

# THE MODEL OF FORESIGHT OF INNOVATIONAL-TECHNOLOGICAL DEVELOPMENT IN ECONOMIC SYSTEMS

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## Melnyk A. G. Foresight Model of Innovational and Technological Development in Economic Systems

The aim of the article is to investigate the methodological approaches to the development of innovation and Foresight of innovation and technological development in economic systems. In this paper, based on the analysis of existing approaches to the prediction of innovative development, as well as the clustering of innovation and scientific and technological activities of economic agents in economic systems, a new methodological approach to the development of Foresight innovation and technological development of economic systems in the dynamics of the processes of reproduction was introduced. The necessity of taking into account, as the objective function of foresight, driving dynamics and transformation of the cost in economic systems was grounded. The methodological approach, according to which the processes of development of economic systems in the dynamics of changes in factor elements characterized by a movement of all factors of reproduction in economic processes to the state of the linear approximation, was reasoned, which is always accompanied by a structural transformation of all the factors of reproduction. The main transformation of the functional content of the theoretical justification of changes in economic systems highlighted the transformation of the determinants of the time, the meaning of which is formulated in the form of a hypothetical prerequisites for building forecast models, namely, the transition from the factor functionality of determinants of time to the functional base models of reproduction, which is manifested in the effects of the acceleration of economic processes and generation of "footholds" for the next technological leap. This provision formed the basis for the calculations for the development of innovation and technological Foresight of the global economic system, presented in the form of a model of structural transformations in the field of generation of innovative technologies.

**Key words:** Foresight, time gaps, technological shift, vector of technological productivity.

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### Мельник О. Г. Модель Форсайта інноваційно-технологічного розвитку в економічних системах

Метою статті є дослідження обґрунтування методичних підходів до розробки Форсайту інноваційно-технологічного розвитку в економічних системах. У роботі, на основі аналізу існуючих підходів у розробці прогнозів інноваційного розвитку, а також кластеризації інноваційної та науково-технічної діяльності суб'єктів економічних відносин в економічних системах, викладено нові методичні підходи до розробки Форсайту інноваційно-технологічного розвитку економічних систем у динаміці процесів відтворення. Обґрунтовано необхідність врахування, як цільової функції передбачення, динаміки руху і трансформації вартості в економічних системах. Обґрунтовано методичний підхід, відповідно до якого процеси розвитку економічних систем у динаміці змін факторних елементів характеризуються спрямованістю всіх факторів відтворення в економічних процесах до стану лінійного наближення, що завжди супроводжується структурною трансформацією всіх факторів відтворення. Основною трансформацією функціонального змісту в теоретичному обґрунтуванні перетворень в економічних системах виділено трансформацію детермінанти часу, що сформульовано у вигляді гіпотетичної передумови для побудови прогнозних моделей, а саме: перехід від факторної функціональності детермінанти часу до функціонального базису моделей відтворення, що проявляється в ефектах прискорення економічних процесів і генерації «точок опори» наступного технологічного стрибка. Дане положення лягло в основу розрахунків для розробки Форсайту інноваційно-технологічного розвитку глобальної економічної системи, представленій в роботі у вигляді моделі структурних трансформацій у сфері генерації інноваційних технологій.

**Ключові слова:** Форсайт, часові розриви, технологічний зсув, вектор технологічної продуктивності.

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### Мельник А. Г. Модель Форсайта инновационно-технологического развития в экономических системах

Целью статьи является исследование методических подходов к разработке Форсайта инновационно-технологического развития в экономических системах. В работе, на основании анализа существующих подходов к прогнозированию инновационного развития, а также кластеризации инновационной и научно-технической деятельности субъектов экономических отношений в экономических системах, предложены новые методические подходы к разработке Форсайта инновационно-технологического развития экономических систем в динамике процессов воспроизводства. Обоснована необходимость учета, в качестве целевой функции предвидения, динамики движения и трансформации стоимости в экономических системах. Обоснован методический подход, согласно которому процессы развития экономических систем в динамике измененных факторных элементов характеризуются стремлением всех факторов воспроизводства в экономических процессах к состоянию линейного приближения, что всегда сопровождается структурной трансформацией всех факторов воспроизводства. Основной трансформацией функционального содержания в теоретическом обосновании преобразований в экономических системах выделена трансформация детерминанты времени, смысл которой сформулирован в виде гипотетической предпосылки для построения моделей прогнозов, а именно: трансформация факторной функциональности детерминанты времени в функциональный базис моделей воспроизводства, что проявляется в эффектах ускорения экономических процессов и генерации «точек опоры» следующего технологического скачка. Данное положение легло в основу расчетов для разработки Форсайта инновационно-технологического развития глобальной экономической системы, представленной в работе в виде модели структурных трансформаций в сфере генерации инновационных технологий.

**Ключевые слова:** Форсайт, временные разрывы, технологический сдвиг, вектор технологической продуктивности.

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The movement of values is the substantial basis for progress, and so it is a key element of prediction. If we could imagine values as the wealth of nations, so it's own dynamic processes of reproduction into the techno-economic and production relations, their conflictiveness and resolving conflicts through the progress, their socialization and socialization of economy on the whole, transformed it from "cost production" to the value and lead to the development of socio-economic systems. So, the discreteness of reproduction and the cost of progress differentiate all values into the value of lifelines and the value of development and its next transformation to value of reproduction. This is the past and present. And what is tomorrow? All methods of extrapolation in identifying the objective function, that is proposed by some authors [1, p. 5] only transmits the functionality of last temporal period and thus can not be regarded as an objective prediction method. This statement is not purely empirical conclusion but is derived from practical calculations. This statement is not purely empirical conclusion but is derived from practical calculations. Perhaps, there is the methodological conflict applying the methodology of economic cycle and the "life cycle", according to which they are trying to calculate the temporal periods of phases and the levels of the extremum of oscillation economic indicators. Ignorance of substantiality of dynamics value and its functional directioning at reproduction, making emphasis on the actualization of determinants of its elements in researches, all of this converts the methodology of Foresight only in one of other methods of short prognoses.

**Studies.** The financial potential of the depreciation fund, endowed in fact by primary functionality, is not integrated into the economic turnover and funding of innovation and technological development of economic systems in innovational dynamics. In this time, interconnection "profit – amortization", if we take it as functionally relevant, clearly indicates that generating the profit should be considered exactly as object for financing in economic systems. It is too important in resolving of problems

of foresight. Also, it is an important indicator for the prediction of structural changes in economic systems. We should also unify the dynamic model of development of innovation and technology and the model of economic cycle for resolving of targets of foresight. Let's partly consider the graph on diagram (Fig. 1) of functional interaction indicators of innovation factors *DD* (depreciation deductions) and *IA* (intangible assets).

So we can see two fixed periods in which the density of the interaction of these factors is "max". This means that the nearness of realisation of factorial components was established, that leads to forming the substantial unit of growth (see point of intersection graphs *DD* and *IA* in 2002 and 2010). How can we interpret it? Let's write as follows:

$$\Delta DD_{2002-2010} = \Delta NA_{2002-2010} \quad (1)$$

or

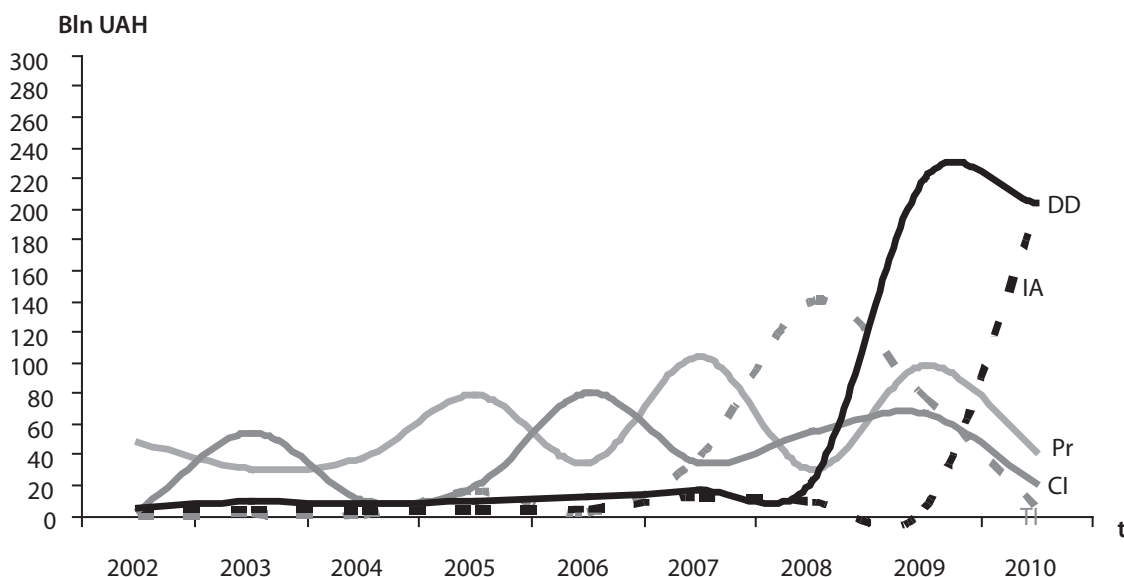
$$DD'_{2002-2010} = IA'_{2002-2010} \quad (2)$$

So in every period, the installation of linearity of index *DD* and *IA* leads to sustainable equality

$$DD'_{2002-2010} = IA'_{2002-2010} \rightarrow 0 \quad (3)$$

The development is latent in this condition. Actually, there isn't any technological shift. Its dynamics is implemented in the production of reproductive potential. We can characterize this period as "production in the transformation from productivity ↔ concentration". Technological shift is characterized by synchronous and equally directed changes of innovation factors of depreciation deductions (*DD*) and the total cost of intangible assets (*IA*). Respectively, by transforming the linearity of factors to a linear functional realizing them, there occurs the maximization of linearity of interconnections of factors together with loss of the linearity of the indicators dynamic of these factors. So a new numerical order of equality in the system of equations of the dynamic of balance of development is formed:

$$\begin{cases} DD_n = IA_n \\ \Delta development = b_0 \end{cases} \quad (4)$$



Key 1: *DD* – total cost of depreciation deductions; *IA* – total cost of intangible assets; *Pr* – profit; *CI* – Volume of capital innovation; *TI* – Volume of technology innovations.

**Fig. 1. Model of innovation activity of the field of mechanical engineering in Kyiv,**

By author.

<sup>1</sup> – here and hereinafter symbols are used in this sense.

In our example this equation corresponds to the base of economic growth in 2010 ( $DD_{2010} = IA_{2010}^2$ ). Thus, the volume increases of DD and IA during the technological shift, between two technological transformations, shows the initial level of base cost of proportions of sharing of the new economic growth. This corresponds to parameter  $b_0$  in the economic-mathematical models. For example: the cost for initialization of the reproduction in the new innovation cycle in the field of engineering in Ukraine is 198 billion UAH (or 24.75 billion USD)<sup>3</sup>. At the same time, on the hands of the population of Ukraine in March 2012 it was 195.0 billion UAH. This indicates the synchronization in time of the innovation reproduction processes and accumulation of common social funds. So we can unify them to the objective function. In other words, a new development cycle will not begin until a maximum linear interaction between all elements of the innovation dynamics will arise, like the next equality shows:

$$\begin{aligned} DD_{1(2002-2010)} &= IA_{1(2002-2010)} = \\ &= TI_{1(2002-2010)} = CI_{1(2002-2010)}. \end{aligned} \quad (5)$$

This is basic condition for method of prediction of systems progress, namely the moment of shifts in technological base of reproduction. So we can reproduce in models, based on available basic indicators of economic development, future configuration of elements in economic systems with the specified parameters. Main methodological precondition is functional unity of technological innovation (CI; TI) and financial factors, which in general view have a form of nonlinear interactions of factors of concentration resources of reproduction:

$$\begin{cases} Y = f(Ipr; Tech); f \Delta K(L; Tech) \\ Y(Pr; Q) = f(DD; IA; CI; TI). \end{cases} \quad (6)$$

So: the volume of concentration of resources of reproduction of innovation-technological type in economic systems is motivated by establishing a nonlinear convergence of factors of productivity of capital dynamics (CI, TI) and next transformation of value into the funds of reproduction (DD, IA)

For example: data (Table 1) fully corresponds with Fig. 1, where there is not dense correlation on all indicators in 2008. In the next period it changes by setting of linearity Ipr (2009) → TI (2009) and to the establishment of linear functions of reproduction in the functional implementation DD (2010) → CI (2010) → TI (2010).

$$Y = 0,9063 \cdot TI - 0,0053 \cdot CI. \quad (7)$$

Thus, the cycle of development is initiated under the influence of the realization of core innovative technology productiveness. It will not have any conditions during this time, necessary to initiate the next technological breakthrough, until forming full volume of distributed values of innovative factors of reproduction DD, IA, CI, TI. At the same time, the distribution of values into the factors of reproduction DD, IA, KI, TI initializes the technological gaps. The technological gaps and temporal gaps are tightly linked. Functionally, the temporal gaps are the factors of losing values.

Economic progress, gradually resolved the problem of reduction of temporal gaps motivated by the technologies. The smaller the productiveness of technology, the greater the temporal gap for the reproduction of the basic values and the more is their loss. Technology, throughout the history of mankind, solves the civilization problem that creates new quality of life – an issue of overcoming the temporal constraints. All technology and efforts of mankind will concern the solution of this problem. This is the base of the prediction methodology of the economic and civilization development.

#### Concerning the vectors of technological performance.

An important element of the proposed method is general direction of technological changes in economic systems, where vector directivity is used as substantiation of methodological approach in the theoretical description of the transformations of the economic systems as a whole.

So:

- ✦ the sequence of interrelated technological innovation will be described by finite vector, which is parallel to trajectory overcoming the limits in space (innovations in transport, to minimize transport time) and in time (the problem is solved by the Internet). This vector is systemic, consistent, linear, ascendant.
- ✦ each point of trajectory of development carries potential of transformation to all directions on stages of reproduction processes. Probabilistic growth points, let's call them "point of fulcrum" will be described by a finite vector;
- ✦ each point of finite vector should be regarded as a "point of fulcrum" for probabilistic scenarios of changes in configuration resources of reproduction;

Table 1

Calculation of correlation coefficients for the indexes of inovational-technology development of Ukrainian machine-bulding industry

2008 year	DD	Ipr	2009 year	DD	Ipr	2010 year	DD	Ipr
IA	0,510	0,603		0,722	0,672		0,106	0,098
CI	0,446	0,788		0,824	0,819		<b>0,94</b>	<b>0,899</b>
TI	0,239	0,27		0,264	<b>0,988</b>		0,389	<b>0,973</b>

By author.

In this case, there is initialization of relevant function of innovation – technological dynamics in the economic system. So, the total cost is distributed into the factors of innovation-technological development of TI and CI according to coefficients of the growth:

<sup>2</sup> Look at the Fig. 1.

<sup>3</sup> This calculation corrected according with some data from the study: Флориан Грубер, Александр Дегельзеггер. Форсайт в сфере научно-технологического партнерства Европы и Юго-Восточной Азии // Форсайт. – 2010. – Т. 4, № 3. – С. 56 – 68 [6].

- ✦ length of the finite vector along which a finite number of alternatives is created, is determined by the potential of productivity of core technology. The start of distribution potential of vector is the endpoint of length of vector.

Accordingly, there is a fundamental amendment to the foresight of future economic systems of innovation type: *the number of probabilities of development any processes in innovation systems is limited*. There is no infinite number of possible scenario. Thus, there is in principle the possibility of mathe-

mathematical calculation of quantitative and qualitative parameters of configuration of any system on the specified term of prediction. Whence are the infinity alternatives of the prediction formed or why there are economic systems with different levels and the quality of reproduction? First of all we can say next: innovative technology in the start of introduction does not allow and does not provide "free up resources" with following their concentration in the funds of playback, so function "of resource consumption in production" is dominant:  $f \text{ concentration resources} \rightarrow \min$ . Consequently, there isn't any resource for the forming of alternatives. The principal restriction in time is a time for concentration of experience in the process of "production-consumption". It is complete development cycle in the "function of consumption" and forming point of growth.

**Also we should take to attention next:**

- ★ in the process of playback, all factors are focused on the point of correlation, where full resources are realized in own interaction and are replaced in form, quality and cost in the long run. Every alternative could be used; each point of vector of development initializes a number of finite vectors and generates the potential of "point of fulcrum";
- ★ all possible alternatives, which were realized in advance are potentially insignificant. They are covered by general vector with greatest potential of core technology, along which the rate of profit on global markets is formed, the technological level of the market's leaders and with corresponding set of competitive benefits.

So, in economic systems of innovative type, the counterparts realize the "point of fulcrum" asynchronously, thus affecting the ununiformity of the processes in economic environment. Situation with the incompleteness of consuming arises, when the firms with little potential for reproduction triggers function  $f \text{ consumption in production} \rightarrow \max$ . It leads to creation of potentially zero cost, pseudo innovative product. Consider the application of this approach to determine the circuit configuration of technological innovation cluster for which all possible economic benefits are generated by the trajectory of the vector, which is described by the equation:

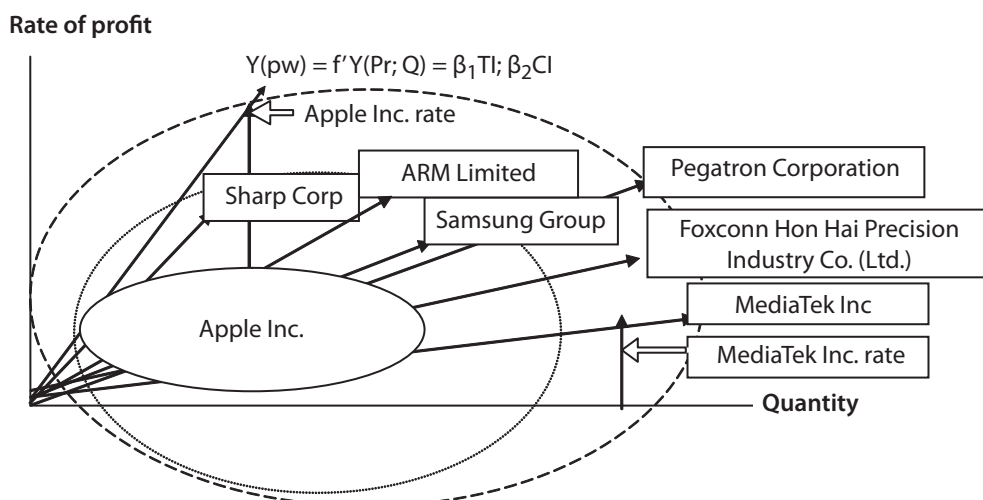
$$Y(pw) = f'Y(Pr; Q) = \beta_1 TI; \beta_2 CI. \quad (8)$$

This reads as follows: all possible economic benefits are generated along the finite vector trajectory, which is described by equation of derivative function "performance  $\leftrightarrow$  efficiency" in the functional cycle of innovation: technological innovation  $\leftrightarrow$  capital innovation. The processes of economical transformations can be represented in the effects the expansion in the models of mutual transition of qualitative characteristics of the interaction of reproduction factors. In mathematical model, these can be represented in changing restrictions of the functionality determinants of the target function. For example: there is production technology (company level), next is  $\rightarrow$  technological base of production (innovative environment sector) generates  $\rightarrow$  global innovation environment (knowledge environment). Centrifugal vectors are vectors of the reproduction, where position of world leadership and competitive advantages management is formed along their trajectory. So monopolization of reproduction happens.

For example: Hi-Tech cluster will be as follows, taking into account vectors of technological of compatibility of the interconnections in the reproduction process on a global scale. (Fig. 2).

Using this approach, the configuration of IT-cluster model<sup>4</sup> was calculated (see fig. 2) according to vectors (see equation (8)) of the relationships of technology corporations. In this case the function  $Y(Pr; Q) = \beta_1 TI; \beta_2 CI$  is based on technological productivity of Internet technologies of data transmission ( $\beta_1 TI$ ) and its derivative hardware of technologies ( $\beta_1 TI; \beta_2 CI$ ). For a given cluster, the Apple Corp is core with contour of technological compatibility of Samsung Group and Sharp Corporation. As periphery is the MediaTek Inc., Foxconn Hon Hai Precision Industry Co. (Ltd.), Pegatron Corporation. We can see (Fig. 2), the rate of profit for all clusters participants is limited by rate of the Apple Inc. So the main effect from technological innovations (TI) is in expansion of the width of the flow of reproduction of values through reducing temporal gaps in the reproduction processes. In practice the

<sup>4</sup>The methodological approach in substantiating the construction of diversified clusters proposed in Porter, M. Clusters and the new economics of competition, Harvard Business Review, 76(6). - 1998 pp. 77 - 81 [7].



**Fig. 2. The Model basis on IT-cluster of technological compatibility vectors in reproduction**

By author.



acceleration of productivity recoil of capital and concentration of depreciation fund due to growth of the accumulated volume of value happened. So the reduction of the temporal gaps also happens due to acceleration of the investment funds playback. In IT industries the cost of the capital is amortized regardless of the temporal characteristics of the technological cycle. Actually, the technological cycle is an infinitesimal minimized in time:  $t \rightarrow 0$  (min) due to processing of information streams by computer systems.

Accordingly, the cost of technologies are completely differentiated and synchronized to the dynamics of creation and augmenting of knowledge, where the time factor is a functional basis. Hi-Tech special systems have any temporal gaps and hence the processes of amortization are approximated in them, they are equally directed and exactly identical to the dynamics of prices. Absence of temporal gaps, due to unclaimedness of time to overcome them and achieving synchronization of reproduction processes, speeds the formation of financial assets for playback on Hi-tech markets.

So, the main provisions of foresight method of innovation-technological development are the next:

- ✦ main methodical approach of forecasting is to overcome the functionality of time factor and transformation of it to the functional base of prognosis models;
- ✦ the duration of each cycle, from innovation to next innovation, will be determined according to time of full realization of the productiveness of the technological factor in reproduction, after that such technology goes into the category of the typical standard technologies, from field of reproduction (in the private case – expanded reproduction), to the sphere restoring (simple reproduction);
- ✦ the methodology of overcoming of temporal gaps could be used as a base for calculation of extremum points of cycles of reproduction, for synchronization and harmonization/unification of macro and micro-economic models of production and finance;
- ✦ innovation economy reduces cost of every new technological level of production in society to a minimum:  $f_{econ} \rightarrow \min \text{ cost}$ .

So we can propose the foresight innovation and technological development in global economic system (Fig. 3).

In this model the cause, order and sequence of steps of critical levels of innovation-technological development was reproduced, it includes the vectors of diffusion of productivity of the basic technology. The closest basic technological shift for the system of reproduction of the Earth will be described by the vector of transformation of efficiency of information technology into energy and transport technology cluster due to synchronization of innovation processes in the field of communication and transportation. The bilateral innovations from transport and from the "urban-cluster" will cause the intensity of innovation in the field of health and will generate a basic innovation for creation of «force fields» and innovation for "continued life of people". The critical level of technological productiveness will be held on the border of the axis of the technological transformation of economic mode of production into the intelligent playback system, for which the problem of replaying socio-humanitarian environment and living systems will stand in future.

## CONCLUSIONS

1. The duration of each cycle from innovation to innovation will be determined by the time of full implementation of productivity of the technological factor of playback. After that, this technology moves into the category of recovery from the field of replay. The base to overcoming the devastating effects of cyclical development is convergence of methodology to overcome temporal gaps, synchronization and harmonization of macro and micro-economic models of production and finance.

2. The function of development has the properties of mutually inverse factors of transformation as such. This means that the resolving the problem of prediction lies in the area of economic turnover. Foresight can be created through calculating of parameters of installation of the linear approximation point of innovation factors of reproduction, such as: TI, CI, IA, and DD.

3. The main characteristic of the process of future development is the realization of ultimate quantity of alternatives for technology development, that are points of support for the implementation of next alternatives. These alternatives for development are limited in their own productiveness by the general vector of the technological productivity of core innovation technology. Every core innovation technology generates values and their further distribution into the potential of resources of the future development. Each economic system can generate their own alternative from own competencies experience, or using the resource of system, in which the technological base of development was generated. This is true for all economic systems of all levels of aggregation.

4. The main function for economy in society in the future is to reduce the cost of each following technological level of production to a minimum:  $f_{econ} \rightarrow \min \text{ cost}$ . This is an objective way to generate a greater ecosystem in the future. ■

## REFERENCES

1. Белоусов Д. Р. Построение долгосрочного научно-технологического прогноза для России методом «Форсайт» / Д. Р. Белоусов, О. Г. Солнцев, М. Ю. Хромов // Проблемы прогнозирования. – 2008. – № 1. – С. 18 – 33.
2. Войнов И. В. Моделирование экономических систем и процессов. Опыт построения ARIS-моделей : монография / И. В. Войнов, С. Г. Подвина, Ф. И. Телегин. – Челябинск : Изд. ЮУрГУ, 2002. – 392 с.
3. Гапоненко Н. В. Форсайт. Теория. Методология. Опыт : монография / Н. В. Гапоненко. – М. : ЮНИТИ-ДАНА, 2012. – 239 с.
4. Ларуш Л. Новая парадигма. Стратегический обзор из США. 2013.04.13 / Л. Ларуш [Электронный ресурс]. – Режим доступа : <http://www.youtube.com/watch>
5. Гоэбель М. Научно-технологическое сотрудничество ЕС и Украины: преимущества и барьеры / Мишель Ле Гоэбель, Дезире Пекарц, Катарина Хандлер, Клаус Шух // Форсайт. – 2011. – Т. 5. – № 3. – С. 44 – 57.
6. Грубер Ф. Форсайт в сфере научно-технологического партнерства Европы и Юго-Восточной Азии / Флориан Грубер, Александр Дегельзеггер // Форсайт. – 2010. – Т. 4. – № 3. – С. 56 – 68.
7. Porter M. Clusters and the new economics of competition / M. Porter // Harvard Business Review, 76(6). – 1998. – pp. 77 – 81.
8. Річна звітність емітентів цінних паперів. Система розкриття інформації емітентів цінних паперів [Електронний ресурс]. – Режим доступу : <http://www.smida.gov.ua>
9. Hines A. Thinking about the future: Guidelines for Strategic Foresight / Andy Hines, Peter Bishop // Social Technologies, 2006, 243 p.
10. Porter M. (2001). Strategy and the Internet / M. Porter. – Harvard Business Review, March 2001, pp. 62 – 78.
11. Porter M. Strategy and Society: The Link Between Competitive Advantage and Corporate Social Responsibility / Micheal E. Porter, Mark R. Kramer // Harvard Business Review. – 2006. – Pp. 78 – 94 [Electronic resource]. – Mode of access : <http://hbr.org/2006/12/strategy-and-society-the-link-between-competitive-advantage-and-corporate-social-responsibility/ar/1>

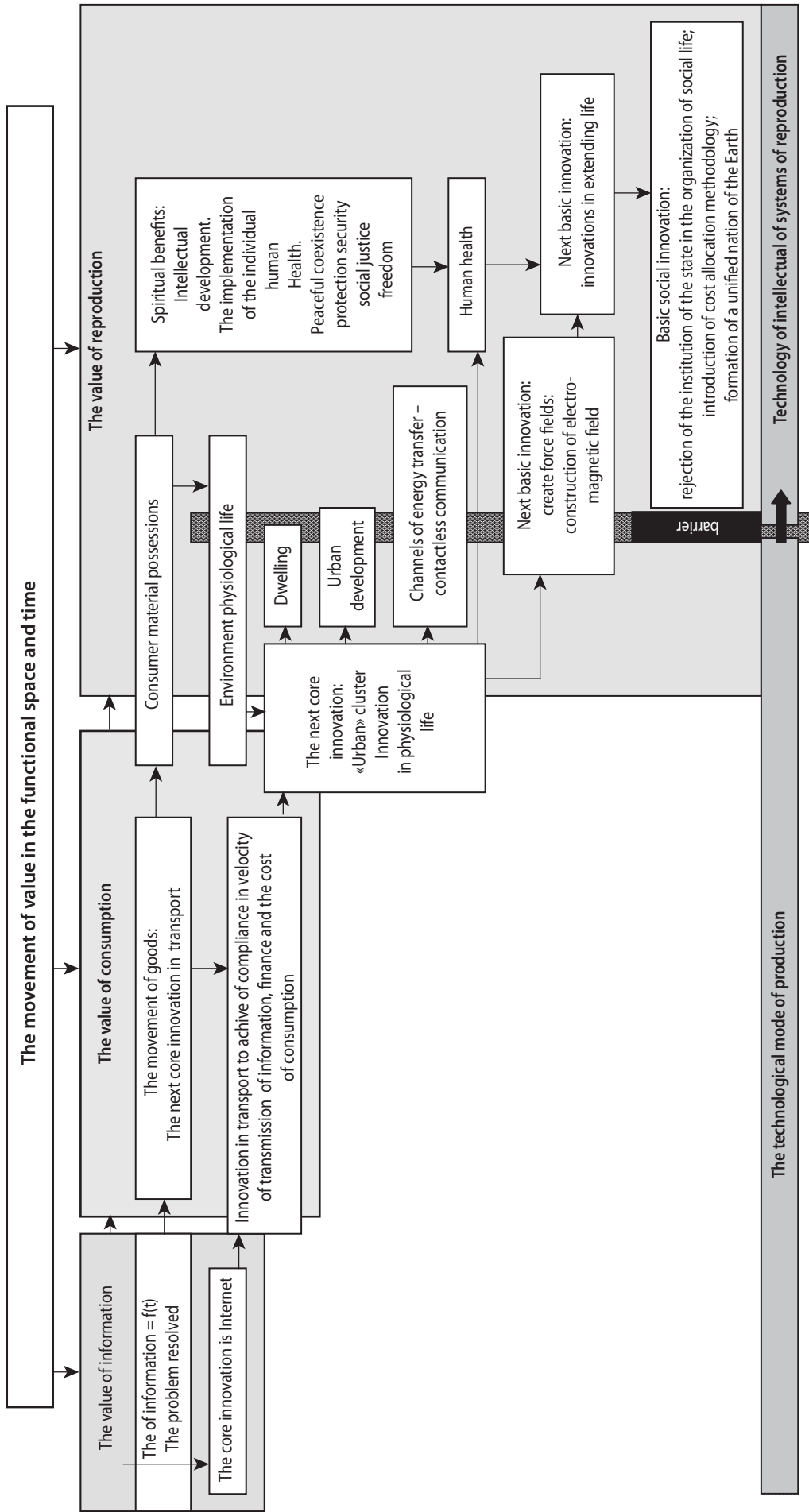


Fig. 3. The Model of foresight of innovational-technological development in economic systems

By autho.

REFERENCES

Belousov, D. R., Solntsev, O. G., and Khromov, M. Yu. "Postroenie dolgosrochnogo nauchno-tehnologicheskogo prognoza dlia Rossii metodom «Forsayt»" [Building a long-term scientific and technological forecast for Russia by "Foresight"]. *Problemy prognozirovaniia*, no. 1 (2008): 18-33.

Gaponenko, N. V. *Forsayt. Teoriia. Metodologiia. Opyt* [Forsyth. Theory. Methodology. Experience]. Moscow: YuNITI-DANA, 2012.

Gruber, F., and Degelzegger, A. "Forsayt v sfere nauchno-tehnologicheskogo partnerstva Evropy i Yugo-Vostochnoy Azii" [Foresight in science and technology partnerships in Europe and Southeast Asia]. *Forsayt*, vol. 4, no. 3 (2010): 56-68.

Hines, A., and Bishop, P. "Thinking about the future: Guidelines for Strategic Foresight". *Social Technologies* (2006).

Le Goebel, M., Pekarts, D., and Khandler, K. "Nauchno-tehnologicheskoe sotrudnichestvo ES i Ukrainy: preimushchestva i baryery" [Scientific and technological cooperation between the EU and Ukraine: benefits and barriers]. *Forsayt*, vol. 5, no. 3 (2011): 44-57.

Larush, L. "Novaia paradigma. Strategicheskii obzor iz SShA" [The new paradigm. Strategic review of the United States]. <http://www.youtube.com/watch>

Porter, M. "Clusters and the new economics of competition". *Harvard Business Review*, no. 76 (6) (1998): 77-81.

Porter, M. "Strategy and the Internet". *Harvard Business Review*, March (2001): 62-78.

Porter, M. E., and Kramer, M. R. "Strategy and Society: The Link Between Competitive Advantage and Corporate Social Responsibility" <http://hbr.org/2006/12/strategy-and-society-the-link-between-competitive-advantage-and-corporate-social-responsibility/ar/1>

"Richna zvitnist emitentiv tsinnykh papieriv. Systema rozkryttia informatsii emitentiv tsinnykh papieriv" [The annual reports of issuers of securities. The system of disclosure of securities issuers]. <http://www.smida.gov.ua>

Voynov, I. V., Pudovkina, S. G., and Telegin, F. I. *Modelirovanie ekonomicheskikh sistem i protsessov. Opyt postroeniia ARIS-modeley* [Modeling of economic systems and processes. Experience in building ARIS-models]. Cheliabinsk: YuUrGU, 2002.

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## МОДЕЛЮВАННЯ ЕКОНОМІЧНОГО РИЗИКУ ДЛЯ ОЦІНЮВАННЯ РІВНЯ ЕКОНОМІЧНОЇ БЕЗПЕКИ РЕГІОНІВ

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### Блудова Т. В., Черевко Д. Р. Моделювання економічного ризику для оцінювання рівня економічної безпеки регіонів

Метою статті є моделювання економічного ризику для оцінювання рівня економічної безпеки регіонів. У статті виокремлено основні загрози економічній безпеці регіону та представлено алгоритм оцінювання рівня економічної безпеки регіону. Розглянуто чинники впливу на значну диференціацію соціально-економічного розвитку регіонів України. Розглядається підсистема індикаторів зовнішньоекономічного регіонального розвитку (індикатори регіональних експортно-імпортних операцій та їх порогові значення) як складової рівня економічної безпеки регіону. Показано тісний взаємозв'язок між елементами зовнішньоторговельної сфери та економікою країни, що в цілому обумовлює необхідність ефективної державної політики, спрямованої на оптимізацію всіх процесів і ліквідацію диспропорцій між рівнями соціально-економічного розвитку регіонів.

**Ключові слова:** соціально-економічний регіональний розвиток, прогнозний сценарій розвитку регіону, макроекономічні моделі, економічна безпека регіону, індикатори, порогові значення.

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### Блудова Т. В., Черевко Д. Р. Моделирование экономического риска для оценки уровня экономической безопасности регионов

Целью статьи является моделирование социально-экономического регионального развития. В статье выделены основные угрозы экономической безопасности региона и представлен алгоритм оценки уровня экономической безопасности региона. Рассмотрены факторы влияния на значительную дифференциацию социально-экономического развития регионов Украины. Рассматривается подсистема индикаторов внешнеэкономического регионального развития (индикаторы региональных экспортно-импортных операций и их пороговые значения) как составляющей уровня экономической безопасности региона. Показана тесная взаимосвязь между элементами внешней торговли сферы и экономикой страны, что в целом обуславливает необходимость эффективной государственной политики, направленной на оптимизацию всех процессов и ликвидацию диспропорций между уровнями социально-экономического развития регионов.

**Ключевые слова:** социально-экономическое региональное развитие, прогнозный сценарий развития региона, макроекономические модели, экономическая безопасность региона, индикаторы, пороговые значения.

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### Bludova T. V., Cherevko D. R. Simulation of Economic Risk to Assess the level of Economic Security of Regions

The aim of the article is modeling of socio-economic regional development. The article highlights the main threats to the economic security of the region and presents an algorithm for estimating the level of economic security in the region. The factors of influence on significant differentiation of socio-economic development of the regions of Ukraine were considered. The sub-system external economic indicators of regional development (indicators of regional export and import operations and their thresholds) were considered as a component of economic security in the region. The close relationship between the elements of the foreign trade sector and the country's economy, which generally leads to the need for effective public policies aimed at optimization of all processes and the elimination of disparities between the levels of socio-economic development of regions.

**Key words:** socio-economic regional development, the forecast scenario in the region, macroeconomic models, the economic security of the region, indicators, thresholds.

**Pic.:** 2. **Tabl.:** 1. **Formulae:** 9. **Bibl.:** 13.

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