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## STRUCTURAL BALANCE OF INVESTMENTS IN INNOVATIVE CLUSTERS' ECONOMIC SYSTEMS

*On the example of the interaction of Ukraine and Russia in the innovations field the author investigates the character of possible transformations in investments due to the integration of local, regional and national economies into the international system of innovation clusters. The findings theoretically describe the regularities inherent in all types of economic systems. The proposed calculated numerical parameters of change determine the structure of the investment environment as a result of integration intensification in the field of innovation.*

**Keywords:** structural balance of investment; investment environment; economic system; international cluster.

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## СТРУКТУРНИЙ БАЛАНС ІНВЕСТИЦІЙ В ЕКОНОМІЧНИХ СИСТЕМАХ ІННОВАЦІЙНИХ КЛАСТЕРІВ

*У статті на прикладі міжнародної взаємодії України та РФ в інноваційній сфері досліджено характер можливих трансформацій в інвестиційній сфері в умовах інтеграції локальних територіальних і національних економічних систем в систему інноваційного міжнародного кластеру. Наведено висновки, загальні для теоретичного опису закономірностей, властивих для всіх типів економічних систем, розраховано числові параметри зміни структури інвестиційного середовища внаслідок активізації інтеграційних процесів у сфері інноваційної діяльності.*

**Ключові слова:** структурний баланс інвестицій; інвестиційне середовище; економічні системи; міжнародний кластер.

**Форм. 1. Табл. 3. Літ. 19.**

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## СТРУКТУРНЫЙ БАЛАНС ИНВЕСТИЦИЙ В ЭКОНОМИЧЕСКИХ СИСТЕМАХ ИННОВАЦИОННЫХ КЛАСТЕРОВ

*В статье на примере взаимодействия Украины и РФ в инновационной сфере исследован характер возможных трансформаций в инвестиционной сфере в условиях интеграции локальных территориальных и национальных экономических систем в систему инновационного международного кластера. Предложены выводы, которые следует считать общими в теоретическом описании закономерностей, характерных для всех типов экономических систем. Рассчитаны числовые параметры изменения структуры инвестиционной среды в результате активизации интеграционных процессов в сфере инновационной деятельности.*

**Ключевые слова:** структурный баланс инвестиций; инвестиционная среда; экономические системы; международный кластер.

**Introduction.** The contradictions caused by the structural transformation of economies, technological nature of the dynamics of economic transformation on the global scale require the systemic approach to study the effectiveness of investments in innovation within economic systems, also revealing the inadequacy of traditional approaches in predicting the volume of major international investment in innovative projects in the long term. The problem here is the impossibility to synchronize the

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investment cycle and the cycle of innovation in terms of system transformations in the economy by means of traditional methodological approaches.

In contemporary models of financial and investment mechanisms it seems too problematic to generate the factors that influence or initiate economic growth of innovative type.

However, the effect of emission is inherent to investments in economic systems. Accordingly, the transformation of investment environment impact all reproduction processes in economic systems, including innovations. This is the main feature of economic dynamics of today's world.

These aspects of transformation of investment environment within economic systems of innovation type needs a more detailed study.

**The objective** is to study the characteristics and to calculate the volume of changes in investment tools due to the interaction of economic systems and initializing the integration process of their transformation into aggregate economic systems.

**Key research findings.** In the dynamics of the investment environment formation, it is necessary to allocate some aggregate ratios of volume of investment resources, in order to determine the nature and the extent of possible transformations during the interaction of economic systems on different levels of aggregation.

In the relatively small economic systems (enterprises) structural transformations can be objectively insignificant, since they might be compensated by reengineering or outsourcing. In regional economy, multinational corporations, localised innovation systems, or international clusters systems the investment environment is transformed under the intensification of interaction of the system elements at the level of technological linkages, information logistics and communications.

As a basic effect of transformations in economies and an important determinant of functional activation in business processes is the effect of reducing temporal gaps, where the time factor is a basic element of effectiveness.

With the integration of the economies of innovation type in combination with the use of macroeconomic regulation tools, it can be possible to use the effect of reducing time gap for creating technological relations on the basis of cooperation in the field of science, technological innovations, forming the efficiency of higher level for technological networks of scientific and technological systems.

Reduced time gap leads to the disposal of "institutional structures" of industrial complexes and to the reduced costs of production. So, there are objective conditions for restructuring resources to create institutions and restructurization processes for activation innovation, research-education and science-technology components of economic systems.

The method of structural balance of investments helps to determine the priority areas for the development of localized industrial complexes, in perspective transformation or integration of them into a territorial cluster-type economy by identification a common model of investment mechanism. Also, this method allows selecting the most efficient vectors of investing already at the level of model of integration into the innovation cluster based on the approximate values of the corresponding coefficients<sup>2</sup>.

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<sup>2</sup> coefficient of structural balance investments.

First of all, the basic factors of increasing investments in economic systems is funding the R&D regardless their regional, industry characteristics, the degree of concentration of intersystem technological ties, the availability and capacity of infrastructure innovation, education.

Second, even in the absence of parity in the volume of investments in particular economic systems, there are advantages, substantiated by internal endogenous factors.

Thus, for organizing cluster-type economic systems of concentration of scientific and industrial complexes and industries overall, the investment environment should be seen as a form of spatial concentration of diversified investment potential. In this case, subject-object interaction is identified by the technological compatibility of scientific and industrial complexes inside the cluster type integrated economic systems.

To determine the structure of investment environment, basic analytical evaluation can be offered to calculate the investment structural balance:

$$k_{sbi} = (DFI + DFlii) / DI, \quad (1)$$

where  $k_{sbi}$  – coefficient of structural balance investments;  $DFI$  – direct foreign investments;  $DFlii$  – institutional investors' direct foreign investments;  $DI$  – domestic investments.

This analytical assessment is carried out based on the assumptions:

if  $r \geq 1$ , so  $\Delta Investments = f(GDP)$ ;

if  $r \leq 1$ , so  $\Delta GDP = f(investments)$ .

Based on this approach let us calculate the indicators of investment environment, for example, for Ukraine and Russia (Table 1).

**Table 1. Structural balance of investments Ukraine/Russia, coefficients**

<b>Ukraine</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
DFI	1.163	1.057	0.438	0.829	0.677	0.534	0.433	0.709	0.755	0.582	0.582
DI	0.713	0.696	0.693	0.722	0.733	0.731	0.74	0.775	0.694	0.719	0.684
General structure DFI/DI	<b>1.63</b>	<b>1.52</b>	<b>0.63</b>	<b>1.15</b>	<b>0.92</b>	<b>0.73</b>	<b>0.59</b>	<b>0.91</b>	<b>1.09</b>	<b>0.81</b>	<b>0.9</b>
<b>Russia</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
DFI	0.090	0.122	0.138	0.148	0.118	0.175	0.132	0.086	0.068	0.072	0.064
DI	0.991	0.988	0.990	0.991	0.984	0.983	0.970	0.968	0.977	0.982	0.988
General structure DFI/DI	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.2</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>

Source: calculated by the author on the data from the State Statistics Service of Ukraine ([www.ukrstat.gov.ua](http://www.ukrstat.gov.ua)); and Russia Federation State Statistic Service: Russia industry in 2012 ([www.gks.ru](http://www.gks.ru)).

This indicates little impact of foreign investment on Russian economy and the total dependence of dynamics of forming investment resources inside its economic system. This also illustrates the ultra-high localization of Russia's economic system of the whole, which adds difficulty to build a diversified economy in which one of the main features is cluster. Such ultra-high localization leads to clear structuring of industrial complexes as innovative clusters on the territorial basis. In Ukraine, on the contrary, these is a formed investment mechanism with a significant structural part of

foreign investments. Thus, in Ukraine there is an available structuration in accordance with the degree of concentration of capital by industries. In this context, the model of territorial concentration as the basis for cluster systems formation can be supplemented by the models characterized by technological information and communication channels for sectoral, technological, innovative features, and these systems can be mutually integrated as in certain ways so complexly integrated too.

Therefore, any integrated economic system will be characterized by the complex of technological linkages and communication infrastructure. Thus, if a cluster is a group of interconnected enterprises and associated with them organizations and institutions, then clustering as a process and cluster development mechanism as a tool are directed at creating technologically identical sets of economic actors into the network technological economic systems of reproduction. This should be considered as an over branch level structuring of an economic system (Fedulova et al., 2013: 271–320).

This feature appears during the simulation of investment environment by means of a complex of indices of territorial, sectoral, industrial, innovative growth areas.

Table 2 illustrates the dynamics and general changes in the structure of the investment mechanism in the context of territorial, industrial, industry and innovative directions. Application of this model (Table 2) is based on equation 1 with regard to the interpretation of the coefficients.

In general, the estimation of parameters coefficients of the structural balance (change / dynamics by years) makes it possible to draw a conclusion about the stability of mechanisms of the economic system.

Comparative characteristics of regional, sectoral, industrial, innovation coefficients allow to draw conclusions about the priorities directions in the development of clusters.

This method is not to estimate the investment mechanism, it should be considered as a method the identifying of functional orientation of investment mechanism, which is common for integrated economic systems. Also, this method is less effective on the identification business corporations and other such economic systems that are characterized by a high degree of localization of internal business environment.

The reason is that corporations of the network type have the environment defined by the general investment strategy, or the most unified overall partners strategy. Environment in such systems is localized and does not provide competitive interaction.

For the approbation of this methodological approach we offer a model of investment environment in several hypothetical areas of implementation of the initiatives for the integration of regional economies in the international system of innovation clusters (Ukraine and Russia) (Table 3).

As Table 3 shows, there is only one prospective in terms of attracting investment, and that is technological cooperation in the field of infrastructure and engineering. All other options of innovation clusters due to the lack of new technologies in production systems both in Ukraine and in Russia are not promising.

In general, it should be noted that the overall thrust of the transformation of investment environment in the process of regional economic integration is characterized by resources restructuring in the structural balance of the investment envi-

ronment of the integrated system, regardless the specialization configuration to the innovation cluster.

**Table 2. The structural balance of investments in Ukraine's regions and regions and clusters of Russia (2002–2012)**

Ukraine								
	Lugansk region	Donetsk region	Kharkivsk region	Dnipropet-rovsk region	Zaporizhzhya region			Kyiv
r <sub>territory</sub>	0.7447	0.9265	1.5894	4.1775	1.2656			4.95
r <sub>industry</sub>	0.8576	1.3348	2.9509	7.1219	0.6024			27.7404
r <sub>branch</sub>	34.4532	27.5335	44.074	89.1588	9.4763			402.4203
r <sub>innovation</sub>	18.6297	8.6970	12.703	67.7097	41.8953			53.2707
r <sub>integral</sub>	4.4947	4.1483	7.1584	20.5865	4.1711			41.4168
Russia								
	Orlovsk region	Bryansk region	Voronezh region	Krasno-yarsk krai	Delgorod region	Rostov region	Kursk region	Lipetsk region
r <sub>territory</sub>	0.0392	0.0298	0.0373	0.0623	0.0312	0.0299	0.0101	0.0310
r <sub>industry</sub>	0.2445	0.1964	0.1326	0.3187	0.2060	0.1853	0.0437	0.1284
r <sub>branch</sub>	0.2835	0.2531	0.2261	0.4412	0.2838	0.2162	0.1555	0.2704
r <sub>innovation</sub>	0.3921	0.5317	0.3498	1.2361	0.7363	0.4638	0.1833	0.5548
r <sub>integral</sub>	<b>0.1806</b>	<b>0.1676</b>	<b>0.1406</b>	<b>0.3226</b>	<b>0.1914</b>	<b>0.1535</b>	<b>0.0595</b>	<b>0.1564</b>
Russia (innovative clusters)								
	Kaluga region	Moscow region			Uilyanovsk region	Moscow		
	Pharmaceutical biotechnology and biomedicine cluster	Pushchino's Biotechnological Innovation Cluster	"Fiztekh-XXI» of Dolgoprudnyj	Cluster of nuclear-physcis and nuclear technology (Dubna town)	Dimitrovgrad nuclear technology cluster Ulnovsk aviation Cluster	«Zelenograd» (ICT and Electronics specialization )	New materials, laser and radiation technologies (in Troitsk town)	
r <sub>territory</sub>	0.3297		0.2542		0.0072		0.4313	
r <sub>industry</sub>	0.5536		0.7222		0.0472		1.5671	
r <sub>branch</sub>	0.8140		1.5231		0.0744		4.1250	
r <sub>innovation</sub>	0.7283		0.9740		0.0742		0.8070	
r <sub>integral</sub>	<b>0.5735</b>		<b>0.7224</b>		<b>0.0370</b>		<b>1.2247</b>	

Source: calculated by the author on the data from the State Statistics Service of Ukraine ([www.ukrstat.gov.ua](http://www.ukrstat.gov.ua)); and Russia Federation State Statistic Service: Russia industry in 2012 ([www.gks.ru](http://www.gks.ru)).

Transformational dynamics of the investment environment in economic systems can be substantiated by the next:

- in interaction of economic systems of the cluster type the technological periphery is integrated first of all through the redistribution of investment resources according to their technological specialization;
- properties of large integrated economic systems generate sufficient resources to overcome the infrastructure gaps caused to territorial remoteness of technological industrial complexes;
- infrastructure development initializes the effects of filling in the institutional vacuum by means of integration the international clusters and thus appear the synergy and multiplier effects: this is the factor of investments concentration in a cluster and its institutional environment.

**Table 3. The model of integrative international economic system of the innovation cluster "Ukraine-Russia" based on the cooperation in science, technology and innovations**

Directions of cluster specialization		Structure of investments, %		Ukraine: volume of investment growth, %		Russia: volume of investment growth, %	
		DI	DFI	DI	DFI	DI	DFI
Ukraine's general model							
	r <sub>territory</sub>	31.35	68.65	— <sup>a)</sup>	—	—	—
	r <sub>industry</sub>	14.64	85.36	—	—	—	—
	r <sub>branch</sub>	7.18	92.82	—	—	—	—
	r <sub>innovation</sub>	1.89	98.11	—	—	—	—
	r <sub>integral</sub>	9.27	85.46	—	—	—	—
Russia general model							
	r <sub>territory</sub>	96.71	3.29	—	—	—	—
	r <sub>industry</sub>	81.97	18.03	—	—	—	—
	r <sub>branch</sub>	72.85	27.15	—	—	—	—
	r <sub>innovation</sub>	68.31	31.69	—	—	—	—
	r <sub>integral</sub>	79.25	15.03	—	—	—	—
Cross-border cluster "Ukraine-Russia"							
Transport infrastructure, machine-building engineering	r <sub>territory</sub>	47.74	52.26	16.39	—	—	48.97
	r <sub>industry</sub>	56.31	43.69	41.67	—	—	25.66
	r <sub>branch</sub>	81.52	18.48	74.34	—	8.67	—
	r <sub>innovation</sub>	94.70	5.30	92.81	—	26.39	—
	r <sub>integral</sub>	75.69	24.31	66.42	—	58.4	—
Innovation cluster "Ukraine-Russia"							
Nuclear and nanotechnologies, new materials, biomedicine and pharmaceuticals, aviation and space	r <sub>territory</sub>	51.38	48.62	20.03	—	—	45.33
	r <sub>industry</sub>	28.18	71.82	13.54	—	—	53.79
	r <sub>branch</sub>	9.29	90.71	2.11	—	—	63.56
	r <sub>innovation</sub>	4.75	95.25	2.86	—	—	63.56
	r <sub>integral</sub>	17.68	82.32	8.41	—	0.39	—
Nuclear and aviation cluster "Ukraine-Russia"							
Nuclear technology, aviation and space technology	r <sub>territory</sub>	43.92	56.08	12.57	—	—	52.79
	r <sub>industry</sub>	21.06	78.94	6.42	—	—	60.91
	r <sub>branch</sub>	18.77	81.23	11.59	—	—	54.08
	r <sub>innovation</sub>	2.23	97.77	0.34	—	—	66.08
	r <sub>integral</sub>	15.56	84.44	6.29	—	—	—

a) "—" – change is missing.

Source: calculated by the author on the data from the State Statistics Service of Ukraine ([www.ukrstat.gov.ua](http://www.ukrstat.gov.ua)); and Russia Federation State Statistic Service: Russia industry in 2012 ([www.gks.ru](http://www.gks.ru)).

**Conclusions.** In interaction of different economic systems, the investment mechanism will always restructure investment resources, which becomes common for all members of an integrated system. This should be considered as the initial effect of structural changes in the investment balance of economic systems.

A common secondary effect is the optimization of investment profitability inside of an integrated system, regardless the profitability of a particular innovative project.

The general effect is revealed in overcoming the destructive time gap consequences in the progress of forming investment resources of common innovation projects inside integrated economic systems.

High structural identity of balance investment in different economic systems is the loss of investment resources in the progress of their integration. It is one of the key factors hindering the creation of the common integrated system.

Restructurisation of investment environment does not have destructive effects for international economic relations. So, it does not require any special extra conditions for the development of international clusters.

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