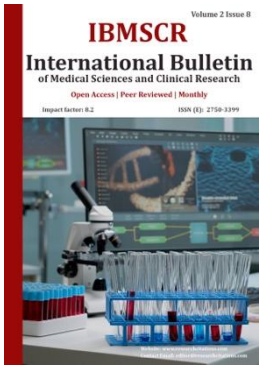

CONTRIBUTION TO THE DEVELOPMENT OF SCIENCE AND SPIRITUALITY IN CENTRAL ASIA BY THE GREAT SCHOLARS AND THINKERS OF THE EAST

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Abstract. The contribution of the great scholars and thinkers of the East, and above all of Central Asia, to the development of world science and spirituality is rightly considered one of the most striking phenomena of medieval human history. At a time when Europe was experiencing a period of intellectual stagnation, powerful scientific and philosophical thought flourished in the East, at the crossroads of transcontinental highways, laying the foundation for the future European Renaissance. In this study, the author seeks to show that this flourishing was not accidental, but was the natural result of a unique synthesis of cultures, a developed economy and state support for knowledge in Central Asia in the 9th–15th centuries.

In the modern era, the relevance of this topic is due to the need for a deep understanding of the origins of contemporary scientific knowledge and spiritual values. Scientific discoveries and humanistic ideas put forward by thinkers from this region a thousand years ago still amaze us with their depth and predictive power. The aim of this study is to comprehensively analyse the decisive contribution of the great scientists of Central Asia to world science and spirituality, identifying the mechanisms for integrating their ideas into the universal civilisational matrix.

In particular, historical-genetic and comparative-historical research methods are used to solve the tasks set in the study. For example, the historical-genetic method allows us to trace the evolution of scientific ideas from their inception in the scientific centres of Bukhara, Khorezm and Samarkand to their formulation in fundamental works. The comparative-historical method is used to compare the achievements of Eastern and Western scientific thought, which makes it possible to objectively assess the extent of the influence of the Central Asian Renaissance on world science. The most important methodological principle is the identification of cause-and-effect relationships, from the objective prerequisites for the formation of the intellectual environment to specific discoveries and, further, to the mechanisms for transferring this knowledge to the global community.

To understand the phenomenon of the scientific explosion in Central Asia, it is necessary to refer to the historical and cultural factors of that time. The region, which included Sogdiana, Bactria, Khorezm and Fergana, had long been located at the crossroads of the Great Silk Road, connecting East and West, North and South. This geopolitical position contributed not only to intensive trade, but also to a colossal transit of ideas, philosophical concepts and religious doctrines.

The cause-and-effect relationship here is obvious: the concentration of economic resources in such megacities as Bukhara, Samarkand, Urgench, and Merv led to the formation of a powerful urban class that needed applied knowledge such as geodesy, astronomy, medicine, and intellectual leisure.

In turn, the rulers of the Samanid, Karakhanid, Khorezm Shah and later Temurid dynasties realised that patronage of science legitimised their power and strengthened the prestige of the state. This synthesis gave rise to unique scientific institutions in the region. The most striking example is the Khorezm Academy of Ma'mun, Dar al- Hikma, founded in Urgench at the beginning of the 11th century by the Khorezm Shah Abu al-Abbas Ma'mun. More than a hundred outstanding minds of their time worked at this scientific centre, including Al-Biruni, Ibn Sina, and Abu Nasr ibn Iraq. The academy functioned as a veritable «scientific laboratory» where an unprecedented integration of ancient Greek, Indian and Persian heritage took place. It was this fusion of tolerance, openness to knowledge and state patronage that became the fundamental prerequisite for an unprecedented intellectual breakthrough. Mathematics and Astronomy Fundamental discoveries in the exact sciences rightfully belong to the scientists of Central Asia, who transformed ancient natural philosophy into a rigorous empirical science. Muhammad ibn Musa al-Khwarizmi (783–850) was the first to systematise algebra as an independent discipline. In his monumental work Al-Kitab al-Mukhtasar fi Hisab al-Jabr wa-l-Muqabala (The Compendious Book on Calculation by Completion and Balancing), written around 820, he not only introduced the term "algebra" itself, but also developed a methodology for solving linear and quadratic equations. Al-Khwarizmi saw science as a universal tool for human progress, noting, «Different sciences do not contradict each other, and this affirms the entire nation, which leads to knowledge of the world and its happiness». The baton of great mathematicians and astronomers was taken up by Abu Rayhan Al-Biruni (973–1048), whose genius encompassed almost all the sciences known at the time. In his work Geodesy, or as it is called Tahdhid Nihayat al-Amakin, Biruni calculated the radius of the Earth with remarkable accuracy — 6,339.6 km, which differs from modern data by less than 1%. Five centuries before Nicolaus Copernicus and Johannes Kepler, Biruni put forward and mathematically substantiated the hypothesis that the orbits of celestial bodies are not perfect circles but ellipses, and that the Earth revolves around the Sun and its own axis.

The culmination of the development of astronomy in Central Asia was the work of Mirzo Ulughbek (1394–1449). The Samarkand Observatory he created became the largest computing centre of the era. In his work "Zij-i Kuragooni", Ulugh Beg compiled a catalogue of 1,018 stars with unprecedented accuracy for that time and calculated the length of the astronomical year to be 365 days, 6 hours, 10 minutes and 8 seconds, which practically coincides with modern data (the error was less than one minute).

Medicine and Natural Sciences The contribution of Eastern thinkers to medicine cannot be overestimated. The central figure here is undoubtedly Abu Ali ibn Sina, also known as Avicenna (980–1037), whose legacy became the foundation of world medicine for the next eight centuries. His encyclopaedic work, The Canon of Medicine, or Kitab al-Qanun fi al- Tibb, written around 1020, systematised medical knowledge, combining the experience of Galen and Hippocrates with the achievements of Eastern clinical practice.

Ibn Sina was one of the first to discover that infectious diseases (such as plague, hepatitis, and cholera) are caused by tiny invisible organisms, anticipating the discovery of microbes and

viruses by Louis Pasteur by 800 years. The scientist paid particular attention to ecology and the impact of the environment on health. Ibn Sina wrote: «Those who choose a place to live should know the following, the soil, the elevation and lowlands... exposure to winds and what kind of winds blow — whether they are cold, healthy winds, as well as what seas, swamps, mountains and mines are nearby».

Al-Biruni also made a significant contribution to pharmacognosy, creating at the end of his life the work Kitab al-Saydan fi al-Tibb , i.e. The Book of Medical Substances, in which he described the properties, places of origin and effects of more than 1,100 medicinal substances, collecting unique ethnopharmacological material in 30 languages of the world.

Geography and history In the fields of geography and history, Central Asian scholars have distinguished themselves as outstanding empirical researchers. Al-Biruni wrote a fundamental work entitled India , or as it is called, Tahkik ma li-l-Hind, in which he impartially and with the highest scientific accuracy described the history, religion, philosophy, customs and geography of the Indian subcontinent. Moreover, based on calculations of geographical latitudes and time differences when observing lunar eclipses from different points (Urgench, Baghdad, Cairo), Biruni confirmed the spherical shape of the Earth and mathematically proved the existence of the unknown continent of America in the Western Hemisphere long before Columbus.

Scientific breakthroughs in Central Asia were inextricably linked to profound developments in spirituality, ethics and philosophical thought. A distinctive feature of Eastern intellectuals' thinking was their desire to harmonise rational knowledge and divine revelation, philosophy and theology.

Abu Nasr al-Farabi (870–950), known as the "Second Teacher" after Aristotle, developed an original philosophical system that synthesised ancient thought and the Islamic worldview. He laid the foundations of Eastern Peripateticism, paying great attention to ethics and social structure. In his work "Treatise on the Views of the Inhabitants of the Virtuous City," al-Farabi constructed a sociological system of an ideal state ruled by reason and enlightenment.

Ibn Sina, drawing on the works of Farabi, took rational methods of cognition to a new level, asserting that "any knowledge that is not weighed on the scales of reason is not true knowledge." Ibn Sina's philosophical teachings, Kitab al-Shifa and Kitab al-Najat, addressed the most complex ontological and epistemological problems: the relationship between matter and form, motion and rest, reason and faith. At the same time, his works are imbued with a deep humanism. In his Treatise on Love, Ibn Sina considers love as a universal cosmic force striving for perfection. He asserted, "Only true sages, freed from the flesh... will find their way to the world of holiness and happiness" or the Book of Justice.

Sufism played a huge role in the spiritual life of Central Asia, becoming a powerful moral compass for society. The philosophy of Sufism focused on spiritual purification, self-knowledge, and selfless service to others. Bahauddin Naqshband (1318–1389), founder of the largest Sufi tariqa, Naqshbandiyya, formulated the ethical principle "Dil ba yur-u, dast ba kor" or, as it is also called, " " Heart with God, hands at work. This teaching did not call for ascetic renunciation of the world, but on the contrary, required active participation in public life and creative work, having a profound influence on the political and social structure of many Eastern states.

Analysing the cause-and-effect relationships of the historical process, we inevitably come to the conclusion that the intellectual explosion in Central Asia in the 9th–11th centuries served as a direct catalyst for the European Renaissance. The mechanism for transferring this

knowledge followed a clear historical trajectory: from the scientific centres of Maverannahr, via Baghdad and Damascus, knowledge was transmitted to Islamic Spain (Córdoba, Toledo) and Sicily, where a powerful school of translators emerged in the 12th–13th centuries.

The scientific discoveries of al-Khwarizmi, al-Biruni, Ibn Sina, and al- Farghani were translated into Latin and became the academic foundation for European universities. For example, Ibn Sina's Canon of Medicine was translated into Latin more than 30 times, starting with its publication in Rome in 1593, and remained the main textbook in European medical schools until the 17th century. Ahmad al-Farghani's astronomical works, "Elements of Astronomy," translated into Latin, became the basis for European astronomy for many centuries. Al-Khwarizmi's work on algebra was translated by Robert of Chester in 1145 and Gerard of Cremona in 1160, laying the foundations for higher mathematics in Europe.

The philosophical concepts of Eastern thinkers had a powerful influence on Western scholasticism and literature. Ibn Sina's ideas about the harmony of the soul and the universe were reflected in the works of European humanists, including Dante Alighieri's Divine Comedy. The rationalist tradition established by Al-Farabi and Ibn Sina paved the way for European empiricism and the scientific revolution of the modern era. Thus, the chain of cause and effect looks as follows: the synthesis of cultures on the Great Silk Road and the patronage of rulers, the creation of unique scientific centres such as the Academy of Mamun, the systematisation of ancient heritage and the generation of fundamentally new knowledge empirical medicine, spherical trigonometry, heliocentric ideas, the translation of these works into Latin in Spain and Italy, the formation of the scientific and educational base of European universities, which led to the Renaissance. In conclusion, we would like to note that we can assert with complete scientific certainty that the great scholars and thinkers of Central Asia made not just a significant, but a decisive and fundamental contribution to the development of world civilisation. The Eastern Renaissance of the 9th–15th centuries became a key link in the global chain of transmission and accumulation of human knowledge. Al-Khwarizmi, Al-Biruni, Ibn Sina, Al-Farabi, Mirzo Ulugbek and many other geniuses formed a universal language of exact sciences and developed advanced philosophical and ethical doctrines that know no spatial or temporal boundaries.

The contemporary significance of this heritage extends far beyond purely historical interest. In the context of globalisation, when the world is facing environmental challenges, a crisis of morality and the need for intercultural dialogue, the works of Eastern thinkers remain an invaluable reservoir of wisdom. The ecological thinking of Ibn Sina, who called for a balance between man and nature, Al-Biruni's warning that «if people commit violence against nature... one day nature may place a burden on their heads that no force can reverse», as well as the philosophical tolerance and scientific objectivity of the Academy of Ma'mun, all sound more relevant today than ever before. The study of their intellectual achievements serves as indisputable proof that science and spirituality are a single, inseparable whole on the path to the improvement of humanity.

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