

Trends in Research Performance and International Collaboration in Central Asia in the Post-Soviet Period

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Abstract

The paper gives a short description of the history of research development in the Central Asia Republics Kazakhstan, Tajikistan, Kyrgyzstan, Uzbekistan and Turkmenistan. Due to their vast natural resources (oil, natural gas, gold) and geographic locations these states attract much attention from world community. There are discussed: trends in research output (RO) by Central Asia, research profile and international collaboration in the post-Soviet period between 1993 and 2006. Data sources were Web of Science, JCR, Essential Science Indicators and SCOPUS. It was found out that “hard sciences” are strongest in Kazakhstan, Uzbekistan and Kyrgyzstan. As a consequence of the tremendous political and economic changes in the 1990’s, the pattern of Central Asia’s external collaboration underwent a strong shift from collaboration with ex-Soviet states toward the western countries. Nevertheless, Russia is still the leader and the Russian Academy of Sciences continues to be a leader in international collaboration for Central Asia. Russian journals serve as a main communication on channel for researchers from Central Asia.

1 Introduction

The great political and economic changes related to the disintegration of the Former Soviet Union (FSU) at the end of 1991 had a strong impact on life in Central Asia. By the end of 1991, five

former FSU republics became independent states. All of them are located in Central Asia: Kazakhstan, Tajikistan, Kyrgyzstan, Uzbekistan and Turkmenistan. Due to their vast natural resources (oil, natural gas, gold) and geographic locations these states attract much attention from world community. For example, there were, and still are, many clashes with Taliban forces along their boundaries so they retain international attention. Central Asia statistics by the World Bank are presented at Figure 1. www.world-bank.org

The tremendous social and political changes that culminated in the Soviet Union’s dissolution had a great impact on science communities in the region. A sharp decrease in the number of research personnel was but one result of these changes. During Soviet times, the USSR Academy of Sciences was the main funding body for basic research. The FSU consisted of 15 soviet socialist republics. The growth of economic, educational, scientific, and cultural levels in all Union republics made it possible to gradually transform the branches and department of the USSR Academy of Sciences into national academies in the republics. In the 1940s, Academies of Sciences in Kazakhstan, Tajikistan, Kyrgyzstan, Uzbekistan and Turkmenistan were established (the Russian Academy of Sciences, 1999). These national Academies of Sciences were the main research bodies in each individual republic.

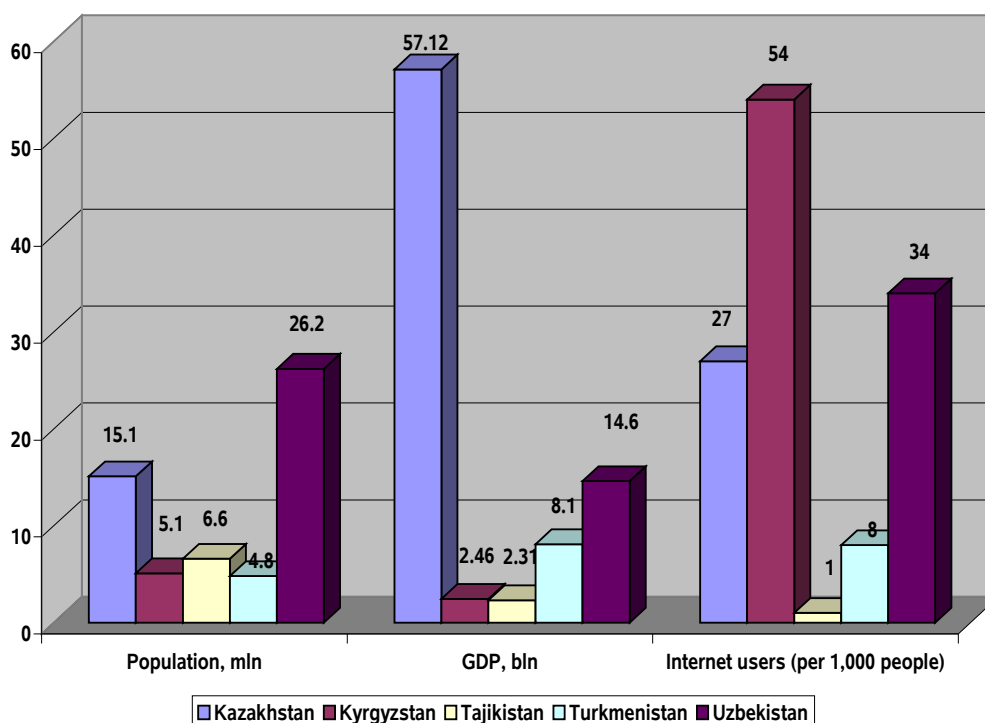
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It is well-known that education and sciences have close ties with cultural and historical traditions. Many well educated scholars trying to escape Stalin's purges voluntarily moved to Asia to be far away from government authority. After Nazi troops invasion to USSR in June 1941 and terrible fighting around Moscow in December 1941, many research organizations and universities were evacuated to Asian Republics of the FSU. These two factors played a significant role in the development of higher education and research there. The national academies continue to carry out research in the post-soviet time with the exception of the Turkmenistan Academy of Sciences which was dissolved by the President of the republic in 1993. In 2007, the decision was

reversed and the President of Turkmenistan decided to rebuild the Academy. Lack of funds for scientific research, obsolete equipment which urgently needs replacement and deteriorating scholarly communications are major factors responsible for the slow development of science in Central Asia. The co-authored papers in the Soviet period were published by exclusively Russian researchers. In 1985 the proportion of FSU research output by international collaborators was 5 per cent, according to data from Science Citation Index. (Wilson C., 2004). The objective of this paper is to investigate trends in research output (RO) by Central Asia and to trace changes in international collaboration in the post-Soviet period between 1993 and 2006.

Figure 1. Central Asia Facts by World Bank, 2006



2 Methodology

Data sources for this study were various information resources produced by the Institute for Scientific Information (ISI): *Web of Science* (WOS), *Essential Science Indicators* (ESI),

Journal Citation Reports (JCR) and statistics derived by SMAGO group from database SCOPUS¹. WOS covers 8.7 thousand journals annually including 114 Russian titles. SCOPUS

¹ available via www.SCIMagojr.com

processes 13.6 thousand journals each year with 189 Russian journals. No journals covered by WOS or by Scopus are from Central Asia. Moreover, among the 189 Russian journals covered by Scopus, 89 journals had zero output in 2006. Nevertheless WOS contains statistics on these journals for 2006. We used the WOS option "research analysis" to get data on RO distribution by country, institutions, subject categories (SC) and journal titles. Users of SCI recognize how difficult it is to collect information about the publications of a researcher who writes using the Cyrillic alphabet; because author and the organization names may be transliterated in many ways, difficulty in searching occurs. For example, we found five version of the Uzbekistan Academy of Sciences (Markusova 1999). The time periods for analysis were 1993, 1997, 2002, and 2006.

3 Results and Discussion

We obtained a set of documents for each country by searching in WOS for each year listed above and for total RO for 1997-2006. Central Asia RO for 1997-2006, according to the statistics by WOS and SCOPUS, is presented in the Table 1 and at Figure 2. As we can see, RO for the countries varies sharply. However we do not see a significant discrepancy between research output covered in SCOPUS and SCI (the only exception being Tajikistan RO in 1997) despite the fact that Scopus covers in 1.5 times the number of journals covered by the WOS.

Journals in SCOPUS are assigned one or several subject categories (there are 27 of them); these were used to determine the subject areas of the documents. We analyzed RO for each year from 1996-2006 and found a steady distribution of papers by subject category except an increase in some subject areas which are noted in Table 2. In Table 2 we included only subject categories whose share of papers was greater than 5 per cent.

We emphasize that in the FSU basic research focused on hard science (Garfield E., 1979). Nevertheless each country demonstrated its own priority: Turkmenistan's output was not significant compared with other Central Asia states, but

it is the only country which shows a large share of documents related to the subject category "Agricultural and Biological Sciences". The share of documents on "Physics and Astronomy" was high for each country; it varies from 14.25 per cent for Tajikistan to 38.4 per cent for Uzbekistan. Uzbekistan, which had built the famous Ulugbec observatory in 1428, continues to carry out research on physics and astronomy. In 2007 Russia and Uzbekistan signed an agreement to build a new powerful observatory. Kazakhstan research is also focused on chemistry and chemical engineering which may be attributed to its extensive oil exploration and refining. Kazakhstan has the oldest FSU missile test site named "Baykonur". It is operated presently by Russia and Western countries to execute collaborative projects and launch space shuttle. In Russia, as in Central Asia, the life science share continues to be much less than the share for hard sciences. Only Kazakhstan and Kyrgyzstan had shown a slight increase in documents on medicine over the years.

We also used ESI to obtain the RO distribution for 1996-2006. Search in ESI by country revealed that there are no data there on Tajikistan and Turkmenistan. The documents are assigned in ESI to 22 subject categories. We found a very strong similarity of RO distribution for Kazakhstan, Uzbekistan and Kyrgyzstan in ESI and Scopus.

Central Asia papers processed by WOS were disseminated in more than 350 journals but the share of papers in western journals was insignificant. We stress that Russian journals were and continue to be the main channel of publications for Central Asia. "European physical journal", "Journal of nuclear material", "Semiconductors" served more often as a communication channel for Kazakhstan and Kyrgyzstan physicists.

We obtained a set of documents in order to study Central Asia's international collaboration by using WOS search option "Address" field for each year 1993, 1997, 2002 and 2006 (as noted in part 2. Methodology).

Russia continues to be a leader of Central Asia' international collaboration; its share of collaborative papers (CP) was consistently above

20 per cent. In 1993 Kazakhstan's collaboration with other countries was insignificant: the share of CP with Germany was about 2 per cent and with the US about 1 per cent. Collaboration with New Independent States was low³. Kazakhstan's pattern of international collaboration is presented in Table 3. We selected the first five countries ranked by their share of CP and then included data on collaboration with other Central Asian states and their strong neighbor China.

Besides a strong collaboration with Russia, there is an obvious dominating role of Western countries. Our findings revealed that USA, Germany, Japan and England were the most favored collaborative partners. The collaboration with the other four Central Asian countries was at a very low level. A growth of collaboration with Germany may be partially attributed to the im-

migration of Germans from Kazakhstan to Germany. It is well known that Stalin forced a large German population from the Povolzh'e region during World War II to Kazakhstan. Potentially their immigration is replacing "brain drain" with "brain gain". The same phenomenon is the Kazakhstan collaboration with Israel which did not exist in 1993 and reached 5.8 per cent for the years 2002-2006.

The leading organization in Kazakhstan's international collaboration was the Russian Academy of Sciences (RAS). Its share was stable, about 15-16 per cent. However, to count the total share of the RAS one has to be able to identify the institutes affiliated with it because often authors do not note the institutional affiliations or addresses within RAS.

Figure 2. Central Asia Research Output, 1997-2006

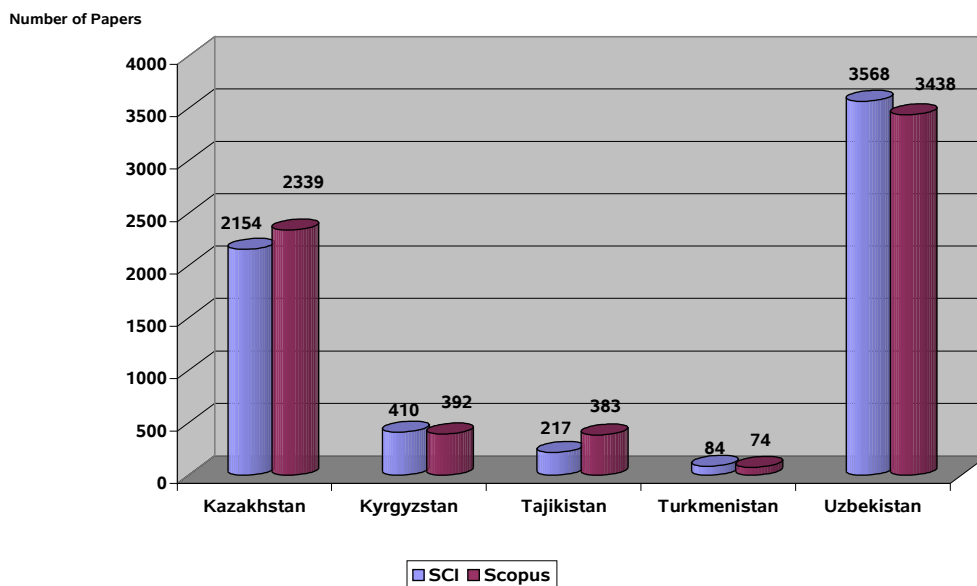


Table 1. Central Asia Research Output by WOS and SCOPUS

Country name	1993		1997		2002		2006		1997-2006	
	SCI	Scopus	SCI	Scopus	SCI	Scopus	SCI	Scopus	SCI	Scopus
Kazakhstan	276	188	185	219	221	246	278	2154	2339	
Kyrgyzstan	43	24	23	51	33	54	61	410	392	
Tajikistan	1	2	43	45	46	40	40	217	383	
Turkmenistan	28	12	13	10	7	6	7	84	74	
Uzbekistan	440	382	393	372	335	334	348	3568	3438	

Table 2. Central Asia Research Output by SCOPUS Subject Category, 1996-2006

Country name	Kazakhstan	Tajikistan	Kyrgyzstan	Turkmenistan	Uzbekistan
Total output	2581	434	424	87	3787
	Per Cent Share				
Agricultural and Biological Sciences	6.94	4.83	4.2	22.99	4.5
Biochemistry, Genetics, and Molecular Biology	6.24	3.68	5.90	5.75	6.73
Chemical Engineering	7.44			3.45	
Chemistry	24.33	15.86	7.08	5.75	31.87
Earth and Planetary Sciences	10.27	25.98	21.23	+ 17.24	5.55
Engineering	+ 10.03	6.21	13.44	18.39	9.82
Environmental Science	4.3		7.08	21.84	
Materials Science	17.78	Strong decline 14.48	5.66	8.05	12.60
Mathematics	7.98	17.70	5.66	11.49	7.8
Medicine	+ 6.08		+ 12.03	6.90	
Physics and Astronomy	22.94	14.25	37.94	17.24	38.40

Table 3. Kazakhstan international collaboration pattern, 1993-2006 by WOS.

Year	1993	1997	2002	2006	1997-2001	2002-2006
Country name	Share of CP, %					
Russia	19.9	19.7	23.7	21.9	18.8	24.3
USA	1.0	8.0	14.6	13.8	8.3	15.3
Japan	no data	1.6	10.0	10.1	3.4	10.0
England	no data	1.0	9.6	7.3	3.7	9.3
Germany	2.9	5.3	11.4	4.9	4.4	10.1
Uzbekistan	2.2	3.7	n/d	3.25	2.4	1.9
Kyrgyzstan	0.7	no data	no data	2.0	no data	0.9
Tajikistan	no data	no data	no data	n/d	no data	no data
Turkmenistan	no data	no data	no data	n/d	no data	no data
China	1.1	3.7	1.4	n/d	no data	no data
Total research output	276	188	219	246	973	1181

Table 4. Uzbekistan International Collaboration Pattern, 1993-2006 by WOS.

Year	1993	1997	2002	2006	1997-2001	2002-2006
Country name	Share of CP, %					
Russia	13.7	7.0	10.6	10.5	8.9	12.0
USA	1.6	5.0	6.5	9.3	5.8	8.3
Japan	3.7	3.9	3.0	4.2	3.3	4.3
England	no data	0.8	2.2	2.1	1.4	2.4
France	0.4	1.3	1.35	3.6	1.8	4.0
Germany	1.8	3.5	7.0	11.1	4.6	9.7
Kazakhstan	1.4	1.8	n/d	2.4	1.3	1.7
Kyrgyzstan	1.4	no data	no data	2.0	1.2	0.7
Tajikistan	no data	no data	no data	n/d	no data	no data
Turkmenistan	no data	no data	no data	n/d	no data	no data
China	0.45	2.4	1.9	3.3	1.2	1.5
Total research output	437	381	369	334	1768	1800

It would be a nightmare to try to evaluate the real total RAS contribution to international collaboration if the evaluator did not have a long experience working with RAS. The same problems arise with the name of the Kazakhstan Academy of Sciences and its affiliated organizations. Over the years we have observed a growth in the share of collaborative papers by Kazakhstan State University. Two countries whose ROs were significantly higher were Kazakhstan and Uzbekistan. Patterns of Uzbekistan international collaboration are presented in Table 4.

The share of Uzbekistan collaboration with Kazakhstan is a less than vice versa. Uzbekistan's collaboration with Western countries (particularly with US, Germany and France) significantly increased over the years. Kazakhstan and Uzbekistan's international collaboration with the five leading collaborative counties is presented at Figure 3a and Figure 3b (s. p. 7).

4 Conclusions

Our findings reveal that Russian journals serve as a main communication channel for researchers from Central Asia. As a consequence of the tremendous political and economic changes in the 1990's, the pattern of Central Asia's external collaboration underwent a strong shift from collaboration with ex-Soviet states toward the western countries. Nevertheless, Russia is still the leader and the Russian Academy of Sciences continues to be a leader in international collaboration for Central Asia. Russian journals were and continue to be the main channel of publications for Central Asia. Our findings could provide a solid and reliable source for policy-makers and funding agencies concerned with Science and Technology development in Central Asia.

Figure 3a. Leading Partners of Kazakhstan international Collaboration by WOS, 1993-2006

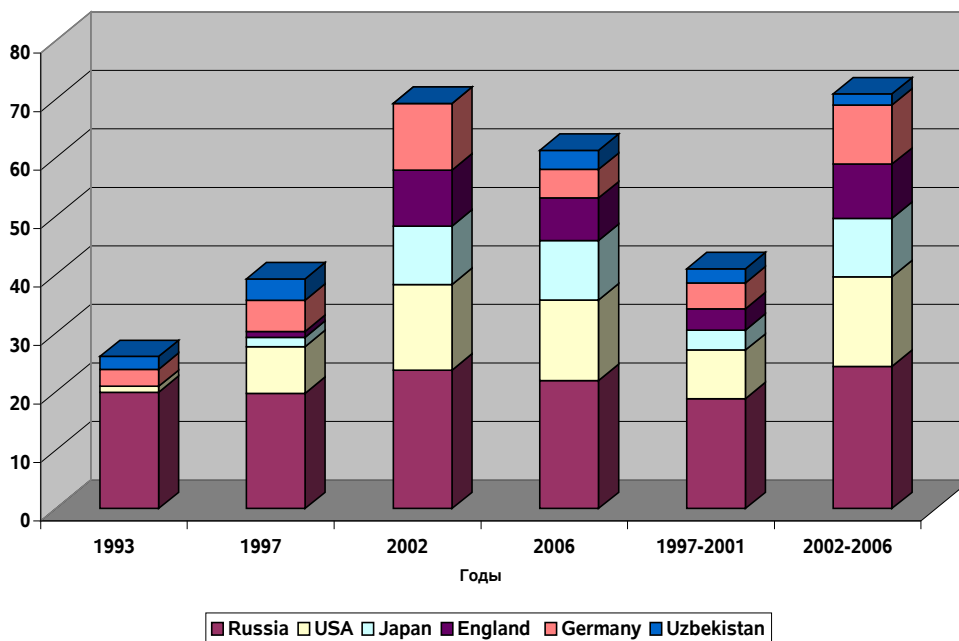
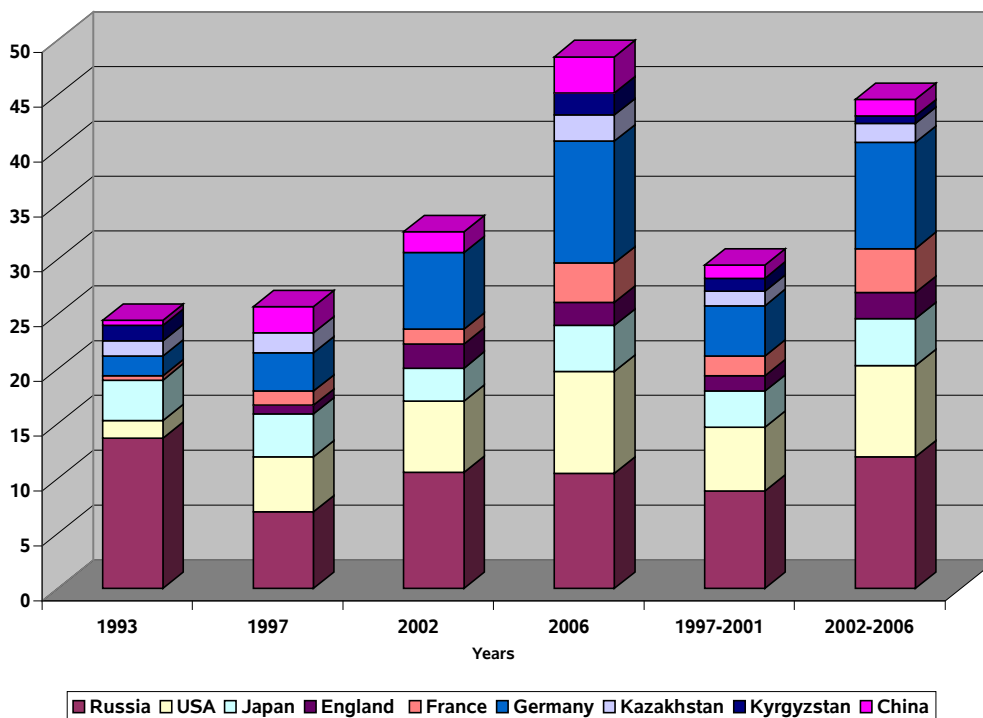


Figure 3b. Leading Partners of Uzbekistan International Collaboration by WOS, 1993-2006



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