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METHODOLOGY OF LEADING ECONOMIC DEVELOPMENT

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Kendyuhov A., Yagelskaya E.,Methodology of advanced economic development

In the scientific literature, the interest in the analysis of economic categories and processes based on energy approach is periodically increasing. Particularly relevant in the context of this issue the problematic of economic development remains, which is described using power structures more often. *The purpose of the article*isto present and justify the concept of transformation of the system based on energy approach and to work out the structural model of leading national economic development. Subject of research is the transformation of economic system. Theoretical researches of world economic thought on assessment of the dynamics of economic systems served as methodological basis of this research. The methods of this research are comparative, structural analysis and logic synthesis, methods of induction and modeling and an integrated approach that combines the innovative basic principles of synergistic, systematic and evolutionary approaches.

*The resultsofthe analysis.*In the article, the concept of transformation of economic system based on energy approach is presented and proved. Since energy is the driving force of any change, it can be considered as the driving force of development processes. The universality of the concept of energy is due to the possibility of applying to any forms of complex phenomena, so the amount of power primitive behavior in any complex phenomenon may be estimated with the help of energy. It is proved that the national economy is a system in which its own potential economic energy is incorporated. Potential economic energy consists of abilities of the various resources. If the vector of economic force coincides with the vector of time, positive work is done, which leads to the transformation of the system by converting potential economic energy to positive kinetic economic energy, which characterizes the development. The process of transformation of the economic system is based on the action of positive feedback and negative feedback. Lots of positive feedback will lead to overheating, crisis, degeneration of the economic system, and negative – to the attenuation, fading, and again to degeneration. A positive feedback leads to hyperbolic acceleration of development, creating the effect of a uniform distribution of events on a log scale of time. This requires an additional study of time features that were considered while the working out the structural model of leading economic development. The model reflects the function of economic energy, economic force and time, seal of which will compensate the expulsion of socio-economic system in the rarefied layers of time, leading to the decline of the system. Economic energy is represented by an array of abilities of the economic system. Economic force depends on the economic weight of the country and acceleration of the economic growth of the national economy. Work describes quantitative and qualitative changes in the system by the force. This allows calculating the efficiency of the system by which it is possible to judge about the state of the economic system. *Conclusions and directions of further researches*. Bringing the proposed model to the level of practical recommendations for the management of economic development and its evaluation based on the dynamics of the national economy will enable the timely adjustment of strategic and tactical problems at the state level. The prospects of further research are to develop and test a methodology for assessing the economic energy of the country.

Кендюхов О.В., Ягельська К.Ю., Методологія випереджаючого економічного розвитку

У статті представлено й обґрунтовано концепцію трансформації економічної системи на основі енергетичного підходу. Описано економічний механізм зворотних зв'язків, який зумовлює трансформацію. Розроблено та описано структурну модель випереджаючого національного економічного розвитку.

Кендюхов А.В., Ягельская Е.Ю., Методология опережающего экономического развития

В статье представлена и обоснована концепция трансформации экономической системы на основе энергетического подхода. Описан экономический механизм обратных связей, обуславливающий трансформацию. Разработана и описана структурная модель опережающего национального экономического развития.

Statement of the problem. The problems of economic development are increasingly described using power structures; after their research, significant prospects are seen. However, the novelty and originality of the energy approach leaves many unexplored issues in this area, in particular, elaboration of the model of economic development.

Analysis of recent researches and publications. At the root of the interesting for us problemswere J. Harris, L. Todaro [1], W. Lewis[2], A. Petrov, N. Moiseev, I. Pospelov [3], V. Kitaygorodskiy, V. Kotov [4] and other scientists, which works formed the basis for our research. Among our contemporaries A. Mehlenbacher [5], S. Kooros, L. Badeaux [6], A. Filipenko [7], O. Soskin [8], I. Kirnos [9], L. Lyubohinets, L. Babich [10], V. Yukish, T. Ovchinikova [11], T. Zhelyuk [12], Yu. Harazishvili[13] paid attention to economic development modeling. Their works aimed at finding the optimal model of economic development of Ukraine. Special attention, in our opinion, awarded the works by A. Granberg [14], A. Osaulenko [15,16], N. Kizim [17], but despite the significance of the named scientists' researches, modern science has not yet developed a unified model of economic development based on current energy approach. In this article of particular interest is leading national economic development, which is almost out of attention. In our studies, we also relied on the energy concept as the result of analysis in [18-25].

The purpose of the article isto present and justify the concept of transformation of the system based on energy approach and to work out the structural model of leading national economic development.

The results of the analysis. In 2006, V. Heyets described the national economic model, as based on the use of resources inherited from the past, while new own resources of development created too slowly, or did not create at all. This exacerbated the need to develop innovative models of relevant changes in society, based on the information. According to the scientist, creating such a model of economy is the problem of long-term strategy, which does not exist [26, c.42]. Unfortunately, since that time nothing changed. Thus, under permanent backlog, Ukraine needs a quick breakthrough that the model of leading economic development can provide.

In our view, exactly energetic approach to the study of transformations of economic systems will form an optimum, scientifically based concept of leading national economic development [27].

According to previous studies [28], the economic energy is a potential of economic system, which is its ability to supply efficient functioning and positive qualitative transformations. The structure of economic energy is an array of abilities that determine the qualitative and quantitative state of the economic system and cause the transformation of its structure by changing the space-time location of the system. Economic fluctuations are caused by different energy values (states) of abilities ("sub energies"). State of ability is defined by its location in time and space.

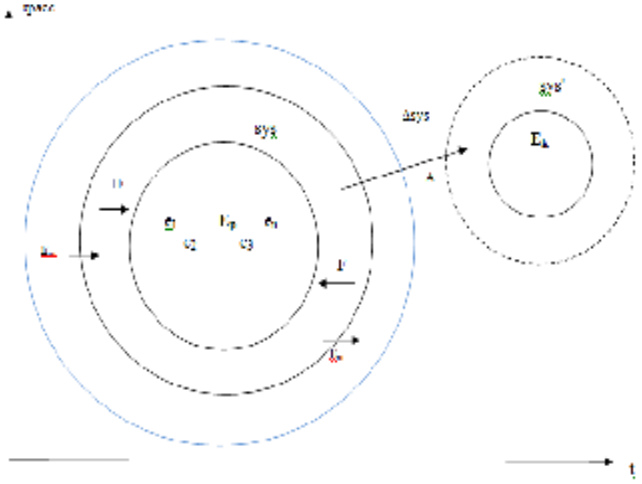
Abilities are displayed in economic force, i.e. economic force is a display of economic energy, which leads to the development of the system. In other words, it is the intensity, the ability to generate and to attract resources providing wealth of the country. Economic force stimulates conversion of potential energy into kinetic one that actually promotes a positive trend. Thus, the economic energy of the country comes out of dormancy and activates the structural elements of the system, stimulating them to action.

Simply put, the national economy is a system in which its own potential economic energy is incorporated **(E_p)**. Potential economic energy, in turn, consists of abilities of the various resources **(e_1, e_2, e_n)**. Thus, economic force **(F)**acts on the system. If its vector coincides with the vector of time, positive work **(A)** is done, which leads to the transformation of the system by converting potential economic energy to positive kinetic economic energy (fig. 1), which characterizes the development.

If vector of economic force does not match the vector of time – there are inverse processes: negative work occurs, the kinetic energy is negative, energy dissipates, and consequently, there is a degradation of the system.

Changing the direction of development, transition to a new stage occurs through a feedback mechanism that underlies the process of system self-organizing. Processes of development are accompanied by constant action of the mechanism by system response to changing conditions of existence by change of negative feedback to positive and vice versa. The work of the feedback plays a key role in the long-term development of the system [29]. If negative feedbacks ensure stability of the system that is useful not for each system (balance of economic energy and entropy suspends the development of open systems) [30], the positive feedbacks contribute to the formation of new properties that provide a transition system to the mode

of self-development [29]. That is, the process of transformation of the economic system is based on the action of positive feedback **(F_{pos})** and negative feedback **(F^{neg})**. Feedback is a supply of the parameter from the output of the system at its input; in phase with the input parameter, a positive feedback is observed, in the antiphase – the negative feedback. Positive feedback leads to strengthening of processes within the system, and as a result, there is a further increase in the output parameter. Conversely, uncontrolled action of feedback leads to the destruction of the system. Lots of positive feedback will lead to overheating, crisis, degeneration, and negative – to the attenuation, fading, and again to degeneration.



E_p – potential energy;
E_k – kinetic energy;
+F – positive force (directed by the same vector with time);
+F – negative force (directed by the opposite vector with time);
e_m money energy;
A – work;
e_a ability, «sub energy» of resource;

1 round – energy of the system (national economy);
2 round – force of the system;
3 round – external system (global economy).

Fig. 1. Transformation of the system by converting the potential economic energy to the positive kinetic economic energy

Sensitization of money energy from an external system performs a kind of feedback stabilizer. In a closed economic system with the administrative-command management, mutual compensation of positive and negative feedback is possible. In a market economy the only way to maintain the stability of the system in a relatively long term is the consumption of energy from an external system (until all the external system does not fall into the state of crisis). The external system has considerable inertia of scale and a huge mass. For example, local wars in some countries are detrimental to the economies of these countries, and are not significant for the external world system.

An array of events that promote the development inevitably generates money energy **(e_m)** or draws it from the external system. Part of this energy in the form of positive feedback returns to the array of events and stimulates its growth, which in turn increases the generation of money energy. Overall, a positive feedback leads to hyperbolic acceleration of development, creating the effect of a uniform distribution of events on a log scale of time.

N. Delas [31] described hyperbolic nature of complex systems development. Scientist proves that hyperbolic distributions occur in systems that are characterized by high dynamism of “resources” and low activity of “carriers”. The law of hyperbolic growth of the world population and the development of flora and fauna for the hyperbolic law must be emphasized [32]. Obviously, it is fair to assume that the feature of economic development is also its hyperbolic nature.In economic theory, namely positive feedback is reflected in such factors as additional work, additional product, and additional cost. Thus, in the practical implementation the energy of positive feedback is an increase in wages, various bonuses, additional payments, etc., that motivates work, know-how and other elements of the array of positive events that stimulate growth.

Positive feedback, being substantial permanent tool to enhance economic processes, eventually leads to overheating and critical processes displaying in the economy as a whole and in individual sectors

and even enterprises. This explains the periodic seemingly inexplicable downs that can repeat cyclically over the years, months or even weeks. Practical implementation of positive feedback is based on psychological human desire to get more money. Thus with each cycle of positive feedback people are invariably close to the limit of their physiological capabilities. Finally, there comes a time when energy received from money is not enough to compensate their personal losses (tension, fatigue, illness, lack of communication with family, lack of proper rest, etc.). When considering the situation in the country, personal losses of individuals transform to social tensions because of the synergistic effect. In addition, the human desire to accumulate own maximum money energy leads to a more intensive use of technical equipment that is not always feasible and reasonable classical energy consumption. In the process of economy "overheating", most industry almost completely exhaust all their resources, including human and research that work at the limit of their capabilities (workfolk work in two-three shifts, the rooms are used for other purposes, etc.).

Thus, due to the positive feedback, the full range of positive processes (events) leads in perspective to destructive phenomenon or crisis. Way out of this situation is seen in the introduction to a certain stage of economic development negative feedback. The depth of negative feedback should be congruent the depths of positive feedback. This aspect should be considered when developing a strategy of national economic development.

Today optimistic scenario of socio-economic development can only be based on economic models of leading development that has taken into account time as a non-renewable resource and rely on quick creation of mechanisms of high-tech export-oriented economy, the driving force of which is intellectual resources, cultural values and creative energy [33].

The model of leading national development should be based on long-term indicative planning to reduce time for implementation the socio-economic processes. Fundamental scientific aspect of this model is to achieve better results in less time.

Structural the model of leading national economic development can be summarized as follows:

$$Dsys = f(E, F, t); \quad (1)$$

$$E = \begin{pmatrix} e_{11} & e_{12} & e_{1n} \\ e_{21} & e_{22} & e_{2n} \\ e_{h1} & e_{h2} & e_{hn} \end{pmatrix} \times V^2; \quad (2)$$

E is reflected with the array of "sub energies", which is presented by abilities of the economic system by years, V^2– time compression (acceleration), to which mode the economy is driven in the process of implementing the strategy of leading development. Economic force depends on the economic weight of the country and acceleration of the economic growth of the national economy:

$$F = EM \cdot g; \quad (3)$$

The economic weight of the country is the set of all economic resources (factors of production) (excluding credit) and is calculated as the total value of these resources:

$$EM = \sum_{i=1}^{I} \overline{m}_i, \quad (4)$$

where $\overline{m}$ – average cost*i*resourcefor the period;*g* – acceleration of economic growth in the national economy that characterizes time efficiency as an economic resource and determines the quantity of money which increases the balance of payments surplus (excluding loans and other obligations) for the period.

$F = 0$ – quiet of the system

$F > 0 - E_p \rightarrow +E_k$ (development)

$F < 0 - E_p \rightarrow - E_k$ (dissipation)

Work **(A)** describes quantitative and qualitative changes in the system by the force [34,p. 99-103].

$$A = F \cdot s; \quad (5)$$

where*s* – passed way, in our case:

$$A = F \cdot t; \quad (6)$$

If $\vec{F}$ meets***t*** (F> 0), then A> 0. According to the physical basics of mechanics, $\vec{F} = - gradE_p$, then

$$COP_{sys} = \frac{A}{Q}; \quad (7)$$

COP_{sys} – coefficient of performance of the system; Q – loss of resources for the period.

$$t = \log \frac{E_m \times grad\, p_{loc} \times F_{pos}}{F_{neg}}; \quad (8)$$

where ρ_{loc}- local time density.

The concept of time in the leading economic development is outlined in [35], where it is proved that for the retention economy in the local time with a density greater than 1 (when development takes place), compensation buoyancy is required, i.e. external additional energy. Buoyant force (F_b) is represented as a ratio of the local time density (ρ_{loc}) to the total time density (ρ_{tot}):

$$F_b = \frac{\rho_{loc}}{\rho_{tot}}. \quad (9)$$

The density of the total time is always constant, the density of the local time can match the total and have aberrations in both upward and downward. In the local time area, the time density is not heterogeneous, that is, it is a gradient of the local time. In our case, the scalar field is a field of the local time density. Gradient at each point of the local time will show the direction of the most sharp density increase, and characterize with its size the rate of increase in the local time density, which will state the economic development, stagnation or degradation of the system.

Conclusions and directions of further researches. Bringing the proposed model to the level of practical recommendations for the management of economic development and its evaluation based on the dynamics of the national economy will enable the timely adjustment of strategic and tactical problems at the state level. *The prospects of further research* are to establish a correlation between economic energy and economic force, and to develop and test a methodology for assessing the economic energy of the country.

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