



# Development of Science, Technologies and Innovation in Tajikistan



Aziza Razykova\*

## Introduction

Being the part of the former Soviet Union (USSR), the development of science in Tajikistan was at a relatively high level. The institutes of the Academy of Sciences of the Republic of Tajikistan, other research institutions and higher educational institutions have created the material and technical base for scientific research. In many areas of science, scientific personnel were trained, original scientific schools were formed. The studies were carried out in coordination with the institutes of the USSR Academy of Sciences and other scientific centers of the erstwhile USSR.

But faced with the consequences of the collapse of the USSR and gaining independence, for which Tajikistan was not prepared financially or morally, as well as the socio-political and socio-economic crisis caused by the events of the early 90s, science became stagnant.

After the proclamation of State independence of the Republic of Tajikistan, great efforts were aimed at preserving and maintaining scientific potential, reforming science and scientific technologies, reorienting science to solving urgent problems facing the country. The process of reforming science is currently ongoing. Research institutions are gradually adapting to activities in the new environment. The country has taken a strategic course to maintain and strengthen scientific potential, as well as the development of scientific technologies as the basis for the successful advancement of the country along the path of sustainable development (Sputnik, 2016).

## Development of STI In The Different Spheres

According to UNECE, as of 2015, the Republic of Tajikistan is still at a very early stage in the formation of its national innovation system (UNECE, 2015).

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\* Academy of Sciences of the Republic of Tajikistan

Meanwhile, Tajikistan is located in a geographically important area where the interests of Central Asian countries intersect. Over the past ten years, the country has achieved impressive results in the development of the scientific and technological sectors. The priority areas of scientific research for Tajikistan are areas such as geophysical instrumentation, forecasting seismic phenomena and earthquakes, the creation of alternative energy sources, for example using solar energy, biotechnology, the use of laser and plasma technologies in medicine.

The results of recent studies conducted in Tajikistan in the joint cooperation of our and foreign scientists and researchers have shown a high demand for photovoltaic systems and solar water heaters in regions that are not connected to the grid, as well as in areas with tourism potential, such as Seven Lakes (Haftkul), Fan Mountains, Baljuvan, Shakhriyev, Shirkent, Darvaz, Vakhan corridor, and others. This direction can be developed by improving the legislative framework and financial opportunities. For information, in Tajikistan pilot (model) solar panels have already been used to accumulate solar energy and use them in the event of a power outage in such sensitive places. Tajikistan is a country located at a fairly high level above sea level, where warm sunny weather prevails most of the year. Therefore, the use of solar panels in the country seems affordable and real (Sputnik, 2019).

Regarding the HPS, the famous scientist in the area of physics and mathematics, academician, Dr. Mamadsho Ilolov cites that HPS is usually installed on large rivers. But he claims that it can be done on small rivers (Fergana International News Agency, 2018). In Tajikistan, there are 20 thousand rivers and streams on which small power plants can be built to provide electricity to small villages in remote regions.

Again, if we talk about heliostations, Tajikistan has many advantages here. Tajikistan is located in the so-called “sunbelt”, where Italy, the countries of the Caucasus and Transcaucasia, as well as Central Asia are located. The use of solar energy also contributes to the relief of Tajikistan. The degree of insolation or, simply, illumination depends on the height: the higher, the more insolation. Solar panels

and modules can be positioned higher, and then they will receive 20 percent more energy than in the lowland. We have territories that are located at an altitude of 1,500 to 3,500 meters above sea level. The air there is drier, which further enhances insolation. The topography offers immense potential to harness solar energy. It requires conducting a separate analysis of the territories in the republic, and trace how the parameters related to height change. This will help determine the best locations for installing solar panels.

## STI Institutions & Regulations in Tajikistan

### Regulatory Documents on STI

To date, the country itself has adopted a number of laws, strategies, directions and decrees of the Government that determine the national policy in the field of science, technology and innovation aimed at supporting the scientific potential and the development of scientific research:

The Law of the Republic of Tajikistan “On Science and State Scientific and Technical Policy” (1998);

Decree of the Government of the Republic of Tajikistan dated July 18, 1996 No. 331 “On the Council for the Coordination of Research in the Field of Natural, Technical, Medical, Humanitarian and Social Sciences in the Republic of Tajikistan”;

Decree of the Government of the Republic of Tajikistan dated March 15, 1999 No. 87 “On the Concept of State Scientific and Technical Policy of the Republic of Tajikistan”;

Decree of the Government of the Republic of Tajikistan of October 1, 2004 No. 385 “On the Activities of the Academy of Sciences of the Republic of Tajikistan”.

National Development Strategy of the Republic of Tajikistan for the period until 2030

The Innovative Development Program of the Republic of Tajikistan for 2011-2020, approved in April 2011 with the aim of forming an effective innovation system that helps to increase the technological level and production competitiveness.

The Law on Innovation, adopted in 2012, creates the legal basis for the implementation of innovation policy in the country.

The Law “On the Technology Park”, adopted in 2011, defines the legal conditions for the creation of technology parks on the territory of the Republic.

The Decree of the Government of the Republic of Tajikistan “On the definition of an authorised state body in the field of innovation”, approved by the Government in 2013 and determines the Ministry of Economic Development and Trade as an authorised state body in the field of innovation.

National Strategy for the Development of Intellectual Property for 2014-2020, approved by the Government Decree in 2014. Improving the legislation, creating specialised infrastructure, improving work in the field of intellectual property management at the departmental (industry) level, developing the educational system in this area and the mechanisms of public access to world achievements in science are the main directions of the programme.

The program of state support for entrepreneurship in the Republic of Tajikistan for 2012 - 2020 was adopted by a Government Decree in 2012. The program describes a number of measures necessary for the development of entrepreneurship in the country.

The programme for the development of human potential and intellectual property for the period until 2020 (2012), the main purpose of which is the development of the country’s intellectual potential and the protection of intellectual property.

The concept of innovative development of the agricultural sector of the Republic of Tajikistan.

Strategy of innovative development of the Republic of Tajikistan for the period until 2020

Decree of the Government of the Republic of Tajikistan “On the Procedure for State Registration, Organisation and Examination and Competitions of Innovation Projects” (2013).

The Strategy of the Republic of Tajikistan in the field of science and technology for 2007-2015 was developed on the basis of the above Laws of the Republic of Tajikistan and Decrees of the

Government of the Republic of Tajikistan (Republic of Tajikistan (2015).

In Tajikistan, today there are many institutions, territories and zones of favor, contributing to the maintenance and development of innovations and technologies, including:

Technological Park of the Tajik Technical University named after academician M.S. Osimi, which was created in 2012 and is engaged in the implementation of scientific research and the manufacture of educational and laboratory equipment. The project’s customers are various private and state-owned companies, such as Gazprom Neft-Tajikistan LLC, UGAI of the Ministry of Internal Affairs of the Republic of Tajikistan and other universities of the country.

The technology park at the Tajik National University was established in 2011 with the aim of implementing innovative programs and projects. The implemented projects include work in the field of energy-saving technologies.

The technological park of the Tajik Agrarian University named after Sh. Shokhtemur has been operating since 2014. A number of laboratories operate at its base: Ichthyology, Lemon Cultivation, Floriculture, as well as the Biotechnology Research Institute.

An innovative center of biology and medicine, established in 2011, whose goal is to develop and promote the scientific and applied aspects of biological and food (food) safety. A number of projects of the Center are devoted to the analysis of genetically modified plants and food products. Projects are implemented in collaboration with international partners.

Business IT incubator Dushanbe established in 2014. The mission of the Incubator is to develop an ecosystem for generating innovative ideas, implementing projects and commercialising technologies. It provides infrastructure for software development, consulting services and various forms of education and training.

The Presidential Foundation for Fundamental Research was established in 1996 and is engaged in targeted financing of fundamental research, which

is promising for the innovative development of the country's economy.

The Business Support Fund (Business Challenge Fund), which was launched in 2012 as a result of cooperation between the Government of Tajikistan and the UN Development Program, is actively working in the Sughd region, where it provides cheap loans to entrepreneurs. The conditions for issuing a loan are at least three years of experience, an innovative approach to production or ideas for the production of new products, the use of new technologies, the use of energy-saving technologies, etc., as well as the status of an exporter.

The Entrepreneurship Support Fund was created in 2013 as part of the implementation of the State Entrepreneurship Support Program in the Republic of Tajikistan for 2012-2020 and operates under the Tajik State Committee for Investments. The main function of the Fund is concessional financing. Currently, the organisation has already issued loans of more than \$ 10 million.

Startup Weekend Tajikistan is a regularly organised initiative for entrepreneurs from Tajikistan, which serves as a platform for communication between young entrepreneurs and mentors. Events are sponsored by GoogleInc.

The role of the Chamber of Commerce and Industry of the Republic of Tajikistan in the innovation system is to attract foreign investment to the Republic to create new, technical re-equipment and modernisation of existing industries.

The Association of Innovative and Technological Entrepreneurship, the main purpose of which is to promote the implementation of innovative solutions and effective technologies in all sectors of the economy and areas of activity in which small, medium and large enterprises operate both within the Republic of Tajikistan and beyond.

Authorised state institutions, including the Ministry of Economic Development and Trade, the Ministry of Industry and New Technologies, the Ministry of Finance, the Ministry of Education and Science, are also responsible for the development and promotion of innovation, science and technology in Tajikistan.

Expert Coordinating Council for managing the implementation of the Innovative Development Program of the Republic of Tajikistan for 2011-2020 (2012)

The State Scientific Institution "Center for Innovative Development of Science and New Technologies" is a unit of the Academy of Sciences of the Republic of Tajikistan, established in 2011.

National Council for the Coordination and Development of Intellectual Property (2015).

The Center for Innovative Development of Science and New Technologies at the Academy of Sciences of the Republic of Tajikistan (2011), the main purpose of which is the organisation and conduct of scientific research, as well as applied work in the field of development and implementation of innovative projects and new technologies.

**Among the research, educational institutions and projects the following can be distinguished:**

Academy of Sciences of the Republic of Tajikistan

Center for the Study of Innovative Technologies at the Academy of Sciences of the Republic of Tajikistan (2017)

Industry research organisations, which include the Research Institute of Labor and Social Protection of the Population, the Research Laboratory of Environmental Protection, the Center for Strategic Studies under the President of the Republic of Tajikistan, the Research Center of the State Committee for Land Management and Geodesy, the Institute for Educational Development Academy of Education of Tajikistan and the Institute of Public Administration under the President of the Republic of Tajikistan.

Council for the Coordination of Research in the Field of Natural, Technical, Medical, Humanitarian and Social Sciences.

As well as information resources, which have gained great popularity among the population and are widely used in recent decades due to their availability. Among them:

The National Innovation Internet Portal of the Republic of Tajikistan, which contains information on innovation, new technologies, both domestic

and foreign research organisations, companies, and small and medium-sized businesses. The portal provides a mechanism for collecting and promoting innovative proposals and projects in various fields of activity (Innovation Cooperation Internet portal, 2020).

National State Institution “National Patent Information Center” (2012). The center was formed by a Government Decree in order to protect industrial property and further develop the system of scientific and technical information in the country.

Despite all this, Tajikistan still faces a number of problems, the timely progress of science, scientific technologies and their joint contribution to the country’s socio-economic development depends on a timely solution.

## Challenges

The difficulties science faces in Tajikistan today:

Inadequate material and technical support of science: The material and technical base for conducting scientific research is very outdated and partially destroyed during the years of the civil war and socio-political instability. Scientific equipment and instruments are physically and morally obsolete and do not meet the requirements of modern science and technology. Although Tajikistan has free aid in the form of innovative technologies from economically developed countries like Germany, China, etc., this is still not enough for full-fledged promotion, processing of products and work with natural resources at the international level.

The lag in the formation of a modern information base in the field of science is another reason why the development of science in Tajikistan is constrained. The institutes of the Academy of Sciences of the Republic of Tajikistan, sectoral scientific institutions, departments and laboratories of higher educational institutions are still not adequately equipped with computer equipment. World experience shows that without the use of modern information and communication technologies, science is doomed to lag, it is impossible to create competitive technologies and effectively put them into practice. This also includes a small edition of publications, including monographs, scientific journals, collections of

articles and proceedings of scientific conferences on pressing problems of science. For this reason, the results of research become obsolete, the development of scientists of Tajikistan does not find timely access to the international scientific and information space, the priorities of scientific achievements are lost. Due to insufficient funding, research institutions are not able to receive foreign journals, books and other scientific information, which also negatively affects the quality and effectiveness of research.

The shortage of highly qualified personnel, like the previous one, today is associated with insufficient funding of science, as well as the fact that many scientists and specialists left the country during the years of the civil war and instability, and it is still not possible to fill the shortage of highly qualified scientific personnel, especially in the specialities of the exact, natural, and technical sciences.

One of the most important factors in increasing the efficiency of training scientific personnel, using the scientific and experimental base of academic institutions in the educational process and increasing the level of scientific research in higher education institutions is the integration of science and education. Lack of proper integration of academic science and educational structures reduces their development potential and contribution to the transformation of the economy and society.

The scientific potential of the institutes of the Academy of Sciences of the Republic of Tajikistan, sectoral scientific institutions and higher educational institutions has not yet been adequately combined in order to consolidate efforts and resources for the training of highly qualified personnel and specialists in the scientific and technological field and to jointly use the scientific and experimental base of the academic industry and university sectors of science, in research and educational processes.

6. Weak concentration of scientific potential in the priority areas of scientific research and socio-economic development of the country. In Tajikistan, scientific developments are carried out in many areas. But the scientific potential has not yet been adequately concentrated on solving the priority problems of science and the socio-economic development of the country. Many

scientific discoveries and scientific research are conducted in the humanitarian fields, less in the field of natural sciences. An insufficient number of scientific personnel is observed in the mentioned industry. Planning for research in this area needs further improvement and development of targeted integrated scientific and scientific-technical programs.

The lack of a proper connection between science and production is also an important problem, contributing to the lag of science from international standards. Scientific and technical developments and practical recommendations do not always meet the requirements of the level of development of modern technologies. The search for new forms of interaction between science and production is poorly conducted; moreover, the transition of the sphere of science and technology to the innovative development path is slowly taking place.

Lack of international scientific cooperation: In recent years, the international relations of Tajik scientists have expanded markedly, however, the level of international scientific cooperation should still be developed. Despite a large number of signed agreements and agreements on cooperation in the field of science and technology, the effectiveness of their implementation is not high enough. Over the past year 2019, there has been a noticeable intensification of scientific ties and the development of a common scientific potential with Russia, Germany and China.

Another problem today is the relationship between science and the economy in the Republic of Tajikistan. It is underdeveloped. Nevertheless, it is absolutely necessary to invest in science and develop the relationship between science and the economy for the future of the country in the long run, while emphasising the development of missing capacity elements such as technology transfer and commercialisation. Low demand for innovation is a persistent problem, as business interest in innovation is a key condition for the development of an active relationship between science and the economy. Innovation policy should aim at building capacity for adaptation-based innovation by stimulating the relationship between science and the economy and supporting the demand for innovation.

The current situation and existing problems in the field of science dictate the need to develop and adopt a set of measures for state support and development of science, the implementation of which should significantly strengthen the influence of scientific potential on the socio-economic development of the country, the rise of education and culture in the Republic in the coming years. For this reason, recommendations were developed to achieve a high level of intellectual potential of society and improve the quality of life of the population.

## Recommendations

Recommendations are an important part of solving problems, developing and promoting the sphere in which they are involved. This is the most optimal way to choose a political course in the mentioned area, among which:

Invest more in education and training, including vocational education and training on the job. To support the aspirations of cadres for additional education. Develop the ability to adopt and adapt innovations. Reforms should be oriented towards international quality standards and support their implementation. For these purposes, it may be necessary to attract funding from international donors, since the need for resources will be significant, given the large percentage of young people among the growing population of the country.

Provide access to foreign knowledge and innovative products, services and solutions that have already proven their worth in foreign markets. In general, it is cheaper, faster and less risky in comparison with the formation of knowledge and the development of completely new products and services by the country itself. Import of machinery and equipment, transfer of knowledge from multinational companies to their subsidiaries located in Tajikistan, acquisition of rights to use foreign knowledge in the framework of licensing agreements of the direction that should be developed. It should be emphasised that related investments in the training of qualified personnel and the development of domestic R&D are necessary so that the Tajik economy can successfully accept and adapt foreign knowledge and innovations.

Mobilise remittances from abroad to finance domestic investment and attract foreign investment. This will not only provide a partial solution to the problem of limited domestic financial resources, but also bring new knowledge.

Reduce the bureaucratic paper - based prevention of the development of the business environment within the country, but in contrary improve it. Reforming the regulatory system, for example, by reducing the number of required permits for starting a business, as well as reducing the number of taxes taxed on startups. The implementation of such measures is feasible in a fairly short time, since experience and practice are publicly available and can be adopted from successful countries. It is also necessary to update the energy and transport infrastructure. This will require significant investments and, probably, assistance, including from multilateral financial institutions.

Streamline and coordinate existing innovative policy measures in order to reduce inefficient spending and increase their effectiveness.

To ensure the improvement of approaches and innovations in business processes that are aimed at improving the quality of products and services. This can be done at relatively low cost and relatively quickly while obtaining significant benefits by expanding the ability of Tajik enterprises to enter international markets.

Focus strategic support on existing sectors to support increased productivity in these sectors. One example is the transition from agriculture to the development of the food industry.

The dissemination of the results of scientific research is mandatory, as it is critical for the links between science and industry.

In the medium and long term, it is necessary to strengthen the awareness of the importance of intellectual property rights among researchers, teachers, students and scientific organisations in general. Special training should be organised for specialists in the field of intellectual property, paying particular attention to the training of patent attorneys. It is also necessary to provide support to domestic inventors in obtaining patents abroad.

## Conclusion

The analysis of the regulatory framework proves that Tajikistan has almost no problems in the field of legislation, that is, the adoption of official documents, but in the field of implementation and timely fulfilment of our goals.

As well as the institutions mentioned in the article should function in a timely manner. This will all be feasible after the implementation of the recommendations implementation mechanism.

Naturally, the development of science, technology and innovation will lead to an improvement in the energy sector of the economy, which in turn will help to solve the most acute environmental management problems in the region.

The key areas are primarily energy, ranging from hydropower and ending with solar panels, on which, mainly, our economy is built. Another equally important area that should be paid attention to and the future of our generation depends on the decision of is the study of the effects of climate change, as well as the annual reduction in the supply of clean freshwater sources.

In addition, innovative technologies and science will have to help the development of the agricultural sector of the Tajik economy, one of the priority areas of which is agriculture, in particular, increasing the yield and quality of food in the country.

Also, for further growth of the economy with an income below the average, such as the economy of Tajikistan, it is not so much the engineering and construction potential that is important as the production and economic, vocational and technical or production potential.

Only by joint efforts can we solve the problems of science and innovative technologies by reviewing the financing of the field of science and rely on the younger generation of researchers, as well as the introduction of applied innovations in production.

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