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When overseas education meets a changing local context: the role of Tokyo Higher Technical School in the industrial modernisation of China in the early twentieth century

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ABSTRACT

It is a wise choice for a backward country to explore overseas education bases to find the training for urgently needed talents. In 1900, the Qing government began actively sending students to study advanced technology in Japan. From that time, Tokyo Higher Technical School (THTS) became an indispensable overseas base for Chinese students studying abroad. Although the educational resources of THTS were not superior to those of the imperial universities, returning THTS graduates played a greater role in the industrial modernisation of China than the graduates from imperial universities. This article shows that the role of importers of technology is not only determined by the technology they have acquired, but also highly influenced by a variety of factors, such as opportunity and social demand, presenting a complex and changeable pattern in different contexts. For developing countries, the 'appropriateness' plays a more important role than the 'proaressiveness' of the imported technology.

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Introduction

In 1853, when the black ships arrived at Uraga Harbor in the Kanagawa Prefecture of Japan under the command of United States Commodore Matthew Perry,¹ the closed-door policy of Japan came to an end. Two years later, the famous educator Fukuzawa Yukichi promoted the 'Datsu-A Ron', the thesis that Japan should 'leave Asia' and 'join Europe'. Here, 'leave' and 'join' do not refer to geographical position, but to the study of the advanced knowledge and policy systems of Europe to bring Japan 'spiritually' closer to Europe.²

To help Japan overcome its backwardness and quickly catch up with the West, the Meiji government initiated the Meiji Restoration in 1868, which marked the emergence of Japan as a modernising nation. To meet the needs of Japan's developing industry, in 1881 the Meiji government founded the Tokyo Vocational School, later known as the

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¹/Perry Ceremony Today: Japanese and U. S. Officials to Mark 100th Anniversary', New York Times, July 8, 1953.

²Shi Xiaojun, Zhongri liangguo xianghu renshi de biangian [The change of mutual understanding between China and Japan] (Taipei: Commercial Press, 1999), 243–5.

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Tokyo Higher Technical School (THTS),³ to produce young craftsmen and engineers. From the early 1900s this school, with its well-developed industrial education curriculum, attracted the attention of other Asian countries, such as China, Korea, India, the Philippines, Thailand and Burma, which were even less developed than Japan (see Figure 1).

After its official renaming as Tokyo Higher Technical School in 1901, THTS became an overseas education base for Chinese students who wished to study advanced technical subjects abroad. Due to the enormous disparity between the numbers of potential students from China and those from other countries, there were considerably more Chinese students at THTS than from anywhere else. During the 1910s, there were about 40 students from China every year at the THTS, while there were no more than five students from other countries.⁴ Up to 1928, there were a total of 604 Chinese graduates, while only 65 came from other foreign countries. Due to the small number of graduates from other countries, neither the THTS nor the Koa-in made a record of their occupations after they returned home.

This disparity in numbers was also closely related to Japan's diplomatic policies towards other Asian countries. The Japanese government believed that the fates of China and Japan were inextricably linked, therefore it put forward the 'Shi'na hozen ron' (Shi'na Protection Theory) to advocate the establishment of the Japan–Qing government league, for cooperation in non-military fields. The Japanese claimed the mantle of 'Asianism' and set up a barrier in China to prevent western powers from offending Japan. The industrial education of Chinese students at THTS was part of the Japanese colonial strategy towards China, helping China to cultivate its future technicians.



Figure 1. Main building of THTS, 1903.

³Tokyo Higher Technical School was originally named Tokyo Vocational School in 1881, later renamed Tokyo Technical School in 1890 and then Tokyo Higher Technical School in 1901. The current name, Tokyo Institute of Technology, was adopted in 1929. It is now a top-tier institution and also the largest university dedicated to science and technology in Japan. See https://www.titech.ac.jp/about/overview/history.html (accessed October 3, 2018).

⁴See Tokyo koto kogyo gakko ichi-ran, 1911–12, 1914–15, 1917–18, 1920–21, 1924–25 and 1928–29 [A general survey of Tokyo Higher Technical School, 1911–12, 1914–15, 1917–18, 1920–21, 1924–25 and 1928–29]. Tokyo koto kogyo gakko ichi-ran was the annual report published by THTS. According to its statistics, there were a total of 604 Chinese graduates up to 1928; however, only 65 graduates came from other foreign countries.

Japan took a very different stance with other countries, however. Taking Korea as an example, Japan's intention was to colonise it and implement a policy of obscuration. With such a political strategy in place, Japan was, of course, not very motivated to help Korea by training its skilled workforce. The THTS accepted six students from Korea in 1896, but thereafter stopped. Instead, the Japanese established the Keijou Imperial University (the current Seoul National University) in the capital of Korea in 1924, and it only accepted Japanese nationals as students; Koreans were not allowed to enrol.

By the 1930s, more than 800 Chinese students had studied at THTS, exceeding the number enrolled at other schools in Japan, as well as those who studied engineering at a US or European university during that period.⁵ At the same time, Chinese students also made up 90% of all the overseas students who studied at THTS.⁶ After completing their studies at THTS, these Chinese students returned home and contributed to Chinese industrial modernisation. This pattern of study and return continued until 1937 when the Second Sino–Japanese War broke out.

Records relating to the activities of the Chinese students' enrolment at THTS can be found in the *Sixty-year History of Tokyo Institute of Technology*⁷ as well as the *Onehundred-year History of Tokyo Institute of Technology*.⁸ These general historical studies highlight the establishment of a specific educational system for foreign students. However, educational outcomes, especially those related to the activities of foreign graduates once they were back in their homeland, are not mentioned. There have also been studies focusing on the history of the reasons why modern Chinese studied abroad, in a historical evaluation of Chinese students' study in Japan, as well as comparative studies of the academic work of Chinese students in Japan, the United States and Europe, in the context of contemporary politics, law and education.⁹ However, little research has examined the activities of Chinese students after they returned to their homeland, from a Science, Technology and Society perspective.

Previous research has examined the main features of the wave of Chinese students studying in Japan at the beginning of the twentieth century. Most of this scholarship has contributed to the understanding of Sino–Japanese interaction in the Meiji period by taking as its medium Chinese students who had studied in Japan. From the perspective of social change, the research raises questions about how these students acquired knowledge of advanced institutions, such as political institutions, economic institutions, cultural institutions and educational institutions, when they were studying in Japan, and subsequently how they introduced this knowledge to China, thereby

⁵See Koa-in [Academy for Revitalization of Asia], Nihon ryugaku chukka minkoku jinmei-cho [Investigation of the students from the Republic of China who studied in Japan], Survey Data No. 2, October 1940. According to this report, the number of THTS graduates before 1937 was nearly 800. However, this statistic did not include graduates from Manchuria. Had it done so, the total number of THTS graduates would definitely exceed 800. Correspondingly, the total number of graduates who studied at imperial universities would be more than 300 and the total number of graduates who studied at any other technical school in Japan would be more than 600.

⁶Tokyo koto kogyo gakko ichi-ran, 1927–28.

⁷See Tokyo Institute of Technology, *Tokyo kogyo daigaku rokujunenshi* [Sixty-year history of Tokyo Institute of Technology] (Tokyo: Tokyo Institute of Technology, 1940).

⁸See Tokyo Institute of Technology, ed., *Tokyo kogyo daigaku hyakunenshi (tsushi)* [One hundred-year history of Tokyo Institute of Technology: a general history] (Tokyo: Tokyo Institute of Technology, 1985).

⁹See, for example, Sanetou Keishuu, Chugokujin ryugaku nipponshi [History of study in Japan for Chinese students] (Tokyo: Kurosio Publishers, 1981), 1–5; Abe Hiroshi, Chugoku no kindai kyoiku to meiji nihon [Modern education in China and Meiji Japan] (Tokyo: Ryuukei, 2002), 223; and Shu Xincheng, Jindai zhongguo liuxueshi [History of studying abroad in modern China] (Shanghai: Shanghai Culture Press, 1989), 7–27.

exercising great influence on the development of the economy, politics and ideology in modern China. Educational historians have also researched specific figures like Lu Xun, Qiu Jin, Chen Duxiu and Cai Yuanpei, who later became great revolutionaries and thinkers after returning to their homeland, playing key roles in the Revolution of 1911, the New Culture Movement, and the subsequent May Fourth Movement in China at that time.¹⁰

Furthermore, there are some scholars who take Chinese students as their research objects and focus on the process of their studying in Japan. For instance, they investigate the reasons why Chinese students stayed abroad, how they studied and lived their lives in Japan, and what knowledge they took from modern Japan.¹¹ Generally speaking, they discuss the 'process' of the students' studies in Japan, with little mention of their activities and contributions after their return.

This, however, ignores an important aspect; that is, the specific group of the Chinese students who studied in technical schools in Japan. After returning to their homeland, they made a great contribution to the technological and industrial development in China during that time. They were the people who helped most with promoting industrial modernisation, which was an indispensable part of the process of the general modernisation of China. However, with only a few scholars conducting related research – Elman, for example, has discussed Chinese students' achievements in translating and introducing Japanese science books to China¹² – it is still a relatively unexplored area. There is still a lack of macro-level analysis in the review of the history of these returning students who learnt about advanced foreign technology in Japan. We also need to figure out what roles the technical schools in Japan, represented by THTS, played in the development of China's industrial modernisation. This is an indispensable and meaningful topic in both modern East Asian history and the history of education research.

This paper examines the activities of the Chinese students who went back to China after completing their studies at THTS and determines the role that THTS played in the process of industrial modernisation in China from the early twentieth century until the outbreak of the Second Sino–Japanese War in 1937. It attempts to address the following questions. Why did so many Chinese students attend this school at that time? What did the graduates do after they returned home? And, finally, what were the merits of THTS compared with other schools, such as the University of Tokyo? This paper investigates the overall background of the rising trend in Chinese enrolment at THTS against the specific historical background, then analyses the activities of the graduates after they returned home, dividing this into different time periods, and concludes with a discussion of the role that THTS played in China's industrial modernisation.

¹⁰See Paula S. Harrell, Asia for the Asians: China in the Lives of Five Meiji Japanese (Portland: Merwin Asia, 2012), 13; Ruth Hayhoe, China's Universities, 1895–1995: A Century of Cultural Conflict (London: Routledge, 1996), 29–72; and Abe Hiroshi, 'Borrowing from Japan: China's First Modern Educational System', in China's Education and the Industrialised World: Studies in Cultural Transfer, ed. Ruth Hayhoe and Marianne Bastid (London: Routledge, 1987), 57–80.

¹¹See Sanetou, Chugokujin ryugaku nipponshi, 29-41; Huang Fuqing, 'Qingmo liuri xuesheng' [Chinese students in Japan at the end of the Qing dynasty], Journal of Institute of Modern History Academia Sinica no. 34 (1975); and Shimizu Minoru, 'Chugokujin ryugakusei wa nipponteki kindai [Chinese students in Japan and modern Japan]', Japan in Asia: Bulletin of the Research Institute of Bukkyo University 1 (1995): 119–38.

¹²Benjamin A. Elman, A Cultural History of Modern Science in China (Cambridge, MA: Harvard University Press, 2006).

Beginning of the admission of Chinese students to THTS

The First Opium War (1840-1842) marked a transformation in China from a feudal to a semicolonial and semi-feudal society. Within this context, the Qing government launched the Self-Strengthening Movement, from 1860 to 1890, under the slogans 'seeking for strength' and 'seeking for wealth', the purpose of which was to refortify national strength and help resist foreign aggression.¹³ This represents the first large-scale attempt by the ruling class at modernisation, along with an endeavour to learn western science and technology.¹⁴ The Qing government adopted the policy of Zhong xue wei ti, xixue wei yong (Chinese classics learning as the fundamental structure; western learning for practical use) in the hopes of continuing its feudal rule while at the same time using advanced science and technology from abroad. It introduced advanced western military equipment to China, developed machine production for the manufacture of guns, cannons and warships, and strengthened both naval and military forces.¹⁵ However, in 1894–1895, the Peiyang Fleet, which was established during the Self-Strengthening Movement, and was deemed the most powerful navy ever to be developed during the Oing Dynasty, was totally destroyed by the Rengou kantai (the Grand Fleet) from Japan. This disastrous defeat marked the failure of the Self-Strengthening Movement, and China's defeat in the First Sino-Japanese War.¹⁶

In light of this, Chinese politicians such as Kang Youwei (1858–1927) and Zhang Zhidong (1837–1909) concluded that the underlying reasons for the failure of the Self-Strengthening Movement were not only the lack of advanced weapons, but also the closed and lagging political system of the Qing government. They advocated taking a cue from the modernising experience of Meiji Japan,¹⁷ because, from a synchronistic perspective, compared with the failure of the Self-Strengthening Movement in China, Japan had achieved extremely positive results from learning advanced technology from the West. The reforms in the Japanese educational system during the Meiji Restoration of the 1860s also helped to ensure that there was training in the new disciplines to help meet the country's practical demands. Kang Youwei commented in the preface to his book *Riben Mingzhi Bianzheng Kao* (*Study on the Meiji Revolution in Japan*) that 'if the broad masses of the Chinese people would learn from Japan, the Qing Dynasty would be [a] powerful state within ten years'. In 1896, the Qing government sent the first batch of 13 students to study in Japan.¹⁸

In 1901, after the Boxer Rebellion, the Qing government implemented the Xinzheng Reform (New Policies Reform), a series of systematic reforms in the

¹³Barton C. Hacker, The Weapons of the West: Military Technology and Modernization in 19th-Century China and Japan', *Technology & Culture* 18, no. 1 (1977): 43–55.

¹⁴Du Shiran et al., *Zhongguo kexue jishu shigao* [Historical manuscript of China's science and technology] (Beijing: Science Press, 1985), 243.

¹⁵Benjamin A. Elman, 'Naval Warfare and the Refraction of China's Self-Strengthening Reforms into Scientific and Technological Failure, 1865–1895', *Modern Asian Studies* 38, no. 2 (2004): 283–326.

¹⁶Stephen Ř. Halsey, 'Sovereignty, Self-strengthening, and Steamships in Late Imperial China', *Journal of Asian History* 48, no. 1 (2014): 81–111.

¹⁷Kang Youwei, Jincheng riben bianzhengkao [Preface of 'Submitting the investigation on the revolution in Japan'] (Beijing: China Renmin University Press, 2011), appendix; Li Renkai and Zhong Kangmo, Zhang zhidong yu jindai zhongguo [Zhang Zhidong and modern China] (Baoding: Hebei University Press, 1999), 122–5. Chen Xuexun and Tian Zhengping, eds., Zhongguo jindai jiaoyshi ziliao huibian (liuxue jiaoyu) [Compilation of Chinese modern educational history: overseas education] (Shanghai: Shanghai Education Press, 1991), 320.

¹⁸Li Xisuo, Jindai zhongguo de liuxuesheng [Students studying abroad in modern China] (Beijing: People's Publishing House, 1987), 118.

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military, bureaucracy, law, commerce and education. To bring about the smooth advance of this institution-wide transformation, the Qing government urgently required a large, well-educated talent pool to carry out the operations of the Xinzheng Reform, and began actively to encourage the sending of more students to Japan to learn about the experience of Japan's advancements during the Meiji Restoration. At the same time, due to the abolition of the imperial examination system in 1905, young people in China were more willing to study abroad, especially in Japan, as a new way of furthering their knowledge. There were many advantages to studying in Japan, such as geographical closeness, relatively lower costs, a similar language and an educational system requiring less time. On 2 August 1898, Emperor Guangxu announced in an imperial edict that 'It is better to study in Japan than in the Western world. Japan is closer, cheaper and has similar writing, which is easy for us to understand. Moreover, all the important Western masterpieces have been translated by the Japanese.'¹⁹ In 1906, the total number of Chinese studying in Japan peaked at more than 10,000.²⁰

Japan itself also played an important role in encouraging Chinese students to come there and study. After the First Sino-Japanese War, the western powers increased their aggression and partitioned China. As an Asian country whose national power was still limited, and that was backward compared with Europe, Japan felt a sense of crisis as well. Using a new colonialist strategy, stating that 'China's rise or fall is closely related to the survival of Japan', Japanese hardliners proposed the so-called Shi'na hozen ron (Shi'na protection theory).²¹ An important feature of this was that the Japanese government should actively recruit Chinese students to study in Japan. In 1898, Yano Bumi (1851-1931), who was the Japanese ambassador to China at that time, put forward a student-aid proposal to the Chinese government, on behalf of the Japanese government, to attract more Chinese students to Japan. Konoe Atsumaro (1863–1904), the speaker of Japan's upper legislative body, the House of Peers, also presented this proposal to Chinese senior officials, such as Zhang Zhidong (mentioned above), Zhang Baixi, Liu Kunyi and Yuan Shikai, when he visited China for the first time in 1899. Liberal Arts Professor Ueda Kazutoshi of Tokyo Imperial University published a commentary in the Taivo magazine proposing that the education of Chinese students was not the duty of other educators, but rather the responsibility of the Japanese government.²² Thus, from the end of the nineteenth to the beginning of the twentieth

¹⁹Zhu Youhuan, ed., Zhongguo jindai xuezhi shiliao [Historical data of modern Chinese school system], vol. 2 (Shanghai: East China Normal University Press, 1989), 17.

²⁰Shu, Jindai zhongguo liuxueshi, 9; Huang Fuqing, 'Kiyosue ni okeru tome-bi gakusei haken seisaku no seiritsu to sono tenkai [Establishment and development of the policy of sending students to Japan at the end of Qing Dynasty]', Journal of Historiography 81, no. 7 (1972): 81–7; Haruomi Koji, 'Kiyosue Tome-bi kyokusei-ki no keisei to sono ronri kozo: seitaigo shinsei no shido rinen to shina-hozen-ron teki taio o megutte [Formation of the peak period of studying in Japan and its theory structure: response of the guiding ideology for the revolution presented by Empress Ci Xi and the theory of China-preservation]', Bulletin of the National Institute of Education 94 (1978): 39–59.

²¹Shimizu, 'Chugokujin ryugakusei wa nipponteki kindai', 119–38. The Shi'na Protection Theory was proposed by a group of 'foreign bashers' in Japan at a time when the western powers were demonstrating aggression against China after the first Sino–Japanese War. Most of the 'foreign bashers' were Ronin and some were also politicians, such as Konoe Atsumaro and Kuga Katsunan (1857–1907), as well as Ookuma Shigenobu (1838–1922). The Shi'na Protection theory advocated that Japan should support China's independence superficially, but its ultimate purpose was to help Japan eventually dominate China through the promotion of economic expansion.

²²Ueda Kazutoshi, 'Kiyokuni ryugakusei ni tsukite' [On the students from China], *Taiyo* 4, no. 17 (1898): 10–15.

century, the Japanese government took positive steps to improve its educational facilities and curriculum to meet the potential needs of students from China.²³

One of the first Japanese educational institutions to accept foreign students, THTS admitted its first group of students from abroad in 1896: six students from Korea. The school prepared 'special courses' to meet their needs, offering individual tuition. In 1900, the Japanese government formally announced the 'Special Enrolment Regulations for Foreign Students who enrol in affiliated schools of the Ministry of Education'. As a response to these new regulations, THTS cancelled the temporary 'special courses', replacing them with a system of select courses for foreign students, in which the students were not required to complete all the courses that the school required for Japanese students, but instead just the select courses that they wished to pursue. The next year, when the Tokyo Technical School was officially renamed THTS, the first group of Chinese students arrived.²⁴

However, between 1904 and 1908, only 21 Chinese students were trained through the select courses system and graduated from this particular school, although the number of students studying in Japan peaked in the thousands during that period.²⁵ There were two reasons for the small number of students completing the programme. First, China lacked a modern educational system, and many Chinese students who went to Japan were unable to meet the admissions criteria of the regular schools, and second, it was difficult for regular educational institutions to accommodate the growing number of fresh students wishing to pursue further studies. Most students, therefore, could only be enrolled in specially established preparatory schools for Chinese students.

Most Chinese students who did study in Japan chose study programmes in political science, law and education, to help the Chinese government cope with its need for political reform. They would return after one or two years, having completed these crash courses. Few students wished to take courses in engineering at higher-level schools such as THTS.²⁶

China was poor because it had not yet industrialised; the solution was to develop modern education in the sciences.²⁷ The graduates returning from Japan helped build a basic modern educational system in China. Along with the continuing reforms, the Chinese government gradually began pursuing an innovative and high-quality educational system, and the students who graduated from the crash courses were no longer able to provide what their country needed. Furthermore, as mentioned earlier, about 80% of overseas students in Japan concentrated on the areas of political science, law and education, with the result that a shortage of high-level engineering talent suddenly became obvious.

In 1906, in an attempt to remedy its lack of domestic educational resources, the Chinese government sent a delegation, made up of education directors from the

²³Shimizu, 'Chugokujin ryugakusei wa nipponteki kindai', 119–38; Abe, 'Borrowing from Japan: China's First Modern Educational System', 58–62.

²⁴Koa-in, *Nihon ryugaku chukka minkoku jinmei-cho*, Survey Data No. 2, October 1940.

²⁵'Senka shuryo-sha' [A list of foreign graduates registered in selective courses], in A General Survey of Tokyo Higher Technical School 1927–1928, 174–88.

²⁶Lin Zixun, *Zhongguo liuxue jiaoyushi* [History of Chinese students studying abroad] (Taipei: Huagang Publication Co., 1976), 37.

²⁷Suzanne Pepper, *Radicalism and Education Reform in 20th-Century China: The Search for an Ideal Development Model* (Cambridge: Cambridge University Press, 1996), 60.



Figure 2. President of THTS, Seiichi Teshima (1850–1918).

provinces, to visit educational institutions in Japan. When the delegates toured THTS, all of them were deeply impressed with the whole educational ethos, and the philosophy relating to industrial education²⁸ presented by Teshima Seiichi, the president of THTS (1850–1918) (see Figure 2).²⁹ One member of the delegation, Chen Botao (1855–1930), from Nanjing City, visited Teshima several times, and requested permission to send a certain number of local students each year from the Three Jiang Area (Jiangsu Province, Jiangxi Province and Zhejiang Province), which was under his jurisdiction, to pursue advanced studies at THTS.³⁰ Teshima accepted his request. At that time, the Three Jiang Area, located on the south-east coast of China, had a rapidly developing modern industry, so industrial talent was urgently required.

After the delegation was sent to Japan, the Chinese government decided to seek a basis for advanced education in Japan on a large scale to cultivate high-level talent that could meet China's growing needs. In 1907 China and Japan signed the

²⁸See Teishima Seiichi, 'kaiko 50 nen' [Reviewing the past 50 years], in *Teshima Seiichi sensei iko* [Mr. Teshima Seiichi's posthumous manuscripts], ed. Dainippon Industry Association (Tokyo: Dainippon Industry Association, 1940), 3–56.

²⁹Ibid. Teshima Seiichi was not only enthusiastic about the industrial education provided in Japan, but also willing to contribute to this kind of education in China and other Asian countries. Teshima believed that the common prosperity of Asian countries would be favourable to Japan. After his visit to the Philadelphia International Exhibition 1876 and the Exposition Universelle de Paris 1878, Teshima realised the importance of industrial education and therefore established Tokyo Vocational School in collaboration with Kuki Ryuichi and Hamao Arata in 1881.

³⁰Tokyo koto kogyo gakko ichi-ran, 1927–28, 208–23.

Special Agreement for the Five Schools, to maximise the use of Japan's superior educational resources and facilities³¹ for training the talented individuals the Chinese government urgently required in its educational reforms.³² According to the agreement, the five Japanese state-run high schools, starting in 1908, would admit 165 Chinese students each year for the next 15 years, with Tokyo First Higher School admitting 65 students, Tokyo Higher Normal School 25, THTS 40, Yamaguchi Higher Commercial School 25 and Chiba Medical School 10. The Chinese government would cover the educational expenses.

Once the contract was signed, THTS set up a special training system for Chinese students, where students who had finished a preparatory year of study could be promoted to undergraduate level and continue their education.³³ Those students who had studied preparatory lessons in mathematics, physics, Japanese language, English language, painting and gymnastics, and had passed the final exam, were able to enter the bachelor student phase.³⁴ From then on, for a long period of time, THTS admitted dozens of Chinese students every year, and became an important overseas education base for the Chinese government, training a large talent pool with the aim of developing modern industry and technology in China.

Statistical features and background factors 1904–1924

Along with the New Policies Reform already mentioned, after the Boxer Rebellion the Qing government drew up plans to abolish the Imperial Civil Service Examinations. To satisfy China's urgent demand for technical knowledge, and to strengthen its domestic power and its stance towards foreign powers, the Qing government began its reform of the educational system.³⁵ After the new *Gui-Mao School System*³⁶ was promulgated by the Qing government in 1904 as an integral part of modern education, industrial education was officially included in the educational system, and the establishment of mechanised industry and the training of technicians became an urgent need.³⁷ This was also the year when the first group of Chinese students graduated from THTS and returned home. In the specific social context in which the Chinese government was actively promoting industrial modernisation, how would the government allocate these graduates, and what occupational fields would they enter after returning to China? For the

³¹Abe, Chugoku no kindai kyoiku to meiji nihon, 124–30.

³²Haruomi, Kiyosue Tome-bi kyokusei-ki no keisei to sono ronri kozo: seitaigo shinsei no shido rinen to shina-hozen-ron teki taio o megutte, 22, 39–59.

³³Tokyo koto kogyo gakko ichi-ran, 1927–28, 208-23.

³⁴Tokyo Institute of Technology, *Tokyo kogyo daigaku hyakunenshi tsushi* [Hundred years of Tokyo Institute of Technology: a general history] (Tokyo: Tokyo Daigaku Hyakunenshi Henshu linkai, 1981), 221.

³⁵Franke Wolfgang, The Reform and Abolition of the Traditional Chinese Examination System (Cambridge, MA: Harvard University Press, 1968), 70–71.

³⁶The Gui-mao School System was the first official and formal schooling system in the modern history of China; it marked the establishment of the modern education system. Based on the levels of primary, secondary and higher education, it made clear the school education curriculum, education administration and school management, which had a great influence on Chinese modern education. See: Liu Zhen, *Jiaoyu xingzheng* [Education administration] [Taipei: Zhengzhong Press, 1950), 93.

³⁷Although the Qing government set up some technical schools specialising in shipbuilding, machine building and telegraphy as part of the movement towards Self-Strengthening, which was launched in the late nineteenth century, there was still no education system officially established in China until 1904.



Figure 3. THTS graduates by occupation.

graduates returning during this period, such questions had even more weight (see Figure 3). 38

As shown in Figure 3, the number of Chinese graduates rose constantly between 1904 and 1922, with sharp growth in 1910 and 1922. The increase in 1910 was due to the impact of the Special Agreement for the Five Schools, mentioned above, while that of 1922 can be attributed to the influence of the expansion of mechanised industry in China following the First World War. This figure also shows that the number of THTS graduates gradually began to decrease after 1922. This was partly due to the establishment of Chinese universities and the rapid development of the educational system in the early 1920s, which led directly to fewer students travelling overseas to study; it was also because of the termination of the Special Agreement for the Five Schools in 1922, meaning Chinese students in Japan were no longer assigned to just a few particular educational institutions but could enter others. Figure 3 also shows the occupations of Chinese graduates from THTS classified into three main categories: bureaucrat, teacher and engineer/business operator. Most of these graduates worked for the government during the period

³⁸Sources of Figures 3, 4, 5, 6 and 7 are as follows: Koa-in Nihon ryugaku chukka minkoku jinmei-cho, Survey Data No. 2, October 1940; Government affairs department of Academy for Revitalization of Asia, Nihon ryugaku shina yojin-roku [A register of important Chinese people who studied in Japan] Survey Data No. 27, 1942; Tokyo koto kogyo gakko ichi-ran [A general survey of Tokyo Higher Technical School] 1911–12, 1914–15, 1917–18, 1920–21, 1924–25 and 1928–29; Association of Chinese Studies, ed., Shina Kan Shin-roku [A Register of Chinese officials], Tokyo: Association of Chinese Studies, 1918; Xu Youchun, ed., Mingguo renwu dacidian [Dictionary of the Characters of the Republic of China] (Shijiazhuang: Hebei People's Press, 1991); Yang Jialuo, ed., Mingguo mingren tujian [Illustrated handbook of celebrities in the Republic of China] (Nanjing: Dictionary House, 1936); Fuwenshe, ed., Zuijin guanshen lüli huilu [Collected personal records of current officials and gentries], vol. 1 (Beijing: Fuwenshe, 1920); and Liu Shoulin, ed., Xinhai yihou shiqinian zhiguan nianbiao [Table of officials in the 17 years after the revolution of 1911] (Beijing: Zhonghua Publishing House, 1966).

1904-1914 but, later, more and more graduates returned to become engineers or business operators, and this reached a peak in 1922.

Roles of returning graduates 1904–1914

After the Self-Strengthening Movement failed, the Qing government realised that truly bringing modernisation and prosperity to the country meant implementing 'self-strengthening' in an all-inclusive way. Therefore, along with the Xinzheng Reform, the demands for institutional reform in the field of industry gradually attracted the attention of the government. In 1904, the Qing government established the Ministry of Commerce to deal with industrial and commercial affairs, and two years later this office was renamed the Ministry of Agriculture and Commerce. In the same year, it also established the Ministry of Post and Transportation.³⁹ To train more people to fill this new need for government officials, the Qing government set up numerous special industrial schools, and recruited people to serve as faculty members who were willing to receive an accredited modern and professional industrial training abroad.

However, because the Qing government was forced to sign a series of unequal treaties with the western powers after end of the First Sino–Japanese War and the Boxer Rebellion, it was under pressure to pay huge war indemnities, and was no longer able to support the development of Chinese industry.⁴⁰ In these new circumstances, the Qing government designed two measures to cultivate talent. One was the signing of the *Special Agreement for Five Schools* with the Japanese government to send students to study in Japan; the second was the sending of young students to the United States with Boxer indemnity funding. Some 70% of the 140 who graduated from THTS and went back to China between 1904 and 1914 worked in the teaching profession or became governmental officials, only rarely taking up industrial occupations.⁴¹

With the abolition of the feudal imperial examination system in 1905, the Qing government set up a new talent selection mechanism specifically for those who had studied abroad. Classified titles based on exam results would be conferred on those candidates who passed the new examination, the same titles whose assignation had previously been based on the abolished imperial examinations. During the seven years between 1905 and 1911, the exam was held about 10 times and 65 students received the highest title, Imperial Scholar in Engineering. Moreover, 29 of these students had graduated from THTS.⁴² There were also many THTS graduates who received the title of First-Degree Scholar in Engineering.⁴³

³⁹See Gong Jun, *Zhongguo xingongye fazhanshi dagang* [An outline of the historical development of the new industry in China] (Beijing: Commercial Press, 1933), 60–8.

⁴⁰Hatano Yoshihiro, *Chugoku kindai kogyo-shi no kenkyu* [Study of modern industrial history in China] (Kyoto: Oriental History Research Association, Department of Literature, Kyoto University, 1961), 283–90.

⁴¹Koa-in, Nihon ryugaku chukka minkoku jinmei-cho, Survey Data No.2, October 1940; Tokyo koto kogyo gakko ichiran 1911–12 and 1914–15; Association of Chinese Studies, ed., Shina Kan Shin-roku; Xu Youchun, ed., Mingguo renwu dacidian, 1991; Yang Jialuo, ed., Mingguo mingren tujian [Illustrated handbook of celebrities in the Republic of China] (Nanjing: Dictionary House, 1936); Fuwenshe, ed., Zuijin guanshen lüli huilu, vol. 1,1920; and Liu Shoulin, ed., Xinhai yihou shiqinian zhiguan nianbiao, 1966.

⁴²Fang Chaoying and Du Lianji, eds., Zengjiao qingchao jinshi timingbeilu fuyinde [An enlarged edition and index of the blockprinted copy of the inscribing of Jin-Shi on the stone of Qing dynasty] (Beijing: Harvard-Yenching Institute, 1941), 241–4.

⁴³For a list of names of the overseas graduates who received honours under the new talent selection exam system, see 'Xuebu kaoyan youxue biyesheng dengdidan', in *Zhengzhi guanbao* [Political Official News], no. 341, September 13, 1908.

During this period, since most of the THTS graduates had received only crashcourse programme training at THTS, they were unable to do more than play the role of ordinary teachers serving at central or local technical schools, or grassroots bureaucrats who served in central or local government. Therefore, from a diachronic perspective, they were considerably less influential than those who returned from the United States thereafter. According to *Dangdai Mingrenlu* (Contemporary 'Who's who' records), published in 1931, among the total number of 1103 'movers and shakers', 82% had overseas study experience, most of whom had studied in the United States; only a few had studied in Japan.⁴⁴

There were indeed several remarkable THTS graduates who served as bureaucrats in ministries under the control of the central government. Among them, eight worked in the Ministry of Agriculture, Industry and Trade, such as Lin Dalü (major: mechanical engineering; year of return: 1909), who was the director of the Bureau of Mining Industry; Yan Zhiyi (applied chemistry; 1907), who was the director of the Bureau of Industry and Trade; Wang Xiaokan (electrical engineering; 1907), who was the director of the Fengtian Industrial Department; and Wang Jidian (applied chemistry; 1905), who served as the director of the state-owned Hanyeping Mining and Metallurgical Company. Another 11 worked in the Ministry of Post and Transportation, such as Zhao Shixuan (architectural engineering; 1910), who was the director of the Bureau of Railways; Zhou Peibing (applied chemistry; 1904), who was the director of the Bureau of Jingsui-Zhengtai Railways; and Lin Dalü, who was also the director of the state-owned Changxindian Rolling Stock Plant. Four were assigned to the Ministry of Education, including Lin Xiuzhu (textile engineering; 1911), who was the vice-minister; and Fan Hongtai (mechanical engineering; 1904), who was the director for the Vocational Education Department; and two worked at the Ministry of Foreign Affairs: Wang Shoushan (applied chemistry; 1904), who served as the consul general in Kobe, Japan; and Kuai Shoushu (textile engineering; 1907), who was the president of the Bureau of Educational Affairs in Japan. Additionally, there was one person in each of the Ministry of the Interior, the Ministry of Justice and the Ministry of Defence.⁴⁵

There were also a number of graduates who chose to take teaching positions in leading schools or established schools on their own.⁴⁶ In 1902, the well-known Imperial School of Beijing (*jin shi da xue tang*), the predecessor of Peking University, was established, and THTS graduates like Fan Hongtai, Liao Shilun (applied chemistry; 1905), Wang Jidian and Wang Shoushan became the first teachers at this school.⁴⁷ Meanwhile, among THTS graduates who had become teachers, 80% preferred to work at technical schools, and a number of them became the presidents of technical schools located in Beijing and the south-east coastal area. For example, Hong Rong (mechanical engineering; 1904), who served as the president of Beijing Higher Technical School; Zhao Shixuan (architectural Engineering; 1910), who served as the president of Jiangxi Technical School; Tong Shiheng

⁴⁴Dangdai zhongguo mingren zhi diaocha yu yanjiu' [Survey and research of contemporary Chinese celebrities], National Magazine, 1935, vol. 3, 2.

⁴⁵For personal details concerning Lin Dalü, Yan Zhiyi, Lin Xiuzhu, Zhao Shixuan, Zhou Peibing and Wang Shoushan, see Xu Youchun, ed., *Mingguo renwu dacidian*; and on Kuai Shoushu, see Lin, *Zhongguo liuxue jiaoyushi*, 233.

⁴⁶For personal details concerning Wang Jidian, Fan Hongtai and Tong Shiheng, see Xu Youchun, *Mingguo renwu dacidian*; for details concerning Hong Rong and Liao Shilun, see Association of Chinese Studies, *Shina Kan Shin-roku*; for details concerning Wang Xiaokan, see Yang Jialuo, ed., *Mingguo mingren tujian*; and for details concerning Xu Bingkun, see Koa-in, *Nihon ryugaku chukka minkoku jinmei-cho*, Survey Data No. 2, October 1940.

⁴⁷Wu Zuxiang and Liu Shaotang, eds., Memorial of National Peking University: Sixth Years of the Republic of China, the 20th Anniversary Memorial Book, 1st photocopy ed., vol. 2 (Taipei: Biographical Literature Publishing House, 1971), 215–90.

(electrical engineering; 1911), who served as the president of Jiangsu Technical School; and Xu Bingkun (textile engineering; 1907), who established the Zhejiang Industrial School (the predecessor of the current College of Engineering of Zhejiang University) in 1911 to meet the increasing demand for technical talent in the local business development of Zhejiang Province (especially the silk industry), and served as its first president. This school concentrated on the two disciplines of mechanical engineering and dyeing & textile engineering, and then added applied chemistry, electrical engineering and civil engineering. Then, to train vocational teachers, Zhejiang Vocational Teacher Training Institute was established within the school, and four classes – metalworking, woodworking, weaving and dyeing – were created to train the teachers. Xu Bingkun laid the emphasis in school policy on 'the importance of both manual practice and brain thinking'. The students studied theoretical aspects for 14 hours a week and had workshop practice for another 18 hours.⁴⁸

During this period, a remarkable group of graduates who had studied ceramics engineering and returned to China became acknowledged as educators, training pioneers and those talented in ceramics, and using advanced technology to reform the ceramic industry in modern China; these were Zhang Hao (who returned from Japan in 1907), Zou Rugui (1913), Shu Xinwei (1918), Zhang Ji'nan (1922), Du Chongyuan (1923), Wang Pan (1930) and Dai Liangji (1936).⁴⁹ Zhang Hao became the first principal of Jiangxi Provincial Pottery School in 1912; Zou, Shu, Zhang, Du, Wang and Dai were to follow.⁵⁰ The length of the course at Jiangxi Provincial Pottery School was two years. The school hired Japanese technicians to teach new machine operating skills and the latest kiln technology. It was the only specialist ceramics institution in China, and its students came from not only Jiangxi province, but all over China, making technical improvements in industrial test institutes, as well as in kiln factory technology, after their graduation.

The educational mission of THTS was to 'teach students the sciences of daily life' and to 'train engineers with practical abilities for factories'.⁵¹ However, as has been shown in Figure 3, most Chinese THTS graduates during this period served as government bureaucrats or teachers, because modern industry, especially private enterprise, had not yet developed in China. The discrepancy between the educational mission of THTS and the occupations that the graduates pursued was a result of the different social contexts of China and Japan; that is, the contradiction between the backwardness of China and the rapidly developing modernisation of industrial education in Japan.

The Meiji government took lessons in advanced industrial education systems from western technology to promote the development of Chinese industry. As representatives of the earliest industrial talent in Japan, graduates who studied at Kogaku Ryo (Imperial schools of engineering) were usually assigned to work in central government.⁵² Meanwhile, playing a supplementary role in the imperial schools of engineering, THTS

⁴⁸Editing group for the history of Zhejiang University, ed., *Zhejiang daxue jianshi* [A brief history of Zhejiang University], vols. 1–2 (Hangzhou: Zhejiang University Press, 1996), 1897–1966.

⁴⁹Tokyo Institute of Technology Internal Data, *Ceramics engineering alumni membership list*, December 1983.

⁵⁰Editing group for the history of college, ed., *Jingdezhen taoci xueyuan yuanshi (neibu ziliao)* [History of Jingdezhen Ceramic College (internal data)], September 2008.

⁵¹Nakamura Konosuke, 'Preface', in Tokyo Institute of Technology, ed., *Tokyo kogyo daigaku rokujunenshi*.

⁵²Nakayama Shigeru, *Teikoku daigaku no tanjo – kokusai hikaku no naka de no Todai* [The birth of the Imperial universities: the University of Tokyo in global comparison] (Tokyo: Chuko New Press, 1978), 77–84.

was established to produce technicians and engineers who could engage in technologyrelated fieldwork.

Although during the late Qing dynasty and the early Republic period the Chinese government began following the lead of the Meiji Restoration, the modernisation of industrial education was not yet complete. Few students who graduated from Imperial schools of engineering in Japan could meet the demand for industrial talent in China, first because many Chinese students were unable to pass the admission exam to Imperial schools of engineering,⁵³ and second because the courses of the Imperial schools lasted much longer than those of THTS. Thus, the THTS graduates who returned to China during this period played a key role as the main force of the first modern industrial technology talent in China and worked in government or in schools. THTS functioned in the same way as the Imperial schools of engineering in cultivating government bureaucrats as well as teachers.

Roles of returning graduates 1915–1924

With the outbreak of the First World War, the European powers temporarily paid less attention to the Chinese market and transferred their focus to the battlefield, which provided a precious opportunity for the development of Chinese capitalism. Answering the call of Zhang Jian (1853–1926), who was known for being an industrial entrepreneur and pioneer, a number of domestic industrial factories emerged along the southeast coast.⁵⁴ The domestic industries, especially light industries such as textiles, flour, oil and tobacco, as well as some other sectors manufacturing daily necessities, advanced solidly within this period. The amount of available capital was much greater than in the pre-war period. In addition, in the area of foreign trade, the trade deficit, 210,030,000 ounces of silver in 1914, declined sharply to 1600 ounces by 1919.⁵⁵

With the rapid growth in domestic capital at this stage, the number of THTS graduates also gradually increased, finally reaching a peak in 1922. The graduates who returned to China at this peak time were usually those who had enrolled in the four-year educational system (the one-year preparatory course plus the three years of the undergraduate programme) in 1918, the last year of the First World War. Most of these graduates preferred to work in business (see Figure 3). Moreover, among the

⁵³According to Koa-in, Nihon ryugaku chukka minkoku jinmei-cho, Survey Data No. 2, October 1940, before the Revolution of 1911 (the Chinese bourgeois democratic revolution led by Dr Sun Yat-sen that overthrew the Qing dynasty), only five Chinese graduates from the engineering department of the University of Tokyo and Kyoto University went back to China.

⁵⁴Zhang Jian stressed the importance of both 'industry' and 'education'. In his opinion, in order to enhance national power, China needed to follow the strategy of 'Fu jiaoyu er mu shiye' [treating industry as father, treating education as mother]. (See Zhang Jian, '*Tongzhou zhongxue fu guowen zhuanxiuke shuyi bing jianzhang*' [Introduction to the Chinese language discipline at Tongzhou College], in *Zhang Jian jiaoyu wenlun xuanzhu* [Annotation of selected papers on education by Zhang Jian], ed. Shen Xingtian (Nanjing: Nanjing Normal University Press, 2016). In Zhang's life, he founded over 20 companies, such as the famous Dasheng Cotton Mill, which became the only private mill in China operating at a profit. (See Samuel C. Chu, *Reformer in Modern China*, Chang Chien, 1853–1926 (New York and London: Columbia University Press, 1965). Zhang also built over 370 schools. See Marianne Bastid, *Educational Reform in Early Twentieth-century China*, trans. Paul J. Bailey, (Ann Arbor: Center for Chinese Studies, University of Michigan, 1988). In conclusion, he made a significant contribution to both the industrialisation and education of modern China.

⁵⁵Gong, Zhongguo xingongye fazhanshi dagang, 60–8; Ichiko Chuzo, Chugoku no kindai [Modern China] (Tokyo: New Kawade Shoboo Press, 1990), 233.



Figure 4. THTS graduates by origin area.



Figure 5. Geographical distribution of working place of THTS graduates, 1904–1937.

returning graduates, a certain number chose to work in the comparatively developed south-east coastal region, and the number of graduates who worked in this area peaked in 1924 (see Figures 4 and 5).⁵⁶

⁵⁶Koa-in, Nihon ryugaku chukka minkoku jinmei-cho, Survey Data No.2, October 1940; Tokyo koto kogyo gakko ichiran 1914–15, 1917–18, 1920–21 and 1924–25; Association of Chinese Studies, ed., Shina Kan Shin-roku; Xu Youchun, ed., Mingguo renwu dacidian, 1991; Yang Jialuo, ed., Mingguo mingren tujian, 1936; Fuwenshe, ed., Zuijin guanshen lüli huilu, vol. 1,1920; and Liu Shoulin, ed., Xinhai yihou shiqinian zhiguan nianbiao, 1966.



Figure 6. Occupations of THTS graduates.

The increasing number of THTS graduates was accompanied by the rapid development of Chinese industry. It is possible to draw several conclusions about these graduates from the information given in Figures 4 and 5. First, most of the graduates came from Central China, along the south-east coast and along the Yangtze River. Second, after graduation, part they remained for the most in these two major areas, or worked at large companies in Shanghai, Tianjin or other port cities, where the best conditions existed for the rapidly developing Chinese industries. The distribution of graduates was directly influenced by the development of Chinese industry during this period.

About 350 THTS graduates returned home to China during this period. Compared with the earlier period, this was not just an increase in numbers, but also a change in the distribution of professions. More than 70% of the returning graduates became technicians, engineers and business owners, who then contributed to the development of Chinese light industry. In addition, meanwhile, some of the earlier returnees quit their jobs and applied for new positions as technicians and engineers in factories, or started running businesses of their own. The percentage of graduates who became teachers was still around 30%, and over 90% of those who were teaching worked at specific technical schools. Unlike the first wave of graduates, very few became government officials during this period. The occupational classifications of THTS graduates who worked in Chinese industry can be seen in Figure 6.⁵⁷

During this period, many outstanding engineers and entrepreneurs emerged in tandem with the rapid development of Chinese industry. The following is a list of some of the important representative figures. In the textile industry, there were graduates such as Zhu Xianfang (textile engineering; 1916), who served as the manager of the Shenxin Textile Mill, which was equipped with 20 thousand spindles, edited China's first textile technology book Lilun Shiyong Fangjixue (Theory and Practice of Spinning Studies) and was the first president of the China Textile Association; Wang Shupan (textile engineering; 1918), who was the general engineer of the Hengfeng Textile Mill and Zhang Fangzuo (textile engineering; 1925), who took the position of director of the Dasheng Textile Mill and was the manager of Shenxin Textile Mill; Shengxin, Hengfeng and Dasheng were top-level textile mills in China. An important individual in the silk industry was Zhu Guangtao (dyeing engineering; 1909), who set up the Weicheng Company in Hangzhou. After his return to China in 1909, Zhu worked first as the chief in the industrial department of Zhejiang Province, then become director of the colour dyeing division of an industrial school, and finally became involved in business from the late 1910s. In the electrical field, Liu Chonglun (electrical engineering; 1909), Lin Tianmin (electrical engineering; 1910), Zhao Shi'an (electrical engineering; 1915) and Zeng Guangji (electrical engineering; 1915) jointly set up the Fuzhou Electric Company, to which they brought the modern enterprise management modality of Mitsui Corp; Wang Xueliang (electrical engineering; 1914) established the Xuzhou Electric Company; Lu Nansheng (electrical engineering; 1915) set up both the Shanhaiguan Electrical Company and the Datong Electrical Company; and Tong Shiheng, mentioned above as holding the position of president of the Jiangsu Technical School soon after his return to China in 1911, also began to be involved in Chinese industry during this period. He founded several companies within different industrial fields, such as the Nanjing Electrical Company and the Zhufeng Enamel Ware Company.⁵⁸ At the same time, he served as the manager of the Shanghai Commercial Press. There were also graduates involved in daily chemical enterprises, such as Peng Shu (applied chemistry; 1918), who founded the Aihua'Ruiji Facial Soap Company the largest Chinese company of the time; Song Qixiu (ceramics engineering; 1915), who set up both the Weiyu Flour Manufacturing Company and the Yulin Flour Manufacturing Company; and Li Zhuchen (electrical chemistry; 1918), who worked as the director of the Yongli Soda Factory. When the First World War broke out in 1914 imports of soda were interrupted, as the British Brunner Mond Soap Company withheld goods from the market to create a spike in prices, seriously affecting the daily needs of the Chinese people. From 1919 to 1925, under the lead of Li, Yongli finally developed the first Chinese-made sodium carbonate, which immediately led to the breaking of the monopoly of the British consortium in the Chinese market. Li also helped establish the Jiuda Table Salt Company. The modern table salt production of Jiuda ended an unchanged thousand-year history of edible salt in China, and opened up new avenues for the domestic chemical industry. Graduates such as Song Shuchen (dyeing engineering; 1921), Zeng Jinbi (electrical engineering; 1915) and Zhang Shushi (applied chemistry; 1915), who served as the director of the Industrial Testing Institutes

⁵⁸Gong, *Zhongguo xingongye fazhanshi dagang*, 244.

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in Shandong Province, Sichuan Province and Shanxi Province, carried out industrial research as well.⁵⁹

With the development of modern industry in China, the China Engineering Association was established in 1913 as an organisation of technicians and engineers. At first, the membership numbered 148, but it quickly rose, reaching 500 by 1921. During this period, THTS graduate Zhao Shixuan, mentioned earlier, served as vice-president of the association.⁶⁰ In addition to joining the association, THTS graduates also set up an alumni association of their own, called the THTS Alumni Association for Chinese Graduates. This organisation was established at THTS in Tokyo around 1920, and published the *Journal of the THTS Alumni Association* for graduates who had already returned to China. Guided by its purpose of providing a timely exchange of information between alumni, the journal published articles and reports introducing the latest industrial knowledge, such as development trends in the global dyeing industry, progress in the electrical and chemical industry, investigations of Japan's largest power generation company, and so on. It also published interactions among members in the column 'Letters between Members'. This journal played a role in popularising advanced technical knowledge in China during this period.

In academic circles, when organisations of technicians and engineers are mentioned, most people think of the China Engineering Association, mentioned above, as well as the China Engineers Association, established in the United States, but few would know of the activities of the THTS Alumni Association for Chinese Graduates. However, the membership of this association outstripped that of the China Engineering Association, which was established at almost the same time, reaching 750 (640 and 120 scholars), according to an issue of the *Journal of the THTS Alumni Association* from 1925. In that same year, the membership of the China Engineering Association totalled 420 and the membership of the China Engineers Association was around 500.

Role orientation of THTS graduates in context: a comparative perspective

From a synchronistic perspective, THTS had a unique and indispensable role in the training of Chinese technical talent, making it stand out from other Japanese schools. In Japan, there were two kinds of industrial education system. One was the colleges of engineering at the seven imperial universities,⁶¹ represented by Tokyo Imperial University, and the other was the group of technical schools, as represented by THTS. Tokyo Imperial University was ranked higher than THTS academically, because the former was aimed at the training of government bureaucrats and academic

⁵⁹For personal details concerning Zhu Xianfang and Zhang Fangzuo, see Xu Youchun, *Mingguo renwu dacidian*; for details concerning Wang Shupan, Zhu Guangtao, Liu Chonglun, Lin Tianmin, Lu Nansheng, Song Qixiu, Zeng Guangji, Song Shuchen and Zhang Shushi, see Koa-in, *Nihon ryugaku chukka minkoku jinmei-cho*, Survey Data No. 2, October 1940; for details concerning Peng Shu, see 'New members list', *Wissen and Wissenschaft Journal* 5, no. 4 (1923); and Gong, *Zhongguo xingongye fazhanshi dagang*, 242–3.

⁶⁰Zhong Shaohua, 'The China Engineer Association', *Chinese Journal for the History of Science and Technology* 6, no. 3 (1985): 36–43.

⁶¹The imperial universities were founded by the Empire of Japan between 1886 and 1939, seven in mainland Japan (now Japan) and one in Korea and one in Taiwan, both of which were under Japanese rule. These institutions were run by the imperial government until the end of the Second World War. They are now informally called the former imperial universities. Here, we only refer to the seven imperial universities (which were Tokyo Imperial University, Kyoto Imperial University, Tohoku Imperial University, Kyushu Imperial University, Tohoku Imperial University, Osaka Imperial University and Nagoya Imperial University) in mainland Japan. See James R. Bartholomew, 'Japanese Modernization and the Imperial Universities, 1876–1920', *Journal of Asian Studies* 37, no. 2 (1978): 251–71.



Figure 7. Chinese graduates majoring in engineering from THTS and seven imperial universities, 1906–1930.

researchers, while the latter focused on training engineers for factories and private business owners, as well as teachers for technical schools.

The Qing government, before the study boom in Japan, began a tradition of sending students to study abroad in 1872–1875, during which time it sent 120 children between 10 and 16 years old, in four batches, to the United States.⁶² Because of age limits, these students received a basic education in primary and secondary schools. The plan was to send students for a 15-year span, but they were forced to return to China in 1881 due to obstruction by conservative forces, and the destruction of the Chinese Exclusion powers in the United States. A second effort by the Qing government arose in the mid-1880s. This consisted of a series of arrangements directed primarily towards training arsenal personnel, from Fuzhou Shipping College and Beiyang Marine College, in military industries in England and France, where they would learn shipbuilding and the manufacture of guns, gunpowder and cannons;⁶³ this was finally suspended in 1880s because of chronic underfunding.⁶⁴

Thus, during the first stage of industrial modernisation (1904–1914), when political reform was the main theme, and because the first two booms in study abroad were not successful, the Qing government had an urgent requirement for more technical talent to

⁶²Zhao Yanling et al., 'Dui zhongguo shehui yingxiang zhi bijiao [A comparison of the influence on China's society by the returned students from the U. S. and Japan in modern times],' Journal of Sun Yat-sen University (social science version) 2 (2002): 38.

⁶³Yao Shuping, 'Zhongguo jindaihua jinchengzhongde shici liuxuechao [Ten waves of students abroad coincided with China's entire modernisation process],' Science & Culture Review 12, no. 2 (2015): 43–4.

⁶⁴Paula Harrell, Sowing the Seeds of Change: Chinese Students, Japanese Teachers, 1895–1905 (Stanford: Stanford University Press, 1992), 11–12.

take up positions as bureaucrats in the industrial department to help with industrial reform. To absorb Japan's advanced experience from the Meiji Restoration, the strategic focus in sending students to Japan needed to be altered; the Qing government hoped that the graduates could fulfil their needs as soon as possible. However, for two reasons few graduates from imperial universities had the ability to meet China's needs. First, due to the weak educational system in China, few Chinese students could gain admission to Imperial universities, and second, those universities usually required a much longer period of study, almost twice that of THTS (see Figure 7).

As a result, Imperial universities were unable to meet the pressing need for talent in China. However, the educational programme of THTS was more flexible and effective, and required less time, which allowed it successfully to meet China's demands during the first stage of reform.

The imperial universities and THTS had different requirements for the length of a course of study but also a different focus on industrial fields. The Imperial universities mainly focused on various heavy industrial domains under government control, such as civil engineering, mining, metallurgy, shipbuilding and weaponry,⁶⁵ whereas THTS mainly concentrated on light industries such as weaving, colour dyeing, applied chemistry, mechanics, electrics and various other facets of daily life (see Table 1).

The Revolution of 1911, which was the Chinese bourgeois democratic revolution led by Sun Yat-Sen, overthrew 268 years of rule by the Qing Dynasty and promoted the development of national industry in China.⁶⁶ Subsequently, the regime of the 1911 Revolution fell into the hands of Yuan Shikai. Yuan was one of the northern feudal warlords who had always tried to restore the monarchy. In order to cajole the bourgeoisie, he appointed Zhang Jian as his chief financial officer and formulated policies and decrees to revitalise industry,⁶⁷ and these measures provided legal protection for the development of national capitalism. Thereafter, the outbreak of the First World War provided a favourable

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	Tokyo Higher Technical School (THTS)	College of Engineering of the Imperial University of Tokyo
Course	2 courses:	Single course: 6 years:
Length	2 years: undergraduate programme	2 years: preparatory course 2 years: major course
	1 year: crash course programme	2 years: factory practice
Disciplines	Applied chemistry	Architectural engineering
	Architectural engineering	Chemical engineering
	Ceramics engineering	Civil engineering
	Dyeing engineering	Mechanical engineering
	Textile engineering	Metallurgical engineering
	Electrical chemistry	Shipbuilding
	Electrical engineering	Telecommunication
	Industrial design	Mine engineering
	Mechanical engineering	

Table 1. Courses offered to students who majored in engineering in THTS and imperial universities at the beginning of the twentieth century

⁶⁵Koa-in, *Nihon ryugaku chukka minkoku jinmei-cho*, Survey Data No. 2, October 1940.

⁶⁶Shi Bo, 'Xinhai geming yu zhongguo minzu zibenzhuyi jingji de fazhan [The revolution of 1911 and the development of China's national capitalist economy],' *Hubei Social Sciences*, no. 8 (1991): 36–9.

⁶⁷Ma Yong, 'From constitutional monarchy to republic: the trajectory of Yuan Shikai', *Journal of Modern Chinese History* 6, no. 1 (2012): 15–32.

environment for the development of China's national industry. Since the import of western manufactured goods was halted during the war, China's industrial development came to possess completely different characteristics from the previous Self-Strengthening Movement. After Yuan Shikai stepped down from rule in 1916, Chinese society experienced a period of unrest and the development of heavy industry slowed down. Meanwhile, national industry, which was at the centre of the mechanical production of daily necessities, had been under development. The industrialisation of domestic capital, the goal of the mechanisation of traditional material production, was at the core of the new industry revitalisation movement.⁶⁸ During the period in which new industries were growing rapidly, THTS graduates were more active after returning home than those who came from the seven imperial universities in Japan. The first reason for this may be that most graduates from imperial universities majored in mining, metallurgy, shipbuilding and other heavy industries, while graduates from THTS studied techniques relating to industries that manufactured daily necessities, and were in great demand in the fast-growing Chinese industries. The other reason is that hundreds of overseas students studying under the Boxer Indemnity Scholarship in the United States began to return in the 1920s; 90% had received a bachelor's degree and more than 40 received doctorates; most majored in science, engineering, agriculture and medicine.⁶⁹ After they returned, most entered universities and research institutions and conducted scientific research, entering the administrative leadership, instruction or research. The graduates from the imperial universities therefore fell into a dilemma: on one hand, there was fierce competition with the students who had studied in the United States; and on the other, because of the limitations of the disciplines they studied, they were not able to enter the prosperous industrial economy.

After the September 18th Incident in 1931, a militarised Japan waged a war of aggression against China for 14 years; the two countries had long been in 'hostile' status, and this had a serious impact on the students studying in Japan. By the end of October 1931 more than 2000 students had returned to China, many of them immediately joining the anti-Japanese national salvation movement upon their return.

Conclusion

At the beginning of the twentieth century, the Chinese government began following the example of the Meiji Revolution in Japan. To improve its backward educational system, the Chinese government signed the Special Agreement for Five Schools to take advantage of Japan's superior educational resources for training talented individuals who would be able to contribute to the modernisation of industry. The process of industrial modernisation in China can be divided into two main stages in the first 20 years of the twentieth century. The events of the first stage include the government's efforts at political reform and its improvement of the industrial educational system in order to revitalise modern industry,

⁶⁸Koa-in, *Nihon ryugaku chukka minkoku jinmei-cho*, Survey Data No. 2, October 1940.

⁶⁹Zheng Xiaohuí, 'Zhongguo liumei jiaoyu lishi huigu [Historical review of China's foreign education in the United States]', Journal of Tsinghua University (Philosophy and Social Sciences) 16, no. 2 (2001): 37–41.

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and the second stage witnessed the rise of new industries and the development of domestic capital during the First World War. THTS played an important role in the entire development of industrial modernisation in China. In both these stages, THTS was a source first of bureaucrats and teachers, and then of future technicians, engineers and entrepreneurs.

In the late 1920s, with the continuous improvement in the domestic educational system in China and the diversification of overseas study, the number of THTS gradates gradually decreased year by year.⁷⁰ Furthermore, when Japanese military forces entered China, the conflict between the two countries could not be reconciled. The Chinese government therefore set restrictions on the number of students permitted to study in Japan. On 7 July 1937, Japan launched a war of aggression against China and as a result 20 of the 23 Chinese students who were studying at THTS were forced to discontinue their studies and return home.⁷¹ This date also marks the end of THTS's work in cultivating modern engineering talent for China.

Although the educational resources provided by THTS were not superior to those of the imperial universities, the returning THTS graduates played a more important role than their counterparts from the imperial universities because, in the first stage of modernisation, when THTS graduates went home and assumed positions there, students from the imperial universities were still studying, due to the longer period of study required. Furthermore, the students who had been sent to the United States under the Indemnity Scholarship had not yet returned. These internal and external factors determined that the THTS graduates played a more important role than graduates from both the imperial and US universities. In the second stage, with the development of civil industry, THTS students who studied 'daily life sciences' were able to meet the demands of the sharp development of industry, whereas the academic background of graduates of the imperial universities, who had focused on heavy industry, was not compatible with the rise of Chinese industry. Although the tide of returning students studying in the United States increased during this time, most of them were to enter universities and research institutions, and seldom engaged in work in industrial companies or technical schools.

As previously argued, the local educational institutions that provided technological education in Japan, namely THTS and the imperial universities, each had a distinct outlook. Although they formed part of the same educational system for overseas students and local students, they produced different results, depending on the match of the educational system with the desired outcomes and the foreign students' local social context. There is a consensus in the study of technology transfer that, for developing countries, the introduction and implantation of the most advanced technologies from developed countries might not be the most beneficial and compatible approach but, rather, the introduction of the technologies that happen to fit a specific social context. In this way, THTS, as a successful overseas education base for Chinese students, contributed significantly to the development of industrial modernisation in China in the early twentieth century. During the first stage of modernisation, it successfully met China's demand for graduates who could work as bureaucrats, as the school had a flexible and effective system, and the period of study was relatively brief. During the second stage, the graduates

⁷⁰Lin, *Zhongguo liuxue jiaoyushi*, 409–10.

⁷¹Koa-in, Nihon ryugaku chukka minkoku jinmei-cho, Survey Data No. 2, October 1940.

from THTS, who had learned techniques that could be applied to industries that manufactured daily necessities, just happened to be able to meet the great demand in fast-growing Chinese industries during the First World War. This case study confirms that, for developing countries, the best technical education is not that which teaches the most advanced technologies, but rather that which teaches the most beneficial and compatible technologies to suit a specific social context.

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