

# King Sejong: For the Heaven and the People

## I. A King Who Served the Nation

Throughout history, monarchs were given heavenly titles. In China, they were called the “Son of the Heavens”, while in Japan, “The Ruler of the Heavens”, and Louis XIV famously called himself the Sun King. However, King Sejong of the 15<sup>th</sup> century Korea genuinely saw his subjects as heavenly.

He never called himself “the Great” – it was a title given by his subjects. His life can be examined through *Sillok*, the world’s **most substantial historical record covering a single dynasty** that recorded the words and acts of kings.

“The common people are the foundation of a country. It is when the foundation is strong that the country prospers.”

- King Sejong (3 July 1423)

While obesity today has become a global issue, barely a couple of centuries ago, the world was mostly made up of inefficient agricultural societies. In Ireland, for example, the population was reduced by one quarter due to the Great Famine that started in 1845.

Six hundred years ago in Korea, Sejong set out to solve the problem of feeding his people. Following his coronation at the age of 22, one of his first acts was to open the government granaries and feed those who were starving. Next year, concerned about a series of bad harvests, he issued a royal order,

“A nation’s foundation is its people, and to the people food is precious as Heaven itself. Let every local governor personally inspect his domain and care for the poor. If even one person dies of starvation, the governor will be punished severely.”

- King Sejong (12 February, 1419)

When a peasant was found to have died from starvation, Sejong punished the officials who had neglected to bring relief efforts.

In the third year of his reign, he had a thatched hut built using abandoned lumber, and lived there for two years in order to share in the hardships of his subjects. In the fourth year, he

commanded that crop reports be brought to his attention every day ahead of all other state affairs. And in his fifth year, blaming himself for the drought, he ordered that not even a single cup of wine be brought to him.

In July 1425, Sillok records that Sejong left the palace and walked the countryside under the scorching sun to inspect the drought with neither a parasol nor a fan. Refusing his midday meal, on his return to the palace, he lamented the condition and said that it brought tears to his eyes. For eleven days then on, Sejong stayed up all night, troubled by the drought. He grew gravely ill, but gave orders that the news of his illness be kept from the people.

## II. Farming and Meteorology

Sejong did not merely lament his people's condition, but sought ways to ease their sufferings, and in the process of doing so, made many great achievements in culture and science.

In particular, the royal publication of *A Plain Guide to Farming* introduced numerous ways to improve soil fertility, and as the use of various fertilizers and crop rotation replaced the fallow technique with intensive farming methods on a national scale, agricultural productivity significantly increased. Arable land increased by **over a million units**, and as **productivity quadrupled**, from the 20th year of Sejong's reign onwards, **no record of famine or hunger** can be found.

His resolve not to let even one person starve led also to advances in meteorology that served as the foundation of agricultural science. Invented in 1441, *Cheugugi* is the world's first rain



gauge, pre-dating **Europe by 200 years** and **Japan by 300 years**. It looks simple at a glance, but the science and significance behind it is far from simple. If the gauge's aperture is too wide, the margin of error increases when there is little rain. If it is too narrow, collecting rainwater becomes difficult in strong winds. Further, if it is too close to the ground, the rain falling on the ground could enter the gauge, or the rainwater inside could bounce out.

*Cheugugi the world's first rain gauge*

In other words, the rain gauge was designed with precision, taking all of these factors into account. Today, as established by the World Meteorological Organization, the margin of error for a rain gauge should be **less than 1%**. *Cheugugi*, made 600 years ago, operates within half that limit. Its **dimensions are perfect**, just as if it were made using modern technology. After standardizing the size, Sejong sent 348 to various regions in the kingdom. The magistrate of each town measured the amount of rain with a ruler in units of *Cheok*, *Chon* and *Poon*. They reported measurements to the Governor of the province, and the Governor relayed these to the Ministry of Taxation. By establishing the world's **first nationwide rainfall measurement system**, Sejong brought about a new era in meteorology.

According to Professor Joong-Yang Moon of Seoul National University, it allowed the first quantitative analysis of rainfall. Instead of using qualitative expressions like “it rained heavily” or “it rained little,” the precipitation data was recorded in **precisely standardized units** of measurement. The whole process might appear simple, but no one had attempted a quantitative analysis of rainfall before, and this remarkable planning, execution, and drawing of conclusions by a monarch, borne out of compassion towards his people, deserves recognition in history. As a result, Korea is the **only country** with continuous climate records stretching back **several hundreds of years**, providing valuable data for weather forecasting and contributing greatly to the study of weather patterns. Born out of a heartfelt prayer to Heaven for timely rain and good harvest, *Cheugugi* was the legacy of Sejong who held his subjects in high esteem.

### **III. Astronomy and Calendars**

On January 1st, 1422, a commotion broke out in the palace. The royal astronomer had predicted the solar eclipse incorrectly by a quarter of an hour and was punished. In Joseon Korea, when there was a solar or lunar eclipse, the king held a special ceremony, pledging to uphold the will of the Heavens. An error of **15 minutes** in this important ceremony led Sejong and his officials to intensify their studies of advanced mathematics and astronomy, leading to the development of a new calendar system.

In 1434, a national project was undertaken to build what would become the largest and most advanced astronomical facility of the 15th century. Finally, eight years later in 1442, Sejong's long-held wish was fulfilled, with the publication of Korea's own almanac entitled, "Calculation of the Motions of Seven Celestial Bodies, inner and outer volumes." Now the astronomers of Korea could calculate the **exact positions** of the **seven celestial bodies**—the Sun, Moon, Mercury, Venus, Mars, Jupiter, and Saturn—with respect to Korea's capital, and predict the precise timings of solar and lunar eclipses **down to the second**, without error. In the 15th century, Korea became the world leader in astronomy.

The calendar also set the circumference of a circle at 360 degrees, one degree at 60 minutes, one minute at 60 seconds, and the length of a year as 365.2421875 days. The last computation is correct to **seven significant figures**, based on today's standards. The new calendar featured unprecedented accuracy. In Korea's five thousand year long tradition of astronomy, Sejong's reign was its zenith.

#### IV. Sundials and Star Clocks

Sejong's advances in astronomy were accompanied by advances in time-measurement, with new **sundials, clepsydras and star clocks**. Since ancient times, many civilizations have used sundials to tell the time. *Ang-Bu-Il-Gu*, created in the 16<sup>th</sup> year of Sejong's reign, was an innovative sundial that displayed not only the time, but **also the date and the solar terms**, thereby functioning as a calendar.



*Ang-Bu-Il-Gu Sundial*

Its **unique concave design** was created by calculating the movements of the Sun during the day, as well as summer solstice, spring and fall equinoxes and winter solstice by calculating the elevation angle of the Sun throughout the year.

For the illiterate, Sejong ordered that the time be marked with pictures of astrological animals. He placed the dials in central locations of the capital for use as public clocks. Sejong earnestly wished to share the benefits of technology with his people.

“Now we have installed the sundials on the busy streets, and many will learn how to make them.”

– King Sejong (2 October 1434)

From then on, portable sundials of various shapes and size were made and used widely among the populace. When we consider that studying astronomy was forbidden and **making almanacs a criminal offence** in other countries, as knowledge was guarded by the ruling class, we can see that Sejong was far ahead of his time.

However, after sundown, sundials are of no use. Therefore, Sejong and his officials began work on a new time-measurement system, and finally succeeded in creating a unique device that could **continuously measure time** by observing the sun by day, and the stars by night. Using the principle that stars make a circle around the North Star once a day, it calculated time by measuring the stars’ **angular displacement**. Because Sejong was committed to national defense, he dispatched two of the four clocks to military outposts in the northernmost territories. Concerned that they might be cumbersome during military operations, he also made smaller versions and sent these as well.

Rain, snow and cloud, however, render sundials and star clocks useless. Therefore, in many countries, the official standard time was usually set using water clocks. A water clock is powered by a constant flow of water with a floating marker that indicates the time. This type of clock required a human observer, who would then signal the time. It was not uncommon for the officer on duty to fall asleep, and face punishment for missing the time. Sejong wanted to solve this

problem, and so developed a new device. In 1434, under Sejong's guidance, an **automatic water clock** was created which set the standard time in Korea.



*Automatic water clock*

Unfortunately the clock was destroyed during the Japanese invasion. Such was its complexity that it was only rebuilt in 2007, after a team of 30 scholars and master artisans spent 23 years reconstructing it based on the Sillok records. Seeing how modern technology struggled to build the 600-year old device, we can infer how truly advanced science and technology were in King Sejong's time.

The clock operates as follows: water flows out from the three-tiered vessels, with the water level rising at a pre-determined speed. When the marker rises up, it touches a lever causing a small marble to be released. Its potential energy is converted into kinetic energy, and it enters a chamber where it activates a larger iron ball. From a small marble to a larger ball, the energy is amplified. As the ball rolls through the tube, it activates the drum, sounds the gong, and tolls the bell. Then a wooden figure rises to announce the time, and withdraws. The precisely controlled wooden figures signal the time automatically and accurately. The transformation of an analogue water-clock into

a digital automated device was a remarkable accomplishment and a significant milestone in the history of robotics and automation engineering. The clock's automated time signaling system requires an analogue-digital converter. This was invented **for the first time** in the 15<sup>th</sup> century in Joseon Korea. It is highly acclaimed among scholars as **one of the most significant inventions** in the world history of science. When the automated water clock beats the drum, the gatekeepers of the Royal Palace would beat their drums. This in turn prompted the ringing of the Central Bell Tower, and the sound was heard all throughout the city. Under this time-signaling system, the gates of the capital would shut at 10 o'clock at night, and reopen at 4 o'clock in the morning. The people began and ended their days accordingly, and kept order in their lives.

## V. Using Science to Benefit the People

Why was King Sejong so enthusiastic about astronomy and time-keeping devices?

According to the Sillok:

“The King, while overseeing the affairs of the state, set his mind to the principles of astronomy and ordered the creation of every kind of astronomical and time-measuring device. The King had a deep-held wish to benefit the lives of the people with the use of such devices. Such purity of spirit is unheard of from time immemorial and truly sacred.” (April 15, 1437)

“There was no astronomical book left unread, no instrument unexamined by the king. In this discipline, he always applied himself to the fullest. You may witness his reverence for the heavens and his desire to help the lives of the people, which extend to the utmost in every respect.” (March 30, 1445)

Reverence for the Heavens was always topmost in Sejong's mind. Sharing knowledge and wisdom with the people was, to him, the putting into practice of that reverence. This is why astronomical instruments are referred to in Korea as the “Beneficial Vessels” – namely devices that bring benefit to mankind.

If people devote themselves to their vocations, look up to their parents and nurture their children, they will live longer and strengthen the foundation of the country. Every household will prosper and all will be affluent. There will arise a culture of humility and respect for others. It will be a time of peace

blessed with good harvests. And together, we will enjoy heavenly peace.

- King Sejong (July 25, 1444)

With a strong sense of duty, believing that not even a second should be wasted, as time was a precious gift from the Heavens, Sejong made giant strides in astronomy, meteorology and chronometry.

He would go on to leave countless other legacies such as the establishment of the Royal Academy which housed the finest minds in the kingdom; the standardization of measurement units across the nation; the development of new weapons for national defense; the distribution of books and knowledge through moveable type; the creation of the Korean alphabet *Han-geul*, acclaimed as the world's most advanced script; and the world's first musical notation system. The driving force behind his accomplishments, unparalleled in world history, was a profound reverence for the heavens and for his people.

“A person who governs must give, and give up, everything.”

– King Sejong the Great –