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**V. F. Savchenko**, Doctor of Economic Sciences,  
Professor, Honoured Economist of Ukraine,  
**S. D. Grivko**, Applicant

**В. Ф. Савченко**, д. е. н., професор,  
Заслужений економіст України,  
**С. Д. Гривко**, здобувач

### MECHANISM OF FORMATION AND ACTIVITY OF INNOVATION CLUSTER STRUCTURE OF ENGINEERING COMPLEX

### МЕХАНІЗМ ФОРМУВАННЯ ТА ДІЯЛЬНОСТІ ІННОВАЦІЙНИХ КЛАСТЕРНИХ СТРУКТУР МАШИНОБУДІВНОГО КОМПЛЕКСУ

**Urgency of the research.** The article covers the procedure of formation and implementation of organizational and economic mechanism of innovative network structures in engineering complex of Ukraine. The common issues of clustering are characterized. The stages of clustering are provided. The Realities of today are considered, where the objective need is a transition to a new organizational forms of interaction of industrial innovation structures in engineering activities, the most effective of which is the cluster approach.

**Target setting.** It's indicated that the mechanism of formation and functioning of innovative engineering cluster developed by authors appears due to difficult economic situation in the country. Cluster associations and the role of the Coordinating Council to manage innovative machine-building cluster summary are detailed.

**Actual scientific researches and issues analysis.** It is advisable to mention leading scientists in studying clustering in the post-Soviet countries: A. V. Voronov, A. S. Halchynskyi, L. M. Hanushchak, V. I. Zakharchenko, A. A. Myhranyan, M. V. Nikolayev. Especially should be mentioned S. I. Sokolenko, who made a significant contribution to the development of the network structures in Ukraine.

**Uninvestigated parts of general matters defining.** It's determined that the implementation of cluster policy promotes the competitiveness of products through the use of synergy members of the cluster.

**The research objective.** Clusters - is one of the levers of the economy development. The mechanism of formation and functioning of these structures will become a beginning of resuscitation of enterprises of Ukraine.

**The statement of basic materials.** The formation and development of clusters is an effective tool for attracting foreign direct investment and foreign economic revitalization integration.

**Conclusions.** The inclusion of local clusters in global value chain can significantly raise the level of national technological base, increase the speed and quality of economic growth by strengthening the international competitiveness of companies that make up the cluster through the acquisition and implementation of new technologies, new equipment; getting businesses access to effective management and expertise; increasing opportunities on highly competitive international market

**Keywords:** innovation; clustering; network structure; communication; development; competitiveness; production; efficiency; association; mechanism.

**Актуальність теми дослідження.** У статті запропоновано порядок формування і реалізації організаційно-економічного механізму інноваційних мережевих структур машинобудівного комплексу України. Охарактеризовано загальні питання кластеризації. Надано етапи процесу кластеризації. Розглянуті реалії сьогодення, де об'єктивною необхідністю є перехід до нових організаційних форм взаємодії промислових інноваційних структур в машинобудівній діяльності, найефективнішою з яких є кластерний підхід.

**Постановка проблеми.** Розроблений авторами механізм формування і функціонування машинобудівного інноваційного кластера обумовлений складним економічним становищем у державі. Деталізувати ролі кластерної асоціації та координаційної ради в управлінні машинобудівним інноваційним кластером.

**Аналіз останніх досліджень і публікацій.** Доцільно виділити провідних вчених з вивчення кластеризації у пострадянських країнах: А. В. Воронова, А. С. Гальчинського, Л. М. Ганущака, В. І. Захарченка, А. А. Миграняна, М. В. Ніколаєва. Слід особливо відзначити С. І. Соколенка, який зробив вагомий внесок в розвиток мережевих структур в Україні.

**Виділення недосліджених частин загальної проблеми.** Підсумовуючи, визначено, що реалізація кластерної політики сприяє зростанню конкурентоспроможності продукції за рахунок використання ефекту синергії учасників кластеру.

**Постановка завдання.** Кластери – це один із важелів розвитку економіки. Відпрацьований механізм формування і функціонування даних структур стане початком реанімації підприємств України.

**Виклад основного матеріалу.** Формування і розвиток кластерів є ефективним засобом залучення прямих іноземних інвестицій та активізації зовнішньоекономічної інтеграції.

**Висновки.** Включення вітчизняних кластерів у глобальні ланцюжки створення доданої вартості дозволить істотно підняти рівень національної технологічної бази, підвищити швидкість і якість економічного зростання за рахунок посилення міжнародної конкурентоспроможності підприємств, що входять до складу кластеру, шляхом: придбання і впровадження сучасних технологій, новітнього обладнання; отримання підприємствами доступу до ефективних методів управління і спеціальних знань; підвищення можливостей виходу на високо-конкурентні міжнародні ринки.

**Ключові слова:** інновації; кластеризація; мережеві структури; зв'язки; розвиток; конкурентоспроможність; продукція; ефективність; асоціації; механізм.

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**Urgency of the research.** To ensure the efficient operation of engineering innovation clusters it's needed to study detailed all the aspects related to the development of network structures, to determine the direction of their solutions and creating organizational and economic mechanism of formation and activities that will improve the efficiency of production processes in the industry and in the country in general.

**Analysis of recent research and publications.** It is advisable to mention leading scientists in studying clustering in the post-Soviet countries: A. V. Voronov, A. S. Halchynskyi, L. M. Hanushchak, V. I. Zakharchenko, A. A. Myhranyan, M. V. Nikolayev. Especially should be mentioned S. I. Sokolenko, who made a significant contribution to the development of the network structures in Ukraine.

**Uninvestigated parts of general matters defining.** In order to develop the clusters the stages of formation of engineering innovation cluster structures and their regulation by the state must be formed, a more detailed analysis of the theory and practice of international and national successful networks must be done. So far the basic mechanisms of implementation of cluster theory in the context of global developments for further theoretical understanding and practical use in Ukraine is insufficiently investigated.

**The purpose of the article.** The main goal of this work is to study issues related to the development of organizational and economic mechanism of creation and activities of engineering innovative clusters.

**The statement of the basic material.** At the beginning of the study we're describing some common questions of clustering. Cluster management model is quite popular in the European Union and in the whole world as being the product of a market economy, it is characterized by a combination of local factors and the development of relations between companies within the cluster.

Clustering - is not only an innovative process of progressive technical and technological capabilities, but also an extensive system of vertical and horizontal linkages, which provide movement of innovations. M. Porter defines clusters as following: "Clusters – is a geographic concentration in the region of interconnected companies and institutions within the related industries." He is the founder of cluster theory. American scientist believes that without cluster industries do not get a high level of competitiveness. Cluster is an alternative grouping in comparison to the industry [1; 2].

Currently, there are 260 Italian "industrial districts" (actually clusters), where take part more than 80 thousand companies, which formally employs more than 800 thousand people. And if we add related businesses, including service field, it can be claimed that these clusters are more than cover about 1.2 million small and medium enterprises, and the number of employees ranges from 4 to 6 million people.

Austria has created 30 mega-clusters, including mechanical engineering, biotechnology and molecular medicine, multimedia, software and other products.

In Hungary purposefully has been implemented programs on cluster development and has been created 100 production structures, which comprise 656 companies employing 60 thousand people. The total production area of clusters is 4400 hectares.

In Shanghai - the flagship of China's economy - a huge mega-cluster, which includes 9 clusters, including high tech, as well as melting steel.

In the UK, of Denmark, Estonia, Ireland, Latvia, Lithuania, Norway and the number of companies covered by clusters reaches 90%.

In Russia has been adopted "Concept of long-term social and economic development until 2020", one of the directions of which was the transition to a new model of economic development, including creation of new centers of economic and social development, based on the development of energy and transport infrastructure, creation of clusters and industrial clusters to implement competitive potential areas.

In the Republic of Belarus in support of cluster models in the late 90's, was adopted The concept of the national innovative system [3].

In October 2008, the European Union in order to support innovation by European clusters approved a memorandum of clusters.

In the European Union counties attention was carefully paid to cluster strategies as the effective tools for innovation. In the EU there are over 2 thousands clusters, which employ 38% of its workforce.

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Over the past two decades, the rate of formation of new clusters has increased. In developed countries and those that are actively developing there are about 50% of the entire economic complex of clusters. Number of clusters by country is as follows: United States - 380, Italy - 206, UK -168, India - 106, France - 96, Denmark - 34, Germany - 32, Netherlands - 20 [4]. Many countries clusters passed an entire life cycle from maturation and transformation to a decline in new clusters. In theoretical terms, there were many studies conducted in this area.

In our state the process of clustering started in 1997 on the initiative of S. I. Sokolenko, who worked and works on improving the attractiveness of the economy of Ukraine in conditions of world globalization through the introduction of local production systems based on network structures, lighting world experience of network structures (clusters) in the industrialized countries and in Eastern Europe and in third world countries [5].

As a result of natural, political and economic transformation, there is the destruction mechanism of sustainable development of all components of the economy, in particular, the one studied engineering complex. Mechanical engineering is characterized by the diversity of legal forms of ownership, the disintegration of industrial structures, lack of systematic regulation of economic processes and the weakness of threats to the action of the environment.

The reality today is that the objective necessity is a transition to the new organizational forms of industrial innovation structures in the engineering business. The most effective of these is the cluster approach. Foreign experience of formation of the engineering cluster shows that the main role in this process belongs to the state. As the developer of cluster initiatives, it should create an enabling environment that would help clustering process. However, to implement this feature, you must run the organizational and economic mechanism of formation and subsequent operation of clusters.

In order to form a cluster of engineering, it's required catalysts that speed up clustering processes in a branch. But for these processes to continue successful development and operation, it is important to manage them, provide them with the resources and absorb the negative effects that arise in this type of interaction. On stage of start with key and most effective methods are economic, while in operation phase of engineering innovation cluster annexed organizational methods. So for the successful operation of clusters it is necessary to ensure the implementation and balanced development and economic data organization methods.

According to the system approach the main constituent elements of the organizational and economic mechanism are:

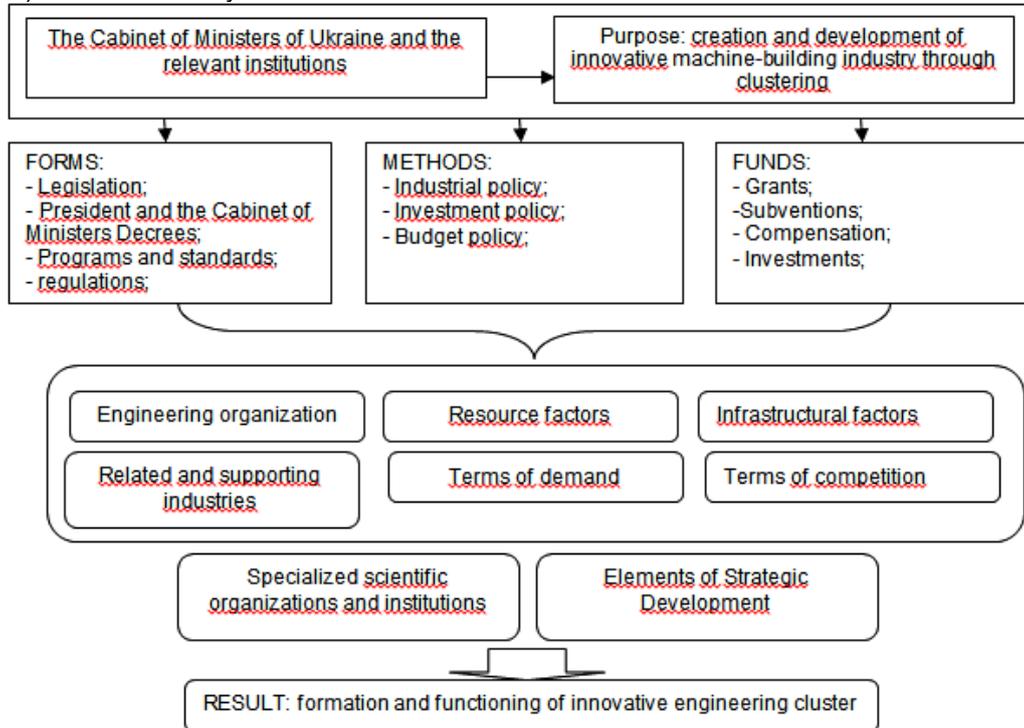
- 1) the subject - the driving force intelligently starts the mechanism;
- 2) object - something toward what the action of the subject is directed;
- 3) goals - programmable desired results of the mechanism;
- 4) methods - tools, methods, technologies achieving goals;
- 5) forms - organizational and methodological support legal registration;
- 6) costs - a set of types and sources of resources used to achieve these goals.

It should be explained who are the subjects of developed mechanism. At this stage they are state and regional authorities (macro engineering innovation clusters) and its meso-surrounding that appears as a result of market processes. The object is scattered enterprise of a complex, that still have a low level of interaction between them.

At the stage of creation a mechanism formation and functioning of engineering innovation clusters the main are principles of goal and systematic management. Due to the fact that in our study the embodiment of organizational and economic mechanism is a form of interaction cluster of engineering and related organizations, the mission, goals, objectives and procedure development strategy that will govern the further development of engineering cluster must be defined. Global engineering innovation cluster designation should be determined through the strategic objectives. Not only setting goals facing the cluster, depends on how properly formulated objectives but also how interested would be that organization to become members. Therefore, the strategic objectives should not be abstract and unrealistic. They have to consider the interests of the government, regional and local authorities, all participants of interaction and also be socially oriented.

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Organizational-economic mechanism of formation and functioning of engineering innovation clusters (Fig. 1) is determined by the current difficult economic situation in Ukraine.



**Fig. 1. Organizational-economic mechanism of formation and functioning of innovative engineering cluster**

Source: [the authors]

At the stage of engineering cluster the condition of the factors of meso-surrounding is important. Having found the most negative of them, it becomes possible to identify the components of economic mechanism, which will be catalyst for clustering in machine-building complex. Also this structure is affected by correctly formed hierarchy of goals and objectives of engineering innovation cluster.

Table 1

**The hierarchy of goals and objectives of engineering innovation cluster**

Level	Providing of the transition from Export commodity type to innovative type of development	Providing of competitiveness goods and services
1	Development of an effective mechanism of state regulation and partnership	Removing of administrative barriers
2	Mobilization of the investors willing to finance cluster objects	Creating an enabling environment
3	Modernization of the main production funds	Diversification of the product range
4	Implementation of the scientific innovation into production	Organization of attracting system for staff
5	Expansion of sales channels of products and services	Development of tax incentives for participants

Source: [developed by the authors]

Having studied the organizational and economic mechanism of innovative engineering cluster, we'll proceed to its component - the mechanism of operation. Its subject is the coordinating council of the cluster (Fig. 2). The object is the engineering organization, to be exact - core cluster. Subject impacts an object on purpose. For example, providing sustainability of enterprises in order to work effectively,

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achieving results that are important for Ukraine. At the same time the implementation of this objective is realized through a set of forms, administrative, regulatory, economic methods and tools.

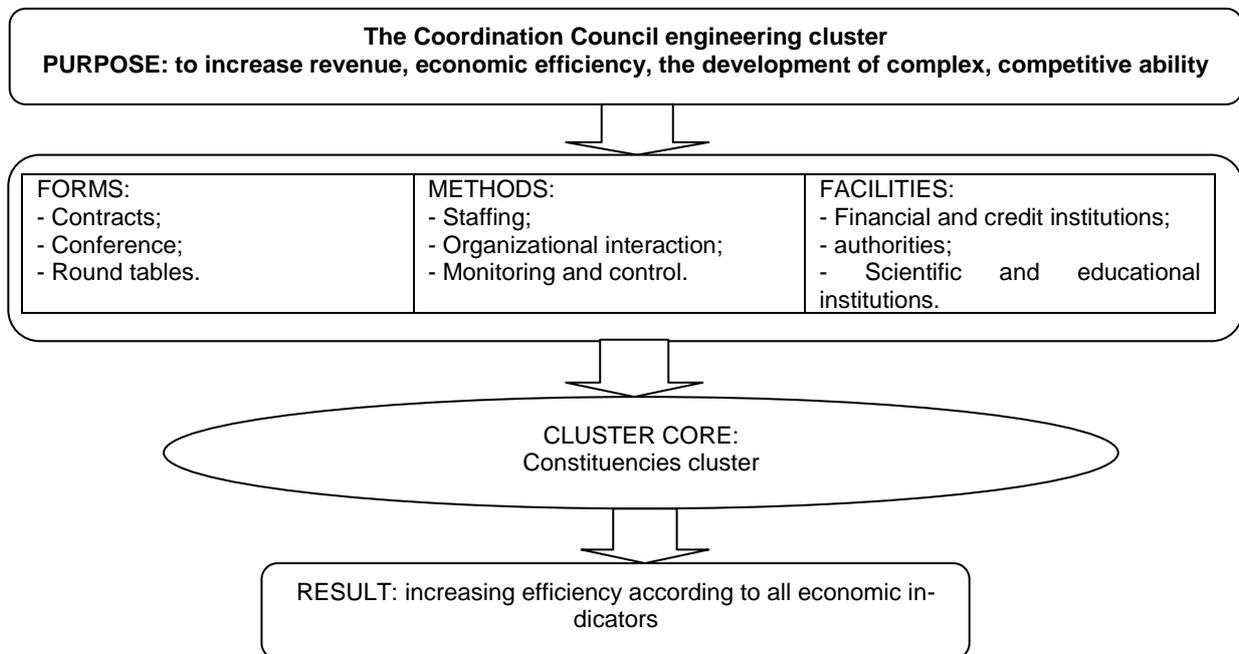
However, form refers to existing forms of cooperation between engineering organizations that can be applied in the operation of the cluster - a contract of partnership, cooperation agreement, consolidated group, regular roundtables, conferences, etc.

The subject at the stage of operation, as has been mentioned, is coordinating council of the cluster, which means to have interaction with him and with different administrative, scientific, financial and credit institutions and Cluster Association. The object of the organizational and economic mechanism is a set of engineering organizations, including the core and enterprises.

According to the principles of functionality, centralization and systematic character of management and consistency for successful functioning machine cluster creating necessary management structures that regulate its activity.

The main role in the management of machine-building innovation clusters play two key management structure:

- Cluster Association;
- Cluster Coordination Council.



**Fig. 2. The mechanism of coordination council**

Source: [developed by the authors]

Each of these structures has different levels of functional load in the organization of their cooperation in the engineering business. Let's examine each of them in detail.

Cluster Association is a nonprofit organization whose primary function is to represent the interests of the cluster as well as responsibility for the strategic development. Legally, the organization can be incorporated as an association that is regulated by the Law of Ukraine "On public associations".

The peculiarity of the cluster association is that the basis for its activity is already formed and functioning. However, the unification of participants described in Table 2, gives an opportunity to preserve and enhance the interests that were persecuted while creating innovative engineering cluster. At the same time interaction within a single system will simplify their work. Thus Cluster Association is more responsible for resource, information and personnel support, which requires a structure which will directly manage the cluster formation.

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That role belongs to the coordinating council of the cluster. This council interacts with Cluster Association to form the necessary requirements for the rational organization of the cluster production process, which leads to further cooperation. In fact Directorate is coordinating council of the cluster "core". Due to this fact the participants automatically become leaders of the most important machine-building enterprises.

Table 2

**Members and tasks of the Cluster Association**

№	Members	Tasks
1	Authorities: - Ministry; - Departments and management	- agitation and motivation of potential participants in the cluster; - Attracting investment to cluster development; - Advising participants on organizational, financial and management issues;
2	Engineering enterprises	- development of strategic directions of development, goals, objectives and mission of the cluster; - coordination of the association members to organize and rationally interact between the main and auxiliary structures; - Advising participants on production and regulating engineering activities; - Regulation of legal framework of engineering complex
3	Universities and other research institutions	- monitoring and evaluation of economic efficiency of the cluster functioning; - Advising participants on organizational, financial and administrative matters; - Providing a cluster of human resources; - An economic and market research; - Development of innovative technologies of production and recycling of the products;
4	Supporting Structures	-providing access to the loans under preferential conditions guaranteed by the government; - celebration of a contract with business objects; - regulation of factoring and insurance operations.

**Source:** [developed by the authors]

The main functions performed by the Coordination Council are coordination and interaction of engineering cluster participants, which involves the following tasks in turn:

- 1) setting up supply chains between products producers as part of its economic activity;
- 2) constant interaction with the issues of the cluster Association;
- 3) the resolution of current production issues;
- 4) searching of distribution channels;
- 5) developing of interaction mechanisms between participants in the form of meetings, plenary sessions, conference, etc.;
- 6) innovation stakeholders encouraging;
- 7) taking the necessary management decisions to improve the efficiency of the cluster.

The management activity of Coordination Council is more focused on the regulation of cluster core. Thus the formation and operation of engineering innovation clusters will achieve synergistic effect of a single production, technology, infrastructure facilities and common resource allocation. Designed organizational-economic mechanism provides engineering complex industrial structures control system, resulting in the regulatory application governance structures and different methods to run the cluster processes.

Innovative component of the engineering clustering is the most important in terms of the businesses competitiveness within the cluster, and the cluster itself. The main purpose of realization of cluster

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policy is to ensure high economic growth and diversify the economy by increasing the companies competitiveness, equipment, components, specialized production and services suppliers, research and educational organizations, that are forming territory-industrial clusters [6].

Implementation of cluster policy promotes the competitiveness of products through the use of effective interaction potential of participants in the cluster. This potential associated with the closeness of the participants. It expands access to innovation, technology and "know-how", specialized services and qualified personnel to reduce costs and ensure the formation of conditions for realization of joint co-operation projects and productive competition. The formation and development of clusters is an effective tool for attracting foreign direct investment and foreign economic revitalization integration. The inclusion of local clusters in global value chain can significantly raise the level of national technological base, increase the speed and quality of economic growth by strengthening the international competitiveness of companies that make up the cluster through the acquisition and implementation of new technologies, new equipment; getting businesses access to effective management and expertise; increasing opportunities on highly competitive international market [7].

Start-ups also develop more efficient in formed "cluster" environment. K. Venberg and H. Lindquist [8] studied the activity of "new economy" enterprises that worked in Sweden since 1993 to 2002 and discovered that the collaboration within a cluster made a significant positive impact on the "survival" of new companies. In these companies are generated more jobs, higher wages, and tax revenue.

Engineering innovation clusters - is one of the levers of the economy development. The mechanism of formation and functioning of these structures will become a beginning of resuscitation of machine-building enterprises of Ukraine.

### Conclusions and suggestions.

1. Creating of economic mechanism of formation and functioning of innovative cluster structures in mechanical engineering - one of the main priorities of innovation and improve the competitiveness of enterprises by attracting investments in high technological infrastructure that promotes for economic potential and sets the pace of economic development.

2. The main constituent elements of the organizational and economic mechanism are: the subject as a driving force in launching the mechanism; facility, to which an action of the subject is directed; objectives under which implied decimal planned results of the mechanism; methods, which include tools, methods and technologies, meeting the goals; shape (organizational and methodological support legal registration); resources - the resources needed to achieve their goals.

3. The leading role in the management of innovative machine-building cluster plays cluster association and a coordinating council to ensure its effective functioning.

4. Implementation of the organizational and economic mechanism of cluster policy promotes for the growth of competitiveness of the products through the use of effective interaction potential of cluster participants.

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