Science, Technology and Innovation Policy in Tajikistan: Present Status and Highlights

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Abstract

The system of research organizations in the Republic of Tajikistan (RT) includes academic and branch research institutions and as well as institutions of higher education. This science structure was established in the 1950s and reflects a division of research fields into the following sectors: academic, applied research and universities. During the transition into independence, economic necessity gave rise to new kinds and systems of research organizations besides the existing rigid centralized system. Furthermore, new private-public and non-government research structures emerged. It should be noted, however, that these new kinds and systems currently pose little competition to the traditional structures.

Keywords: research organization, innovation performance review, science indicators, science financing, new technologies

1. Introduction

It has passed 25 years from the date of acquisition of the state independence of the Republic of Tajikistan. The decade following Tajikistan`s independence was very turbulent and dominated by a bloody civil war. In 1997 when the war was over, it took several more years for society to concentrate on policies of peaceful state-building. Naturally, the policy priorities in these years were dominated by the efforts to establish constitutional order and functioning public institutions. In this context, it was only in the late 2000s when entrepreneurship, development and innovation issues started to surface and materialize in the public policy agenda. In the first half of the 2010s, the authorities started to assign an increasing priority to entrepreneurship and innovative development in their policy efforts.

It should be noted that the collapse of the Soviet Union brings the former Soviet republics, including Tajikistan, to find their own sources of funding for research institutions in connection with the liquidation of the Academy of Sciences of the USSR −the world's largest scientific organization. Moreover, leading universities of Tajikistan have also lost their main funding sources−ministries and agencies of the Soviet Union. Over the past 25 years, the Government of the Republic of Tajikistan has done a lot to ensure the effective functioning of the system of research organizations. At the same time it established the National Innovation System with the new approaches to the organization of research activities. It provides a comprehensive legal

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framework on the basis of international agreements and treaties, national laws and regulations. The Government has reformed branch ministries and departments in order to improve management and organizational functions. So in 2011, the main scientific organization of the country—Academy of Sciences of the Republic of Tajikistan (ASRT) has conducted managerial and organizational reform. The number of employees of the Central Executive Office of ASRT has been shortened, profile Institutes and Research Centers have been combined. In 2014 Ministry of Science and Education of the Republic of Tajikistan on the basis of the former Ministry of Education was established. The Government adopted the Strategy of the Republic of Tajikistan in the field of Science and Technology (2007), Programme for Innovative Development of the Republic of Tajikistan (2012). At this stage, we can say that the transition period is complete and the current system of research organizations is already gathering pace under the new conditions and rules. However, there is still a lot of uncertainties, and therefore it is required comprehensive understanding of the new challenges.

Tajikistan has achieved strong economic and social development over recent years, and has made important steps in moving away from a controlled to an efficiently controlled model of growth.

This article is an attempt to comprehend new terms on the example of the Republic of Tajikistan. In the first section we present a structural analysis of the system of research organizations in the country, the principles of selection of personnel for these organizations, ways and means of searching new sources of funding. The second section presents the main ideas of the Programme for Innovative Development of the Republic of Tajikistan. Finally, the third section is dedicated to public policy in the field of research and innovation.

The main conclusion of this work is that the newly independent state occurring after the collapse of the Soviet Union, have their own way of development in science, technology and innovation. The way is not similar to the one in the developed and developing countries.

Additionally, we will stress that Innovation will be in the governmental level to move towards to the next level of economic prosperity, and the right policy measures will play a decisive role.

2. Materials and Methods

Narrative documents which we used in this paper are divided in four parts:

I. a) Article 40 of the Constitution of the Republic of Tajikistan

"Everyone shall have the right freely to take part in the cultural life of society, artistic, scientific, and technical creation and to use their achievements. The state shall protect cultural and spiritual values. Law shall protect intellectual property."

b) Article 41 of the Constitution of the Republic of Tajikistan

"Everyone shall have the right to education. The basic general education shall be compulsory. The state shall guarantee the free of charge general basic compulsory education in the state educational establishments. Everyone shall get free of charge general vocational, primary specialized, vocational specialized and higher specialized education in the state educational establishments, within the framework determined by law. Other forms of education shall be determined by law."

II. International regulations (bilateral and multilateral agreements and treaties).

III. Legislation of the Republic of Tajikistan in the fields of science, technology and innovation (more than 30 laws approved by the Parliament and signed by President of the Republic of Tajikistan).

IV. Regulations (decrees and orders of the President of the Republic of Tajikistan, decisions

Table 1. Distribution of research organizations across sectors and directions of science (January, 2014)

Sectors / Directions	Number of organizations	Natural sciences	Social sciences	Applied and technical sciences	University based research
Academic	23	15	8	-	-
Applied research	40	16	4	20	-
University	37	-	-	-	37
Total	100	31	12	20	37

Source: Statistical Collection of the Ministry of Education and Science RT, 2016

and orders of Government of the Republic of Tajikistan, decisions of the Board of Ministry of Science and Education, decisions of the Presidium of Academy of sciences of the Republic of Tajikistan). Data used in the paper are taken from sources listed in the references [1-3]. Basic research methods are scientometrics and complexity system analysis [4].

3. Research Structure

The system of research organizations in the Republic of Tajikistan (RT) includes academic and branch research institutions and as well as institutions of higher education. This science structure was established in the 1950s and reflects a division of research fields into three sectors: academic, applied research and universities.

During the transition to an independent state, economic necessity gave rise to new forms and systems of research organizations besides the existing rigid centralized system. Furthermore, new private-public and non-government research structures emerged. It should be noted, however, that these new forms and systems currently constitute little competition to the traditional structures.

According to Table 1, the ASRT remains the main scientific center of the country despite the managerial and organizational reform implemented in 2011. ASRT organizes research activities in the various institutes and centers and at the same time carries out the work in the realization of the country's scientific-technical, technological and innovation policies. ASRT is also responsible for implementing the legislation in the field of science, technology and innovation issued by the Parliament of the country. In addition, ASRT composes project resolutions for the Government of RT and other normative and legal documents in the above mentioned field.

The total number of institutions involved in research and development amounts to 100 (January, 2014) with more than 18000 employees (Table 2). This is a low figure compared with the developed countries. Accordingly, the total number of patents applied by Tajik scholars amounted to only 76 in 2015.

Table 2. Number of personnel of research organizations by category (January 2014)

Scientific sector	General staff	Researchers				Support personnel
		General	PhD	PhD candidates	No degree	
Academic	1560	781	152	271	358	779
Applied research	2033	1102	114	359	629	931
University	14445	8495	529	2486	5480	5950
Total	18038	10378	795	3116	6467	7660

Source: Statistical Yearbook, Dushanbe, 2015.

Table 3. Scientific and technical work funded by state budget, institutional resources, and investments (thousands somoni)

	2008	2009	2010	2011	2012	2013	2014
Total volume of executed works from the beginning of the years	12452.1	19775.0	22027.0	36530.1	41342.1	47699.2	52275.5
including: scientific-technical	12210.4	19664.4	21887.3	35746.3	41238.4	47631.7	52099.5
from them: scientific research	11223.4	14858.9	17987.3	32065.9	39090.7	44339.1	51526.5
fundamental	4017.4	7397.0	8508.7	8968.2	10014.8	14254.0	15836.4
research-developmental and technological	59.2	419	22.8	51.9	112.7	194.1	24.8
making experimental samples (series)	-	-	-	-	-	43.9	-
building projects	169	10.3	10.0	-	-	45.9	54.2
scientific-technical services	758.8	4405.5	3867.2	3628.5	1942.6	2948.7	314.3

Source: Statistical Yearbook, Dushanbe, 2015.

The structure of execution of scientific-technical works funded by both State budget and own resources, and investments is shown in Table 3.

Currently, there are three funding mechanisms of scientific organizations in Tajikistan. Each of these mechanisms has advantages and disadvantages. For instance, thematic funding has made it possible to essentially reduce the duplication of scientific research work and helped to improve the general democratization of the national scientific system.

At the same time it should be noted that funds are mostly spent on salaries rather than on strengthening the material-technical basis of the organizations. Core funding is allocated to the main research areas of Institutes or Centers and to support research infrastructures. Targeted funding is directed to major innovative large-scale research with the participation of industry and SMEs. There is a huge need to attract funds from the private sector. Unfortunately, private sectors in Tajikistan still remain undeveloped and have no capacity to allocate funds for science and technology.

In 2014, the volume of research work performed amounted to 46,483,900 somoni (5,217,721 EUR).

The proportion of funding of research work from the budget in relation to the GDP for the period 2008-2014 continues to remain low (Figure 1).

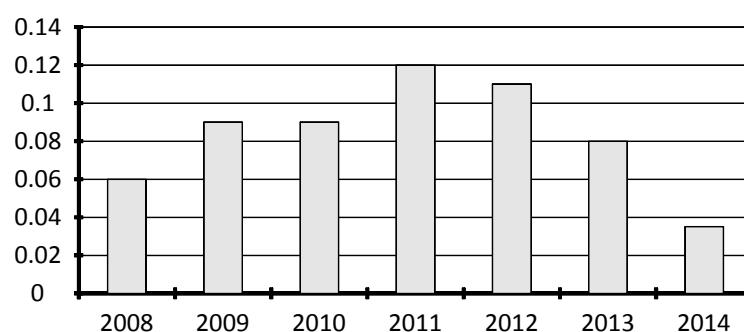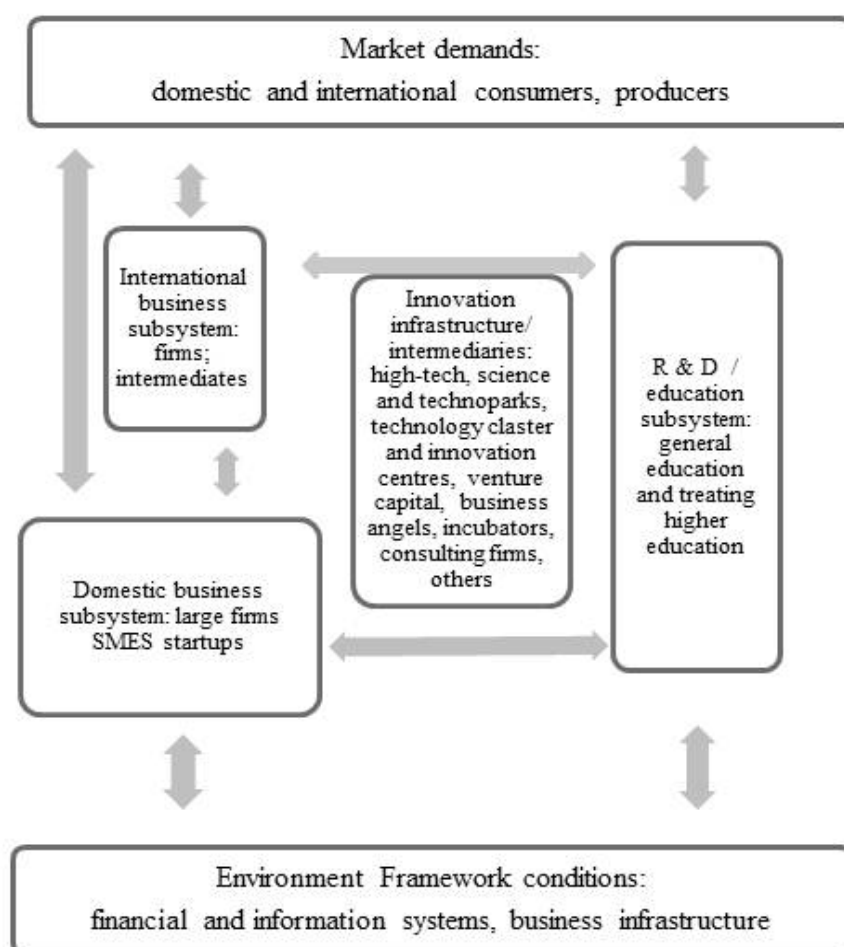**Figure 1.** Dynamic volume of research work relative to GDP in Tajikistan (2008-2014)

Figure 2. The National Innovation System of a small open economy

4. The National Innovation System of the Republic of Tajikistan

National Innovation System of Tajikistan (NIST) is the network of institutions in the public and private sectors, activities and interactions of which initiate a dissemination of new technologies (Figure 2). The system of approach to innovation helps to identify strengths, weaknesses, driving forces of the innovation process and to identify possible policy actions and measures that could lead to improvements in innovative performance. Generally, innovation is a complex process, involving interactions of a whole range of innovation stakeholders: innovative entrepreneurs, academic and research development institutions, the business sector (as source and target of innovation), innovation intermediaries and support institutions, public bodies with the responsibility to support innovation, financial institutions, national policies in the area of innovation, the framework conditions for innovation, consumers (more generally the market for innovation) etc.

The way from idea to market requires the mobilization and application of many various capabilities and skills. At the beginning an individual entrepreneur can suggest some know-how and he must attract folks with good knowledge in appropriate technology. Therefore, there is a need to bring together relevant actors and stakeholders who can launch the process. Stakeholder cooperation is another important feature of the modern innovation process and is also integrated into of the methodological approach of this paper.

NIST has a number of specific specifications. First, limited local markets call for a high degree of innovation in the global economy and fully-fledged participation in the international division of labor. Well-functioning bidirectional linkages to large international markets are one of preconditions for local firms to grow and necessary conditions for the inflow of the modern technologies and new ideas. These linkages are important for the connection of local innovation stakeholders to international partners and, eventually, for the establishment of stable partnership relations well in global supply value chains.

The second specification is a systemic process of public policy choices and changes that can evolve division of competencies and responsibilities among the various branches of government. Until 2010, most of the legislative and normative acts were adopted without having a clear reference to their main implementing agencies. The decisions regarding the responsibilities for the actual implementation were left to the discretion of the executive power, to be decided at a later phase. However, these practices began to change in the 2010s when policy documents became more elaborate and included references to the responsibilities of concrete branches of government.

The process of dividing competencies and responsibilities among the bodies assigned with responsibilities in implementing public policy is quite advanced in Tajikistan. This refers also to the functional responsibilities for the conduct of innovation for development policies.

5. Science, Technology and Innovation Policy

Today, research and innovation have become the main factors for social development, economic growth and the achievement of a high standard of living. Innovations created through new technologies, production and equipment, the rendering of services, new approaches to organizations and through raising the skill levels of staff, ensure a highly competitive economy. Unfortunately, in the first years of independence Tajikistan was deeply entangled in a civil war and, as a consequence, issues related to the development

of science and innovations were put aside for the whole decade. From 2000 onwards, appropriate measures were taken by the Government to support scientific potential, to reform and re-orientate the science sector, and to solve socio-economic problems. Tajikistan strived to strengthen scientific-technological potential as a necessary factor for the modernization of its economy and the gradual transition towards increased innovation.

A number of national laws and government resolutions were passed that defined state policy in the field of science and innovation directed to support scientific potential, the development of scientific research, new technology development and their implementation in production.

A special section "Forming innovative infrastructure and supporting innovative activity" was dedicated to these problems in particular in the Strategy of RT in the field of Science and Technologies for 2007-2015. Laws were passed "On the Academy of Sciences of the Republic of Tajikistan" (2002), "On Industrial Samples" (2004), "On Invention" (2004), "On Rights Protection for the Topology of Integrated Microcircuits" (2006), "On Trademark and Service Marks" (2007), "On Geographical Indicators" (2007), "On Scientific and Scientific-technical Expertise" (2010), and "On Innovative Activity in the Republic of Tajikistan" (2012). A section on "Intellectual Property" was included in the third part of Civil Code of RT (2005).

In 2007, the Government of RT approved the National Development Strategy of Tajikistan 2007-2015. Part of this document is the Science Development Strategy which foresees the updating of the legislative basis of S&T and finding measures to ensure its proper execution. In this strategy, science is described as a national priority. The strategy also aims at further strengthening the collaboration between research organizations and the different ministries, and outlines an ambitious Programme for developing scientific cooperation with other countries, including fellow members of CIS, as well as with international organizations, via intergovernmental agreements and partnerships to be concluded by the Academy of Sciences, research institutes, and universities.

Tajikistan's Science Development Strategy identifies several weaknesses in the national S&T system such as lack of funding and insufficient research infrastructures, many of which were destroyed during the years of civil war from 1992-1997. The strategy underlines the need to build adequate information infrastructures in order to improve the institutes' connection to modern information technologies and to make additional scientific literature available to the libraries. There is also lack of highly educated scientific staff due to the very low funding of the research area. To improve the situation, Tajikistan seeks to better integrate its higher education and S&T systems. Moreover, the strategy points out the need to establish comprehensive national S&T programs to tackle the important scientific and socio-economic problems of the country. It also points out that international research collaboration is insufficient despite a high number of signed S&T agreements.

In 2011, the Programme of Innovative Development of the Republic of Tajikistan for 2011-2020 was adopted by the Government. The Programme is to be implemented in two stages:
First stage (2011-2014): Preparation and organization;
Second stage (2015-2020): Development of innovations.

Based on the new national innovative system created, a thorough effort to realize the Programme is to be made during the second stage in order to steadily increase the innovation component in the country's economy year by year. The national innovation system shall provide the following main components:

1. Creation and development of innovation infrastructure (technical and technological);
2. Forming and improving the system of retraining and professional training of specialists in the field of innovation activity;
3. Organization of the information system in the field of innovation activity;
4. International cooperation in the field of innovation activity;
5. Involving scientific potential in the innovative processes;
6. Tasks related to the innovative development of the fields of economy, education and health.

In 2011, during the realization of the Programme, the Government approved a resolution regarding the foundation of the Center for Innovative Development of Science and New Technologies of the Academy of Sciences of the Republic of Tajikistan. The main task of the Center is to develop scientific bases to implement the main components of the Programme.

6. Conclusion

Currently, Tajikistan is still in the very early stages of establishing a national research, technology and innovation system and the range of recommendations for enhancement is broad. In 2014, Tajikistan moved from being a low income to a lower-middle income model according to the World Bank classification. The approach of this paper is to focus on issues that are critical for the functioning of the STI system in Tajikistan and which would produce visible results without requiring substantial financial and human resources.

In this connection, the following measures have a priority:

1. Increase investment in STI, which is focused on improving absorptive and adaptive capacities. This kind of reforms should be aligned with and support the implementation of international quality standards. This may require financing from international donors because the resource requirements will be significant given the young and growing population of the country. Possible conduits of foreign knowledge are the import of the machinery and equipment, knowledge transferred from multinational companies to their subsidiaries in Tajikistan.
2. Reduce bureaucratic obstacles to business activity and improve the general business environment. Improve the legal provisions aimed at reducing the number of permissive documents required for the establishment of private firms and companies. Such measures can provide rapid results at low cost. It is also necessary to improve the energy and transport infrastructures. This obviously requires a big investment and financial support from international institutions.
3. Coordinate executing innovation policies in order to reduce waste and improve effectiveness (in terms of budgetary resources and policy implementation capacity). Facilitate improvements and innovations in business processes, management and marketing that support greater quality in products and services.
4. Focus policy support on exalting industries, particularly on tradable goods and labor-intensive industries, with a view to supporting productivity improvements in these sectors which can then form the basis for additional investment and economic diversification into related activities. Moving from agriculture to food processing is one of such example.

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