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A Study of Western Influence on Chinese Building Tools in Chinese Treaty Ports in the Early 20th Century

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Abstract

This article looks at building tools and the significant evidence for the transition from craftsmanship and the mixing of Chinese and foreign working methods in the early 20th century. Although a number of Western scholars and Chinese researchers have studied traditional Chinese traditional tools, the transformation of tools from their traditional forms to modern ones in China has not been properly investigated. This article provides the first discussion of the introduction of Western tools and machinery and their effects on the building industry in Chinese Treaty Ports in the early 20th century. It highlights how the contemporary Western standards and expectations distorted Western perceptions of Chinese tools, and how European traders promoted Western hand tools and machines in China. It also shows how the Chinese fascination with Western machinery in turn blinded them from appreciating their traditional heritage in the eyes of some Westerners.

Keywords: building construction; tools; Western influence; apprenticeship; machines

1. Introduction

Building tools provide significant evidence for the move away from craftsmanship. A number of Western scholars – such as A. Emms (1937), R.P. Hommel (1937), J. Needham (1965), R.A. Salaman (1975), etc. – and Chinese researchers – such as Yang H. (1982), Yun X. (1986), Sun J. (1987), Li Z. (2001, 2004, 2009), Chen Z. (2004), Yao B. and Hsu M. (2012) have studied traditional Chinese tools, but the transformation from traditional to modern tools in China has not been properly investigated. Against this background, this study seeks to address this hugely important transition. It first examines the traditional tools that were in use before modern Western influences came into play, before looking at the Westernization of hand tools and the introduction of machinery to replace handworking methods.

The main sources of this study are: 1) archeological reports on Chinese ancient tools, and a survey carried out for this study on the 19th-century Chinese hand tools in the Science Museum, London (Blythe House); 2) contemporary text and illustrations about tools in early trade catalogues and products lists, newspapers,

journals and industrial reports; 3) and Chinese building construction textbooks and manuals published in the early 20th century.

2. Chinese Tools before Foreign Influence

Given the significance of timber in China, the history of tools for building construction is largely the history of tools for woodworking. According to Li's research (2009), woodworking tools in China slowly evolved from the Neolithic period, and had become stable after the 15th century. In general, native woodworking tools can be classified into four groups on the basis of their function. The tools for felling (Chinese: *fa mu*) were the felling axe, ancient adzes (*jing*), and saws (*ju*); conversion (*jiemu zhicai*) was carried out with wedges, wedging adzes, wedging chisels, ancient adzes, and frame saws; planing and smoothing (*pingmu*) relied on axe, adzes (*ben*), shaving knives (*xiao*), spears (*si* or *tuo*), flat chisels (*chong* or *chan*), drawing knives (*gua*), grinding stones (*long*), spokeshaves (*gunbao*), and planes (*bao*); and joint making (*zhisun*) and carving (*diao*) was achieved using chisels (*zao*), flat chisels, drills (*zuan*), and carving knives (*jjue*). (Fig.1.) Amongst all these tools, saws and planes have excited the most interest because of their surprisingly late emergence in China. Current research suggests that frame saws probably did not appear in China until about 500AD (Yun, 1986: 92). Based on the latest archaeological evidence, the oldest Chinese plane dates back to the 14th century (Kong, 2011). With the wider use of planes between the 15th and the 17th century, Chinese planing tools in woodworking gradually

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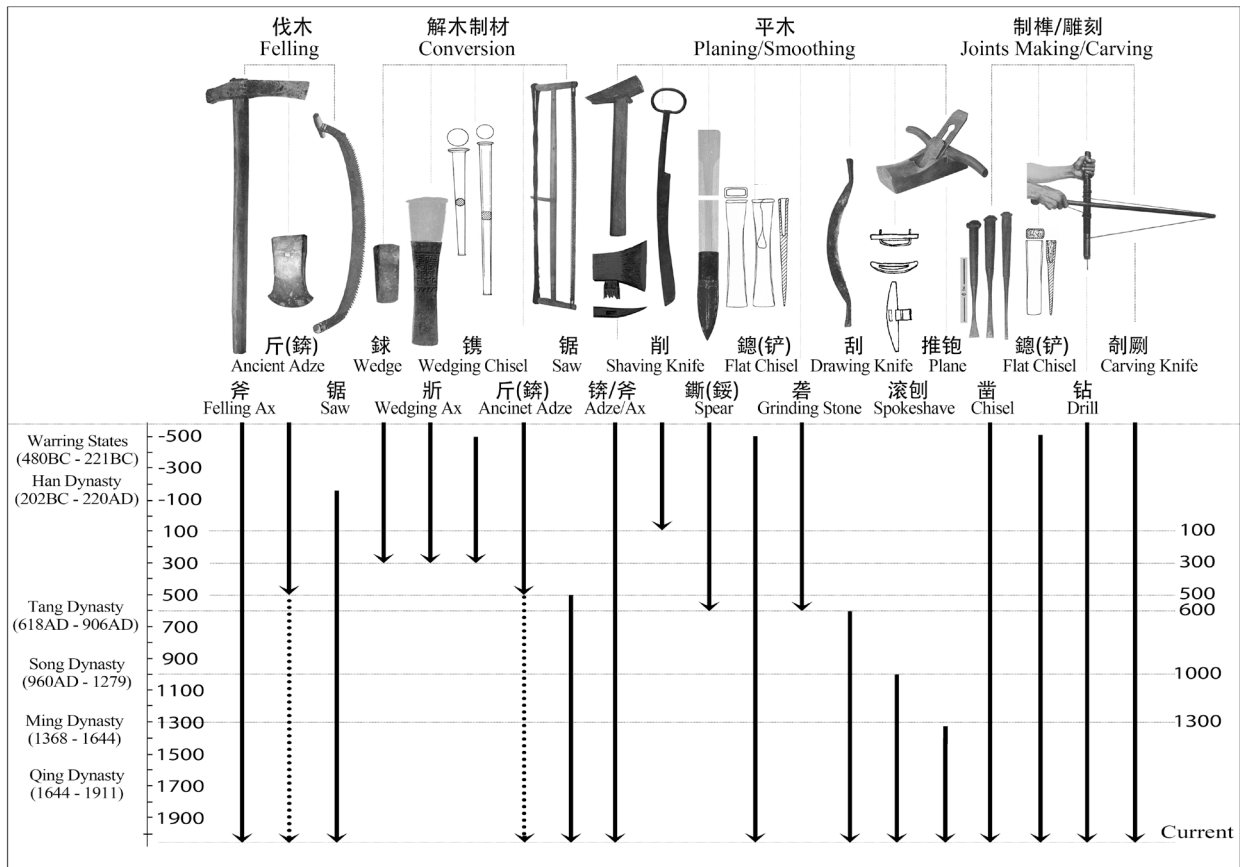


Fig.1. Historical Overview of Chinese Woodworking Tools. (This diagram is reproduced by the authors of this article, with illustrations of tools from Hommel, Emms, and others, with contents translated and modified from Li Zhen's diagram 2009, p.31)

shifted from being open-bladed tools that were difficult to use (adzes, axes, flat chisels, knives, spears) to tools that were simpler to control (shaves, planes).

Both the origins of and the subsequent cross-cultural transmission of Chinese tools remain mysterious. It is interesting to note that the so-called "traditional Chinese tools" in China (e.g., planes, frame saws, adzes, chalk lines and bow drills) were not only widely used across South Asia and the Middle East, but also in Europe. These tools and their counterparts elsewhere are all based on similar principles, handling methods, and purposes, thus there seems to have been a common understanding of building instruments, which nevertheless fostered a diverse range of building crafts and architecture (Pan, 2014: 123). This suggests that a comparative observation of the tools and crafts from around the world might lead to a better understanding of those specific to a given nation.

Just as the cross-cultural transmission of tools has not been fully explored, the same applies to relationships across trades (how tools transferred from one trade to another). In both Europe and China, early planes were found in cooperage and shipbuilding. In China, a special type of plane for smoothing the surface of bricks even emerged in the 1930s-40s (Wang, 1996: 202). These examples reveal the transferability of tools, which could enable new designs to be adopted across trades. Although etymology can be misleading

and should be used with caution, it can also sometimes give clues to possible origins. For example, the history of the Chinese "bao" (its original meanings were closer to "shave", used to refer to a type of horse shave and a Chinese scraper) evolved along diverging and converging pathways. There is a process of diverging from fuzzy differentiations of shaving tools (i.e., "bao") to an independent tool category (i.e., "plane") with its own characteristics. There is also a process of converging, probably attributed to the increasing Sino-Europe communication and the national circulation of native craftsmen during the Yuan dynasty (1271-1368) and the Ming dynasty (1368-1644). The direct outcome was tools that have similarities but also differences across different trades.

Regional features were one of the most important aspects of tools in China. Tools varied between North and South China, between open ports and inland areas, and between Han people and ethnic minorities. The regional differences of tools no doubt reflect the differences in traditional usage and in variations in raw materials and finished products used in different regions and climates. Hatchets and adzes provide an excellent example. While carpenters typically used hatchets around Shanghai for virtually everything from cutting, to rough planing, sharpening and also hammering (Fig.2.), in some other parts of China adzes were more common (Fig.3.).



Fig.2. A Woodcarving Artisan, Shanghai, [Beginning of the 20th Century]. (Source: Shanghai Municipal Archives: H1-25-3-64)

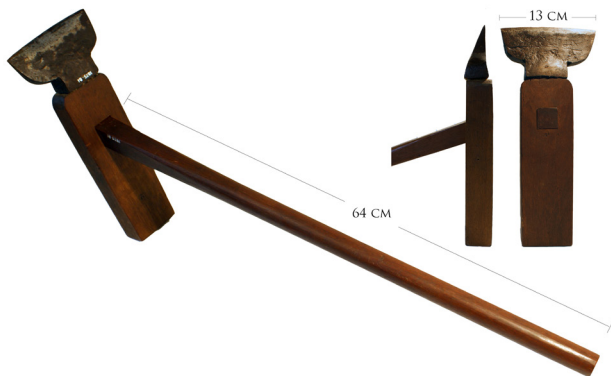


Fig.3. A Chinese Adze, Mid-19th Century. (Source: Science Museum, London, Object No. 1875-81)

Simplicity was an outstanding feature of Chinese tools, relying heavily on the artisans' wisdom and skill both in use and manufacture. The making of tools was a measure of an artisans' technical competence. Multifunctional tools were a Chinese tradition.

Chinese carpenters tended to use a more limited number of tools than the English carpenter and joiner, who generally had a large collection of tools for different purposes. Although they could not boast about their toolboxes, Chinese carpenters meanwhile were adept at producing new tools to suit particular projects. (Fig.4.)

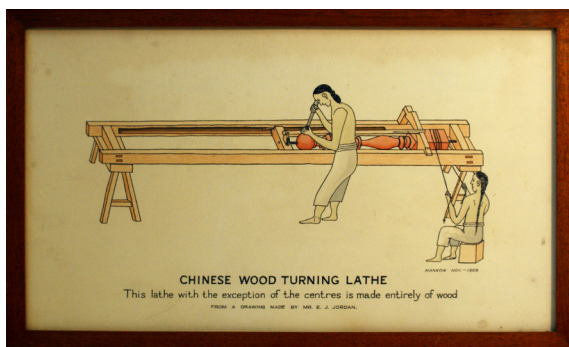


Fig.4. "Chinese Wood Turning Lathe" (Original Title), Hankou, Mid-19th Century, Drawing by Mr. E.J. Jordan (Source: Science Museum, London, Object No. 1939-343)

Chinese bricklayers' toolboxes contained even less than the carpentry ones. The mid-19th-century bricklayers' trowel (Fig.5.) from the Science Museum, London is similar to the square trowel, or *fangwadao*,

illustrated in the *Hegong Qiju Tushuo* (1836), although the latter did not have a wooden handle (Fig.8. Left). The mortar hod in Fig.7. was a typical Chinese wood bucket used widely across trades. Ashworth, an English architect in Hong Kong, 1851 description of plasterers' and painters' work clearly shows the Chinese pursuit of efficiency with such simple tools: "I was dumbfounded to see the plasterers treading on the heels of the bricklayers, and laying on the pricking-up coat as fast as the wall rose in height: being very thin, this plaster is not disturbed by the settling of the brickwork." (Fig.8. Right)



Fig.5. Bricklayers' Trowel, China, Mid-19th Century (Source: Science Museum, London, Object No. 1875-60)



Fig.6. Bricklayers' Pad, China, Mid-19th Century (Source: Science Museum, London, Object No. 1875-69)



Fig.7. Bricklayers' Mortar Hod, China, Mid-19th Century (Source: Science Museum, London, Object No. 1875-70)

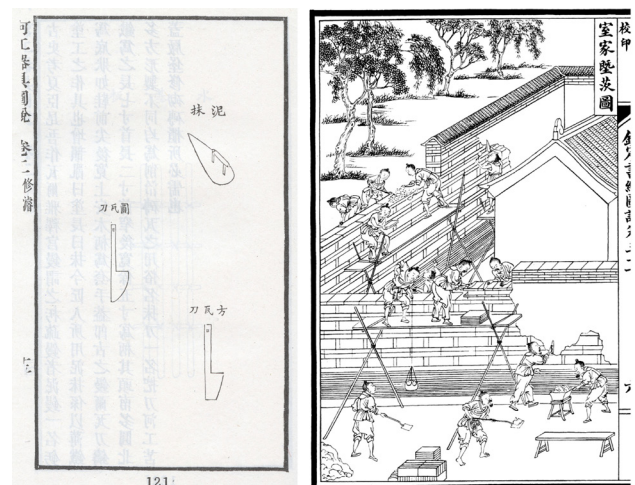


Fig.8. Left: Bricklayers' Trowel and Plasterers' Trowel, Illustrated in *Hegong Qiju Tushuo* (Source: Lin, 1836: 121) Right: Bricklayers and Plasterers at Work Illustrated in *Qingding Shujing Tushuo* (Source: Sun, 1905, vol. 31, p.6)

3. The Trade in Foreign Cutting Blades and Tools

Westerners saw a number of problems in traditional Chinese tools, despite their many merits. To Western perceptions, Chinese tools were general inefficient. The iron blade was regarded as most problematic. The quality of the blade was the core of Chinese carpenters' tools. A good illustration of this issue can be found in the well-preserved iron blades in the Science Museum, London, which feature a slightly uneven surface. Consistent with Emms (a Western engineer in Shanghai), these artifacts confirm that "the thickness of the blade would naturally vary not only in its length and occasionally also in its width" (1937: 9). This was the natural result of traditional Chinese blades being hammered to shape by hand. (Fig.9.)



Fig.9. A Chinese Gouge (Object No. 1875-54), Two Chinese Chisels (Object No. 1875-53), and Two Chinese Plane Irons (Object No. 1875-59), All Marked with the Name of The Blacksmith, Mid-19th Century (Source: Science Museum, London)

European traders claimed that Chinese hand-hammered iron blades were inferior in quality compared to their Western counterparts. It is not clear whether this was actually true, but there is no doubt that this claim was central to those seeking to promote export of cutting blades to China. *The Building News* in 1887 described an exhibition of Chinese carpenters' tools in Sheffield: "By direction of the late earl of Iddesleigh, 13 parcels containing samples of tools in common use by Chinese carpenters have been received by the Sheffield chamber of commerce for exhibition before the manufacturers and artisans of the town, with a view to stimulate trade with China. The British consul at Swatow, by whom the goods were forwarded, says he has always noticed in Chinese carpenter's tool-boxes at least one European plane-iron or chisel, in many instances worn down a third of their original length. This seems to him to indicate a preference for European steel, and that were tools made of such steel, obtainable at anything like the market rate for Chinese tools, a large trade might be the consequence, for the carpenter plays a very important part in Chinese house-building."

By the 20th century, Sheffield was leading the world trade in cutting blades. The trade in foreign cutting

blades and tools spread to Chinese Treaty Ports such as Shanghai. (Fig.10.) Emms (1937: 7, 12, 77) in his paper stated that Chinese carpenters in Shanghai first used foreign cutting irons around 1920, and that by the mid-1930s they had become "practically standard in Shanghai and other towns where these are obtainable". He stated that Chinese carpenters used them in their native planes.

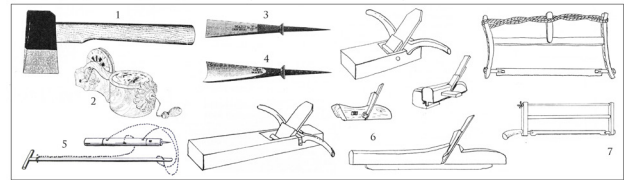


Fig.10. Chinese Woodworking Tools in Salaman's *Dictionary*, with Some Made by English Toolmakers for Export to China in the Late 19th Century. (Source: Salaman, *Dictionary of tools*, 1975. Engravings reproduced are mostly taken from 19th century trade catalogues and from the Sheffield Illustrated List of 1888; Other drawings from various authors.)

Keys:

1. Chinese axe: "wedge shaped with very flat cheeks." "Many English toolmakers make Axes for export, and some of these are occasionally found in English workshops." (Salaman, pp.52-53).
2. "Oriental line, used with ink." "A line and ochre box was part of a carpenter's tool kit in ancient Greece, and it is also frequently depicted in medieval manuscripts." (Salaman, pp.128-9).
3. Chinese chisel: "A small tanged or socketed chisel with a flared blade from 1 to 3 in. wide, made for export. Chinese chisels of native manufacture come mostly in sizes below 1 in." (Salaman, pp.133, 138).
4. Chinese gouge: "Made for export, this is a short out-cannel gouge, 1/4 - 2 in. wide, with a flared blade tapering back sharply from the cutting edge." (Salaman, pp.212-13).
5. A bow drill from China. "The bow drill as we know it was in use in Egypt about 2500 B.C. This remarkable invention (whose earliest form may have been an arrow rotated by a bowstring twisted around it) is widely distributed, and it was used in Europe for many drilling operations until supplemented by the brace in the Middle Ages. The pump drill, which may be a development of the bow drill, is also of ancient origin, but there is no evidence of its use before Roman times." (Salaman, pp.185-86).
6. Chinese plane: "Chinese planes (which may occasionally be found in British workshops) often have a central ridge running down the top surface of the stock. The cutting irons are sometimes secured in the stock in an archaic manner, like the Roman planes. Contrary to the general belief, Chinese joiners use a bench for their work and the planes are pushed away from the body." (Salaman, pp.311-12).
7. Chinese saw: "Many of the saws used in China and Far East are of the bow type and are similar to ours except that the blade is held in the slotted ends of wooden pins, which can be twisted to turn the blade. The teeth of their large two-man framed saws are often cut to point in opposite directions in each half of their length, thus giving equal work to both men on the cutting stroke." (Salaman, pp.411-12).

The outcome of Western initiatives was that planes in Shanghai and other open ports showed more foreign features: with more varied sizes and types for different purposes, sometimes adopting imported iron blades, cap irons and screws. An interesting example is the plane in Fig.11., in which the shape of the hole where the iron blade sits suggests that the tool was made with an imported iron blade refitted by the carpenter into a pit saw set. However, in general these planes remained

fundamentally Chinese in terms of the choice of wood, the design of handle shapes, and the ways of using them.

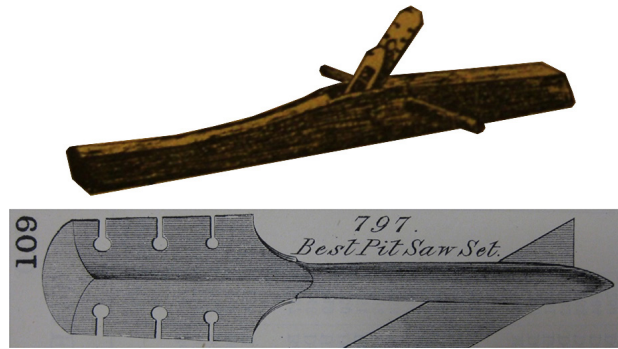


Fig.11. Top: A Chinese Bench Plane in Shanghai, Drawing by Emms, 1937 (Source: Emms, 1937: 8); Bottom: "Best Pit Saw Set" (Original Title), Illustrated in *The Illustrated Sheffield List*, 1871 (Source: Edward Brooks (Firm), *The illustrated Sheffield list*, 11th & 12th edn. Sheffield: Edward Brookes, 1871, p.109).

The Western perception of Chinese problems were inevitably colored by contemporary Western standards and expectations. For instance, the traditional Chinese way of putting together mortice and tenon joints relied on wedges or pins (mostly bamboo). Emms commented that Chinese nails were "square [in] section", "thick and heavy material", and thus "clumsy". He discovered that glue was not used to strengthen wood joints in making tools, and he attributed this phenomenon to the humidity in certain areas. Emms therefore suggested that Western-style screws would be the best solution. (Emms, 1937: 46-68) Indeed, contemporary artifacts illustrate the popular use of thumbscrews, set screws, etc. in fixing different parts of Chinese plough planes, wooden vices, Chinese wood sash cramps, moulding planes, gauges, and bevels, as a result of European influence.

It was both Western criticism and initiatives that brought changes to Chinese tools. The Western impact on tools varied, with some tools remaining unchanged, some mixed with foreign blades or decorations, and some being imported. Foreign influence, however, did not completely westernize the making and the use of tools in China. The essential characteristics of traditional Chinese tools seem to have been largely maintained until 1920.

4. Continuity of Chinese Craftsmanship Under Western Influence

As Emms pointed out, the extent of the change in Chinese tools was initially limited: Western tools really only began to appear in Shanghai in the 1920s; noticeably late when compared to the transformation of building types and styles. Behind the Western façades, Chinese craftsmen worked with their own familiar tools to try to produce the Western forms of building construction expected by Western architects. The way in which the Chinese craftsmen built an English house in 1845 in Hong Kong made a deep impression

in the English architect Edward Ashworth. He drew a sketch to depict how the Chinese worked in his project (Fig.12.) and he also recorded the details in his memoir: "I admired the patience of the masons, each perched upon a block, punching with iron hammer and chisel steadily through the long, long summer hours, snatching only a few moments for the simple refreshment of little else but rice and tea, and a few whiffs at a pipe, without stepping off their block." (Ashworth, 1851: 686)



Fig.12. Stone Masons Working for an English House, in "D'Aguilar Street, Victoria, Hong Kong, 1845" (Original Title), Drawing by Edward Ashworth (Source: Hong Kong Museum of Art)

Ashworth's memoir is full of evidence of Chinese craftsmen still maintaining the native styles of working, even under the supervision of Western architects. His memoir illustrates his anxiety at the inability to control the way the Chinese worked. When he noticed the limited traces of Western practices being used, he emphasized them with joy: "I was pleased to observe a proper English mason's level employed in place of the clumsy water-trough generally used by the Chinese." (Ashworth, 1851: 686) By the early 20th century the "proper English" level had become common in China, and Emms (1937: 57) reasoned that its popularity was probably due its ease of use and its accuracy and convenience, especially in windy weather.

From the early foreign-style buildings of the mid-19th century to the modern buildings built in the early 20th century, foreign constructors and foremen played a critical role in promoting the use of Western tools on the construction site. However, their attempts were not always successful. The field report (1919) of the Union Medical College Buildings in Beijing presents a mix of Western construction and Chinese modes of work: "The constructors soon gave up their attempts to introduce foreign tools, and have permitted the coolies to use their own handsaws, their own stone-cutting implements and to haul stone in their own manner. During the setting of the foundations, the visitor to the work could see laboring gangs at work in their trenches as the laboring gangs of old were used to work, not too swiftly nor with varying speed, but uniformly and to the rhythm of an ancient labourers' tune."

This type of mixing can be seen in a considerable number of examples in Chinese Treaty Ports and Markets throughout the early 20th century. Du Yangeng's Building Construction book *Yingzao Xue* (1935-37) provides insights into this problem. According to Du's text on

stonework, for instance, Chinese stonemasons used a type of planing axe, called "zaofu", which resembles a smaller version of the Chinese carpenters' axe with two sharp blades. The Chinese masons also used a type of pointed hammer (*langtou*) for taking off projections. It is obvious that Du referred to Mitchell's English text book on construction in writing his own account but Mitchell described how the "spall hammer" was used for rough squaring, the pick for taking off the projections, and "patent axe" for planing the surface. Mitchell's description of the working process is also different. Mitchell said that the axe in Britain should be "worked vertically downward upon the surface [...]". While he translated much of Mitchell's book word-for-word, *Yingzao Xue* consciously omitted these sections as being impractical. The Chinese sought to produce the Western details, but they would largely ignore British methods, preferring to achieve the same effect in their own familiar way.

The continuing use of traditional tools and processes was partly because of the low cost of Chinese labor and the shortage of capital to afford to buy scientific machines or equipment. The continuity of Chinese craftsmanship also partly stemmed from the Western appreciation of Chinese work.

The combination of the Western requirements and the Chinese way of working was a common phenomenon extending to industries associated with building construction. In his travels in the first decade of the 20th century, Shaw (1914) noticed a general absence of saw-mills in native timber trades. Many historical photos of "timber yards" taken across China between the late 19th century and the 1920s show Chinese workers sawing timber by hand. Emms (1937) noted that: "Whereas in Europe hand planing has practically given way to machine planing, in China, it is still supreme". A similar situation – manual work practices instead of mechanized ones – was present in stone quarrying and stonework.

5. Westernization of Tools and Machines for Building Construction

Thus far this article has shown the continuing use of traditional tools (with foreign components) and traditional working processes in the face of a rapidly changing building industry (Part 3, 4). This was however countered in the 1920s and the 1930s with a fascination with Western Technology. In the early 20th century, the nationalism in China focused itself on modernization, that is a thirst for Western-style efficiency and science. During WWI with the imported materials and machines being cut off, native companies in China had a great opportunity to grow in the absence of Western competitors (Fei, 2017: 45). The gradual rise of Chinese national industry fostered localization of the Chinese modern building industry. Therefore, a corresponding change in building tools was bound to happen eventually, particularly as the attitude at the time was noticeably lacking in any sentimental ties to tradition.

The awareness of conservation and tradition from Western perspectives was visible only in English articles of the time, perhaps because the British had been through their own industrial revolution and only belatedly realized what had been lost. Emms's stated in carrying out his survey of carpenters' and joiners' tools in the Yangtze Valley that "If some record is to be made it should be done quickly before the Western influence has permeated to every village in China" (Emms, 1937: 75). Arthur De C. Sowerby, editor of *The China Journal of Science & Art*, had a similar far-sighted point of view. He pointed out that the Chinese fascination with Western machinery and mass-production blinded the Chinese from an appreciation of their marvelous arts and crafts from the past (Sowerby, 1934: 1).

Foreign construction firms and foremen played an important role in introducing Western machines on the construction site, with Chinese workers generally welcoming the mechanization. Wilson (1930) stated that, before the arrival of the London contractors Messrs. Trollope & Colls in Shanghai (who erected the Hong Kong and Shanghai Bank, The Chartered Bank, the Yokohama Specie Bank, and the Glen Building), no cranes had been used in the construction of buildings, materials being lifted by block and tackle; but he pointed out that "Now every Chinese contractor worthy of the name employs cranes, concrete mixers, plaster mixers, concrete hoists, and other modern equipment." Modern technology had arrived.

The main driver behind this was, of course, the introduction of ferro-concrete frame construction. A significant portion of the work involved in erecting concrete buildings was the making of concrete, which was carried out by small local contractors. Western motor-driven concrete mixer machines, however, had been introduced to Shanghai in the 1910s. According to C. He (1997), when the Asia Building (1913-1916) was being erected in Shanghai, a type of cylindrical-shaped concrete mixer was used. C. He stated that a building worker called Longhu Lu quickly mastered the techniques of making concrete, and later became a concrete subcontractor. When the HSBC Building (1921-1923) was being built, the local concrete contractors in Shanghai had produced China's earliest concrete mixer, probably by imitation of Western models. (Fig.13.)

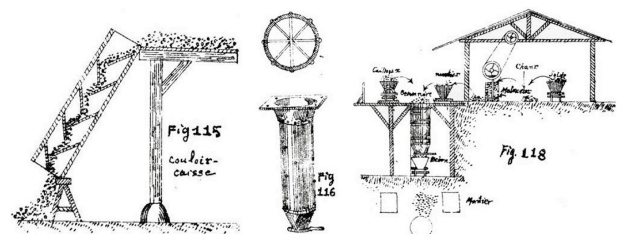


Fig.13. Early Concrete Mixers, 1919 (Source: Hua, *Jianzhu cailiao zuoyao*, 1919, p.16)

Apart from the building construction sites, machines were also widely employed behind the scenes – in the manufacturing or processing of building materials. A multitude of machines were introduced in the timber sawing, national brick making and cement manufacturing industries in China.

A nationalist passion for manufacturing these machines locally developed in the 1920s. The promotion of machines among the national bourgeoisie received active support from the Chinese government. The local production of machines or foreign tools based on Western models was possible in China because of the lack of a patent system. The Chinese governments deliberately delayed the introduction of the patent system, in order to encourage the Chinese imitation of Western machines (Wang, 1998: 6-7). Western ideas of solo rights had been introduced to China by Hong Rengan in his published political ideas *Zizheng Xinpian* in 1859, with the aim of promoting native crafts. American and European countries, on account of their technological advantages, had been urging the Chinese governments to protect their patent rights in China since 1902. Therefore, motivated by the aim of promoting national industries, both the Qing Government and the National Government actively used delaying tactics to postpone the introduction of patent legislation. As a consequence, the sensitive issues concerning foreign patent protection remained unsettled until 1944, when the nationalist government of the Republic of China issued its own first official "Patent Law". Although the patent system had played a significant role in the early development of machines in the West; the absence of the patent system in China encouraged local manufacture of machines across different industries. Western machines were purchased, copied and replicated, a practice that was to remain common in China well into the 21st century, even after the copyright laws had been in force for over 50 years.

The increasing use of machines in China inevitably led to a series of labor problems including unemployment, the mediation of which was primarily carried out by the trade unions. The local news entitled "The Appeal of Sawyers" in *Jianzhu Yuekan* 1935 shows that sawyers of Shanghai lost their jobs owing to the emergence of machines. This gives an important example of how the Trade Union of Contract helped to draw a line between the carpenters' and sawyers' work, so that carpenters had to stop doing the portion of sawyers' work. Incidentally, this piece lists the names and home addresses of 79 sawyers of Shanghai, probably the last trained sawyers in the city before the craft was entirely replaced by machines.

The change of tools and building methods went hand in hand with a transformation of the technical education system in China in the early 20th century. In terms of general education, some renowned Chinese contractors opened primary schools for the children of craftsmen. Moreover, Western-style technical

colleges were established in larger towns and cities, as exemplified by the Henry Lester Institute of Technical Education in Shanghai. By the end of the 1930s, knowledge of Western machinery and methods had become an important part of the teaching of Building Construction in Chinese Treaty Ports. (Figs.14.-15.) Chinese translations of foreign textbooks were commonly used in these schools.



Fig.14. Building Construction Laboratory in the Henry Lester Institute of Technical Education in Shanghai, 1940 (Source: Ly, "New and old education in China", 1940, pp.174-182)

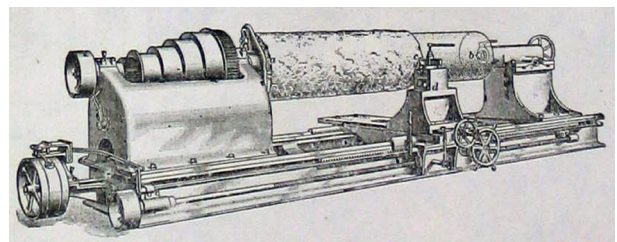


Fig.15. Stone-Turning Machine, Illustrated in Yangeng Du's Building Construction Book *Yingzao Xue*, 1936 (Source: Du, "Yingzao Xue (Chap. 3, Sec. 1. Masonry)", *Jianzhu Yuekan* 6, 1936, pp.29-31)

6. Conclusion

This article has traced the shift of tools from hand tools with regional features in the 19th century, to the increasing use of Western-inspired but Chinese-manufactured machinery in the 1930s. The 1920s arguably signifies the turning point of the westernization of Chinese building tools.

Before the 1920s: Chinese tools remained in use for a remarkably long time while the rest of the industry changed radically in the early 20th century. While the poor quality of native hand-hammered iron blades inevitably led to the extensive adoption of foreign cutting irons in native tools starting from Chinese Treaty Ports, the essential characteristics of Chinese carpenters' and joiners' tools remained unchanged until 1920. This article has also shown that it was possible for Chinese workers to work on the same construction details and effects as the Western Building Construction books, but realize them with tools and processes of their own. The transformation

of tools could and did lag behind the visual imitation of Western façades and the revolution in materials and building techniques for decades.

In the 1930s: despite the general continuous use of Chinese tools by craftsmen, the fascination with machines in the national bourgeoisie, governments, educators, and native workers was conspicuous. The Chinese governments had been deliberately delaying the construction of the patent system, in order to encourage the Chinese imitation of Western machines in a blatant attempt to catch up with and exceed perceived Western technological dominance. The result was a nationalist passion for making machines starting in the 1920s, with in the 1930s Western-style tools and machines becoming an important part of the teaching of Building Construction in Chinese Treaty Ports.

Note

It is important to note that the modernization of building tools was asynchronous across crafts and unbalanced across regions. Therefore, the reported degree of mechanization in the Chinese "modern" building industry in the 1930s should be treated with caution.

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