

3.2 Cluster model of USA's national economy development

Currently, an effective tool for the transformation of national economies is a clustering mechanism, which involves the development of concepts of cluster entities (e.g., transport and logistics [101-106], agricultural [107], eco-energy [108], IT [109]) and a system of measures on financial incentives for cluster initiatives. The concept of clustering is a fundamentally new approach to the territorial organization of ecosystems, which focuses on the links between companies, and the availability of clusters of interconnected areas of economic activity. In most countries of the world, the cluster approach is effectively implemented in order to achieve sustainable development of economic systems of different levels in the context of the implementation of smart specialization strategies [110-117].

In view of this, *the purpose of this work* is to study the features and trends of cluster development in the United States and to identify priority areas for state cluster policy in the national economy.

World practice testifies to the intensification of the processes of formation of cluster associations of organizations in the last two decades. Currently, approximately 50% of the economies of developed countries are covered by the processes of creation and functioning of cluster structures. For example, there are 380 clusters in the USA. More than 50% of enterprises operate in the country within clusters, and the share of GDP produced in them exceeds 60% [118].

The Agency for International Development of the USA found that the successful implementation of cluster initiatives is based on strong local and international competition. American researchers also concluded that indirect support for clusters can have a greater effect than direct support. Indirect support may include reforming issues of cluster regulation and meeting the need for labor resources by improving cluster training programs.

In government programs of the USA to support networks and clusters, two typical network models can be distinguished, which are considered clusters. The first model reflects the structure of many industrial clusters, where networks of small and

medium-sized firms, including venture capital firms, are grouped around an "anchor centre", which can be a large corporation, university, or scientific laboratory. In the United States, such ecosystems are called the concentric circle model [119]. Industrial clusters have highly formalized internal connections and can be developed within the framework of a single cluster project, which is implemented with the help of a cluster manager. They can be created both by the method "from above" and "from below". However, their design is not about creating a platform for collaborative action, which is very different from effective innovation ecosystems built on the triple helix [120].

Inter-company cooperation is developing poorly here – each company is vertically tied to a key player, and in order to stimulate cooperation with small businesses, this player, as a rule, needs state assistance (money or benefits). Serious global companies do not come here either. Such networks can grow in breadth, giving rise to numerous start-ups, but do not reach the main thing – the critical density and the required quality of horizontal cross-contacts necessary to ensure sustainable self-development. In most cases, they remain dependent on state aid or orders, that is, they grow, but do not develop innovatively.

The second model reflects full-fledged innovative cluster ecosystems of the post-industrial era, which rely on innovation as a driving force. These include a number of well-known cluster networks in the United States. They are well integrated into global chains, have coordinating network nodes in the form of a platform for collaboration, build interactions on long-term agreements, and collectively generate continuous innovation. It is this model that achieves dynamic self-development, successfully fulfilling the final functional task of the cluster – to become a growth pole for the region of deployment.

The secret of the unique technological achievements of Silicon Valley in the 1980s was first revealed in 1994 by A. Saxenian [121], a professor at the School of Information at the University of California, Berkeley. She showed that, unlike the high-tech area of Route 128 on the East Coast of the United States, which was dominated by hierarchical, vertically integrated companies, the Valley was organized as a decentralized regional production system, where horizontal networks of legally

independent firms relied on a tradition of mutual knowledge sharing and outsourcing practices for suppliers.

From subsequent work, it turned out that by the middle 1990s, 8427 firms were operating in the Valley, and its organization was a combination of two models of network connections – a system of vertical integration supplier firms by stages of the production chain and the system of horizontal cooperation between industrial companies and non-productive sectors of the economy [122]. The logic of the formation of global chains, which was gaining strength, was combined here with a new business organization model in the form of a network ecosystem.

In the 2000s, the specifics of the network organization of the Valley began to be applied to the description of clusters as innovative ecosystems far beyond the US. In 2012, Valley business climate experts W. Hwang and G. Horovitt described the specifics of the business environment necessary for the emergence of new "silicon valleys" in the form of the "Rainforest" concept, referring to a communications environment that is conducive to the intensive emergence of new start-ups, innovative entrepreneurs, and innovative communities. Companies thrive in this environment and organizations of a wide variety of specializations and sizes, entering into network interactions under the influence of spontaneous market forces. As in a tropical forest, all flowers and plants, including weeds, must grow here (the effect of the functional diversity of players), self-organization and a high density of communications must be present, and all participants in communications must have a culture of continuous change, i.e. strive for updates [123, 124].

Modern cluster practice confirms the universal patterns that once developed in Silicon Valley. The formation of new valleys, designed for the synergy of innovation, depends on two interrelated factors – the quality of the business environment in the local economy and the very model of cluster organization.

Thus, the United States is one of the leading powers in the field of successful cluster policy. In general, the cluster policy implemented in the country can be characterized as liberal. However, the model for the formation of clusters and their management includes many completely different methods and tools, in the application

of which there is no uniformity for different formations. The country has a number of cluster formations called industrial and innovation centers, the leading of which is the world-famous Silicon Valley center, on the territory of which many high-tech companies operate. There are states and territories in America, for example, the cities of Pittsburgh, Akron, Cleveland (Ohio and Pennsylvania) – technologies of "clean" energy; Boston (Massachusetts) – biotechnology; Austin, Dallas (Texas) – developments in the field of semiconductors, etc., which are distinguished by a successful policy pursued in the field of managing innovation clusters located on their territory [125]. If in 1991 years 9 successful cluster models were identified in America, then at present the development of clusters in the USA has reached a new level – there are more than 20 production cluster groups that maintain intensive ties between industries – there is a diversification of intersectoral ties. A general review of practice allows us to note that most of the cluster formations in America are quite independent and have "technological networks" – a system for accumulating and disseminating knowledge and technologies; cluster members have a common scientific base, which allows for internal "specialization" and "standardization".

Another feature of American innovation-industrial centers is a flexible system of small businesses, which allows the formation of "innovative growth points" within the cluster. As for the role of the state in the clustering of the US economy, the support and development of clusters is its priority. Thus, in 2011, the country passed the law "On creating opportunities in America for significant assistance in matters of technology, education, and science". Programs aimed at supporting innovation and research in this area at the regional level are widespread.

The country is implementing such a management tool as the creation of commissions for the initiation and development of innovative clusters – the initial capital for the development of such an "initiated" cluster is allocated by the state, and then funds from private companies are attracted. The state provides tax incentives, incentives for the purchase of raw materials to participants in developing promising clusters, and rental incentives for the use of equipment and scientific laboratories in the state. Support is widespread here on a competitive basis and through a system of grants.

Thus, the emergence and development of clusters in the United States is the result of the impact on the region of a complex system of factors, among which, in addition to the territorial location, the presence of a complex system of interaction between participants, inter-industry relations, the presence of a highly skilled workforce, and the role of the state is to identify such conditions and comprehensively support development existing cluster complexes [126].

Based on the foregoing, the following conclusion can be drawn. The experience of the USA in the field of formation of cluster structures is very interesting. There is no clearly formulated federal policy aimed at the development of clusters. The federal government does not have the right to directly intervene in the policy of individual states in the field of regulation of regional clusters but provides them with indirect support in the form of subsidies for competition development programs, research, and educational activities.

The essence of the American type is to create a favourable economic environment for the development of clusters, where the introduction of innovations becomes a necessary condition for the functioning of firms. The state provides R&D program executors with significant benefits: tax incentives, free use of industrial and scientific equipment, free lease of land plots, subsidizing scientific developments, etc. [127].

The success of American clusters is based on an effective strategy supported by three strengths: continuous innovation, technology transfer, and market application, retraining and constant attraction of highly qualified human capital, and an efficient financial system. Innovation is a source of competitiveness for American clusters and a determining factor in maintaining global competition. Since the cluster system is organized on maintaining close links between the academic environment and the business environment, it offers a constant transfer of technologies and their application in the market. In this regard, all American universities have technology transfer offices.

In addition to investments in basic research, most of them are directed towards applied research and development. Therefore, US policy encourages technology transfer through universities and on an ongoing basis and creates start-ups as well as

spin-off projects to promote cluster expansion and hence regional development. Innovation is constantly stimulated through centers of excellence and various programs created for this purpose. Centers of excellence experiences are created by combining the efforts of the state, the scientific community, and education, the private sector in order to create companies in the fields of new technologies, as well as for the commercialization of innovative products.

The constant attraction of talent and qualified personnel is a constant concern for the United States. Added to this is a wide scope of efforts at the state or federal level to train human capital, retrain and quickly adapt to change. In addition to all this, the US annual policy of attracting "brains" around the world through various programs that contribute to its own development is well known, which is a very successful strategy.

American clusters, contrary to expectations, are very strongly supported by the state, both at the federal level and at the level of each state. First of all, this is aimed at ensuring that clusters receive permanent insurance funds for innovative activities, the creation of laboratories for the research and the development of new technologies. At the federal level, this is achieved through federal funding programs, such as the Small Business Innovation Research (SBIR), created in 1982 for SMEs, which was completed in a short time with the help of the Small Business Technology Transfer (STTR), designed to create research laboratories at universities [128].

Funding is through grants and takes place in two stages: a grant of 100 thousand US dollars for 6 months at the initial stage and 750 thousand US dollars for a maximum of 2 years for the development of prototypes, and products. Also at the federal level, large US federal agencies such as the Small Business Administration provide or subsidize RDI loans at universities. At the state level, there is a system of financing through loans at preferential rates and special funds with an annual budget of 2 billion US dollars.

At the local level, clusters are financed by local governments through public funding to create jobs, support loans, relocating companies, etc. There are also various private foundations and other foundations that constantly provide innovation and

technology transfer and market application, materialize in the marketing of products and services, and create start-ups and spin-offs that contribute to local development. In particular, the following forms of financing and the corresponding types of investors can be mentioned:

- commercial banks offering companies profitable loans;

- financing from large companies within clusters, which provides about a third of the total funding for the initial stage;

- private or mixed organizations providing grants or loans at subsidized rates;

- investments in a type of venture capital (venture funds) and business angels;

- significant financial support from the universities that are members of the clusters. American universities have intellectual property rights to the results of research conducted in their laboratories, capitalized through the sale of licenses. These institutions are also developing multinational partnerships for educational projects or research contracts;

- the attraction of foreign direct investment (FDI) within the clusters through programs implemented for a maximum of 5 years in advanced areas such as pharmaceuticals, and biotechnology, to promote the opening of business incubators, start-up dynamics, etc.

It follows from this analysis that the main factors for the success of American clusters are provided by a very effective funding system supported by government policy, as well as some features that are found in the studied models: the presence of some prestigious international universities in their composition; specialization in the field of high technologies; support for research and innovation; technology transfer and application of innovations in the market; possession of a highly skilled workforce; continuous implementation of qualification and retraining programs for human capital in accordance with the current requirements of the labor market.

As a result of the study, the main factors for the success of American clusters can be identified: a strong entrepreneurial spirit that is cultivated on an ongoing basis, great thematic diversification and specialization in the field of high technologies, the presence of some prestigious international universities in their composition, several

research laboratories, both at universities and in the private sector, excellent international visibility through universities and research labs, international assistance to attract FDI financing, skilled and highly skilled workforce, adaptation to market demands through human capital retraining programs, and efficient funding system through strong government support, and a wide range of funds for continuous financing of innovation, high concentration of companies at the regional level, constant innovation, technology transfer and application of innovation in the market, high labor mobility and constant involvement of "brains", the presence of some business networks and some internal social networks based on the spirit of cooperation and dissemination information between researchers and between companies in a cluster.

Prospects for further research are to substantiate the conceptual provisions and develop specific practical recommendations for the formation of a regional cluster policy in Ukraine, taking into account the best world practices.