On training personnel for the interregional research and manufacturing cluster of aviation industry enterprises

Marina Nikandrova[1,*], *Roman* Moiseev[1], and *Alexander* Snegurenko[1]

[1]Kazan National Research Technical University named after A.N. Tupolev, 10, K. Marx st., Kazan, 420111, Russia

Abstract. The purpose of the article is to develop proposals for improving the efficiency of the forward-looking training system for the Russian Aviation Industry, located in the Volga Federal District. This territory is a concentration of enterprises of the machine-building complex, a significant part of which is represented by enterprises of the aviation industry. It is proposed to consider the aviation industry of the Volga Federal District as an interregional research and manufacturing cluster. The author presentation of the element composition of this cluster includes a production base, infrastructure, a system of state control, as well as consumers. As the core of this cluster, it is proposed to consider research and academic organizations, and industrial enterprises of the participant regions. Tatarstan is central to the Volga Federal District. This makes it a fairly convenient region in terms of logistics and interregional management of aviation industry enterprises. As the central headquarters of the interregional research and manufacturing cluster of the aviation industry, there is a scientific and educational institution in which scientific activity in the field of design and production of aviation equipment is set at a high level, as well as an extremely important function is implemented, namely the training of highly qualified personnel for the industry. The cases of KNRTU–KAI in the field of career guidance, teaching talented students, as well as the implementation of master's degree programs are considered. Many universities have got number of other similar unique practices for organizing staffing for the future development of enterprises in the aviation industry. In the authors' view, the significant potential for the development of the training system for the aviation industry lies in the efficient interaction between university communities within the Volga Federal District, as well as universities and employers. This will ensure consistency and continuity in training.

The Volga Federal District is a region that has concentrated a large number of enterprises of the aviation industry: in the Republic of Tatarstan there is a significant number of such production enterprises and scientific organizations: Kazan Aviation Plant—a branch of Tupolev PJSC, Kazan Helicopter Plant PJSC, MVEN Firm LLC; Tulpar Aero Group Group of Companies; Kazan National Research Technical University named after A.N. Tupolev—KAI; JSC Kazan Research Institute of Aviation Technologies, and many other subjects of the aviation industry; in the Republic of Bashkortostan, an aircraft manufacturing enterprise operates in the city of Kumertau, and aircraft engine production is carried out in the city of Ufa; in the city of Perm, the production of aircraft engines and components for them is carried

*e-mail: MVNikandrova@kai.ru

out (Perm Engine Company, JSC Perm Aggregate Association "Inkar", JSC "Aviadvigatel", JSC "Perm Motors"); the world's largest aviation-industrial complex Aviastar operates in the Ulyanovsk region, where the serial production of wide-body heavy and super-heavy transport and passenger aircraft of the AN-124 Ruslan and Tu-204 types is established; in the Samara region there is an aviation enterprise JSC "Aviakor", which produces Tu-14 aircraft, space techniques such as space carriers "Proton", carrier "Energia", rocket and space complexes "Soyuz-Progress", spacecraft "Foton", "Bion", "Resource"; in the Saratov region, the production of Yak-42 aircraft with various modifications is located, the production of multipurpose sports aircraft is also carried out. Due to the fact that these enterprises are sophisticated research and production complexes, they currently remain relatively closed to the external environment. Considerable reserves for increasing the efficiency of scientific and technical activities and production results of these enterprises lie in the organization of their coordinated and mutually beneficial interaction. The solution of this problem is directly related to the improvement of the system of forward-looking training of highly qualified personnel. Taking into account the development of production technologies and the spread of *Industry 4.0* technologies, to which the high-tech aviation industry is most susceptible, it is important to train personnel taking into account the results of the analysis of the experience of automating production processes and improving the tools of human-machine interaction [1]. At the same time, the pace of development of the modern aviation industry requires the organization of effective training of specialists at all stages of their professional life cycle, knowing as life-long learning. In this regard, the most urgent are the issues of effective retraining of personnel in the framework of continuing vocational education [2].

Today, in almost all regions of the district, training is organized for various levels of education—vocational and higher education. At the same time, work on training highly qualified personnel has been effectively organized in scientific centers and technical universities. However, the system of training highly qualified personnel for the industry has significant development potential. The training of personnel for the aviation industry, according to the authors, should be carried out in the interaction of specialized departments and organizations in the regions interested in the future development of the Russian aviation industry.

In this regard, the purpose of the article is to develop proposals for improving the efficiency of the forward-looking training system for the Russian aviation industry, in particular, localized in the Volga Federal District.

In the view of the authors, the concept of Aviation Industry is very broad. The number of enterprises and organizations of the aviation industry should include all economic entities associated with the design, production and operation of aviation equipment, as well as all entities that ensure the functioning of the relevant infrastructure, e.g. research, training, financing, insurance, etc.

Currently, there is a growing demand for aviation equipment on the Russian market. This is confirmed by the state program of Russia "Development of the Aviation Industry" adopted on September 21, 2021, in which the goal is to increase by 2030 the share of Russian-made aircrafts and helicopters in the fleet of the largest Russian air carriers at least 30 and 90%, respectively. So, according to this state program, it is planned in 2022 to have 14% of the fleet of domestically produced aircraft within the fleets of Russian air carriers (amount of 14% is the target for the coming year). Accordingly, every year the state plans to increase production volumes and the number of operated Russian aircraft, including on domestic route lines.

Along with the program documents, the growing trends in demand for air transportation and, as a result, the prospective demand for aviation equipment are confirmed by the data of the SberPress service. According to this service, the Russian aviation industry is recovering at a high rate, the volume of domestic air transportation by the end of 2021 will reach

81.6 million people, and will exceed the 2019 pre-COVID indicator by 12%. It should be acknowledged that the pandemic has become a new factor in socio-economic development. Due to epidemiological limitations, the aviation industry turned out to be the most sensitive to this fact [3].

Achieving the relevant indicators and meeting the demand for air transportation requires, first of all, an increase in the efficiency of forward-looking training for the aviation industry. In the authors' view, the key task is to ensure the efficiency of the functioning of the industry infrastructure, in particular, personnel training, as well as financial and economic support for the growth of aircraft production and economic conversion [4]. In this regard, the management and organizational problems of the development of the aviation industry of the Russian Federation in modern conditions are being mainstreamed. New integration mechanisms are required to improve the efficiency of interaction between participants of aircraft production [5].

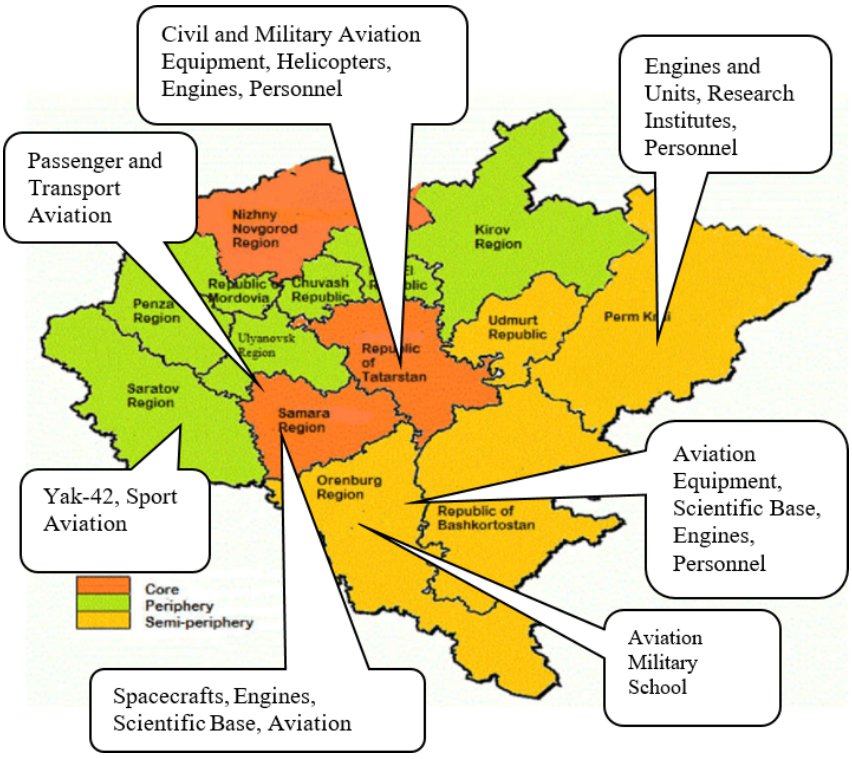

Figure 1. Volga Federal District as the territory of the interregional research and production cluster of the aviation industry

In modern regional management, the cluster approach has proven itself well. The essence of the approach is in the systemic consideration of homogeneous independent elements of the regional economy having individual properties. In this regard, it is proposed to consider the aviation industry of the Volga Federal District as an interregional research and production cluster. As the core of this cluster, it is proposed to define scientific and educational organizations and industrial enterprises of the participant regions.

Tatarstan is central to the Volga Federal District. This makes it a fairly convenient region in terms of logistics and interregional management of aviation industry enterprises (figure 1).

According to the authors, a scientific and educational institution should act as the central headquarters of the interregional research and production cluster of the aviation industry, in which scientific activities in the design and production of aviation equipment are carried out at a high level, as well as an extremely important function is implemented, namely the training of highly qualified personnel for the industry.

The most suitable organization, in accordance with the above parameters, according to the authors, is Kazan National Research Technical University named after A.N. Tupolev—KAI (hereinafter—KNRTU–KAI). It is proposed to view KNRTU–KAI as a specialized organization within the framework of the cluster being created. The organization occupies a central place in the system of the interregional aviation industry, has significant opportunities to attract various resources available through the implementation of its own organizational potential. We believe that in order to attract the resources of KNRTU–KAI, it is necessary to initiate the creation of an interregional research and production cluster of the aviation industry. It is envisaged that KNRTU–KAI will act as a specialized organization—the core of a new structure coordinating regional system-engineering projects aimed at developing the Russian aviation industry as a whole. It should be noted that KNRTU–KAI has effectively organized international cooperation within the framework of the German-Russian Institute of Advanced Technologies (GRIAT KAI), which makes it possible to ensure the active participation of students in international projects in a multicultural environment, and to involve teaching staff and industrial technologies for the development of enterprises of the aviation industry [6].

Among the important results of the implementation of the directions for the development of the interregional research and production aviation industry are the following: resource and legal support for innovative activities of KNRTU–KAI by other enterprises of the aviation industry; forward-looking training of personnel to achieve the goals and objectives of the regional research and production cluster of the aviation industry; information support and ensuring the possibility of effective communication; the use of public institutions in solving economic, social and environmental problems of the aviation industry [7].

The author's presentation of the composition of the elements of the interregional research and production cluster of the aviation industry is shown in figure 2.

The objects of management of the interregional research and production cluster of the aviation industry include: Infrastructure (Research Institutes, Design Bureaus, Universities, Aviation Training Centers, Financial Institutions, Airports, etc.); Production Base (Aviation Equipment, Aircrafts, Helicopters, Sport Aviation, Spacecraft, Engines, etc.), Consumers (Civilian Consumers, Military-Industrial Complex, Sport Aviation Enthusiasts); the System of State Control for the Aviation Industry (Federal Agency for Air Transport "Rosaviatsiya", Federal Aviation Regulations, State Support, etc.).

According to the authors, the main task of the interregional research and production cluster of the aviation industry is to create conditions for the long-term technological leadership of the Russian aviation industry based on the development of scientific, technical, production and personnel potential of specialized enterprises. The development of corporate culture at enterprises that is part of the interregional research and production cluster, according to the authors, should be based on the best properties of the Russian model of production management and the use of foreign practices with their adaptation to the Russian conditions of functioning of enterprises of the aviation industry [8].

As part of the organizational development of the cluster, according to the authors, it is necessary the following: transformation of the existing specialized organization of the cluster into the format of a project team; development of regulations on the activities of a specialized cluster organization; introduction of payment of membership fees of participants for the development of a cluster system of interaction; organization of monitoring of satisfaction

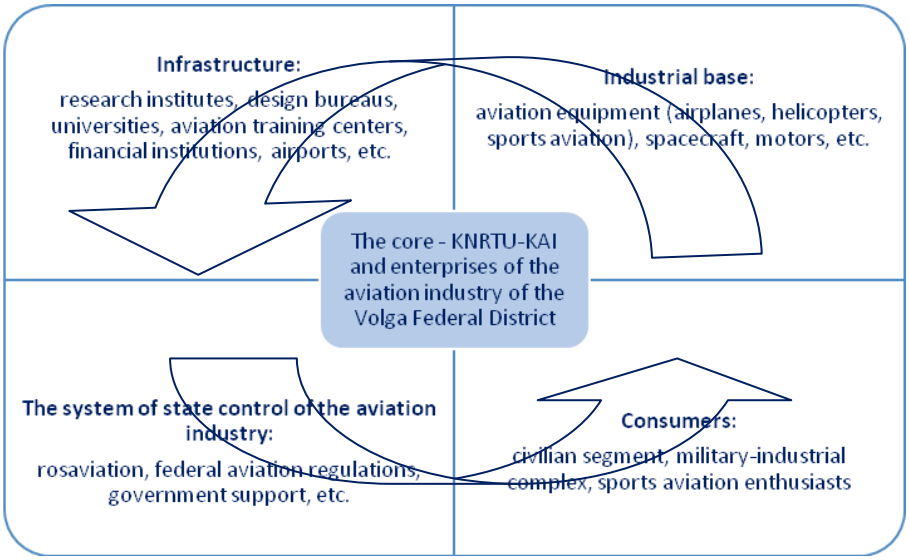

Figure 2. Author's presentation of the composition of the elements of the interregional research and production cluster of the aviation industry

with the activities of a specialized organization; creation of a technology commercialization center; creation of a prototyping center.

According to the logic of the National Technology Initiative, state development institutions should act as services that provide support, provide services to high-tech businesses. Companies need competent government services delivered on time and at a high level. In this regard, services should be created around the cluster that form a favorable breeding ground for cluster members. First of all, personnel training should become such a service.

KNRTU–KAI has been successfully solving the problem of training highly qualified personnel for the aviation industry for many years. This is a university with a tradition that has developed for almost a century. Of interest is the university's system of organizing career guidance aimed at identifying talents and developing them in the field of engineering, starting from an early age. So, KNRTU–KAI is implementing a project to create a unique educational complex "Technopolis" in Russia. This is an interactive space that integrates various forms of supplemenatry education for children in the field of physical and mathematical sciences, engineering and technical creativity. The complex includes three structural elements united by a single concept: the world's only interactive educational center for aviation and technology based on the first supersonic passenger aircraft Tu-144; engineering lyceum-boarding school for gifted children; children's scientific and practical laboratory located in the city center in a park area. The educational complex is a place for the development of children's abilities for technical creativity and entrepreneurship. At the same time, the concept of the educational complex provides for the consideration of the aviation industry, not only the production of aircrafts and helicopters, but small aircraft objects (drones and UAVs). At the same time, in order to identify children's abilities for technical creativity, KNRTU–KAI together with the Kazan Aviation Plant, is holding a profile Olympiad for schoolchildren in Physics. These and many other measures make it possible to ensure the identification and development of children's abilities for technical creativity in the field of aircraft construction and the operation of aircraft equipment.

Along with career guidance, KNRTU–KAI offers ample opportunities for the students who have already decided on their future profession and entered the university. Thus, KNRTU–KAI takes part in the All-Russian program for training engineers of a new generation for the construction industry "Wings of Rostec". The program is being implemented on the initiative and with funding from the State Corporation Rostec. In addition to the Kazan Technical University KNRTU–KAI, universities from other technical universities located in other cities of the Volga Federal District: Ufa, Samara, Perm, participate in the program. The essence of the project lies in the fact that in 2021, 120 applicants were recruited to Russian technical universities, who began their training in enhanced programs. It has been envisaged that from the very beginning of the training program participants will be given the opportunity to work in the structures of the State Corporation. Taking into account academic performance, all students receive motivational payments. The focus is on young people who are passionate about technical creativity and in the future will be able to ensure the development, including of enterprises of the aviation industry.

Graduates who have mastered bachelor's programs both at KNRTU–KAI and at other universities can enroll in international master's degree programs implemented at KNRTU–KAI. In order to effectively organize the educational process within the framework of the implementation of international master's degree programs at KNRTU–KAI, the German-Russian Institute of Advanced Technologies (GRIAT) has been created. This educational subdivision of KNRTU–KAI is a unique educational platform that unites German and Russian universities and enterprises. GRIAT trains engineers with global engineering skills and knowledge of a foreign language, develops international research and development, and also promotes intercultural exchange between Germany and Russia. Within the framework of GRIAT, various training programs are being implemented, including training of engineers in the field of aircraft engineering. Along with the training of aviators, GRIAT prepares masters in various fields of study. The competencies formed in master's students are in demand at enterprises of the aviation industry, as well as other industrial enterprises. The training activities are carried out at KNRTU–KAI for the aviation industry enterprises, and aimed at providing the industry with highly qualified specialists.

Thus, the aviation industry, as one of the most high-tech sectors, is undergoing major transformations today. In the face of constantly accelerating competition, the development of the aviation industry requires significant investments, which should bring maximum results. The article discusses the issue of creating an interregional research and production cluster of the aviation industry, in which KNRTU–KAI is considered as a specialized organization coordinating cluster projects. Tatarstan is central to the Volga Federal District. This makes it a fairly convenient region in terms of logistics and interregional management of aviation industry enterprises. The strategic areas of development of the interregional research and production cluster of the aviation industry include the following: organizational development of the cluster; development of the scientific and educational potential of the cluster; development of the information environment. This will make it possible to effectively attract and carry out joint investments in the system-engineering projects of the aviation industry. Cases of KNRTU–KAI in the field of career guidance, teaching talented students, as well as the implementation of master's degree programs are considered. Many universities have got many other similar unique practices for organizing staffing for the future development of enterprises in the aviation industry. In the authors' view, the significant potential for the development of the training system for the aviation industry lies in the effective organization of interaction between university communities within the Volga Federal District, as well as universities with employers. This will ensure consistency and continuity in training.

References

[1] L. Mládková, *Industry 4.0: Human-technology interaction: experience learned from the aviation industry*, in Proceedings of the 19th European Conference on Knowledge Management (ECKM 2018), 6–7 September 2018, University of Padua, Italy, **1**, 571 (2018)

[2] R.R. Anamova, L.V. Bykov, D.A. Kozorez, *Aircraft industry staff retraining as a part of vocational education in the Russian Federation*, TEM J., **8(3)**, 978 (2019)

[3] A.A. Sozinova, E.V. Sofiina, M.F. Safargaliyev, A.V. Varlamov, *Pandemic as a New Factor in Sustainable Economic Development in 2020: Scientific Analytics and Management Prospects*, Lecture Notes in Networks and Systems, **198**, 756 (2021)

[4] V.M. Kraev, A.I. Tikhonov, S.V. Novikov, *Economic conversion in the aviation industry*, Russian Engineering Research, **38(4)**, 330 (2018)

[5] A. Emir, *Urgent managerial and organizational issues in the industry of aviation in the Russian Federation*, in Theory and Practice of Management: the Response to Challenges of Digital Economy: Proceedings of X Scientific Conference for young scientists, 6 December 2019, Plekhanov Russian University of Economics, Moscow, Russia, 439 (2019)

[6] T.M. Tregubova, V.E. Kozlov, A.S. Kats, *Discource on students participation in international projects on inter-ethnic tolerance formation in multicultural environment*, Journal of Siberian Federal University. Humanities & Social Sciences, **12(2)**, 261 (2019)

[7] L.F. Henriksen, S. Ponte, *Public orchestration, social networks, and transnational environmental governance: lessons from the aviation industry*, Regul. Gov., **12(1)**, 23 (2018)

[8] M. Kulapov, Y. Odegov, V. Sidorova, N. Sidorov, E. Zotova, *Corporate culture of organization: typical and Russian model*, Montenegrin J. Econ., **15(1)**, 215 (2019)