* sustainably produced per unit of time is the criterion for such systems development.

3. The volume of negative entropy produced by the system is equally driven by the following 3 factors: a) the amount of *free energy* in the system, necessary to perform any type of work; b) perfection of the *information algorithm* for realization of metabolic flows in the system; c) quality of *internal and external system connections*. System efficiency and its energy potential use depend on the latter two groups of factors.

4. Volume of system's *free energy* can be only considered as a prerequisite for its successful development. However, by itself this index cannot serve as a criterion of system orderliness. For example, enterprise capital (quasi-analog of free energy) accumulated as a result of random bargain or by selling its own fixed assets cannot be used as an indicator of company's successful *development*. Sustainable dynamics of energy (quasi-energy) indicator can potentially serve as a criterion for monitoring changes in trends of system orderliness level, if considered together with the parameters describing the dynamics of the other two groups of factors – informational and synergetic.

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