

## THE 17<sup>th</sup> CENTURY

### GRAINS, WHEELS AND WELLS

At the beginning of the 17th century, Ming China was the largest, richest and most populous country of the world.

The vitality of its society is well reflected in a book published in 1637, the *Tiangong Kaiwu*, *The Exploitation of the Works of Nature*, written by Song Yingxing.

Song was an unsuccessful scholar who failed again and again the highest level of the official examinations.

At the end he felt weary and he took a different course, based on his personal research.

He had travelled a lot and was a good observer.

And he had noticed that scholars who spent long years secluded in their studies they also needed practical preparation to deal with real life.

The *Tiangong Kaiwu* is a comprehensive treatise that blends together agriculture, craftsmanship and material inventiveness.

It documents the extraction and processing of raw materials and the manufacture of goods essential to everyday life.

The book describes the means of producing rice, silk, salt, pottery and porcelain, metals, coal, paper, weapons and many other commodities.

The book is lavishly illustrated with hundreds of woodblock prints and gives testimony of the extraordinary genius of Chinese technology.

The *Tiangong Kaiwu* opens with the agricultural chapters.

It illustrates the manifold kinds of wheels applied to irrigation and their ingenious combinations to redirect the hydraulic energy. Those big hydraulic wheels were technological marvels, but they went side by side with the small wheels that could be operated by one or two persons.

All these agricultural implements were made of wood, which means that they could be made or repaired at family or village level.

The book also provides the processes involved in the preparation of grains like the water powered rolling mill. Pounding mills deserve a great attention, from the foot-operated pounding mill to the water powered pounding mill with its enormous hydraulic hammers that could pound hundreds of kilos of grain at a time.

The book also details the necessary methods to avoid agricultural calamities, detailing at length the different types of rice and wheat disasters.

The text focuses mainly on Chinese traditional grains, mainly rice and wheat, and no mention is given to the American products, like maize and peanuts that had arrived to China in the 16th century.

In the chapter of clothing materials, it details the long process of silk production, from the gathering of cocoons into large trays, to the preparation of the silk threads.

All kinds of looms are taken into account.

The huge loom for figure weaving comes with a detailed description of the frame of the loom and the cross-plank placed in the tower for the draw boy to sit in. Many of the illustrations of those looms will appear later on in 18th European books. The waist loom operated by a man is a clear novelty in itself. In the household division of labour of traditional China, men worked in the fields and women made the cloth. But this man working at the loom shows that in late Ming China a merchant oriented production was changing the long-standing division of labour between men and women.

The book details which part of the process can be done at family level and which require an industrial approach.

It also details the tools necessary for cotton production, like this cotton gin for separating fibres from seeds. The cultivation of commercial crops, like cotton, was beginning to replace rice land.

Conversely, the book reserves only a small section for wool, following the ancient tradition of using long-fibre materials and making little use of the short-fibre wool.

A very long and detailed section deals with salt, which was a government monopoly since ancient times; even if since the late Ming the monopoly was operated by government-licensed merchants.

Due to the fact that the taxation and distribution of salt was of paramount importance for the Imperial budget, those are the only illustrations of the book that bear witness of a state supervision.

The weighing and storing of salt was always done under official control: this scholar-official with his characteristic long robe casts a sidelong glance to the lowering of a bamboo stalk into the bottom of a salt well.

The book provides detailed descriptions of the enormous structures erected over the salt wells, and of the complex processes involved in the extraction and boiling of the brine, using for it the gas coming from the well.

As is always the case with salt there is an official supervision of the whole process.

Some scholars suggest that the high towers erected for extracting salt from the salt wells, as well of the use of the gas that ensued had an influence on the modern structures for extracting oil.

The chapter on ceramics contains a detailed description of porcelain, from the selection of clays to the firing process.

That was something very sought after by Westerners.

But the Tiangong Kaiwu had a very restricted circulation under the Qing, probably for fear that it might unveil secrets of crafts under government monopoly.

**And so the Jesuits didn't have knowledge of this book for the whole 17th century: it was only in 1712 that a French Jesuit, François Xavier d'Entrecolles, learned the Chinese technique of manufacturing porcelain and wrote about it, partly reproducing the explanations contained in the Tiangong Kaiwu.**

These letters were included in the Empire of China of Du Halde that from 1735 onwards was translated to all European languages.

By then Europe had already discovered the secrets of Chinese porcelain, and the first European pieces began to be produced in 1710 in Meissen, albeit retaining a Chinese reminiscence.