

Igor Vikhrov , Sherzod Ashirbaev ,
Mokhinur Kadirova* 

Tashkent Pediatric Medical Institute, Tashkent, Uzbekistan
*e-mail: mkadirova2018@gmail.com

PUBLICATION ACTIVITY OF CENTRAL ASIAN SCIENTISTS ON ARTIFICIAL INTELLIGENCE INCLUDING MEDICINE

This paper presents the results of the publication activity research of scientists from Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) in the field of Artificial Intelligence (AI), including health science and medicine in the referenced databases Web of Science, Scopus, EBSCO Publishing and Springer Link. The issue of strategic and regulatory documents on the development of AI in the countries of Central Asia (CA) and measures for developing this area in the region was considered as well. From the scientometric review, it became known that in the aggregate, the Central Asian countries make an insignificant contribution to the development of AI, including the development of AI in medicine, if we consider the number of publications and their citations in databases at the time of the study in May-July 2021. It was recommended to multiply support for scientific research and publication activity of scientists in Central Asia to increase the regional contribution to the development of AI in medicine and healthcare.

Key words: Publications, Artificial Intelligence, Medicine, Central Asia.

Introduction

The Central Asian region is a growing market for more than 74 million people. It is located between two major world economies – China and Russia, thus creating additional potential for its development. However, so far, not all the opportunities for growth have been used.

As a growing market, Central Asia meets the key factors to become a distinctive research and innovation center on the map of the world's leading innovation centers. Innovations play a particularly important role for the region, as they can bring potential benefits to it. Innovations can contribute to solving existing problems, such as large groups of the population without sufficient access to digital services, banking services, health care and education. Currently, the potential for regional cooperation is still low, which affects regional initiatives in the field of economics, science, education and healthcare. Nevertheless, there are already some regional initiatives, especially in the field of economics, energy, and recently in the field of science and education, including cooperation in the field of AI technology. Therefore, we consider it important to study the level of publication activity and normative activity of Central Asian scientists in the field of AI, as well as AI in medicine.

Currently, for an independent and objective assessment of the activities of scientists and

researchers, it is customary to use scientometric indicators or indices of the effectiveness of scientific activity. According to experts in the field of scientometrics the following indicators are critical among many others assessing the effectiveness of scientific work: the total number of publications, the citation index of publications and the Hirsch index (h-index).

As in the whole world, the system of scientometric indicators is increasingly being used in the countries of Central Asia (CA) to increase the scientific potential of scientists and research organizations. A number of government decrees and documents regulating the regulatory framework in the field of science development have been adopted at the legislative level of all Central Asian countries. The Ministries of Education and Science of the Central Asian countries recommend scientometric indicators when determining the individual and institutional rating, which directly affects the level of funding for the scientific direction.

Interdisciplinary research is developing particularly intensively, including those in the field of digitalization and informatization. In this regard, many countries have also developed national development strategies and concepts for focused research of certain areas of science.

In our study we have combined 2 directions, which, in our opinion, are the points of growth and

development of the country and society: an artificial intelligence and AI in healthcare. The importance of AI technologies can hardly be overestimated, especially the rapid development of AI technologies has taken place over the past ten years. In this context, big data has accumulated that can be objectively studied and taken into account when developing national AI development strategies. Moreover, various international organizations also pay attention to aspects related to the development of AI. The WHO (2021) has listed basic principles for the ethical use of artificial intelligence in the field of healthcare. Twenty experts participated in the preparation of the guidance and has developed it over last two years. This guidance highlights the huge potential of the technology, especially in resource-poor regions. But the authors also warn against hasty and thoughtless use of AI in medicine. As was indicated in the guidance, – “There are many ways to use AI in healthcare, from analyzing images and medical histories to monitoring devices for the state of the body and systems for predicting outbreaks of infections. But if you implement this tool without due care, instead of the expected benefit, the patient may be harmed”. Nevertheless, the importance of AI technologies in general is not disputed by anyone, but there are calls to be careful. In this connection, the study of the level of development of AI technologies in the world, including by region, in our opinion, has a certain scientific and practical significance.

By studying the publication activity of Central Asian scientists in this field of research, we have analyzed regulatory documents and scientometric indicators in the referenced databases Web of Science, Scopus, EBSCO Publishing and Springer Link.

A group of researchers from Stanford University (USA) annually presents a report on the level of AI development “AI Index”, which analyzes the level and development trends of about 20 countries by more than 20 indicators, AI Index Report [1]. In the latest report for 2021, the following main conclusions were made in chapter IV on publication activity: – The number of journal publications in the field of AI increased by 34.5% compared to 2019 and 2020; – over the past 6 years alone, the number of review publications in the field of AI based on the materials of the arXiv has increased more than sixfold, from 5,478 in 2015 to 34,736 in 2020; – AI publications account for 3.8% of all peer-reviewed scientific publications worldwide in 2019, compared to 1.3% in 2011 [2].

When studying the publication activity of scientists, referenced databases are widely used, the Web of Science and Scopus databases are especially

in demand. For example, such a Scopus tool as the Scimago Journal & Country Rank allows to identify country leaders of publication activity in various fields of science. For the country rating of publication activity in the field of AI, publications from 1996 to 2020 are used for analysis. For the period of our research, the top 3 countries in the field of AI are China, the United States and India. Nevertheless, the publication activity in the field of Health Informatics (ICT in healthcare and medicine), including AI in medicine and healthcare in the United States, is about 2 times ahead of China. In turn, Russia takes the first place in the Commonwealth Independent States (CIS) in terms of publications in the field of AI, and Kazakhstan takes the first place in the countries of Central Asia, Scopus. Scimago Journal & Country Rank [3].

Materials and Methods

Content analysis of regulatory and legal documents in the field of digitalization of the national economies of Central Asian countries. The study of the national strategies of Central Asian countries in the field of AI development. Conducting a multifactorial scientometric analysis of the activity of education in the CA countries in the field of AI in medicine and healthcare in the referenced databases Web of Science, Scopus, EBSCO Publishing and Springer Link.

Results

State legal regulation in the field of AI in the Central Asian countries at the level of national strategies has already determined the development priorities. A number of legislative initiatives of the Central Asian governments were devoted to the development of ICT infrastructure, innovation and digitalization of economic sectors. In a number of these regulatory documents, AI, Big Data and intelligent systems technologies were also mentioned. However, in our analysis, we focused only on those regulatory documents that are directly related to the AI development strategy (Table 1).

Thus, at the time of writing the paper in May-June 2021, there was no separate state regulatory document defining the AI development strategy adopted in the Republic of Kazakhstan. However, in 2017, the Government of the Republic of Kazakhstan adopted Resolution No. 827 of December 12, 2017 “On approval of the State Program “Digital Kazakhstan”. A number of provisions of this Resolution indicated priorities for developing AI until 2030, Resolution of the Government of Kazakhstan [4].

Table 1 – National AI development strategies of Central Asian countries (as of July 04, 2021)

Country	Main legal document	National AI strategy	Date of adoption
Kazakhstan	Yes	No	12.12.2017
Kyrgyzstan	Yes	No	14.12.2018
Tajikistan	Yes	No	30.12.2019
Turkmenistan	Yes	No	30.11.2018
Uzbekistan	Yes	Yes	05.10.2020 17.02.2021

On December 14, 2018, the Concept of Digital Transformation “Digital Kyrgyzstan 2019-2023” was approved by the Decision of the Security Council of the Kyrgyz Republic No. 2. The main goal of the Concept is the formation of an open digital society, the transition to digital governance, providing digital conditions for citizens when interacting with state bodies and local self-government bodies, ensuring transparency, reducing bureaucracy and corruption in state bodies, Decision of the Government of Kyrgyzstan [5].

The concept of the digital economy in the Republic of Tajikistan dated December 30, 2019, No. 642 was approved by the Decree of the Government of the Republic of Tajikistan. The main goals of the Concept are the creation of a stable and secure ICT infrastructure for high-speed transmission, processing and storage of large amounts of data, accessible to all organizations and households, as well as the use of mainly national software by state bodies, local governments and organizations, Decree of the Government of Tajikistan [6].

The concept of development of the digital economy of Turkmenistan was approved by the Decree of the President of the Republic of Turkmenistan dated 01.12.18 “On the concept of development of the digital economy of Turkmenistan for 2019-2025”. The document reflects the state of the ICT system, the goals and objectives of the concept, the ways and mechanisms of its implementation, and the expected outcomes. It is expected that the transition to the digital economy will contribute to the development of investment activity, the introduction of advanced methods of public administration and the creation of new jobs in Turkmenistan, Decree of the President of Turkmenistan [7].

The Republic of Uzbekistan also actively carries out research in the field of AI, including the development and adoption of legislative acts, development strategies and support for scientific projects and academic educational initiatives. Thus, by the Decree of the President of the Republic of Uzbekistan No. UP-6079 dated 05.10.2020 “On approval of the strategy Digital Uzbekistan-2030

and measures for its effective implementation”, the Digital Uzbekistan – 2030 strategy was adopted, where, among other items, it is expected that targeted programs of research and innovation projects to be adopted in the areas of development of the country’s digital economy, Decree of the President of Uzbekistan [8].

On February 17, 2021, Uzbekistan adopted a Presidential decree “On measures to create conditions for the accelerated introduction of artificial intelligence technologies”, which indicates the development of a national AI development strategy. The Resolution approved a list of pilot projects for the introduction of AI technologies in various fields that will be implemented in 2021-2022, including the development of AI technologies to diagnose pneumonia based on the analysis of computed tomography of human lungs, as well as breast cancer in the early stages based on the analysis of mammography. Moreover, the development of the necessary regulatory documents on the use of AI in medicine will begin, which will expand the capabilities of AI technologies in healthcare. The resolution also notes the creation of the first national repository for storing big data, including medical data, which give some hope for the rapid development and introduction of AI technologies in the healthcare of the Republic of Uzbekistan, Decree of the President of Uzbekistan [9].

When searching for publications on AI in the EBSCO Publishing database in Uzbekistan with the query “Artificial intelligence in Uzbekistan; Machine Learning in Uzbekistan; Big data in Uzbekistan”, three publications were identified issued by Azimova, Matkovskaya et al. and Vikhrov, of which one is devoted to AI in medicine and one to Big Data in healthcare [10,11,12]. In Kazakhstan, two publications outside the field of medicine and healthcare were identified with the same search query, Abdrakhmanova et al. and Merembayev et al., [13, 14].

A search in the Springer Link database at the time of the study yielded one result only for Kazakhstan in the field of machine learning, Khoroshilov et al.

[15]. There were no publications in the study area indicated for the rest of the Central Asian.

A search in the Web of Science database on the Publons platform showed the following results: out of 10,532 scientists in Kazakhstan, only 22 have areas of scientific interest in their profile “Artificial intelligence; Machine Learning; Big Data”, two scientists in the field of “Artificial intelligence in medicine” and there are the authors of 123 articles indexed in the WoS, Web of Science Group. Publons [16]. In turn, out of 2,586 registered Uzbek scientists, only 7 have “Artificial intelligence; Machine Learning; Big Data” in their profile with one scientist working on the theme “Artificial intelligence in medicine” and there are authors of 7 articles in the field of AI, Web of Science Group. Publons [17].

From Kyrgyzstan, only 1 scientist noted “Artificial intelligence; Machine Learning; Big Data” as his area of interest, with 1 article in the field of AI. There are 112 scientists registered of Tajikistan and 3 scientists of Turkmenistan, respectively, in Publons WoS, who mentioned “Artificial intelligence; Machine Learning; Big Data” as their area of interest.

The data from the Scopus compare the number of publications in the field of AI among 5 Central Asian countries for the entire period of Scopus database. The comparison was carried out against 6 indicators, such as the total number of publications in the field of AI, the number of cited publications, the total number of citations, including the number of self-citations, the relative index of citations per publication and the country Hirsch index in the field of study.

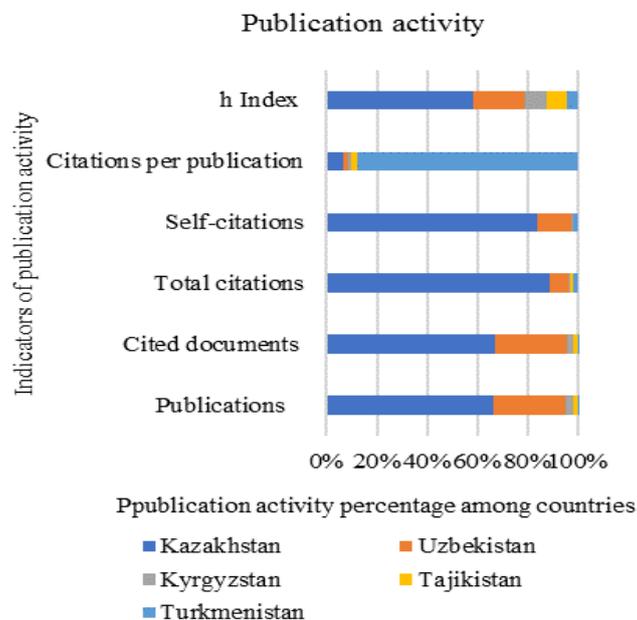


Figure 1 – Percentage of distribution of publication activity of Central Asian scientists in the field of AI in Scopus 1996-2020

As shown in Figure 1 the leaders of publication activity in the field of AI, including medicine are scientists of Kazakhstan, who wield about 2/3 of all published documents in the field of AI research. Then there are scientists of Uzbekistan with 1/3 of publications and the remaining Central Asian countries account for less than 10% of all publications, Scopus. Scimago Journal & Country Rank [18].

Discussion

The obtained results of our research, based on the analysis of strategic and regulatory documents,

including lysis of publication activity, show a dramatic lag of Central Asian scientists not only in the field under study, but also in other areas.

Uzbekistan alone at the time of the study adopted a strategic document on the development of AI in the country. Nevertheless, Kazakhstan was the first to take care of the issues related to digitalization of all spheres of activity in the state and society. Moreover, the issues of financing research in the field of AI are also more related to the issue of state support, as well as the development of venture funds and the startup ecosystem, where Kazakhstan has also been identified as a leader among neighbors in the region.

We can assume that another reason for this lag of Central Asian countries in terms of publication activity is related to the fact that the number of scientific journals in Central Asian countries in the referenced databases of WoS and Scopus is minimal (Table 2).

Table 2 – Central Asian journals indexed in the WoS and Scopus databases (as of July 05, 2021)

Name	WoS/Scopus	Active or Inactive	Country
Eurasian Journal of Chemical Technology	W/S	Active	Kazakhstan
Eurasian Journal of Mathematical and Computer Applications	W/S	Active	Kazakhstan
Eurasian Mathematical Journal	W/S	Active	Kazakhstan
Eurasian Journal of Physics and Technology	W/S	Active	Kazakhstan
Series of Geological and Technical Sciences	S	Active	Kazakhstan
Bulletin of Karaganda University-Chemistry	W	Active	Kazakhstan
Bulletin of the Karaganda University-Physics	W	Active	Kazakhstan
Bulletin of Karaganda University-Mathematics	W	Active	Kazakhstan
Complex use of mineral raw materials	W	Active	Kazakhstan
Solar engineering	S	Inactive	Uzbekistan
Chemistry of Natural Compounds	S	Inactive	Uzbekistan
Healthcare in Kyrgyzstan	S	Inactive	Kyrgyzstan

Since the period of the study, a total of 12 journals included in WoS and Scopus databases were discovered in Central Asia, of which only 9 are active and are all located in Kazakhstan, and 3 are inactive, 2 are in Uzbekistan and 1 in Kyrgyzstan, WoS and Scopus [19,20].

On the other hand, perhaps the issues of financial support of publication activities are related to funding of the study area, and the funding associated with publication is insufficient. In addition, if we talk about the regional contribution to the development of AI, including those in medicine, through the analysis of publication activity, it remains insignificant.

Conclusion

According to the results of our study of the level of publication activity of Central Asian scientists in the field of AI, including AI in healthcare and medicine, there is a clear lag behind other regions

in terms of the number of publications, citations and the overall Hirsch index in the field of AI, including AI in healthcare. The degree of maturity of the national strategy for developing AI and, in general, the digitalization of the Central Asian countries is also starting out. Nevertheless, over the past 5 years, scientists from Central Asian countries have become more active in terms of scientific research and publications in the field of AI in healthcare, but such activity is not homogeneously distributed across countries. There are clear leaders in the region in terms of publication activity – they are Kazakhstan and Uzbekistan. In general, the scientometric effectiveness of Central Asian scientists in the field under study may depend on the number of international scientific journals, the reviewed Scopus and WoS databases, the level of development of the country’s digitalization, science funding and the development of the startup ecosystem.

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