THE DEVELOPMENT OF ENGINEERING SCIENCE DURING THE REIGN OF AMIR TEMUR AND THE TIMURIDS

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Abstract: This article analyzes the development of engineering activities during the reign of Amir Temur and the Timurids, in particular, the rise of metal casting, metalworking, the glass industry, construction, architecture, pottery, papermaking, artificial irrigation in agriculture and other engineering sectors, and draws the necessary conclusions.

Keywords: Amir Temur and the Timurids, engineering, development, prosperity.

During the reign of Amir Temur and the Timurids, engineering activities, especially civil engineering, were highly developed. Along with these, during the reign of Amir Temur, metal casting, metal processing, glass industry, construction, architecture, pottery, paper production, and agriculture also developed in Turan. While these types of production were mainly practiced in cities and suburbs, metal smelting enterprises were located in mountainous areas where mineral resources were found.

In the metalworking industry, non-ferrous metals, including gold and silver jewelry, were an important area. Copper processing and the manufacture of various household items from it also played a special role. As a result of archaeological excavations conducted in recent years, a metal casting furnace used in the late 14th and early 15th centuries was found on the eastern side of the Sherdor madrasah.

During the reign of Amir Temur, crafts developed so much that separate neighborhoods were created in the city of Samarkand itself according to the types of production. Silk fabrics, clothes, household items, jewelry, leather and leather products, seeds, dried fruits, metal products made in them reached far and wide countries of Asia, Europe and Africa along the caravan routes.

The Great Sahibkiran did not limit himself only to the interests of his empire, but also carried out landscaping, clearing land, draining water, and erecting monuments in the conquered lands. Under his rule, many canals were built in Azerbaijan and Khorasan. The names of some have survived to this day. A 70-kilometer ditch was dug in Nagorno-Karabakh and drained water. Twenty ditches dug in Khorasan caused the Murghab oasis to bloom. Considering that canals are the most important factor in the production of agricultural products, a kind of machine, we can correctly assess the work done by Amir Temur.

Amir Temur understood well that it was impossible to develop a state and society without relying on science and culture. Therefore, he issued a number of decrees related to the expansion of the network of madrasas, the material support of teachers and students. This custom was continued after the Sahibkiran. In addition to respecting scholars and craftsmen, all the Timurids themselves were highly educated in science, art and culture, knew several foreign languages, were able to think well in literature, astronomy, medicine, history, architecture, poetry and other fields, and had a rich personal library. Timur's descendants also left their monuments to various cities of the empire, leaving behind madrasas and mosques.

The conditions created for scholars during the reign of Amir Temur could not fail to attract scientists from different parts of the world, so craftsmen, masters, scientists began to voluntarily come to Samarkand, Bukhara, Shakhrisabz, Kesh, Herat and other large cities. To be convinced of this, it is enough to recall the Baytul Hikmat, which was established under the leadership of Ulugbek. Scientists from Arabia, Iran, Rum and other places came here. Qazizoda Rumi, Ali Kushchi, Giyasiddin Jamshid Koshi, Mo'iniddin Koshi, Jalolddin Astrobodi, Nizamiddin Birjandi, Miram Chalabi, Mansur Koshi, Aboulkadir Lo-khiji, Muhammad Husayni and others worked there.

However, it must be admitted that no engineering activity during this period developed as much as civil engineering. We can cite the famous inscription on the facade of the Oqsaroy Palace in Shahrisabz as proof of our point: “If you doubt our power, look at the buildings we have built!” This phrase is key to understanding the architectural style of the era of Amir Temur. The natural reflection of the acceleration of construction

was the flourishing of architectural decoration and the development of innovative techniques and technologies for decorating walls. Amir Temur sought to amaze the imagination of the whole world with his cities.

Along with large city ensembles and monumental structures, Amir Temur paid special attention to the creation of suburban park and park complexes, where he preferred to spend the spring and summer. The tradition of building gardens has long been inherent in Eastern culture. But here too, the famous ruler managed to say something new: the size of his gardens was as impressive as the size of city ensembles.

The era of Amir Temur gives a new meaning to the type of decoration. The innovation of the Timurid architects and decorators was manifested in the adaptation of geometric patterns to new finishing materials and the increase in architectural proportions.

The mausoleums of Guriamir and Shokh-Zinda, the Bibi-Khonim mosque, the Oqsaroy palace, the Ulugbek madrasah and many other monuments demonstrate the vivid development of geometric constructions, their elevation to the level of high art.

In the 15th century, both in Samarkand, the capital of Movarunnahr, and in Khirat, the center of Khorasan, the spiritual traditions of Timur were continued, and a large group of scholars, fuzalos, poets, composers, architects and builders gathered. The role and contribution of Ulugbek, who was known as a famous scientist from his youth, is extremely great. Ulugbek's contribution to the development of the rich and diverse culture of Movarunnahr and Khorasan is incomparable.

During the reign of Ulugbek, mathematics, geometry, astronomy, natural sciences, literature, history, and art reached high peaks, and his capital Samarkand became the largest scientific center of the medieval world. Among the most famous buildings of the reign of Ulugbek, there is a famous hadith on the door of the Bukhara madrasa: "The pursuit of knowledge is the duty of every Muslim man and woman." Although our Prophet intended to know the Quran, this inscription installed at the entrance to the educational institution acquires a new secular meaning. Ulugbek was a great astronomer. His main interest in science was astronomy. In 1428, Ulugbek built an observatory in Samarkand and equipped it with first-class devices for that time. He

compiled an accurate catalog of stars and a table of planetary movements. The results of the observations made by Ulugbek characterize the high level of astronomy. His main engineering device was a huge protractor (or quadrant), directed directly from north to south. The radius of the device was 40.2 m, and its arc was one-sixth of a circle with a working part ranging from 20 ° to 80 °. Due to its enormous dimensions, each level of the device corresponds to 70 cm. The observatory was housed in a three-story cylindrical building with a height of 30.4 m and a diameter of 46.4 m, and was used to measure the height of celestial bodies above the horizon as they passed through the celestial meridian. Azimuthal observations could be made on the horizontal circle on the roof of the building. There were other devices that have survived in the observatory. Such prominent astronomers as Qazizod ar-Rumi, al-Koshi, and Ali-Kushchi worked at the Ulugbek Observatory. Here, by 1437, the Ziji kuragoniy, that is, the starry sky catalog, was compiled, which described 1018 stars. This catalog was the most accurate catalog in the world before the invention of the telescope. In 1437, Ulugbek determined the length of the astronomical year - 365 days, 6 hours, 10 minutes, 8 seconds. The error was +58 seconds.

At the Ulugbek Observatory, sine tables with nine numbers and a frequency equal to one minute were obtained. His employee Jamshid ibn Masud al-Koshi developed a method for solving cubic equations. In addition, he created a systematic exposition of the theory of decimal fractions and, using the Archimedean algorithm, determined the number p with an accuracy of 16 digits.

Along with the astronomical research of medieval scientists and other achievements in science and technology, it later became known in Europe and gave impetus to the development of European astronomy.

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