**Appendix to Section 2.2.**

**Table 1. Growth Points in accordance with the Objectives of the Region**

| **Regional Economy Cluster** | **Priority areas of scientific and technological development of the Russian Federation** | **National projects** | **Priority research topics from the Strategy of socio-economic development of the Astrakhan region** | **Scientific capability of Astrakhan State University** |
|---|---|---|---|---|
| Agroindustrial complex<br><br>Food production, import substitution | Transition to highly productive and environmentally friendly agriculture and aquaculture, implementation of systems for the rational use of chemical and biological protection of agricultural plants and animals, storage and efficient processing of agricultural products, creation of safe and high-quality, functional food products | "Science", "Ecology", "Health",<br><br>"Comprehensive plan for the modernization and expansion of the backbone infrastructure" | Creation of safe and high-quality, functional food products based on import substitution | Joint Scientific Laboratory for Soil & Vegetation Monitoring in Volga River's Delta by Astrakhan State University & by Institute of Physicochemical & Biological Problems of Soil Science of Russian Academy of Sciences (Pushchino town)<br><br>Innovative Technological Center "Biotechnologies to Obtain Original Pharmaceutical Substances"<br><br>Innovative Technological Center of Agricultural Biology, Information Technologies, & Automation |
| Extraction and refining of hydrocarbons | Transition to environmentally friendly and resource-saving energy, increasing the efficiency of extraction and deep processing of hydrocarbons, the creation of new sources, methods of transportation and storage of energy | "Science", "Ecology", "Health" | Development of modern environmentally friendly technologies for the production of petroleum products and chemicals | Green Chemistry Research & Educational Center |
| North–South Transport Corridor | Sustainable connectivity of parts of the Russian Federation through the creation of intelligent transport and telecommunication systems, as well as maintaining leadership position in the creation of international transport and logistics systems, the use of outer space and air space | International cooperation and export ",<br><br>"Safe and high-quality roads",<br><br>"Comprehensive plan for the modernization and expansion of the backbone infrastructure" | Development of new scientific products for the transport and logistics, creation of intelligent transport and telecommunication systems for the port.<br><br>Development of the regional infrastructure based on the modernization and expansion of the main urban infrastructure | Transport & Logistics Consortium of Caspian Higher Educational Institutions, presided by ASU |

| Regional Economy Cluster | Priority areas of scientific and technological development of the Russian Federation | National projects | Priority research topics from the Strategy of socio-economic development of the Astrakhan region | Scientific capability of Astrakhan State University |
|---|---|---|---|---|
| Preservation of cultural heritage, tourism, recreation<br><br>National security and sustainable development of the region | The possibility of an effective response of Russian society to major challenges, taking into account the interrelationship of man and nature, man and technology, social institutions at the present stage of global development, implementing the methods of the humanities and social sciences.<br><br>Counteraction to technogenic, biogenic, socio-cultural threats, terrorism and ideological extremism, as well as cyber threats and other sources of danger for society, economy and state | «Culture» | Development of a system for digitalization of cultural objects for the preservation of cultural heritage and its promotion; research of new objects of historical and cultural heritage (including archaeological), development of new tourist routes (ecological, cultural, religious, gastronomic, ethnographic, etc.) to increase the unique tourist and recreational attractiveness of the region | UNESCO Chair "The Learning Society and Human Sustainable Development"<br><br>Laboratory for Research of Social, Political, and Cultural Dynamics of Lower Volga & Caspian Sea Region<br><br>**School "Lower Volga Archaeology"**<br><br>Center of Research of History of Lower Volga Region during Soviet Period. |
| IT, AI, robotics, nanoindustry | Fundamental research, driven by the internal logic of the development of science, ensuring the country's readiness for major challenges that have not yet manifested themselves and have not received wide public recognition, the possibility of a timely assessment of the risks caused by scientific and technological development.<br><br>The transition to advanced digital, intelligent production technologies, robotic systems, new materials and design methods, the creation of systems for processing large data volumes, machine learning, AI | "Digital Economy of the Russian Federation"<br><br>"Small and Medium Business and Support for Individual Entrepreneurial Initiatives" | Conducting fundamental and applied research in breakthrough strategic directions of scientific and technological development, in the interests of the digital economy (information technology, nanomaterials, alternative energy, etc.) | Joint Research Laboratory of Construction & Physicochemical Research of Oxide Magnetic Materials by Astrakhan State University & Institute of Metallurgy, Ural Division of the Russian Academy of Sciences<br><br>Research Laboratory "Mathematical Modeling & ICT in Science & Education"<br><br>Joint Research Laboratory of Condensed-Matter Physics and of New Methods in Material Science by Astrakhan State University & by Institute of Solid State Physics of Russian Academy of Sciences |

**Figure 1. Dynamics of R&D revenues 2010-2020**

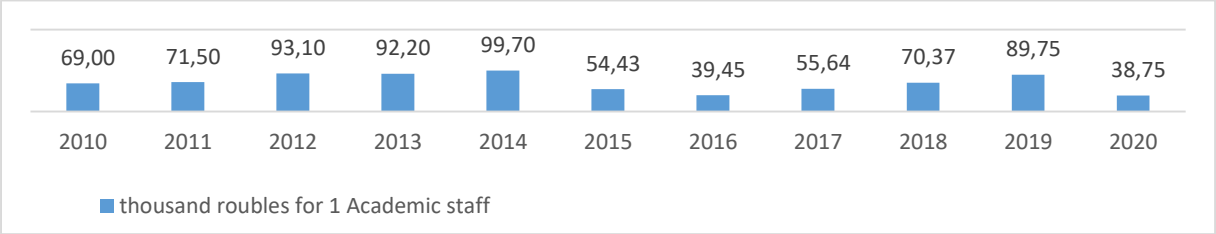
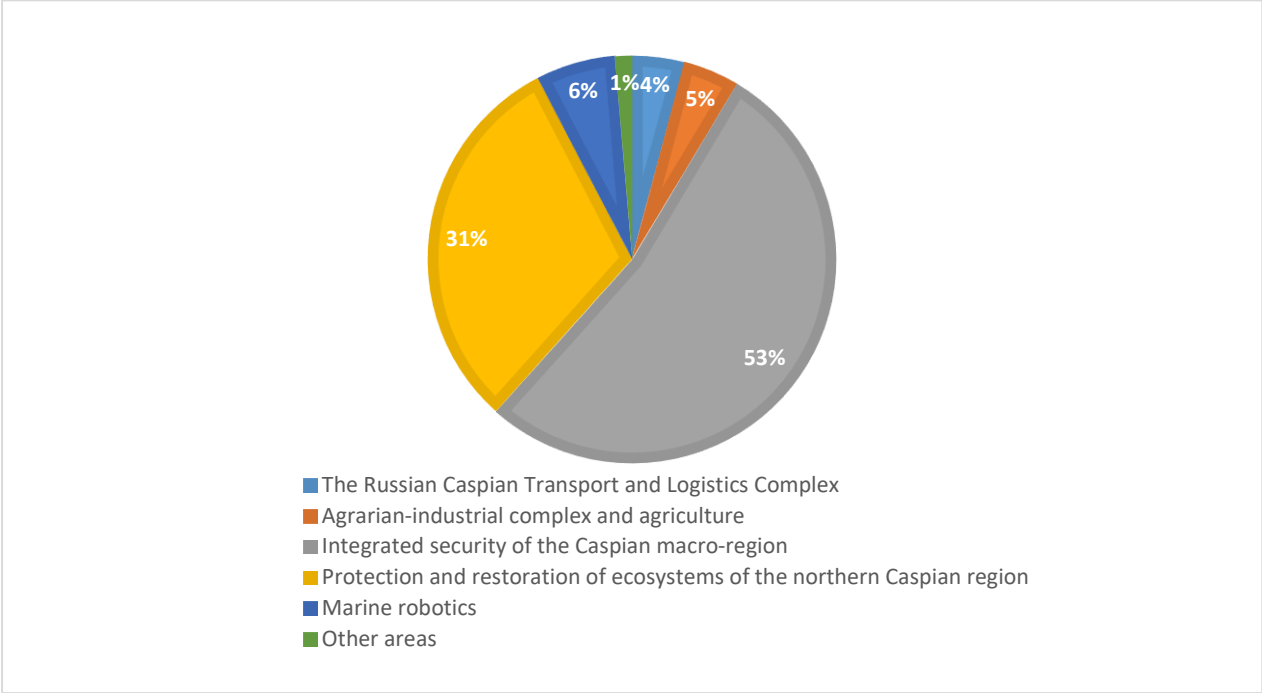



**Figure 2. R&D income structure**




## Benchmark universities

When creating the target model of the university in the field of research, commercialization and innovation, a reference group of universities (benchmark universities) was determined, this group includes Russian universities with confident growth in academic rankings, they successfully implement project and research activities both at the regional level and at national level. The criteria for the selection of benchmark universities were: high performance of the scientific research, the impact of the university's activities on the regional economy, similar scientific and educational profiles, the policy implementation of “advanced” nature of the development of science. At the same time, the university sets itself ambitious goals to achieve the declared indicators, nowadays it does not have such a level of development of the competencies of the academic staff and financial support for R&D. Replenishment of the resources is expected through participation in the Priority-2030 and active interaction with members of consortia involved in the implementation of strategic projects.

ASU has chosen Russian universities as benchmark universities in research and innovation activities, which show steady growth in academic rankings, successfully implement project and research activities both at the regional and national levels:

| Name | Positioning | Best practice | Opportunities for implementation in ASU |
|---|---|---|---|
| **HSE (Moscow)** | **Top 25** best universities in the world according to the Times Higher Education Emerging Economies and **top 3** best universities in Russia | HSE has created one of the most successful systems of internal research grants for scientists of various levels (Competition for individual research projects of the HSE Academic Fund; Competition for the creation of research and study groups; Competition for the creation of project and study groups; Promotion of applied research; Support for the growth and academic development of experts and analysts (talent pool "Promising experts"). The selection of applications is carried out on the basis of external expertise, including international experts. The target indicators for the implementation of projects are exclusively publications of Scopus, WoS and monographs.<br><br>HSE has created an effective system for the development of scientific personnel “on the basis of Postgraduate schools and the creation of a“ closed” system, where graduate students are completely immersed in research, and their labor activity is not related to external secondary job, but is devoted to the research topic, which is achieved by providing increased scholarships for the best graduate students working on topics relevant to industrial partners (https://aspirantura.hse.ru/asp_school). Postgraduate students of the Academic Postgraduate of the HSE study according to an expanded educational program in Russian and English and participate in research projects of the HSE (paid employment) corresponding to the area of their dissertation (https://aspirantura.hse.ru/acad_asp/) | 1. Creation of a system of internal grants with the involvement of external experts to stimulate scientific fundamental and applied R&D in priority areas for ASU and the Astrakhan region.<br><br>2. Creation of a system of additional incentives for graduate students who carry out research on priority topics (paid employment); compulsory training in an expanded program in English for participation in international projects. |
| **Tomsk Polytechnic University (TPU) (Tomsk)** | One of the best universities in terms of research activities | TPU attracts leading world scientists to work on university research projects, also within the framework of a successfully implemented system of internal grants; creation of centers of excellence; reorganization of the publication activity of the academic staff. An example of an effective system is TPU's Rocket Hirsch project (http://rh.tpu.ru), which contributes to the growth of the university's ranking at the international level. The Publication Activity Development Office signed an agreement with the Elsevier to translate articles and recruited about fifty qualified experts, which gave an intensive growth in scientometric indicators for publications in WoS | Creation of a structure for the development of the publication activity of the academic staff, contracts for translation and examination of articles for submission to scientific journals |
| **Kazan Federal University (Kazan)** | Leader in the creation of a regional | Centers of excellence and unique laboratories have been created at Kazan Federal University based on global development trends and the features of | Creation of world-class centers in the agro-industrial complex in the regional |

| Name | Positioning | Best practice | Opportunities for implementation in ASU |
|---|---|---|---|
| | scientific and educational center | global and regional markets. In 2020, on a competitive selection, a world-class center was created in the priority area "Environmentally friendly resource-saving energy, effective regional use of subsoil and biological resources" (https://media.kpfu.ru/news/kfu-utverzhden-na-sozdanie-nauchnogo-centra-mirovogo-urovnya-po-osvoeniyu-zhidkikh-uglevodorov).<br><br>The total amount of financial support for the Center for 2020-2024 is 15.46 billion rubles. The target model of the university successfully combines the interests of the regional economy and world-class trends. The development tool was fundamentally new Laboratories (open labs) - sites with modern infrastructure, open for Russian and foreign world-class scientists who, together with KFU researchers, carry out applied projects in the interests of regional development | priority area of socio-economic development<br><br>Creation of open laboratories for scientists of ASU, universities and research institutes of the region, RAS, RF. |
| **ITMO University (Saint Petersburg)** | Top 10 Russian universities according to the innovation and entrepreneurship | The university has created a successful ecosystem for supporting scientific and innovative activities: 2 business incubators, a technopark, 40 small innovative companies, the Center for Scientific and Technological Foresight (CSTF) aimed at analyzing long-term trends for the purposes of scientific research and development of the competencies of the academic staff (https://itmo.ru/ru/viewunit/83767/centr_nauchno-tehnologicheskogo_forsayta.htm), the Academic Writing Laboratory to develop the skills of preparing scientific texts. Unique tools have been created to support university companies in the early stages of development, on the basis of support from the funds of the university and its foreign partners | Creation of an innovative ecosystem of the university, including business accelerators, incubators, funds to support small innovative companies in their early stages. |
| **Peter the Great St. Petersburg Polytechnic University (Saint Petersburg)** | Leading Russian center of excellence with the largest project consortium in the area of "New production technologies" (digital design and modeling, digital twins, new materials, additive technologies | The University has a developed infrastructure for interaction between scientific and industrial companies in order to ensure the global competitiveness of domestic leading companies in the NTI markets and in high-tech industries.<br><br>One of the main guidelines for technological developments of the university is the creation of "Factories of the Future" (Digital / "Smart" / Virtual Factories) aimed at digital design and modeling, new materials, additive technologies, the industrial Internet, robotics (https://fea.ru/ compound / national-technology-initiative / # fof). The basis for the implementation are innovation centers and laboratories: Computer Engineering Center, Educational, Scientific and Innovation Laboratory "Computational Mechanics" (CompMechLab) IAMM SPbPU, LLC Laboratory "Computational Mechanics" (CompMechLab®), LLC "Polytech-Engineering ". | Creation of digital platforms and big data management systems:<br><br>1. creation of scientific big date for the management and systematization of scientometrics; 2. digital twinning of complex problems of the region to increase the stability and security, as well as the investment attractiveness of the region (based on a clear diagnosis of market needs, constraints and prospects). |

| Name | Positioning | Best practice | Opportunities for implementation in ASU |
|---|---|---|---|
| | | | |

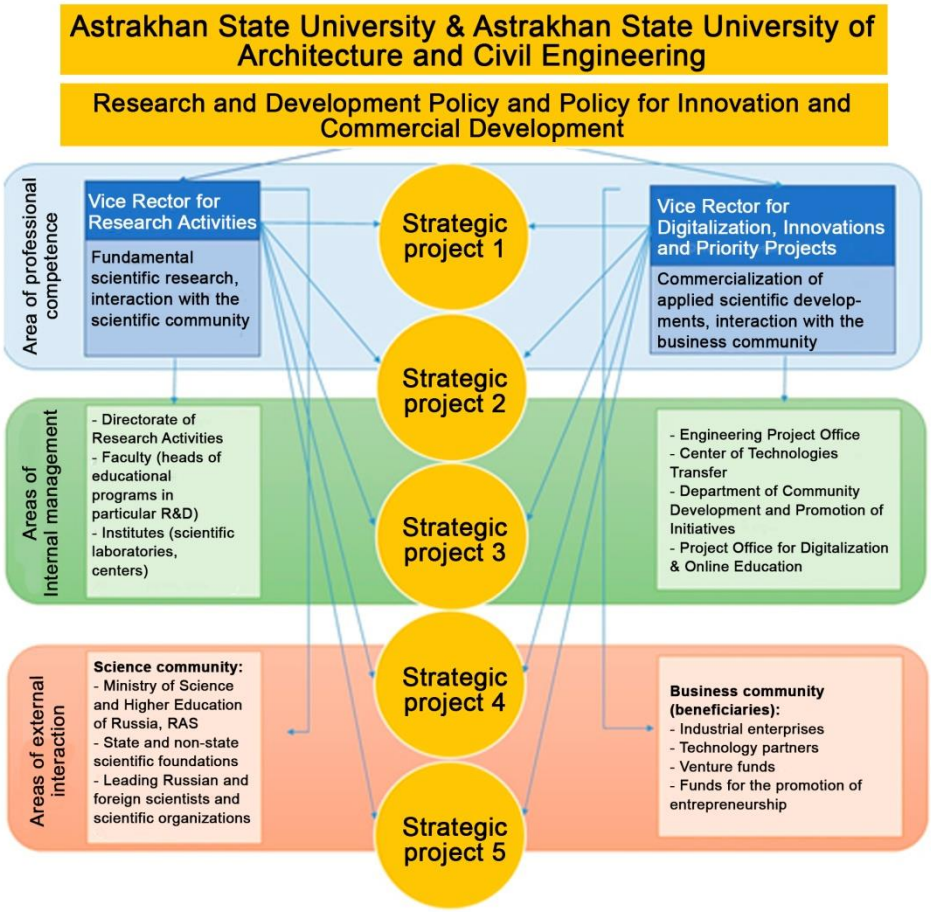



**Figure 3. Converged R&D Management System**

**Appendix to Section 2.2. part 2**

***"5 Priorities Program" – priority of five strategic development routes of the university research activity:***

- ***1. Priority "Marine Robotics".***

The development of the transport, logistics and environmental area is closely related to the development and creation of underwater and surface unmanned vehicles - marine robotics. This direction is new for the university and was designated only at the beginning of 2020, however, at present a pool of intellectual property objects has been created in the field of autonomous surface marine robots, a marine information and telecommunication network adapted for E-Navigation tasks, a testing ground for digital twins in the field of innovative shipbuilding and marine robotics has been developed, as well as experience in the design and operation of intelligent transport systems, a digital twin of a marine multipurpose unmanned platform is being completed. The development of the direction provides for partnership within the framework of the Consortium "Shipbuilding and Marine Facilities", as well as NTI "Marinet", Center of Competence of NTI "New Production Technologies".

*Integration with national goals:*

- Decree of the President of the Russian Federation of July 02, 2021 No. 400 "On the National Security Strategy of the Russian Federation" (sustainable development of the Russian economy on a new technological basis).

- Decree of the President of the Russian Federation of December 01, 2016 No. 642 "On the Strategy of Scientific and Technological Development of the Russian Federation" (transition to advanced digital, intelligent production technologies, robotic systems, new materials and design methods, creation of systems for processing large amounts of data, machine learning and artificial intelligence).

- Decree of the President of the Russian Federation of July 07, 2011 No. 899 "On Approval of the Priority Areas of Development of Science, Technology and Engineering in the Russian Federation and the List of Critical Technologies of the

Russian Federation" (robotic complexes (systems) for military, special and dual purposes).

- The list of instructions following the results of the plenary session of the ASI forum, approved by President of the Russian Federation on 19.12.2020 No. Pr-2177 (stimulating the production of unmanned (autonomous) navigation equipment and their use on ships).

- State program of the Russian Federation "Scientific and Technological Development of the Russian Federation", approved by Decree of the Government of the Russian Federation of March 29, 2019 No. 377 (expanding the influence of science on society, understanding the value of the results of intellectual work, increasing the prestige of a career in science, technology and innovation).

*Design and creation of innovative developments, ready for implementation:* building digital twins of marine robots and conducting virtual tests; manufacturing of technological equipment and pilot industrial samples of marine robots; conducting tests in the test water area to obtain certification and assignment of the level of autonomy; design of the marine robot MMBP-max in accordance with the rules of the Russian Maritime Register of Shipping; development and maintenance of software and hardware systems installed on the MMBP, in the control center for marine robots to ensure safe navigation conditions.

***2. Priority "Transport and Logistics Complex of the Caspian region".***

The creation of a modern center of the North-South International Transport Corridor (hereinafter - the North-South ITC) in the Astrakhan Region is strategically important both for the region and for Russia. The University, on the basis of the Transport and Logistics Consortium of Russian Universities created by it, will initiate a project to develop digital technologies for managing the transport and logistics ecosystem of the North-South ITC and intermodal organization of cargo transportation, which allows combining the advantages of all major modes of transport: sea, river, rail, road and aviation.

*Integration with national goals:*

- Decree of the President of the Russian Federation of July 02, 2021 No. 400 "On the National Security Strategy of the Russian Federation."[1].

- "Transport Strategy of the Russian Federation for the Period until 2030", approved by the order of the Government of the Russian Federation dated November 22, 2008 No. 1734-r.[2] (hereinafter - Transport strategy of the Russian Federation).

- Decree of the Government of the Russian Federation dated November 07, 2020 No. 1792 on the creation of a port special economic zone in the Astrakhan region[3]

*Integration with regional strategic documents:*

- Strategy of Socio-Economic Development of the Astrakhan Region until 2035, approved by The Law of the Astrakhan Region dated December 25, 2020 No. 115/2020-OZ (hereinafter referred to as the AR SED Strategy)[4].

*Regional strategic projects:*

- construction of the infrastructure of the port special economic zone in the Astrakhan Region - ASU & ASUACE provide research support for projects to create colliving for employees of PSEZ Olya (University development strategy until 2025);

*Key regional indicators:*

Freight turnover of transport enterprises should increase from 19.9 billion ton-km. in 2021 to 34.8 billion ton-km. by 2035, the volume of cargo transshipment in seaports - from 2.7 million tons to 4.6 million tons by 2025 year - ASU & ASUACE ensure the development and implementation of the Olya SEZ Smart Port concept, through the creation of a digital logistic platform for the seaport (University Development Strategy until 2025);

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[1] Solving the problem of integration into the global transport space, fulfilling the transit potential of the Russian Federation

[2] Creation of modern high-tech transport hubs in seaports, including PSEZ Olya

[3] Uniting PSEZ Olya and SEZ of industril type "Lotos" into the Caspian cluster, which is the cargo base of the "North-South" ITC.

[4] Organization of acceptance of test shipments of containers along the North-South ITC, using the existing infrastructure of the Astrakhan region, modernization of the transport infrastructure of the Caspian region, which is part of the North-South ITC in order to eliminate bottlenecks, development of freight traffic in the Caspian direction

*Research topics* (ASU & ASUACE)*:*

- Development of digital technologies for managing the transport and logistics ecosystem of the ITC "North-South" (modeling the digital twin of the transport corridor "North-South" based on Big Data technology);

- Development of a project for the creation of colliving for employees of PSEZ Olya;

- Creation of a digital logistic platform of the seaport - creation of a digital logistic platform of the seaport.

*Partners:*

Transport & Logistics Consortium of Caspian Higher Educational Institutions (provides a solution to the personnel problem of Olya SEZ, synchronizes educational programs, increases the mobility of students and academic staff); PSEZ Olya and SEZ of industrial type "Lotos", JSC "Astrakhan Sea Port", JSC "Commercial Sea Port of Olya", JSC "Airport Astrakhan" (provide resources for testing research projects); Privolzhskaya Railway - a branch of Russian Railways OJSC (provides financial resources for R&D on improving the customer service process).

➢ ***3. Priority "AIC".***

The agro-industrial complex of the Astrakhan region has unique natural opportunities for growing vegetables and melons, potatoes, prospects for the development of the processing industry and occupies leading positions in the region's economy. It is proved by the outstripping average Russian growth rates of gross agricultural production.

In 2020, the Astrakhan region took 2nd place among the regions of the Southern Federal District in terms of the growth rate of gross agricultural production, which amounted to 102.3%, with an average indicator in the Southern Federal District of 95.3%, and in Russia - 101.5%. The volume of gross agricultural production increased by 3 billion rubles against the level of 2019 and amounted to 53 billion rubles. The industry is confidently increasing the share of production in the total volume of the gross regional product, which is 10%.

*Integration with national goals:*

- Decree of the President of the Russian Federation dated July 02, 2021 No. 400 "On the National Security Strategy of the Russian Federation" (solving the problem of intensive technological renewal of the basic sectors of the economy (industry, construction, communications, energy, **agriculture,** mining).

- Federal Law of December 29, 2006 No. 264-FZ (as amended on December 30, 2020) "On the Development of Agriculture".

- "On the State Program for the Development of Agriculture and Regulation of Markets for Agricultural Products, Raw Materials and Food", approved by Decree of the Government of the Russian Federation of July 14, 2012 No. 717.

*Integration with regional strategic documents:*

- Strategy of Socio-Economic Development of the Astrakhan Region until 2035, approved by Law of the Astrakhan Region of December 25, 2020 No. 115/2020-OZ (introduction of scientifically grounded agriculture and nature management and improvement and mechanisms of land management in the Astrakhan Region; integration of research activities and agribusiness for the purpose of scientific, technological and innovative development of the agro-industrial complex).

- Decree of the Government of the Astrakhan Region dated April 16, 2020 No. 170-P "On the Procedure for Granting Subsidies for the Development of the Plant Growing Industry" (creation of high-yielding varieties of agricultural crops with aimed technological parameters and the development of innovative technologies for their cultivation based on biologization and greening of arid agriculture).

*Regional strategic projects:*

- Organization of the activity of a wholesale distribution center for the storage of vegetable products.

- Construction of a greenhouse complex of a limited liability company "Greenhouse complex" KEDR "(hereinafter – LLC "GC "KEDR") for year-round growing of vegetables.

- Agro-industrial complex for growing and processing tomatoes.

- Construction of a shop with refrigerated chambers for processing and storing vegetable and fish products of the agricultural consumer cooperative "Ovoshchevod".

*Key regional indicators*:

The volume of gross agricultural production will increase from 50.9 billion rubles in 2021 to 94.1 billion rubles by 2030.

The volume of gross crop production will increase from 29.9 billion rubles up to 57.7 billion rubles by 2030.

The number of people employed in agriculture will increase from 64.0 thousand people up to 70 thousand people.

*Research topics*:

Creation and implementation of digital platforms at all levels of agricultural enterprises, development of science-based technologies for water supply, monitoring of climate change and soil diagnostics, as well as the problems of selection of sustainable and safe Russian agricultural crops;

- Creation of high-yielding varieties of agricultural crops with aimed technological parameters, development of innovative technologies for their cultivation based on biologization and greening of arid agriculture;

- Obtaining highly productive farm animals adapted to arid climatic conditions, consistent improvement of the economic indicators of the farmed livestock of great cattle, sheep, goats, horses and camels through the introduction of the latest genetic technologies;

- Development and implementation of modern technological approaches for the creation of innovative agricultural food products based on the effective use of natural and climatic conditions and environmentally friendly raw resource material of the Russian Caspian region;

- Development of alternative and cost-effective sources of protein components for feed in aquaculture, taking into account the regional raw material base; creation of new generation algicides to suppress the development of

microalgae and cyanobacteria that cause toxic water bloom; creation of complex biological additives based on aquatic macrophytes and microalgae in feed to reduce the development of diseases of aquatic organisms, using physicochemical and genetic methods for assessing the quality of aquaculture products;

- Creation and introduction of digital solutions, including those using robotics and artificial intelligence systems to identify problem areas in agricultural fields and greenhouses.

The research will bring the following results: obtaining of highly productive farm animals adapted to arid climatic conditions will increase the productivity of farms in the Russian Caspian region by 12.5%, create innovative agricultural food products based on the use of environmentally friendly raw materials, increase import substitution by 2.5-5% the region.

The project will contribute to the increase of bio-independence of the Astrakhan region and the Russian Caspian region; will contribute to the accelerating the genetic technologies development; will contribute to the introduction of technologies for curbing soil degradation (desertification, salinization) and technologies for remediation of agricultural land; will extend the area of agricultural land by 15%; reduce the risk of sand storms and mass depletion of agricultural land; will create mechanisms for the integration of natural soil information into the distributed information management system "Soil-Geographical Database of Russia" for the operating management of land resources at the regional and federal levels.

*Partners:*

Consortium of Educational, Scientific Organizations and Industrial Partners in the Food and Nutrition Industry (interaction in promoting projects in the field of food production); World-Class Scientific and Educational Center “Innovative Solutions in the Agro-Industrial Complex” of the Belgorod region (co-execution of subprojects, interaction with strategic partners in the agro-industrial complex from other regions); World-Class Scientific and Educational Center “Engineering of the Future”, Samara Region (interaction on projects within sections “Smart Agro” and

“Artificial Intelligence”); Consortium of Educational Institutions of Higher Education of Astrakhan Region (scientific and educational cooperation in research, training and promotion of initiatives within the region).

*Academic partners for cooperation in the agricultural sector:* FSBEI HE “Astrakhan State Technical University”, FSAEI HE “Kalmyk State University named after B.B. Gorodovikov”, FSBUI “Caspian Agrarian Federal Scientific Center of the Russian Academy of Sciences”, FSBIS “The Daghestan Federal Research Center of the Russian Academy of Sciences”, FSBIS “The Order of the Red Banner Nikitsky Botanical Garden – National Research Centre of the Russian Academy of Sciences”, SFBSI “Federal Research Center for Animal Husbandry named after Academy Member L.K. Ernst”, Federal Research Center “N.I. Vavilov All-Russian Institute of Plant Genetic Recourses”.

*Academic partners for cooperation in the aquaculture sector:* FSBIS “Institute of Limnology of the Russian Academy of Sciences” (St. Petersburg), Papanin Institute for Biology of Inland Waters Russian Academy of Sciences (Borok), FSBSI “Russian Federal Research Institute of Fisheries and Oceanography”, FSBSI “VNIRO” (Moscow), Volga-Caspian Branch of the VNIRO (“CaspNIRKH”, Astrakhan), Saint Petersburg Branch of the VNIRO (“GosNIORKH named after L.S. Berg”, Saint Petersburg).

*Partners from the real sector of economy in the aquaculture sector*: “Astrakhan Association of Fishery Organizations (Astrakhan Rybkhoz)”, LLC “Fish Feed”, LLC “BIFF”, LLC Aquatrade Fish Breeding, LLC Fish Breeding Complex “Raskat” are the bases for the approbation of the technologies that are being developed.

- ***4.Priority “Ecology and preservation of the Caspian ecosystem”.***

Russian Caspian Region has a large number of biotopes and species of national, regional and global importance, which are to be protected, preserved and revived.

It is also necessary to develop technologies that provide sustainable, rational and scientifically based use of the biological resources, to implement technologies

to protect and preserve the endangered biological species at the national and regional levels. It is especially relevant taking into consideration the pressure on the environment of the region, including intensive production of hydrocarbons. As a result of various anthropogenic activities it becomes a priority to preserve the biological diversity and to improve the state of the natural and cultural inheritance of the coastal and marine areas of the Caspian sea.

The special attention is paid to the problems of biodiversity preservation and commercial fishing in the Caspian basin and the Lower Volga. 80% of the sturgeon fish species is concentrated in the Caspian area, but their number has significantly decreased since the 90s due to the anthropogenic factors. Artificial reproduction of valuable fish species and aquaculture is one of the most important trends of the regional economy.

*Integration with the national goals:*

- Ecological Doctrine of the Russian Federation, approved by the order of the Government of the Russian Federation of August 31, 2002 No. 1225-r (nature preservation and environmental improvement; preservation of natural systems, support of their integrity and life supporting functions for the sustainable development of the society, improvement of the quality of life, of the people's health and demographic situation, as well as ensuring the ecological safety of the country).
- Federal Law of January 10, 2002 No. 7-FZ (edition of July 2, 2021) "On Environmental Protection" (ensuring the reduction of the negative impact of the economic and other activities on the environment in accordance with the environmental standards, which can be achieved by using the best available technologies taking into account economical and social factors; preserving biodiversity, etc.).
- "Principles of the State policy in the area of environmental development of the Russian Federation for the period up to the year 2030", approved by the President of the Russian Federation of April 30, 2021 (scientifically-based combination of ecological, economical and social interests of

a person, a society and a state in order to develop sustainably and to provide favorable environment and ecological safety; protection, reproduction and rational use of the natural resources are the necessary conditions to ensure favorable environment and ecological safety).

- The Russian Federation State Program “Environmental Protection”, approved by Decree of the Government of the Russian Federation of April 15, 2014 No. 326 (solving social and economic issues which provide environmentally oriented economic growth, preservation of the favorable environment).

*Integration with the regional strategic documents:*

- Law of the Astrakhan Region of November 19, 2014 No. 77/2014-OZ “On certain issues of legal regulation of environmental protection and preservation of the biological diversity in the Astrakhan region”.

- Regional projects “Preservation of the biological diversity and development of the ecological tourism (Astrakhan Region)”, “Volga Sanitation (Astrakhan Region)”, “Preservation of the Unique Water Objects (Astrakhan Region)”, “Preservation of the biological diversity and development of the ecological tourism (Astrakhan Region)”, “Preservation of the Forests (Astrakhan Region)”, “Clean Country (Astrakhan Region)”.

- Strategy for socio-economic development of the Astrakhan Region up to 2035, approved by Law of the Astrakhan region of December 25, 2020 No. 115/2020-OZ (improvement of the environmental situation due to: improving the way the available resources are used by implementing new energy saving technologies, transition of the industrial enterprises to lean manufacturing; available investment projects aimed at the development of the alternative energy (solar, wind); participation in the federal projects (“Volga Sanitation” and others); improvement of the ecological education of people; increase of the ecological and recreational potential of the river Volga.

*Strategic projects of the region aimed at the improvement of the ecological situation due to the investment projects aiming to develop alternative energy (solar, wind)*:

- Production of photoelectric solar panels by LLC “Helios Systems”.
- Construction of solar power plants.
- Construction of a wind power plant.
- Development and modernization of fish processing production.
- Modernization and development of pond fish farms, construction of closed pools by LLC “Aqua-Nova”.
- Creation of closed-type farms for intensive cultivation of sturgeon and production of sturgeon caviar, as well as clariids with the further obtaining of seeding.
- Creation of diversified agricultural enterprise.
- Sturgeon rearing in aquaculture.

*Key regional indicators:*

The percent of re-cultivated and ecologically rehabilitated lands from the total amount of lands under the negative impact of the accumulated ecological damage will be 100% by 2030.

The volume of production of fish and fish products (processed and canned) will increase from 42,4 thousand tons to 52 thousand tons in 2030.

The population of the regions with local water deficits where the reliability of water supply is increased (accrued total) will double and will be 70,34 thousand people by 2030.

*Research topics*:

The result of the development of the scientific priority route will be development of resource-saving and environmentally friendly technologies for the sustainable aquaculture by optimizing and modernizing rearing technologies, by providing balanced and available feed, by having effective and approved ways of preventive care and treatment based on world standards; creation of the digital copy of the Caspian ecological system and variability of bioresources exploitation to provide sustainable development; evolutionary model of the state of the Volga delta and Volga-Akhtuba floodplain ecosystems; the Astrakhan region being among 3 regions with the biggest volumes of commercial aquaculture.

*Partners*:

Consortium "Ecology of the Volga River Basin" involves: FSBEI HE "Samara State Technical University", FSBIS “Institute of Ecology of the Volga river basin of Russian Academy of Sciences”, Federal State Budgetary Institution "Caspian Agrarian Federal Scientific Center of the Russian Academy of Sciences", The Caspian branch of Federal State Budgetary Institution of Science P.P. Shirshov Institute of Oceanology and ASU; LLC Aquatrade Fish Breeding, LLC “Chinar”, LLC “GlobalCatering Service”, LLC “Astrakhan canning company”, LLC Fish Breeding Complex “Raskat”, LLC “Lebed”, Charity Foundation for the Rescue and Protection of Sturgeon Species “Beluga”, LLC “Oil and Gas Equipment”, LLC “Scientific and Technological Company “Marine Robotic Systems” (LLC STC “MorRobotSystem”), LLC “LUKOIL – Nizhnevolzkskneft”, Astrakhan Association of Fishery Organizations (Astrakhan Rybkhoz), JSC “Fish Feed”.

➢ ***5 Priority “Integrated safety and security of the Caspian macroregion”.***

Geopolitical and social sustainability of the region as the key condition for the successful development of the regional economy depends on the external and internal factors. One of the most important external factors is the policy of the deprivation of Russia and its influence from the Caspian region (for example Turkey presented the map of its geopolitical interests and borders expansion by 2050 where Astrakhan is shown on its territory[5]); policy of incitement of ethnic and religious hatred from the side of the terrorist organizations, as well as the active Islamization of the south regions of Russia. Under such conditions, the study of the integral safety and security of the Caspian region becomes the source of important risk-generating tendencies and development of methods to counteract destabilizing factors. This priority area presupposes the implementation of the projects aimed to ensure the integral safety and security of the Caspian

[5] https://lenta.ru/news/2021/02/12/vliyanie/

macroregion. Safety and promotion of Russia' interests in the Caspian region are one of the most geostrategic goals in the South of the country. Their implementation will have impact on Russia's influence on the Caspian bordering countries, on the cooperation with the countries of the macroregion (those which are economically interested in the development of the relations in the Caspian region), as well as on the relations with the countries – opponents which have strategic plans to control the resources of the Caspian region.

Integration with the national goals:

- Decree of the President of the Russian Federation of July 2, 2021 No. 400 "On National Security Strategy of the Russian Federation" (ensuring and protecting the national interests of the Russian Federation).

- Decree of the President of the Russian Federation of July 7, 2011 No. 899 "Priority directions of the development of science, technology and technology in the Russian Federation" (science).

- The initiative of the President of the Russian Federation on the need for special attention to ensuring the security of Russia in the Caspian region (Minutes of the speech of V.V.Putin at the meeting of the Security Council dated April 30, 2021).

*Integration with the regional strategic documents*:

- Strategy for socio-economic development of the Astrakhan region up to 2035 (to ensure the high standards of life, favorable environment for investments, favorable living of people in the Astrakhan region it is necessary to carry out comprehensive activities aimed to improve the life safety of the population.

- State program "All-Russian civic identity and ethnocultural development of the peoples of Russia on the territory of the Astrakhan region", approved by Decree of the Government of the Astrakhan region of November 20, 2015 No. 568-P.

*Strategic projects of the region:*

Project direction "Civil society and public safety".

Research topics:

1. Creation of the digital analytical model of the societal security in the form of a software product for studying the interdependencies of the factors that determine the stability and development of the Caspian region in diachronic and synchronous aspects. Obtaining the scenarios of the development of the Caspian region based on the variability of the model parameters.

2. Creation of a forecasting and monitoring system in the field of complex security of the Caspian region and the Astrakhan region which takes into account the relationship and mutual influence of the social, geopolitical, economic, ethno-confessional, ecological factors to ensure social sustainability. The system will be aimed at identifying risk-generating tendencies in migration, intercultural, interfaith practices, assessing risks and developing recommendations to stabilize possible problem situations.

3. Creation of the system preserving the unique regional cultural inheritance, developing regional history to improve social sustainability, multiculturalism and policonfessionalism as a base for the conflict-free intercultural dialogue and civil-patriotic education.

*Partners*:

FSAEI HE “Kalmyk State University named after B.B. Gorodovikov”; FSBIS “Daghestan Federal Research Center of the Russian Academy of Sciences”; Ministry of Culture and Tourism of the Astrakhan region.