

INNOVATION DEFENSE CLUSTERS - AN EFFECTIVE DRIVER OF DEFENSE AND NATIONAL SECURITY OF UKRAINE

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Abstract: Today, Ukraine finds itself at a stage where there is an understanding that we significantly lag behind leaders in terms of technological and innovative solutions. There is recognition that the existing innovation system is outdated, failing to foster genius or facilitate a formal process for generating new ideas. Even if it does foster innovation, it fails to provide adequate work and compensation, leading to a brain drain of talented youth and experienced professionals abroad. As is well known, any war serves as a driving force for progress; it was during periods of war that numerous ingenious modernizations, design decisions, and inventions were made. However, despite the aggression of the Russian Federation, in Ukraine, the innovation landscape, including the defense innovation system, operates with significant slowdown, encountering barriers leading to minimal efficiency, and fails to address both the acceleration of economic development and the provision of national security for the state. After a brief analysis of the experience of leading countries around the world in utilizing innovations, an assessment of Ukraine's innovative policies is presented. Key recommendations are provided regarding the establishment of innovative clusters for defense tailored to the specific branches of the Armed Forces of Ukraine. These clusters are designed to serve both the defense needs of the state and the broader national security interests of Ukraine.

Keywords: innovation; cluster; defense; national security.

1 Introduction

Innovativeness is a defining characteristic of modern scientific, technical, industrial, socio-economic, and all societal processes. The fate of Ukraine depends on mastering innovative development mechanisms: whether it will move towards joining the ranks of developed countries, or remain a stagnant country on the sidelines of scientific, technical, and social progress. This is associated with the general patterns of social development, according to which the world is transitioning from predominantly reproductive to innovative types of development. Those who timely understood this and built their economic system accordingly to this historical imperative, succeed, gain respect and glory, while those who did not, are left with problems, failures, and impasses.

Innovativeness is not only the key to dynamic development, prosperity, and personal success, but also a means of ensuring the sovereignty of the country and its competitiveness in today's highly complex world [43].

Innovations are newly created (applied) and/or improved competitive technologies, products, or services, as well as organizational-technical solutions of a production, administrative, commercial, or other nature, which significantly improve the structure and quality of production and/or the social sphere [25].

In the classical exposition, the concept of "innovation" is an idea, a cutting-edge product in the field of engineering, technology, management organization, as well as in other spheres of scientific and social activity, based on the utilization

of scientific achievements and advanced experience; it represents the ultimate result of innovative activity [15].

Innovative activity, in turn, is the activity aimed at utilizing and commercializing the results of scientific research and development, resulting in the release of new competitive goods and services onto the market [47].

Encompassing various aspects of market relations (production, entrepreneurial, social, scientific-technical, and marketing), the innovation process contributes to the growth of industrial production, increased labor productivity, and the mobilization of new reserves into the production sphere. Unfortunately, the realities of the current economic situation in Ukraine indicate that unlike developed countries, which provide up to 85-90% of GDP growth through so-called "intensive factors", including innovation, Ukraine underutilizes its innovation potential. The market for scientific and technical products continues to degrade due to low demand for innovative developments caused by the limited purchasing power of domestic consumers [14].

Meanwhile, innovative activity takes on special significance not only in high-tech sectors but also in traditional sectors of the economy and defense. The main threat to Ukraine's existence as a state is seen not only as external adversaries or domestic criminal terrorism but also as a sharp decline in the scientific and intellectual level of society, leading to potential complete dependence of the economy and population on the assistance and favor of stronger nations. A country that neglects and fails to support its own science falls into vassalage to the science and economy of other countries, thereby losing the ability to independently guarantee its security. Therefore, one of the main priorities of the state authorities in Ukraine should be the scientific and technical sphere. This should begin with the reform of the state management system, ensuring both the purposefulness of state policy in this area and the diversification of instruments to support and stimulate science [15].

Today, Ukraine finds itself at a stage where there is an understanding that the country significantly lags behind leaders in terms of technological and innovative solutions. There is recognition that the existing innovation system is outdated, failing to foster genius or facilitate a formal process for generating new ideas. Even if it does foster innovation, it fails to provide adequate work and compensation and leads to a brain drain. While any war serves as a driving force for progress (during periods of war numerous ingenious modernizations, design decisions, and inventions were made), despite the aggression of the Russian Federation, the innovation in Ukraine, in particular in the defense sphere, is slow, encountering barriers, showing minimal efficiency, and fails to address both the acceleration of economic development and the provision of national security for the state [11].

The issue of economic prosperity concerns every Ukrainian. However, equally important is the issue of national security, upon which prosperity directly depends. Therefore, in Ukraine, as in all advanced and developed countries worldwide, it is necessary to develop innovative activities. Innovations in Ukraine have not yet reached a decisive importance for economic development and ensuring the economic stability of the state [52]. The weak and outdated equipment currently represents the "Achilles' heel" of the defense complex, which requires modernization, including through innovative projects. Therefore, these issues require further discussion, development, improvement, and making of appropriate decisions at the state level.

2 Materials and Methods

The research implies application of methodological provisions of state management in the field of invention, rationalization, and scientific work, aiming to increase demand for national

innovations [48-50]. Provisions of public administration and national level economic efficiency are employed, which, along with general scientific methods of analysis and synthesis constituted a ground for formulating and substantiating of the creation of Innovation Defense Clusters for the branches of the Armed Forces of Ukraine in the interests of defense and national security of Ukraine.

3 Results and Discussion

Analysis of Foreign Experience

The experience of creating and operating innovative systems in advanced countries around the world indicates that its fundamental element is cooperation, which has found its solution primarily through cluster initiatives aimed at enhancing competitiveness and development. The majority of countries have initiated these efforts since the 1990s.

The issue of cluster formation and its impact on the economy has been addressed by numerous scholars, including American researchers such as J. Berkowitz, E. Glaeser, M. Enright, W. Kerr, J. Cortright, D. Audretsch, A. Saxenian, M. Storper, S. Rosenfeld, M. Feldman, J. Francis, and others, as well as domestic Ukrainian scholars such as Z. Varnaliy, M. Voynarenko, B. Hubska, O. Yermakova, V. Zakharchenko, S. Krymsky, S. Sokolenko, and such well known economists as M. Enright, P. Krugman, F. Cook, A. Marshall, M. Porter, R. Hasanov, and others. In particular, the question of clusters as a tool for development and competitiveness has been studied by I. Babenko and O. Varyanichenko. Scholars like R. Hlushanitsa, I. Kosach, O. Kuzmin, L. Levkovska, O. Mazur, and V. Melnychuk have investigated the impact of clusters on regional development. The main focus of these works is on analyzing the advantages and positive aspects of economic clustering.

According to some expert assessments, clustering encompasses about 50% of the economies of advanced countries worldwide. Danish, Finnish, Norwegian, and Swedish industries are fully covered by clustering initiatives. The process of clustering is actively underway in Southeast Asia, China, and Japan.

In the EU, the "Cluster Manifesto in EU Countries" (July 2006) and the "European Cluster Memorandum" (January 2008) have been approved, with the main goal of increasing the "critical mass" of clusters capable of influencing the competitiveness of both individual countries and the EU as a whole.

The development of innovative activities is also facilitated by the framework agreements of the European Union (one of the examples is agreement "Horizon 2020" and more recent projects).

In the USA, an important direction in the development of innovation systems is the creation of regional innovation clusters in priority scientific and technical fields. Since 2010, these clusters have been supported at the federal level by a special federal program (prior to this, funding was provided by regional authorities).

The most prominent example of the innovation system in the USA is the "Silicon Valley" - a leading innovation cluster that receives one-third of all venture (high-yield, but risky) capital investments made in the USA. In 2010, the US government established a special commission for cluster policy (the Federal Task Force on Regional Innovation Clusters).

An important component of the "smart innovation policy" of countries in the conditions of a post-industrial society is measures to address external economic integration issues, primarily related to significant growth in global and regional competition [1]. To achieve this, the role of innovation systems at various levels is being emphasized, enhancing the synergistic effects of innovative development both through direct state intervention and through principles of self-regulation and self-organization [2-4]. The network organization of such systems particularly promotes enhanced interaction between regions and

is characterized by the influence of interregional cooperation on ensuring their competitiveness.

If we are talking about an effective mechanism for creating innovations, following the DARPA experience, which is highly respected worldwide, it should be understood that in Ukraine, it should pursue one important component - namely, it should seek out individuals within its own country, create an environment where these individuals can implement their ideas, propose and create mechanisms for crystallization, and translate them into specific products needed either by the state as a whole or specifically in particular sector.

Innovative systems, crucial for the development of a country's defense and security, are possible and necessary to create in the defense sector as well. Analysis of innovative systems in the military sphere of advanced countries, primarily NATO member states, clearly indicates the advantages of the system established and successfully operating within the United States Armed Forces [5-7; 12]. This system includes branch-specific research centers and the interagency Defense Advanced Research Projects Agency (DARPA), mentioned above. The unique feature of the latter is the development of interdepartmental, high-risk projects with further prospects (2-4-year research programs), support for breakthrough research, bridging the gap between fundamental research and its implementation in the military sphere. Examples of DARPA-inspired counterparts exist in other countries, such as GDA (France), SASTIND (China), MAFAT (Israel), and DRDO (India). The Department oversees 24 Centers of Innovation, whose structural units are located both within and outside the United States. Each Center is assigned specific specialized tasks and areas of activity.

Analysis of the State of Innovation Policy in Ukraine

The main goal of Ukraine's state innovation policy is to create socio-economic, organizational, and legal conditions for the effective reproduction, development, and utilization of the country's scientific and technical potential, ensuring the implementation of modern environmentally friendly, safe energy- and resource-saving technologies, as well as the production and marketing of new types of competitive products, including those for military purposes.

The current state of Ukraine's national innovation system comprises scientific and industrial-commercial components. The scientific component includes institutions of the National Academy of Sciences of Ukraine, sectoral research centers and institutes, and higher education institutions [8-10; 13]. The industrial-commercial component encompasses production enterprises, regardless of ownership form. Due to the lack of competitiveness of the scientific potential of domestic research institutions in Ukraine, scientific-production structures have emerged, the most powerful of which are Design Bureau "Pivdenne" and Design Bureau "Antonov", which have independent scientific tactics and strategies, personnel potential, and oversee the process of training specialists in relevant fields at selected higher educational institutions in Ukraine.

The existence of scientific-production enterprises highlights a situation in which institutions of the National Academy of Sciences of Ukraine, sectoral research centers and institutes, and higher education institutions are essentially remnants of the Soviet system, which did not utilize innovation principles.

When discussing Ukrainian products, it is necessary to understand the criteria for innovativeness. For example, when domestic manufacturers started producing passenger train carriages at domestic enterprises, would this be considered an innovative product? From the perspective of the railway's needs and the absence of a saturated market, it is an innovative product [15]. However, from the standpoint of global trends, such carriages are not innovative products because Ukraine cannot sell them to a country that manufactures similar carriages but with greater comfort and using advanced materials and technologies than Ukrainian ones [53]. Nevertheless, among innovative projects, similar examples can be found among

private companies - they are significant and interesting enough. But it is also necessary for the state to create a mechanism that allows for the implementation of these products. And they, in turn, would then become the basis for economic progress [51].

A key element in ensuring the security of the country and fostering a high patriotic spirit among its citizens is a high level of science. Without it, a successful and secure tomorrow in Ukraine will not come.

For example, according to data from the State Statistics Service, back in 2015 industrial enterprises implemented only 3136 innovative types of products, of which 548 were new exclusively for the market, and 2588 were new only for the enterprise. Out of the total amount of implemented products, 966 were new types of machinery, equipment, devices, apparatuses, and so on [41].

Recognizing the necessity of innovative systems (innovations) in the defense sector, the creation of Innovative Defense Clusters by branches of the Armed Forces of Ukraine is proposed. Establishing an innovative cluster is a complex multi-stage project [16; 19; 21]. Each stage of cluster construction represents the solution of a certain set of priority management tasks, without the successful resolution of which the execution of the next stage becomes impossible.

A cluster is a geographically proximate group of interconnected companies and affiliated organizations, associated institutions within a particular industry or field linked by common technologies and skills, characterized by shared activities and mutual complementarity [17; 18]. They typically exist in a geographical area where communications, logistics, and human resources are easily accessible. Clusters are usually located in regions, and sometimes in a single city. Clusters should have active channels for business transactions, dialogue, and communication [20]. Without active channels, even a critical mass of relevant firms does not represent local production or a social system, and thus does not function as a cluster.

The innovation defense cluster may represent a comprehensive system of enterprises and organizations for the production and consumption of the final innovative product, encompassing the entire innovation chain from the development of fundamental scientific ideas to the production and distribution of the finished product, as well as a system of close relationships among firms, their suppliers and customers, knowledge institutions that contribute to the emergence of innovations.

The innovation defense cluster forms a certain system for disseminating new knowledge and technologies, ensuring the acceleration of the process of transforming inventions into innovations, and innovations - into competitive advantages; it implies the development of high-quality, sustainable relationships among all its participants [22-24]. The emergence of such clusters is a natural process when there is a common scientific and production base. The cluster includes companies that both cooperate and compete with each other.

It should be noted that Innovation Defense Clusters for the branches of the Armed Forces of Ukraine can work both independently (on issues related to the branch) and jointly (on issues concerning the Armed Forces of Ukraine as a whole, for example, the creation of armaments (military equipment) that can be used in all branches of the Armed Forces of Ukraine) [26; 27; 31; 34]. Now, in the conditions of full-scale invasion of Russian Federation and continuous process of weapons enhancement in Russia, creation of such clusters in Ukraine acquires not only important, but really crucial nature.

Structurally, the innovation defense cluster has a classic composition: a core, product engineering companies, two environments: scientific-production and infrastructural, as well as a cluster council and a management company.

Currently, little attention is paid to the prospects of creating and developing clusters in the state and in the defense sector [28-30].

Priority areas, such as defense, and especially national security, require further research in this plane. Appropriate research in this field may spark keen interest primarily among military scientists at various levels, government officials, individuals engaged in scientific and scientific-technical activities, inventors, and rationalizers, as well as representatives of private and state enterprises.

Taking into account the above, it is possible to outline the main proposals regarding the establishment of innovative defense clusters by types of the Armed Forces of Ukraine in the interests of defense and national security of Ukraine, namely:

1. To cover the entire spectrum of security, starting from space and computer systems and their software, new defense systems, communication, defense objects, and means of communication and transportation, and extending to applied research on ways of transportation and ocean depths, from new materials integrated into systems to household items in defense facilities and military equipment, it is necessary to create Innovative Defense Clusters by types of Armed Forces of Ukraine (following the example of DARPA or MAFAT).

The main idea behind constructing such a structure is that every citizen of Ukraine, whether military or civilian, can submit their innovative ideas, proposals, and inventions to the respective Center, which ensures their consideration, analysis, study, and, if necessary, implementation for defense purposes [32; 33]. Considering the number of personnel involved in military operations and their expertise in their respective fields, the primary proposals should ideally come from them.

2. To concentrate technologically interconnected organizational structures of defense and dual-purpose, which will interact and enhance the effectiveness of defense and national security of Ukraine, it is necessary to establish Innovation Centers (innovation clusters) for each branch of the Armed Forces of Ukraine. This will enable cluster participants to become successful entities capable of functioning outside the cluster [35-38]. At the same time, by voluntarily joining clusters, its members gain access to each other's resources, transforming into rapidly progressing technological alliances. As a result of such collaborations, each cluster participant benefits. Moreover, individual gains are obtained by the branches of the Armed Forces, and the region in which the cluster is formed, and this is leading to an increase in both defense and national security levels.

3. To optimize measures for improving the state defense procurement and utilize it as a driver for stimulating innovation processes, it is necessary to refine the system of state management of innovation activity within the public sector of the economy.

4. Providing the opportunity for every average citizen with a penchant for invention to obtain patent documents should be accessible to both individuals and legal entities. The exorbitant fees associated with intellectual property rights protection hinder this accessibility [39; 40; 42]. Ultimately, this will incentivize the talented population of the country to engage in scientific, inventive, and rationalizing work. It will also lead to a high educational and scientific potential capable of producing a variety of innovations in the form of ideas, scientific developments, and patents. Therefore, there is a need to review and repeal Cabinet of Ministers of Ukraine Resolution No. 496 of June 12, 2019, "On Amendments to the Resolution of the Cabinet of Ministers of Ukraine of December 27, 2001, No. 1756, and of December 23, 2004, No. 1716".

5. To incentivize talented citizens of Ukraine to engage in inventive, rationalizing, and scientific work, which will lead to a high educational and scientific potential capable of producing various innovations in the form of ideas, scientific developments, and patents:

- Enhance the prestige of scientific workers through explanatory work, advertising, increasing the number of informational events, and expanding their audience;
- Ensure real financing for inventive, rationalizing work, and scientific research;
- Create social programs targeted towards the population (by categories: children, students, workers, civil servants, etc.) aimed at engaging and popularizing inventive, rationalizing activities, and scientific work (utilizing mass media extensively);
- Make legislative decisions to incentivize innovative achievements (e.g., free education in universities for children, job placement or reimbursement of educational expenses for students, additional paid leave or bonuses for workers and civil servants).

6. To increase demand for national innovations both domestically and internationally, and to boost the country's economy, including in the defense sector, the role of demand formation factor is becoming more significant [44-46]. This necessitates appropriate conceptual development in the field of shaping and implementing state procurement. Therefore, it is necessary to develop a project for the Concept of Stimulating and Forming Demand for Ukrainian Innovations.

7. To conduct objective and qualified expertise within the decision-making system on scientific and technical matters and the selection of development priorities, promoting the broad recognition of the importance and prospects of innovative activities, and enhancing its role in addressing the dual task of enhancing the competitiveness of the domestic economy and ensuring national security, it is necessary to elevate the level of innovation culture.

4 Conclusions

The following conclusions can be drawn:

1. Innovations in Ukraine have not yet attained decisive significance for the development of economic activity, ensuring the economic stability of the state and defense, although innovative activity is today perhaps the most important condition for creating competitive goods and services as a factor in enhancing defense capability and economic growth in Ukraine. The state should provide direct funding for innovative projects, stimulate investment in innovative projects by private and state enterprises by creating favorable conditions for those enterprises that implement advanced techniques and technologies, as well as engage in scientific and scientific-technical activities.

2. Despite all the benefits of collaboration, innovation clusters do not emerge spontaneously and do not begin to integrate on their own. Very often, the initiators of cluster formation are their future residents, and launching cluster-forming mechanisms can only be done by the state (Ukraine), which, in turn, is capable of ensuring the acquisition of new developments by becoming a customer of innovative products and creating fiscal and other incentives to attract cluster residents. Therefore, one of the initiators of the creation of the aforementioned clusters could be either the Central Military Scientific Directorate of the General Staff of the Armed Forces of Ukraine, the General Staff of the Armed Forces of Ukraine itself, or the Ministry of Defense of Ukraine.

3. The need for defense innovations is more pressing today than ever before. This is due to firstly, the necessity to restore the defense and economy of the state, where innovations can become an effective means to achieve this goal. Secondly, it is about the change in the ways the economy and society function as a result of modern technological transformations, especially in the field of information and communication technologies (such as the implementation of artificial intelligence, blockchain, Internet of Things and Industrial Internet of Things, 3D printing, 5G communication, augmented and virtual reality, etc.), which fundamentally alter processes in manufacturing and construction, trade and logistics, education and knowledge accumulation, and so forth.

4. The country's system of governance should play its leading and significant role in the aforementioned issues and simultaneously ensure the coherence of state policy in the field of invention, rationalization, scientific work, and the development of national innovations, as well as the diversification of tools to support and stimulate science in general.

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Primary Paper Section: A

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