INSTRUMENT FOR REGIONAL ECONOMIC DEVELOPMENT: DYNAMIC CLUSTER LOGISTIC (SEA PORT) MODEL

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Козак Ю.Г., Онофрей І.В. Інструмент регіонального економічного розвитку: механізм динамічних морських портових транспортно-логістичних кластерів.

Дана стаття присвячена економічному механізму динамічних морських портових транспортно-логістичних кластерів в економіці Одеської області. Необхідність переходу на нові кластерні структури та впровадження їх в українську економіку обумовлена високим ступенем ефективності, а також тим впливом, який на економіку області та країни мають порти та логістичні підприємства.

Ключові слова: динамічні кластерні логістичні морські портові моделі, моделювання економічних процесів, модель Регіон-Кластер.

Козак Ю.Г., Онофрей И.В. Инструмент регионального экономического развития: механизм динамических морских портовых транспортно-логистических кластеров.

Данная статья посвящена экономическому механизму динамических морских портовых транспортно-логистических кластеров Одесской области. Необходимость перехода на новые кластерные структуры и внедрения их в украинскую экономику обусловлена высокой степенью эффективности, а также тем влиянием, которое на экономику области и страны оказывают порты и логистические предприятия.

Ключевые слова: динамические кластерные логистические морские портовые модели, моделирование экономических процессов, модель Регион-Кластер.

Kozak Y.G., Onofrei I.V. Instrument for regional economic development: dynamic cluster logistic (sea port) model.

This article is dedicated to the economic mechanism of the dynamic sea port logistic (transport) cluster in the economy of the Odessa region. The need to transition to the new cluster structures and their implementation into the Ukrainian economy is caused by the high degree of efficiency, as well as the influence, which the ports and logistics businesses have on the economy of the country.

Keywords: dynamic cluster logistic (sea port) model, modelling of economic processes, quantitative "Region-Cluster" model.

The inclusion of an open economy of Ukraine into the world economy on a parity basis is impossible without reforming the economy and its sustainable development. The leading role in this process is given to the establishment and development of a competitive national economy, which is impossible without the use of all available mechanisms to accelerate the reforms and improvement of the internal market institutions [1].

One of the theories of the formation and development of regional competitiveness is the cluster theory of economic management.

The problems that the country faces in this context, in the most general terms are listed at the end of 2008 by the Ministry of Economy of Ukraine in their «Concept of Creation of Clusters in Ukraine». The concept highlighted the main vectors of state policy in the field of cluster development and suggests that the implementation within the cluster investment and innovation projects should strengthen competition with their own operating company and attract foreign investors [2].

However, among the aspects of the theory of cluster management most relevant today is the use and implementation into the Ukraine's economy the models of development of innovative regional industrial clusters, particularly in the field of maritime transport and logistics. Models of creation and development of sea port clusters today in Ukraine's economy in general are not used and are not discussed, therefore they are recommended to study, analysis and use of international experience in Europe and other world regions. The success of these models is proved in practice and has a clear digital expression [3].

Actuality of the research subject

Nowadays, Ukraine and its regions face many problems, which were accumulated and not solved during last several decades. Some issues and problems of the current economic stagnation and situation have their deep roots in previous economic and historic experience. To those problems one could assign:

1) Regional misbalances in the economic development, which mostly are the result of the downfall of the common internal market of the ex-USSR and the following breakage of close ties and production cycles within them. Up to now Ukraine at the state level has enormous systemic difficulties with

rebuilding its economic power and has not find the way to create and improve many of substitution productions in a wide range of sectors.

2) Low-tech economy.

3) Agricultural backwardness.

4) Week and outdate road network, which was not substantially renovated and modified during Euro-2012 football championship as it was expected.

5) Low level of social support and morality etc.

Now as a state Ukraine is still far away from the way of modern capitalist development and EU standards. It is obvious that Ukraine should implement the overtaking economic development by inheriting and adopting the best global practices of economic management. Besides that, we should find new effective instruments for our economic development and one of them is clusters.

The steep drop of production volumes in terms of the global economic crisis have had a great impact on the Ukrainian volume of transportation of goods by all types of vehicles and transport, including marine transport. The forming process of transport infrastructure and complex system of activities in regional logistic nets should play the decisive role in the current difficult situation. According to the abovementioned, the theoretical issues concerning innovative transport infrastructure and logistic system development in Ukraine and its regions in terms of globalisation needs to be revised using cluster models and mechanisms.

In modern conditions, in order to succeed in the competitive global market, companies need to understand their costs in the economic chain as a whole, and to cooperate with the rest of the chain in the interest of cost management and revenue maximization. This means the transition of enterprises from cost accounting only in their organizations to estimate the costs of the economic process as a whole, in which even the biggest company is just a link. In terms of the short-term contracts and relationships, poor communication and lack of coordination between providers and consumers in one economic process the guarantee of cost control of the whole chain is impossible. Again, such opportunity is given to enterprises through the organization of participants of the chain into the cluster.

Main goal

In this research paper, the main task is to analyze implementation of the dynamic cluster (sea port) logistic models in the economy of the Odessa region.

Degree of Problem Development

Cluster approach to the economy structuring and justifying strategies of economic policy, and competitiveness' increase of countries and regions is generally recognized.

Clusters and cluster policy are sufficiently widely covered in the works and publications of western and local scientists – Ukrainian and Russian experts.

In particular, these issues are revealed in scientific publications of leading Western cluster specialists, among them such prominent authors like Michael E.

Porter (the founder of a cluster concept), Peter W. de Langen, Dimitrios V. Liridis, Vassilios K. Zagkas, Maria Angel Diaz, Maria Esteban Soledad – world experts in the area of sea port clusters, Thomas Andersson, Sylvia Schwaag-Serger, and also Ukrainian and Russian scientists, among whom are distinguished such authors as A. Stepanov, A. Titov, L. Rybina, S. Sokolenko, J. Kovaleva., S. Gritsenko, S. Bludova, L. Pryshtchyepa etc [sources 4, 5, 6].

Many works of both domestic and foreign scholars and scientists are dedicated nowadays to the issue of modelling of economic processes, as well as problems of regional clusters and foreign economic activity.

Among those who considered the problems mentioned in the article are such scholars as already mentioned Michael E. Porter, as well as Lance Taylor, H. Amman, P. Dixon, B. Parmenter, and local scientists V. Makarov, A. Bakhtyzin, S. Sulakshyn, T. Pankova, N. Jankovskyi, L. Sukhova and others.

It should be noted that the issue of efficiency of foreign economic activity of individual industrial enterprises is covered quite extensively. But still up to now there was no substantial research that could examine in details the mechanisms and models for improving the efficiency of foreign economic activity in the region, in particular using dynamic cluster models.

It is worth noting that there are a number of problems in application of cluster model and sea port clusters in the Odessa region nowadays.

In the first place, such a problem is the existence of appropriate organizational and functional mechanisms of creation and construction of the cluster, and the problem of availability of adequate mathematical economic models. Their implementation in practice would provide an opportunity to assess the effectiveness of the cluster and to identify ways to improve and further develop.

The core of the new clusters may be large industrial and economic systems. Center of Odessa Sea cluster potentially can become a state enterprise «Odessa sea commercial trade port».

Creating a cluster in this case refers not so much and not only in the form of new investments in technical modernization, but actually changing the very nature of the organization and interaction between members of the chain within the cluster.

Disclosure of main material

One way of mobilizing resources in the regions for dynamic social and economic development in the medium and long term, competitiveness and diversification of the regional economy is the development and use of clusters and cluster policy based on market principles.

New tasks facing reform-minded regional and local authorities on the content of the socio-economic development of territories and their communities is to step up innovation and investment potential of the territorial organization of economic cooperation and businesses. International experience proves successful regional dependence of their results not only from the

classical factors - resource support, successful placement, availability of improved technologies. Much attention in the theory and practice of optimal strategy of regional development today is given to the cluster model of sectoral and territorial development.

The concept of clusters is very promising for use in the transformation economy of Ukraine. Through cluster approach at the level of a region becomes possible the cross-sectoral cooperation, as initiators and active participants in its favour are local authorities. With the spread and ongoing communication are possible mutually beneficial business contacts in the region, extends cooperation between different-business entities. Thus, consumers have the opportunity to get better products, made from local resources. The mechanism of cluster cooperation is beneficial because considerably reduced transaction costs participants become possible large-scale entrepreneurial projects through participation in cluster members on the basis of cost-sharing, enhanced information capabilities of enterprises in the region, which helps to attract domestic and foreign investment, the consumer market is filled with quality and diverse products.

The emergence and rapid spread and success of cluster model sectoral-territorial entities related to a change in economic priorities in the context of globalization changes. As noted by foreign and domestic researchers, members of the cluster benefit, based on local institutional specificity (knowledge, motivation, relationships). Only local economic actors, as opposed to distant competitors have this specific and are able to use it. Thus, globalization indirectly leads to an increase in performance of production units, which are parallel to the principle of individual economic interests are able to take advantage of the principle of collective activity. In domestic economic conditions, this combination is subject to deliberate and consistent support of cluster systems of regional and local authorities.

Many advantages of cluster model does not deprive it of deficiencies in a market-oriented economy can be significant. Primarily this is excessive concentration, and therefore - potential for monopolistic tendencies in certain market sectors. In this connection it should be emphasized the need for authorities of cluster formations (Administration Council of the cluster, etc.) consider formal features of the market environment and avoid receiving sanctions under state antitrust correction.

For the calculation of efficiency of foreign economic activity of the Odessa region is suggested to use a «Region-Cluster» model.

For the first time for this purpose the methods of economic-mathematical modelling are applied.

Pursuing the structure of this model which is offered, there are three levels, which are determined by the groups of factors and special indexes. This model allowed us to form the unique method of calculation of efficiency of foreign economic activity of region through Odessa port.

It is also important to make proposed cluster models dynamic. That means that they should go much far away from traditional «Economics» provisions.

Traditional static models do not take into consideration qualitative changes. That stands for not only quantitative changes should be observed, but first of all, changes in values should be examined and included into measurement of the regional economic structure. Qualitative changes are not properly reflected in current economic theories.

The main idea is that economic models should serve the people, not visas versa at the first place. Those people, the population, who have their own economic interest, but moreover, and that is much more important have their own values. These modern cluster models should be aware of cultural and religious peculiarities of regional development, demographic tendencies and changes.

All these dynamic sea port logistic cluster models should be much more social-oriented. Besides, there is no doubt they should be applied. This is the most important philosophical point of all concept of cluster regional development. Current software techniques give an opportunity to make a research in constantly changeable environment. The other point is that we should have criteria connected with «the chain of values» inside the dynamic clusters.

Our method includes such steps:

1) For providing comparableness of data of various years we will correct the monetary indicators on the accumulated size of deflator. The indexes of the prices of the year 2009 should be taken (previous year to the research).

2) Calculations should be taken after a formula 1:

$$D_i^A = D_{i+1} \times D_{i+1}^A, \qquad (1)$$

where

D_{i+1} - deflator for the next year after i-d year;

D_{i+1}^A - the accumulated size of deflator for the next year after i-d year;

$D_n^A = 1$ - prices of 2009 year.

The accumulated values of deflator since 1999 till 2009 are given in Table 1.

3) The integral indexes should be applied to objectively characterize all categories of efficiency of second level of the offered "Region-Cluster" model: investments in the fixed assets in millions of hryvnas (UAH, national currency), unemployment rate in Odessa region after the methodology of ILO in percents, turnover of goods of Odessa port in thousands of tones.

4) The real foreign trade turnover in the prices of 2009 should be calculated.

5) Next step is to calculate the correlation of the real commodity turnover in the i-year (in millions UAH) to turnover of goods of i-year (in thousand of tones). Value, which is got for turnover of goods for

2009 year we take as a standard, at the same time the calculation index is equal 1 (one).

6) Then we should calculate the turnover of goods in "conditional units of commodity", taking into account the indexes of calculations, that represent high-quality changes in a model, which take place in the structure of loads that are transported through Odessa port.

Table 1. Accumulated value of deflator in 1999-2009 years

Years	Deflator for the current year	Accumulated value of deflator
1999	127,3	4,322
2000	123,1	3,511
2001	109,9	3,195
2002	105,1	3,040
2003	108,0	2,814
2004	115,1	2,445
2005	124,5	1,964
2006	114,8	1,711
2007	122,7	1,394
2008	129,1	1,080
2009	108,0	1,000

A model was tested after the Fisher's test which confirmed its adequacy [7].

The compared data for this model resulted in Table 2.

As it could be seen from the abovementioned model the direct dependence between a gross regional product per capita and investments in the fixed assets and turnover of goods of port is obvious. Thus there is a reverse dependence between a gross regional product per capita and unemployment rate in the Odessa region.

In accordance with the abovementioned model and conducted calculations we can assert that increase of investments in the fixed assets in the Odessa region on 1 million UAH through port results in growth of gross regional product per capita on 23 copecks (1 UAH = 100 copecks).

Multiplying unemployment on 1% brings to the loss of 292 UAH over 24 copecks of gross regional product per capita.

Multiplying turnover of goods with a nowadays commodity structure per 1 million tones will result in multiplying of gross regional product per capita on 7 copecks.

Table 2. Compared Data in the Prices of 2009 year in the "Region-Cluster" Model*

Years	GRP real per capita in UAH in the prices of 2009	Investments in the fixed assets of Odessa Port in millions of UAH in the prices of 2009	Turnover of goods in Odessa port in conditional units of commodity	Unemployment rate in a region after the methodology of ILO, %
1999	13 025,87	3 553	11762	12,6
2000	13 474,63	4 733	22294	12,6
2001	14 258,54	7 894	19147	10,3
2002	14 750,14	7 930	25072	6,9
2003	15 626,04	9 313	29339	5,7
2004	17 184,53	12 561	34845	7,4
2005	16 927,52	10 122	30570	5,9
2006	17 756,20	12 555	30888	5,6
2007	19 278,71	14 640	33101	4,8
2008	19 400,09	13 483	36035	4,9
2009	17 451,13	6 426	28008	5,1

Source: [8] Data of the State Statistics Committee of Ukraine for 1999-2009 years is used

Dynamics of gross regional product of the Odessa region (efficiency of foreign economic activity) per capita in the prices of 2009 year for 1999-2009 years is represented on Fig. 1.

Main relations and logic inside the dynamic sea port logistic cluster model in Odessa region are represented at Fig. 2.
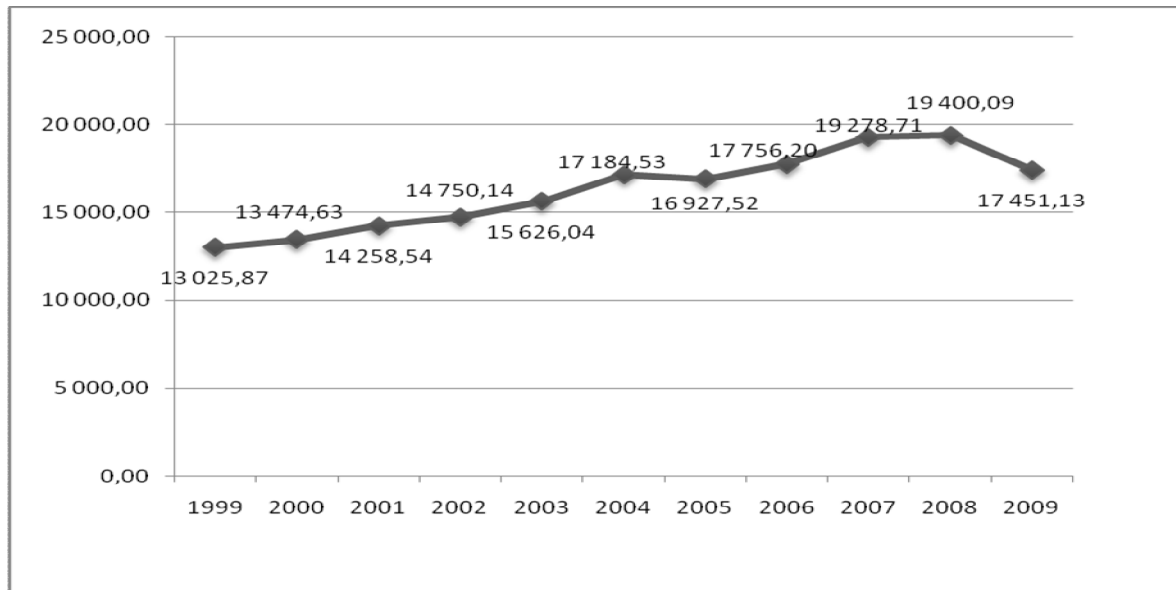
Fig. 1. The dynamics of GRP of the Odessa region (efficiency of foreign economic activity) per capita in the costs of 2009 for 1999-2009 years in UAH
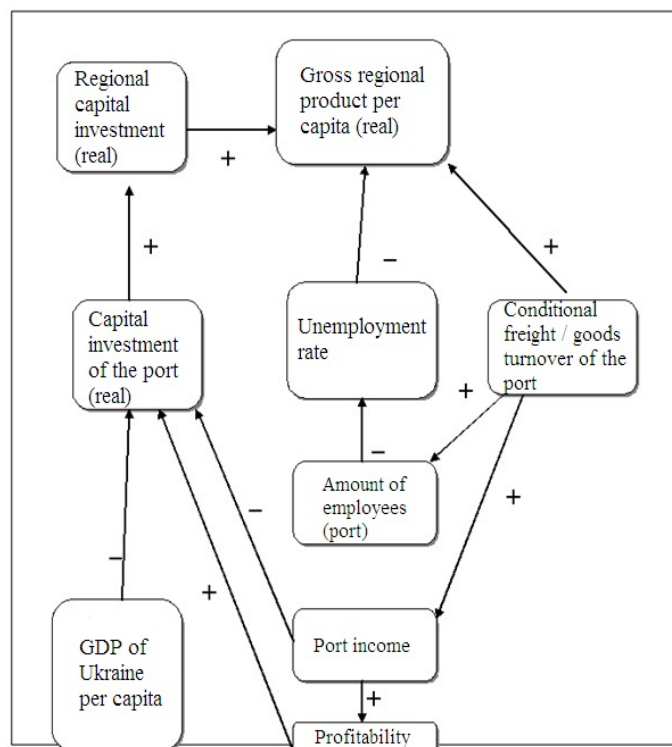

Fig. 2. The layout scheme of main relations and logic inside the dynamic sea port logistic cluster model (Odessa region)

The core of new clusters may be large industrial and economic systems. In Odessa transport cluster (also known as the Odessa sea port maritime cluster) according to a preliminary concept the core is state-owned enterprise "Odessa Commercial Sea Port".

On August 26, 2011 in accordance with Article 43 of the Law of Ukraine "On Local Self-Government in Ukraine" and the execution of the decision of the Odessa regional council "On implementation of the cluster model for infrastructure development of the Odessa region" No. 88-VI dated February 18, 2011,

given the results of the public hearing of April 21, 2011 and the recommendations of the working groups and experts, Odessa Regional Council decided to approve the Regulations on the transport cluster, which can be a base for the formation of clusters of transport in the Odessa area. In this case, the improvement and development of the cluster continues.

Creating cluster in this case involves not so much and not only investment in technological upgrading,

as the change of the nature and organization of interaction between the chains belonging to the defined cluster (table 3).

Through a combination of measures will allow the cluster to effectively implement international agreements and to achieve effective co-operation, reduce operating time and reduce transaction costs.

Table 3. "The chain of values" inside the logistic sea port dynamic cluster (production chain) explained
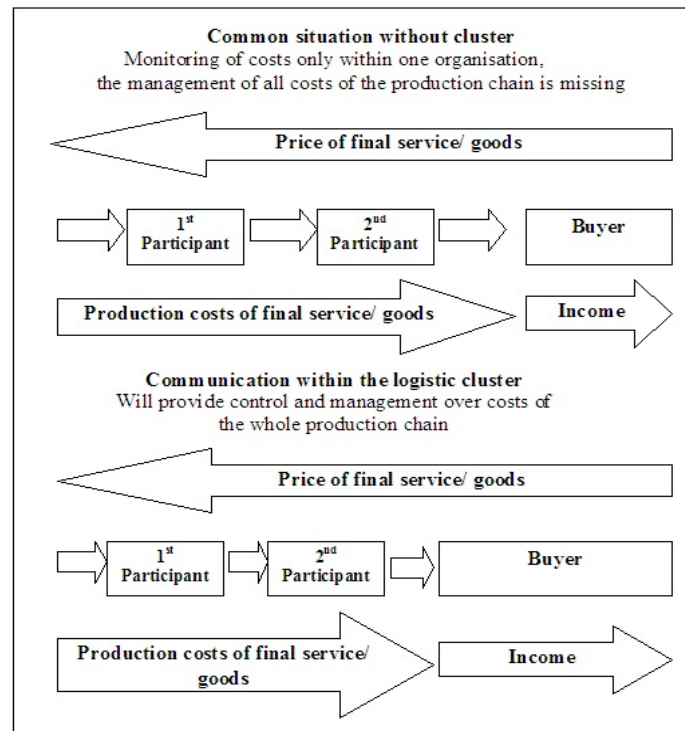
The successful development of the Odessa transport cluster is necessary formulation of its strategic vision, which is compatible with the long-term goals for the region. The organizational structure of the cluster arises from the functional structure and is defined by the short-and long-term goals and objectives of the cluster. It is worth noting that the participants of foreign economic activity within the cluster communicate with each other under certain integration. In this case, the importance and opportunities for such integration are dictated by trends in the global economy in a globalized world.

According to the review of the concept, state enterprise "Odessa Commercial Sea Port" will be, as already noted, perform the core of the cluster, which is to unite around another cluster different transport and logistics and trade groups. That is, a cluster that is developing, will be a complex system that takes into account all aspects and logistics network of Odessa region. From the creation of the cluster in the long run will benefit not only one of us, the economy and the Odessa region in general.

It is need to be mentioned that the introduction of the cluster policy and the creation of the corresponding cluster is not a one-time procedure, it requires constant monitoring of the results of this policy, monitoring and making appropriate adjustments.

Implementation of cluster policy and the creation of the Odessa transport (sea port) cluster in the modern Ukrainian economy in the short term can cause price increases in some markets, the demand for which will increase due to the revitalization of the industrial chains in the cluster. Therefore, to prevent wash-out of funds from production to ensure quality control for the preservation of competition, free access to goods and services, as well as transparency in pricing. Moreover, the need is to control the activities of the cluster management to prevent the development and application of corruption schemes.

To estimate the expected effect on the formation of the Odessa transport cluster I created economic and mathematical model that determines what percentage of the gross regional product of the Odessa region is

generated transporting goods across the state enterprise "Odessa Commercial Sea Port". Also offers the opportunity to evaluate not only the profitability of investments within a single enterprise, but also the effect on investment in the cluster to scale a specific region or group of settlements, that is, to take into account the socio-economic impact of public investment policy in general. With the use of this model is to assess adequately the assets of Odessa transport cluster as a single production system in response to external effects, which are clearly higher than the value of the individual companies. The application of this model is the most efficient way investment to determine state funds.

When you create a model designation I took into account that the economic system is a subsystem of the Odessa region of Ukraine's economy and, in many respects, the fluctuations in the primary system determine the state of its subsystems. In this case, the state enterprise "Odessa Commercial Sea Port" is an element of the economic system of the Odessa region. The port does not function in isolation from the rest of its elements, on the one hand generates costs of its customers, on the other hand is a source of income for their employees and maintain the plants. The latter, in turn, spend funds received, generating revenue other companies. This whole chain leaves its "footprint" in the path of the economic system of the Odessa region.

Gross Regional Product (GRP) in the Odessa region, per capita, which characterizes its economy, because of the economic relations with other regions of the Ukraine, a single currency, financial, legal systems, etc. has a close relationship with the other regions of the GRP. This connection is largely determined by territorial imbalances in regional development in Ukraine, which is stored for many years.

The tests carried out using Fisher's exact test and Student's criteria indicate the significance of the constructed model and its parameters. As part of the model variation in sales volume of services the state enterprise "Odessa Commercial Sea Port" explains 89% of variation of the Odessa region of GRP per capita. As a result, in view of the fact that the state enterprise "Odessa sea trading port" is operating in a monopolistic competition, and has enough self-tariff policy, also adopted a hypothesis about the degree of influence of the state enterprise "Odessa Commercial Sea Port" on the economy of the Odessa region.

The analysis of the model parameters led to the conclusion that an increase in the volume sold the port services per 1 USD leads to an increase in the Odessa region of GRP 7 UAH 73 kopecks.

For the prediction of possible outcomes and highlight the scale of the cluster was used scenario approach.

If we consider the scenario of a return to the highest cargo handling state company "Odessa Commercial Sea Port" at the 2008 level, by the low-key (pessimistic) evaluation as a result of the calculations increase the port capacity in the cluster at 1 kt leads to an increase of the gross regional product of the Odessa region 200 thousand 980 UAH.

Also, if pessimistic assessment (i.e., a minimum cluster implementation of the project) as a result of the calculations showed that to increase the gross regional product of the Odessa region of the current level of 1% is necessary to increase the current port capacity by 2 million 296 thousand tons [9-12].

All these tasks are achievable. Their implementation can help Odessa transport cluster, which acts as the most effective way to improve the efficiency of the foreign activities of Odessa region.

Conclusions. The perspectives for further research

We offer unique economic and mathematical model for evaluating the effectiveness of investing in the creation of the cluster in the region's economy. An opportunity to evaluate not only return on investment within individual enterprises, but also the effect of investments in the cluster to scale a particular region or group of settlements that take into account the socio-economic impact of public investment policy in general.

Using this model makes possible an adequate assessment of the assets of the cluster as a single production system based on externalities, which is definitely higher than the cost of individual enterprises. Application of this model will determine the most effective option for investment of public funds.

We offer unique, based on an analysis of international experience in the creation and development of clusters, the model and method of constructing an organizational structure that provides a real connection between the goals of the establishment and functioning of the cluster and its organizational structure by functional relations between its members and external contractors. This structure establishes clusterpreneur - particularly nonprofit organization that provides effective representation of real interests of the cluster, including representatives of private capital to the state. Having clusterpreneur will combine regulation undertaken by the relevant sectoral ministries, with territorial adjustment, which will increase its effectiveness.

The proposed model has been tested in SE "Odessa Sea Commercial Port", which is the largest and most successful seaport of Ukraine. SE "Odessa Sea Commercial Port" provides 19% of the gross regional product of the Odessa region. On the basis of the port consider creating Odessa sea port cluster.

Constructing such cluster structure determinable methods and establish the necessary mechanisms within it, thus achieving such predictive results:
— The growth of gross regional product Odessa area per capita by 5% only as the effect of the inclusion of cluster port - the overall effect when creating a cluster would be more;
— Return port in the cluster will increase to 171%, which is almost 2 times;
— Income port cluster increased by 36%;
— Port costs reduced by 14%;
— Expected growth in fixed capital Port for 1,85 times.

The results and methods of modeling can be used at sea ports, transport and logistics and other industrial enterprises, as well as other sea port clusters. Defined in Article models are versatile because they can be used to design and build sea port clusters and other industry clusters, both in Ukraine and abroad. The proposed methods and models can be applied to the creation of clusters of various industries, including shipbuilding, chemical, metallurgical, mining and other industries.

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