

Engineering Education and the Spirit of Samurai
at the Imperial College of Engineering in Tokyo, 1871-1886

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Abstract

The Meiji Restoration was the revolution that overthrew the feudal regime of the Tokugawa period in late nineteenth-century Japan. It was also the time of the opening of the country to the rest of the world, and Japan had to confront with Western powers. The Meiji government boldly accepted the new technologies from the West, and succeeded in swiftly industrializing the nation. However, this same government had been aggressive exclusionists and ultra-nationalists before the Restoration.

In light of this fact, I investigate how national identity is linked to engineering education in Japan. My focus is on the Imperial College of Engineering (ICE), or Kobu-daigakko, in Tokyo during the late nineteenth century. The ICE was at the forefront of Westernization in the Meiji government. I specifically examine Yozo Yamao and Hirobumi Ito, who studied in Britain and were the co-founders of the college; Henry Dyer, the first principal; and the students of the ICE.

As a result of the investigation, I conclude that the spirit of *samurai* (former warriors) was the ethos for Westernization at the ICE. They followed ethical code for the samurai, the essence of which was lordly pride as a ruling class. They upheld their ethical standard after the Meiji Restoration. Their spirit of rivalry and loyalty urged Yamao, Ito, and the students to emulate Western technology for ensuring the independence of Japan. The course of the ICE's development reveals that non-engineering motivations shared a mutual relationship with the engineering education of those at the ICE.

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Explanatory Notes

The custom in Japan is to put the surname first and the given name last, as in: Yamao Yozo (Yamao is the family name). In this thesis, all the names of Japanese figures are shown in the Western tradition of given name first and family name last, for example: Hirobumi Ito (Ito is his family name).

There are many Japanese sources referenced in this thesis. In the bibliographic information section, I have put English translations of the titles in parentheses and brackets after the original Japanese titles. If the English translation is provided by the authors of the book and/or paper, the translation is in brackets. If it is not, I have put a tentative translation of the title in parentheses. For example:

Author, *Original Title* [*Official Translation by the Author*] (Tokyo: Publisher, 2007).

Author, *Original Title* (*Tentative Translation of the Title*) (Tokyo: Publisher, 2007).

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1. Introduction

The purpose of this thesis is to show how engineering education is linked to the formation of national identity in late nineteenth-century Japan by focusing on the Imperial College of Engineering (ICE).¹ After Tokugawa shogunate opened the country, Japan aggressively absorbed knowledge from the West by using foreign employees and sending students abroad. One of the typical institutions that promoted Westernization was the ICE in Tokyo, founded in 1871.

Japan is often thought of as a mysterious country.² The Restoration leaders, such as Toshimichi Okubo (1830-1878), and Yoshitaka Kido (1833-1877), the co-founders of the college Hirobumi Ito (1841-1909) and Yozo Yamao (1837-1917) were the ultra-nationalists who advocated *sonno joi* (honor the emperor, expel the barbarians) under the feudal system. A few years later, these leaders became the proponents of *bunmei kaika* (civilization and enlightenment), which virtually made Japan comparable to Western ways. How can we understand reasonably their “inconsistent” actions without concluding that Japanese people are mysterious or exceptional?

The Meiji government carried out rapid industrialization and Westernization in Japan by imitating Western science and technology. What, however, was the purpose of imitation? I assume that Japanese engineers did not passively accept, but actively acquired Western technology, thus creating the hypothesis that Japanese national identity was the main factor that moved Japan toward Westernization. Then, I add

¹ The name of the college has changed several times, and there are some differences of translations into English. When the college was established in 1871, it was called Kogaku-ryo. The name was changed into Koku-daigakko in 1877. In this thesis, I will use the name of the college the "Imperial College of Engineering (ICE)." Since 1873, it had been less than fourteen years that the college put its unique education into practice. Two hundred eleven students graduated from the ICE in its history. The college was merged with the University of Tokyo in 1886, and the name of the university was changed to the Imperial University at that time. The faculty of engineering has been, specifically, called the "Imperial University, the College of Engineering" since then. The name of the Imperial University became the Imperial University of Tokyo in 1897, and the University of Tokyo in 1947.

² A view of "Japanese are mysterious" seems a conservative theme of Western journalists and scholars concerning Japan. Karel van Wolferen is a journalist who describes Japan as an enigmatic country in his works. Even a prominent anthropologist Ruth Fulton Benedict, the author of *The Chrysanthemum and the Sword*, could not avoid such a point of view. Among Japanese people, the question "what is Japan?" is one of the most popular topics. We can find many books regarding "Japanese civilization" that examine the peculiarity of Japanese culture and society. Taichi Sakaiya's *What is Japan? Contradictions and Transformations* (Tokyo: Kodansha International, 1993) is a balanced study that tackles the problem squarely.

questions. What spirit motivated their actions? How did the Japanese leaders and the students at the college maintain Japanese-ness at the college? Self-awareness of the Japanese people contributing to the college is the key in this study. What did they recognize in themselves—professional engineers, technocrats, or the elites of Japan? Had their recognition of national identity influenced their motives for the development of engineering education in Japan? To answer these questions is the main goal of this thesis. I treat the ICE as a historical case study in Japanese engineering education.

I focus on the ICE because it was at the forefront of encounters with the Western culture. The first nine teachers were all foreigners. The college invited a twenty-four year old Scottish engineer, Henry Dyer (1848-1918), as the first principal of this college. The Japanese government trusted him with substantial power to establish the curriculum of the college. His contribution was enormous to the college. It was so great that the ICE was often referred to as "Dyer's College" among foreigners in Yokohama.³ Later, Dyer recalls the evolution of Japan and states, "It has been acknowledged by the highest authorities in Japan that the Imperial College of Engineering has been one of the most important factors in the making of New Japan."⁴

In this thesis, I investigate the national identity of Japanese people at the ICE, and conclude that the spirit of samurai was the ethos for the development of the college. Most of the Japanese participants at the college were from the samurai class, and they had common characteristics as members of the samurai. They showed their identity as samurai in their sense of rivalry, loyalty, and the spirit of independence. The essence of their spirit was a pride and honor, which was cultivated by the members of the ruling class in the feudal society to maintain their superiority to others.

There are studies that assert engineering and engineering education were affected by national politics; however, there are few studies that focus on how such non-engineering factors related to the establishment of engineering education in Japan. We can see, in the case of the ICE, that the social background and the political decisions of the participants of the ICE were decisive factors to the development of engineering

³ Edward Divers, "The Training of Engineers in Japan," *The Engineer* (May 6, 1898), p. 434.

⁴ Henry Dyer, *Introductory Address on the Training and Works of Engineers in Their Wider Aspects* (Glasgow: The Glasgow Technical College, 1905), p. 9.

education in early Meiji Japan.

Inazo Nitobe asserted that the spirit of samurai had been the major ethics among the Meiji Restoration leaders in his well-known book, *Bushido*, first published in 1899.⁵ The essence of the spirit of samurai, according to Nitobe, is "the sense of honour which cannot bear being looked down upon as an inferior power."⁶ Dyer also witnessed lordly characteristics in the behavior of the students at the ICE. Dyer emphasized the existence of Bushido as a spiritual factor in motivating the leaders to industrialize the nation in his writing *Dai Nippon*.⁷

The spirit of samurai had been working at the time of the feudal clan before the Meiji Restoration. The five Choshu blockade runners, including Yamao and Ito, changed their identities from the feudal clan of Choshu domain to the nation of Japan after visiting Britain in 1863.⁸ Their spirit of samurai manifested itself in their behavior, aiming to gain the independence of Japan by competing with the Western powers. Their national identity as Japanese was based on this loyalty to the nation.

When the leaders felt the nation was being humiliated on the international stage, overcoming its inferiority became their top priority. Yamao and Ito, the co-founders of the ICE, recognized that the power of Western technology was the source of the threat to the independence of Japan. At the same time, Western technology was the power to secure the independence of Japan, and to avoid being looked down upon. It may sound paradoxical, but Japanese-ness, which emerges from a sense of rivalry, motivated Westernization at the ICE. We can understand the paradox that the ultra-nationalists and aggressive

⁵ "Bushi" means literally warriors, and "do" means the way. Nitobe wrote the book to introduce the spirit of samurai to the international society.

⁶ Inazo Nitobe, *Bushido: The Soul of Japan, An Exposition of Japanese Thought* (Tokyo: IBC Publishing, 2003), p. 162, in Chapter XVI, "Is Bushido Still Alive?"

⁷ Henry Dyer, *Dai Nippon: The Britain of the East, A Study in National Evolution* (London: Blackie & Son, 1904), p. 32.

⁸ "Choshu" is a name of the domain of Choshu clan, which is in current Yamaguchi prefecture. Choshu clan placed its office of the feudal government in it. At the time of the voyage Ito's name was Shunsuke Ito, Kaoru Inoue was Bunta Inoue, and Masaru Inoue was Yakichi Nomura. They are often called the "Choshu Five." The Tokugawa regime abolished the notice of banning people from going abroad on May 21, 1866. Students who left Japan before that day without permission were blockade runners. Students who went abroad at the end of the Tokugawa and the beginning of the Meiji periods are listed in Minoru Ishizuki, *Kindai Nihon no Kaigai Ryugakushi (A History of Studying Abroad in Modern Japan)* (Kyoto: Minerva Shobo, 1972).

exclusionists became the leaders of Westernization, when we comprehend that they had the spirit of samurai.

In the following section, I introduce a brief background of the Meiji Restoration by focusing on the impact of sudden encounters with Western powers, and on the formation of national identity in Japan, as well as a cultural background of science and technology in the Tokugawa period.

The Meiji Restoration

The Japanese islands do not share a topographical border with other nations so; the "Japanese" people have naturally formed a loose sense of community since ancient times. There have been a few upheavals of national identity, such as aggressive Mongolian messengers who came to Japan in the thirteenth century, and the movement for national unification in the Age of Provincial Wars in the sixteenth century. However, these affairs were not threatening to the nation of Japan. The Japanese people had not had an overwhelming occasion of crisis as a nation until the middle of the nineteenth century.

The Tokugawa shogunate had closed the country for more than two hundred years to control the domestic order.⁹ The arrival of Commodore Matthew Calbraith Perry (1794-1858) at Uruga (currently Yokosuka) by way of four attacking black ships in 1853, to demand the opening of Japan's borders, was a crucial event in opening the eyes of Japanese leaders to the world outside of the country. Perry asserted the possibility of warfare depending on the result of the negotiation. At that time, Perry handed the letter from the President of the United States to the shogunate, and left Japan with a notification of the next visitation in the following year.

The shogunate knew the miserable consequences of the Opium War in China from 1840 to 1842. China eventually accepted an unequal treaty with Britain as a result of the war. Because the shogunate recognized China as a great power and viewed Japan as a small country, the shogunate was afraid of warfare with Britain and other Western powers.

In 1854 on March 3, Japan and the United States established a treaty. This treaty was the first treaty for

⁹ A "shogunate" is a military government, in which a *shogun*, or a general, seizes power. Tokugawa clan established a capital at Edo (current Tokyo) in 1603. The Imperial Court existed in parallel.

Japan as a nation. In this treaty, Japan opened its ports at Shimoda and Hakodate to the United States shipping industry for supplying fuel and water, and set the consul at Shimoda. Also, Japan gave the US most-favored-nation status, which allowed the US the most advantageous position among the nations with whom Japan completed treaties in the future.

In 1858, Japan signed the treaty of amity and commerce with the United States. At this time, Japan opened five additional ports, including Yokohama. Later, Japan made similar treaties with the Netherlands, Russia, Britain, and France in 1858, Portugal in 1860, Prussia in 1861, Switzerland in 1864, Belgium and Italy in 1866, and Denmark in 1867. All those treaties were one-sided, with Japan at a disadvantage. These nations kept consular jurisdiction in Japan, but yet the Japanese government was not allowed to have customs autonomy. The presence of these treaties insulted the pride of the Japanese people. Japanese diplomacy struggled to revise these unequal treaties.

The political order in Japan became chaotic at the end of the Tokugawa period. Among the samurai class, exclusionists became dominant, and they were critical of the weak attitude of the shogunate against foreign powers. On the other hand, Japanese mythology has the idea of an unbroken line of Emperors. While the tradition of the Emperor system had been in name only since the thirteenth century under the authority of the shogunate, the exclusionists utilized this idea of the unbroken line of Emperors to overthrow the shogunate. The main figures in this thesis, Yozo Yamao and Hirobumi Ito, both from *Choshu* domain (current Yamaguchi prefecture) and lower class of the samurai, had been extreme exclusionists at the beginning, and yet became two of the most ardent promoters of Westernization in the Meiji government later. The pressure and tension from the Western powers was so great that a group of lower class samurai took the leadership of the Meiji Restoration and convinced the *daimyos* (feudal lords) to give up their fiefs in order to make the country strong enough to deal with a threat of colonization by the Western powers. External pressure was the main force contributing to the radical political revolution at the end of the Tokugawa period.

The last shogun Yoshinobu Tokugawa (1837-1913) returned the political power of the shogunate to the Meiji Emperor (1852-1912) in 1867, and the era name Meiji was adopted in 1868. The Meiji government

promulgated the Imperial Covenant of Five Articles under the name of the emperor.¹⁰ It is worth mentioning that the fifth article proclaims that people should obtain knowledge from the world to raise the Imperial authority. The new Meiji government was struggling to take the initiative by using the emperor as a symbol.

The government abolished the hierarchy system of *shi-no-ko-sho* (warriors, farmers, artisans, and merchants from higher to lower), which had been established in the feudal period. The government enforced policies of dissolution of the feudal system one after another: repeal of stipends for the privileged class, introduction of conscription, and the banning of wearing swords. The government came up with an alteration of the names of the classes as a transitional policy; court nobles were referred to as *kazoku*, samurai as *shizoku*, and the other three classes as *heimin* (commoner) since 1870. While social restrictions, such as occupation and marriage, that depend on classes were removed, cultural and mental discrimination remained. In 1877, the unsatisfied elements of shizoku in the Kyushu region caused the Seinan War against the government. This civil war was the last and biggest rebellion in the Meiji Restoration period. The government established the foundation of its political authority when it overcame this crisis.

Indeed, Westernization and industrialization were dramatic in the Meiji era, and scientific engineering education began with the Meiji Restoration, though educational legacies existed from the Tokugawa period. Elementary education had been established by the time of the Restoration. Many introductory and educational materials of industrial technology of Japanese tradition had been published since the middle of the Tokugawa period.¹¹ The contents of these materials, however, were only a collection of experiences, and there were few systematized experiments. The rate of literacy in Japan at that time was much higher than in most developing countries.¹²

¹⁰ The English translation of the Covenant is in Dyer's *Dai Nippon*, pp. 27-28.

¹¹ Toshio Yamazaki, *Gijutsushi (The History of Technology)* (Tokyo: Toyo Keizai Shinposha, 1961), p. 4.

¹² R. P. Dore, *Education in Tokugawa Japan* (Berkeley: University of California Press, 1965), p. 321. Dore estimates that the proportion of children who got "some kind of schooling at 1868 rates of attendance" was "43 per cent for boys and 10 per cent for girls." He points out that the spread of elementary education in a developing country means that the people are trained and ready to get further training whether it is in the military, a factory, or a lecture class by an agriculture association in a village.

During the Tokugawa period, the Netherlands was the only Western nation allowed by the shogunate to conduct commerce with Japan with the condition that the Netherlands not spread Christianity in Japan. The Tokugawa shogunate considered Christianity a politically dangerous religion for destabilization of political order, and oppressed believers. The main purpose of the isolation policy was to exclude Christianity from Japan. The shogunate also severely restricted voyage abroad of and outside trade with Japanese people.

Since the middle of the eighteenth century, the Western education that had been mainly studied was medicine. Western learning through Dutch language was called *ran-gaku* (Dutch learning). Until the Western powers demanded treaties of commerce, systematic study of Western learning had not been done in Japan. Science of the *ran-gaku* school had not been applied to general technology during the Tokugawa period except to military technology, although it would have influence on science and technology after the Meiji era.¹³ The scholars in the *ran-gaku* school needed to read Dutch. Translation was an essential task for them. Because translation was considered as the fundamental study to absorb Western learning (even after the Meiji Restoration), the mainstream focus of the University of Tokyo was on the Office of Translation in the Tokugawa period.¹⁴ By the end of the Tokugawa shogunate, the school of *ran-gaku* had educated many talented leaders, such as Kaishu Katsu (1823-1899), and Shoin Yoshida (1830-1859), and Yukichi Fukuzawa (1834-1901). Shoin Yoshida, who was a member of Choshu clan and opened a private school, had a considerable influence on the leaders from Choshu clan, such as Takayoshi Kido (1833-1877), Ito and Yamao.

The Meiji Restoration and the opening of Japan had the same influence on foreign policy. The Restoration leaders were longing to not be inferior to the West, so they decided to make the most of Western technology. The policy of the Meiji government to deal with the Western powers that would confront them before long consisted of three approaches: preparations in terms of legal and cultural preconditions to revise the treaties to get equal position with those Western powers; creation of military strength; and cultivation of national wealth as a foundation for the former two strategies. Slogans in the Meiji period, such as *bunmei*

¹³ Yamazaki, *op. cit.* (1961), p. 4.

¹⁴ Shigeru Nakayama, *Teikoku Daigaku no Tanjo: Kokusai Hikaku no Nakadeno Todai (The Birth of the Imperial University)* (Tokyo: Chuo Koronsha, 1978), pp. 3-8.

kaika (civilization and enlightenment) and *fukoku kyohei* (prosperous country and strong army), expressed these policies of the government.¹⁵

Kobu-sho, or the Ministry of Public Works, established in 1870, was the central office in the Meiji government that dealt with basic industry for national wealth, and was in charge of heavy industries, such as mining, steel, shipbuilding, and construction of railroads and lighthouses. The Ministry had a few significant features. The Ministry invited *oyatoi gaikokujin*, or foreign employees, and promoted importation of Western technology rather than encouraging local and traditional industry in Japan. Leaders believed that Western technology was superior to Japanese technology. In the Ministry of Public Works, leading figures were deeply related to Choshu clan and Britain. Hirobumi Ito was the first Minister of the Ministry of Public Works. Kaoru Inoue took over the position. Later, Yozo Yamao became the Minister. They were from Choshu domain and went to Britain to study at the end of the Tokugawa period. Characteristically, the Ministry of Public Works also gave high priority to technology and engineering education. There were several educational institutions in the Ministry to instruct practical works. The ICE was the most authoritative school in engineering education. ICE was under the control of the Ministry of Public Works until it was dissolved in 1885. The Ministry of Education took over the jurisdiction of the ICE, and it merged with the University of Tokyo in 1886.

2. Literature Review

The history of the Imperial College of Engineering (ICE) cannot completely be understood as an internal history of engineering or education. The Meiji government took the lead and founded the college in the midst of the Meiji Restoration. Thus, the formation of the college was considerably affected by social, cultural, and political factors. Numerous studies deal with national identity and engineering, technology transfer, and education at the ICE respectively. In this section, I clarify the problems around these studies, and propose my viewpoint and method to reveal how national identity was linked to engineering education

¹⁵ Hideo Nagai, *Meiji Kokka Keiseiki no Gaisei to Naisei (Foreign and Domestic Policies in the Time of Formation of the Nation of Meiji)* (Sapporo: Hokkaido Daigaku Tosho Kankokai, 1990), p. 206.

at the college. The study of social history of the ICE is highly interdisciplinary research. For the sake of convenience, I categorize related studies into three fields: education at the ICE, technology transfer, and national identity and engineering.

Cultural, social, and political factors are present in the relationship between national identity and engineering education in Meiji Japan. When the Japanese people encountered a great crisis of Western authority, the consciousness of their identity at once became their major concern. After the crisis was abated, Japanese national identity seemed to stabilize. Concern for social positions and political status among the Japanese people regained importance. Identity of students at the ICE shows a typical case of Japanese awareness of national identity because the college directly confronted with Western culture. Therefore, the object of this thesis is to investigate the recognition of Western technology among Japanese people at the college, and their actions in terms of Western technology by focusing on what motivated them to develop the ICE. While there have been a number of studies conducted about the administrative history of the ICE, it is hard to say that the sociological, ideological, and political aspects of the college have fully uncovered. Moreover, there has not been any research about ethos of the participants at the college.

Education at the ICE

There are numerous studies on education at the ICE. *Tokyo Teikoku Daigaku Gojunenshi*, and *Tokyo Daigaku Hyakunenshi* are official materials that contain not only the history of the University of Tokyo, but also the history of higher education in Japan.¹⁶ These writings do not accredit the ICE as a root of the University of Tokyo. The ICE is described as an attached institution. Moreover, the purpose of these official publications is to illustrate administrative history of the university. Therefore, there is not any analysis of social and ideological background.

Nobuhiro Miyoshi uncovers a broad history of industry education at the end of the Tokugawa and the beginning of the Meiji periods.¹⁷ He places the position of the ICE in the history of industrial education in

¹⁶ *Tokyo Teikoku Daigaku Gojunenshi (The Fifty Years History of the Imperial University of Tokyo)* (Tokyo: Tokyo Teikoku Daigaku, 1932), and *Tokyo Daigaku Hyakunenshi (The One Hundred Years History of the University of Tokyo)* (Tokyo: Tokyo Daigaku Shuppankai, 1984).

¹⁷ Nobuhiro Miyoshi, *Nihon Kogyo Kyoiku Seiritsushi no Kenkyu: Kindai Nihon no Kogyoka to Kyoiku*

Japan. The administrative history of the ICE is described in his work, but the social side of the college is not the target of his study. Shoichi Ohyodo discusses the transitions of the purpose of the ICE by analyzing official documents of administration of the college.¹⁸ He illustrates how the mission of the ICE changes from practical engineering to theoretical and academic engineering. There is not an analysis from a viewpoint of ideological and social history.

Naofumi Nakamura analyzes the development of the railroad industry and Japanese engineers.¹⁹ Until the first students of the ICE graduated, sufficient technicians had been educated, and they absorbed technology from foreign engineers. In addition, students who studied abroad occupied higher offices. Therefore, graduates from the ICE could not become high-ranking engineers in the railroad field. Even though they were highly evaluated in various studies, students from the ICE were not essential personnel in the railroad industry. Nakamura does not conduct an analysis of thoughts of the participants at the ICE.

Makoto Aso illustrates eight kinds of paths for higher education in the early Meiji.²⁰ He places the ICE in the category of the technical schools controlled by the government. The study shows that there were various educational institutions for students in the chaotic situation of the Meiji Restoration. Nevertheless, Aso does not explain the motivations and the social background for why students chose each school.

There were many participants at the ICE. 211 students graduated from the college, and 49 foreign teachers were employed until December, 1885. In all, 493 students entered the college, and 153 students were still enrolled when the college closed.²¹ Many of the students, as well as the staff members, have been studied. The most important figures were Yozo Yamao and Hirobumi Ito, the co-founders of the college.

(A Study of the Formation of Industrial Education in Japan) (Tokyo: Kazama Shobo, 1979).

¹⁸ Shoichi Ohyodo, "Meijiki Nihon Shakai ni Okeru Sendoteki Gijutsusha Yosei Kikan no Igi to Henyo (1)," ("The Meanings and Changes of the Leading Institutions for Raising Engineers in the Society of Meiji Japan,") *Shimane Daigaku Kyoiku Gakubu Kiyo, Kyoiku Kagaku* [*Memoirs of the Faculty of Education Shimane University, Educational Science*] 21 (1987): 31-54, and 22 (2) (1988): 1-24.

¹⁹ Naofumi Nakamura, "Tetsudo Gijutsusha Shudan no Keisei to Kobu Daigakko," ("The Formation of the Group of Railroad Engineers and the Imperial College of Engineering,") in Jun Suzuki, ed., *Kobusho to Sono Jidai (The Ministry of Public Works and Its Era)* (Tokyo: Yamakawa Shuppan, 2002): 95-116.

²⁰ Makoto Aso, *Daigaku to Jinzai Yosei: Kindaika ni Hatasu Yakuwari (Universities and Educating Talented People: Roles to Play for Modernization)* (Tokyo: Chuo Koron, 1970), pp. 5-9.

²¹ *Kobusho Enkaku Hokoku*, pp. 403-411.

Yozo Yamao is recognized as "the father of industry" in Meiji Japan.²² Since he wrote few private documents, there are not many studies on Yamao. I track a small number of his official reports to the government. On the other hand, there are enormous studies on Hirobumi Ito, the first Prime Minister, though I have not been able to find any research to reveal his contribution to engineering.

Students studying abroad were the key figures that brought Western cultures into Japan. *Kindai Nihon no Kaigai Ryugakushi* by Minoru Ishizuki is a comprehensive study of the history of the students who studied abroad from the end of the Tokugawa period to the first-half of the Meiji era.²³ Ishizuki describes the background of the Choshu clan and the five Choshu blockade runners including Yozo Yamao and Hirobumi Ito. For Yamao and Ito, studying in Britain was the trigger to change their identities from members of a feudal clan to a national one. Nonetheless, Ishizuki does not report on how their national identity is linked to their conviction to lead industrialization.

Foreign employees were also major contributors to cultural exchange. There are a large number of studies about *oyatoi gaikokujin*, or foreign employees. Hiroto Saigusa collects data on more than 1100 foreign employees, who were in Japan from 1860-1914, in eleven fields of industry.²⁴ A comprehensive study has been conducted by Noboru Umetani and others, and a series of *Oyatoi Gaikokujin* was published by Kajima Kenkyujo Shuppankai.²⁵

The first principal of the ICE Henry Dyer one of the most significant figures in the history of the ICE. He was a prominent Japanologist as well as an engineer and teacher. Although most of his works were

²² Namio Haga, "Gijutsu Shiwa 2, Kogyo Shikan no Yosei: Kogaku, Kogyo no Chichi Yamao Yozo," ("A Story of Technology Policy 2: The Father of Engineering and Industry, Yozo Yamao,") *Kogyo Gijutsu [Industrial Science and Technology]* 27 (2) (1986): 31-34, and Masanori Kanekiyo, *Yamao Yozo Den—Meiji Kogyo Rikkoku no Chichi (Yamao Yozo: The Father of the Founding Meiji Industrial Nation)* (Yamaguchi: Yamao Yozo Kenshokai, 2003).

²³ Minoru Ishizuki, *Kindai Nihon no Kaigai Ryugakushi (A History of Studying Abroad in Modern Japan)* (Kyoto: Minerva Shobo, 1972).

²⁴ Hiroto Saigusa, et al., *Kindai Nihon Sangyo Gijutsu no Seioka (Westernization of Industrial Technology in Modern Japan)* (Tokyo: Toyo Keizai Shimposha, 1960). Scientists and teachers are not the subjects in this book.

²⁵ The series consists of seventeen volumes. The twelfth volume and the later are published by Kajima Shuppankai.

written after he went back to Scotland, they were based on his experiences in Japan.²⁶ Japan is the main topic in his three major works, *The Evolution of Industry*, *Dai Nippon*, and *Japan in World Politics*.²⁷ Masami Kita describes the contribution of Dyer to the ICE through illustrating the relationship between Scotland and Meiji Japan.²⁸ There is a chapter of "Dyer's view of Japan" in which Kita summarizes Dyer's three major writings on Japan. Nobuhiro Miyoshi depicts the process of Dyer's visit to Japan, his works on engineering education at the ICE, and his life after going back to Scotland.²⁹ Shoji Katoh scrupulously reveals Dyer's life based on historical sources.³⁰

All these studies on the foreign employees in Meiji Japan, including Henry Dyer, report mainly their works. The subject of foreign employees as observers is not fully explored. Foreign observers who lived in Japan during the Meiji Restoration are significant because they supposedly had more discerning senses than did Japanese people about affairs in Japan. Specifically, the observant eye of Dyer for the Japanese students at the ICE is meaningful to reveal the ethos at the college.

The students and graduates of the ICE were significant in the history of Japanese technology because they promoted industrialization in every field of engineering in the Meiji period. They were virtually the pioneers of engineering in Japan. There are several biographies of graduates of the ICE.³¹ In addition, the

²⁶ A complete list of his writings is in Nobuhiro Miyoshi, *Dyer no Nihon (Dyer's Japan)* (Tokyo: Fukumura Shuppan, 1989). The English version of this book is: *Henry Dyer: Pioneer of Engineering Education in Japan* (Folkstone: Global Oriental, 2004), translated by Takuji and Aiko Sarada. Major works of Dyer are republished with an introduction by Miyoshi, *The Collected Writings of Henry Dyer: A Collection in Five Volumes* (Tokyo: Edition Synapse, 2006).

²⁷ Henry Dyer, *The Evolution of Industry* (London; New York: Macmillan, 1895), *Dai Nippon*: (London: Blackie & Son, 1904), and *Japan in World Politics. A Study in International Dynamics* (London: Blackie & Son, 1909).

²⁸ Masami Kita, *Kokusai Nihon o Hiraita Hitobito (People Who Opened International Japan)* (Tokyo: Dobunkan Shuppan, 1984).

²⁹ Miyoshi, *op. cit.* (1989).

³⁰ For example, Shoji Katoh, "Tokyo Daigaku Shozo, Henry Dyer Kanren Toshō, o Meguru Kosatsu," ["A Collection of Books at Tokyo University That Are Related to Henry Dyer,"] *Journal of the History of Tokyo University* (20) [2002]: 25-39; "Kobu-Daigakko Shobo-kake Inomata Masatake to Oyatoi Kyoshi Henry Dyer," ["Librarian Masatake Inomata Meets Principal Henry Dyer at the Imperial College of Engineering, Tokyo,"] *Journal of the History of Tokyo University* (23) [2005]: 1-24

³¹ For example, Kogaku Hakase Asano Osuke Sensei Denki Hensankai ed., *Kogaku Hakase Asano Osuke Sensei Den (A Biography of a Doctor of Engineering, Osuke Asano)* (Tokyo: Kogaku Hakase Asano Osuke Sensei Denki Hensankai, 1944), and Hideo Segawa, ed., *Kogaku Hakase Fujioka Ichisuke Den (A Biography of a Doctor of Engineering, Fujioka Ichisuke)* (Tokyo: Kogaku Hakase Fujioka Ichisuke Kun Denki Hensankai, 1933).

pioneering figures have been investigated as a part of the history of industries, such as Kingo Tatsuno in architecture, Sakuro Tanabe in civil engineering, and Rinzaburo Shida in electrical engineering.³² However, there is not a study conducted from a sociological viewpoint—here it is the ICE as an educational institution—in terms of these pioneers.

Technology Transfer

Technology transfer is a process of industrialization by introducing a system of advanced technology from another society. Technology transfer causes conflict in the technology-introduced society often resulting in failure. Not only technological factors, but also political and cultural factors influence the success of technology transfer. Therefore, thoughts and social factors behind technology transfer are significant. Success in the case of Meiji Japan implies a key to solving the problem of overcoming the cultural conflict associated with technology transfer.

In the nineteenth century, there were several failures of industrialization caused by Western technologies introduced to the world. Egypt, for example, intended to transfer new technologies, to establish the Western style of military system with the support of France, and to begin the construction of spinning and shipbuilding industry, and sent students abroad to make them absorb new technologies.³³ However, the attempt failed because of interference by the Western powers. Industrialization was unsuccessful in the Ottoman Empire by the Turks. There were domestic and international factors that prevented the introduction of Western technologies in the complicated situation with political and religious

³² For example, regarding Kingo Tatsuno, Shiro Ouchida, "Obigata kara Mita Marunouchi Hon-oku no Isho ni Kansuru Kosatsu," ["The Design of String-Courses at the Tokyo Station: Study on the Architectural Design of Tokyo Station 1,] *Nihon Kenchiku Gakkai Keikakukei Ronbunshu* [*Journal of Architecture and Planning*] No. 589 (2005.03): 201-205.

Regarding Sakuro Tanabe, Kozo Amano, "Sakuro Tanabe," *Doboku Gakkaishi* [*Journal of the Japan Society of Civil Engineers*] 67 (11) (1982.10): 63-67.

Regarding Rinzaburo Shida, Noboru Wakai, "Waga Kuni no Denki Tsushin no Pioneer: Shida Rinzaburo," ["Pioneer of Telecommunications in Japan: Rinzaburo Shida,"] *Denshi Joho Tsushin Gakkaishi* [*The Journal of the Institute of Electronics, Information and Communication Engineers*] 78 (9) (1995.09): 907-908.

³³ Tatsuya Kobayashi, *Zoku Gijutsu Iten—Dochakuka eno Chosen (Sequel, Technology Transfer: Attempts to Naturalization)* (Tokyo: Bunshindo, 1983), pp. 196-197.

strife.³⁴ China also failed to adopt new technology in the nineteenth century, even though China was defeated by Britain in the Opium Wars and realized the significance of industrialization. These failures of industrialization indicate that technology transfer implies social and political factors besides technological matters.

In the United States, on the other hand, technology transfer naturally generated as people settled in new lands.³⁵ After defining the American system of factory, Daniel J. Boorstin mentions the background of thought that brought technological innovations to the United States by the middle of the nineteenth century: "If the American Factory System was a triumph of organization and of cooperation, it was also a triumph of naiveté, for its essence was a loosening of habits and of ways of thinking. Ignorance and "backwardness" had kept Americans out of the old grooves."³⁶

Tatsuya Kobayashi discusses that there were social factors in Japan to accept technology transfer after the Meiji Restoration. Preconditions in Japan had been established by the end of the Tokugawa period. A high standard of education had been established in the Tokugawa period, and exchanges of culture and technology among inter-local communities through *sankin kotai*, or the system of alternate attendance by a daimyo in Edo (current Tokyo), prepared the foundation to receive new technology from outside of these societies.³⁷ High-levels of ethnic homogeneity also make it easier to unite under the initiative of the government with the slogan "prosperous country and strong army." When Japan opened the country at the middle of the nineteenth century, the industrial system, which Japan tried to introduce from the West, was still "idyllic."³⁸

Miwao Matsumoto considers that the attainment of industrialization in the field of shipbuilding was a

³⁴ *Ibid.*

³⁵ Tatsuya Kobayashi, *Gijutsu Iten—Rekishi karano Kosatsu, America to Nihon (Technology Transfer: A Historical Study of the United States and Japan)* (Tokyo: Bunshindo, 1981), pp. 236-238.

³⁶ Daniel J. Boorstin, *The Americans: The National Experience* (New York: Vintage Books, 1965), p. 21.

³⁷ Kobayashi, *op. cit.* (1981), p. 162.

³⁸ Mitsukuni Yoshida, *Oyatoi Gaikokujin, 2, Sangyo (Foreign Employees, 2, Industry)* (Tokyo: Kajiima Shuppan, 1968), p. 206.

social result of the institutionalization of professional engineers and scientists.³⁹ The Ministry of Public Works tailored the positions of specialists in engineering for talented people who wanted social success, specifically the lower class samurai. Indeed, these social factors were significant; the motivation of the participants at the ICE should be investigated to understand the development of the college.

There were also ideological and psychological factors to overcoming confliction caused by technology transfer. There have been studies of standard morals conducted that relate to industrialization in Japan. A significant model of those studies is Max Weber's theme in *the Protestant Ethic and the Spirit of Capitalism*. An ethos exists that explains economic activities in society. Michio Morishima accounts Confucianism to be the ethos for a spirit of capitalism in Meiji Japan.⁴⁰ Indeed, Confucianism was a major philosophy in Tokugawa Japan, but the principles were naturalized in Japan and were much different from the ones practiced in China. The biggest obstacle for Confucians was the fact that they were speaking to samurai as military officers in Japan unlike China, in which Confucians faced civil servants.⁴¹ Because of the struggles of Japanese Confucians, they chose to change the teachings for the ruling warriors instead of changing the Tokugawa society according to the original principles of Confucianism. In other words, what changed Confucianism in Japan is more important than Confucianism itself.

In his work, Tatsuya Kobayashi emphasizes the importance of Japan's change from a traditional culture and value system as a reaction to Western technology.⁴² Various thoughts and ideologies justify the adoption of Western technology. All of them show the process of simplification toward pragmatism, according to Kobayashi. Dichotomization, such as East and West, is one form of simplification in making the adoption of Western technology as smooth as possible. Japanese phrases that indicate duality, such as *wakon-yosai* (Japanese spirit and Western arts), and *wayo-secchu* (blending of Japanese and Western

³⁹ Miwao Matsumoto, *Fune no Kagaku Gijutsu Kakumei to Sangyo Shakai: Igirisu to Nihon no Hikaku Shakaigaku (The Revolution of Science and Technology of Ships and Industrial Society: Comparative Sociology of Britain and Japan)* (Tokyo: Dobunkan Shuppan, 1995), p. 133

⁴⁰ Michio Morishima, *Zoku Igirisu to Nihon—Sono Kokuminsei to Shakai* (Tokyo: Iwanami Shoten, 1978), *Why Has Japan 'Succeeded?': Western Technology and the Japanese Ethos*, (Cambridge: Cambridge University Press, 1982).

⁴¹ Ikegami, *op. cit.* (2000), pp. 299-300.

⁴² Kobayashi, *op. cit.* (1981), pp. 162-169.

elements), show their struggle to maintain Japanese identity while they were shrewdly adopting new technology, including the factory system. He concludes that Japanese people chose to avoid confliction with the West by giving up consistency of their spiritual tradition. Acceptance of thoughts imported from entirely alien cultures as if they will not affect Japanese culture or identity works to avoid unnecessary friction when adopting new technology.

Kobayashi proposes the idea of Meizen Kimbara (1832-1923), and states that there was no thought worthwhile to consider besides the idea of Kimbara that motivated people to adopt the concepts of Western civilization and promoted local business talents to participate in the trend of Westernization during the transition time at the end of the Tokugawa period.⁴³ Kobayashi points out that Kimbara's concept was one of "extreme simplification" of thoughts, which proved to be pragmatic, as well as Shozan Sakuma's idea of the mixing of "Eastern morals and Western arts." Kobayashi assumes that Kimbara's notion was popular at the end of Tokugawa Japan; however, there is no persuasive evidence that shows people believed in, or at least had interest in, Kimbara's philosophy at that time.

Tadaaki Kimoto suggests that the essential point is that industrialization was accomplished even though there were countless troubles in every factory. He concludes that there was flexibility with engineers and workers at a local site, and they struggled and made up for the failures of politicians and the management of the factories.⁴⁴ The problem is where did this flexibility and sustainability come from, and what ideology and cultural tradition justify these features; but this subject is not a target in Kimoto's research.

Industrialization in Japan was a result of the fusion of Western technology with the local culture. A study reports that it was hard to recruit workers at a thread-manufacturing plant in Tomioka, which was one of the first government operated plants, because there was a rumor that a foreign employee drank wine

⁴³ *Ibid.*, p. 163.

⁴⁴ Tadaaki Kimoto, *Kobusho to Meijiiki Nihon Gijutsu no Shakaiteki Keisei no Sougo Kanren ni Kansuru Kenkyu (A Study on Mutual Relationships of the Social Formation of the Ministry of Public Works and Technology in Meiji Japan)* (2002), p. 29.

made with the blood of young women.⁴⁵ One young woman was convinced by her father and grandfather to work there for the sake of the nation. This episode shows that Western technology was not necessarily welcomed and there was resistance to it in the local community. Moreover, it shows that a nationalistic consciousness was one factor to motivate the workers to engage in these jobs. Nevertheless, it is difficult to generalize the motivation of factory workers because there are not sufficient numbers of evidence. The ICE as an educational institution is a suitable subject to collect evidence of participants: the founders, teachers and administrative staff, and students.

In terms of the native culture in Japan, various studies propose adaptability of Japanese people against encountering an alien culture. According to Kagefumi Ueno, it was critical that Japanese people did not have conflicting thoughts or religions with Western civilizations.⁴⁶ Ueno emphasized that animistic feature of Japanese thoughts make pliable measures possible against a crash of civilizations.

Shichihei Yamamoto refers to the solidarity of Japanese people as "campaign style rice farming."⁴⁷ The harvest season is also the typhoon season. A one-day delay of harvesting might threaten the yield of the year. A timeline for everything they do must be constructed for the farmers by counting backward from the day of the harvest. The farmers, 85 percent of the entire population until the Middle Ages, had been trained for hundreds of years to work together to finish their task. In such a society, a creative person is not necessarily welcomed; but punctual, obedient, imitative, and cooperative people can survive.

Taichi Sakaiya describes Japan as a polytheistic and animistic society, and states that there is "no sense of an absolute good," and "right and wrong are relative values" among people.⁴⁸ Sakaiya explains that people's unprincipled behavior is their wisdom to keep away from troubles over the different opinions in a small society. People's opinions depend on the environment and their circumstances, and this behavior is the standard of judgment for the Japanese, according to Sakaiya. His account explains the mental structure

⁴⁵ Yoshida, *op. cit.* (1968), p. 67.

⁴⁶ Kagefumi Ueno, *Gendai Nihon Bunmei Ron (Studies of Current Japanese Civilization)* (Tokyo: Daisan Kikaku, 2006), pp. 75-83.

⁴⁷ Shichihei, Yamamoto, *Nihonjin to Yudayajin—Yamamoto Shichihei Library* 13 (Tokyo: Bungei Shunju, 1997, c1970), pp. 43-47.

⁴⁸ Sakaiya, *op. cit.* (1991), p. 117. *What Is Japan?: Contradictions and Transformations* (New York; Tokyo: Kodansha International, 1993), translated by Steven Karpa, p. 144.

of the group psychology of Japanese people who think that harmony is the highest value in human relations. Indeed, these accounts of characteristics of Japanese culture can explain the probability of swift industrialization, but they do not explain inevitability of industrialization and Westernization. Were the actions of industrialization and Westernization passive behaviors for the Japanese people? In contrast, the competitive spirit that comes from national identity suggests a reasonable account of their behavior as active.

National Identity and Engineering

Shigeru Nakayama focuses on the formation of the Imperial University and its features, and analyses it from the viewpoint of social history.⁴⁹ The Imperial University was established in 1886 after the ICE merged with the University of Tokyo. He illustrates that the students studying engineering at the ICE and the Imperial University were the major source of bureaucrats in the Meiji government. The schools under the Ministry of Public Works secured the jobs for the students after their graduation, in contrast to the schools under the Ministry of Education. The Meiji leaders actively imported engineering from Europe. Although the learning of engineering was not necessarily accredited in universities in Europe, according to Nakayama, the leaders and participants put efforts into making it legitimate for higher education in Japan. The learning of engineering became an authority by being kept away from people. Since most of the engineers in the early days of Meiji were from the samurai class, he supposes the characteristics of engineering in Meiji are due to "samurai mentality."⁵⁰ Although there is statistical analysis of the students, the characteristic of samurai mentality is not analyzed enough; what it is, where it comes from, and how it works. Furthermore, the process of establishing the ICE is not a target of the study; thus, it is not clear what drove the participants to develop the ICE.

Seiji Tsunekawa discusses the characteristics of artisans and engineers in the Meiji period by focusing on the practical workers.⁵¹ He concludes that artisans rather than highly educated engineers were needed in

⁴⁹ Nakayama, *op. cit.* (1978).

⁵⁰ *Ibid.*, pp. 78-79.

⁵¹ Seiji Tsunekawa, *Meijiki ni Okeru Gijutsusha no Bunseki—Kindai Gijutsu Kakuritsu o Meguru Shokunin to Shokuninteki Gijutsusha* [An Analysis of Engineers in Meiji Japan—Artisans and

the early days of Meiji Japan. Tsunekawa also conducts a statistical analysis of engineers and their social origins, and concludes that many lower class samurai became practical engineers, and practical engineers were mainly from lower class samurai.⁵² Nevertheless, the ethos of engineers in higher education is not a target in his study. The motivation of engineers in higher education was not purely pursuit of the advancement of technology. I assume that national awareness was a significant driving force to advance engineering education after the Meiji Restoration.

Kiyoshi Inoue argues that the increase in nationalism during the Meiji era was created by the creation of unequal treaties with Western powers.⁵³ Since the Tokugawa shogunate agreed to a treaty with the United States in 1853, the Japanese people had been forced into unfavorable commerce under the absence of a protective tariff, and subjected to humiliating treatment under extraterritorial rights. Those experiences brought to the Japanese people an awakening of national identity and sense of unity as Japanese. Revising these unequal treaties had been a top priority in Japanese diplomacy until Japan achieved this goal in 1911. However, Inoue does not analyze the influence of national identity on industrial policy in Japan. Moreover, the ethos of politicians as the actors is not clear. Engineers in the early days of Meiji Japan were mainly former samurai. After the Meiji Restoration, their loyalty to the feudal clan changed into a national one. Their energy of loyalty was sublimated to nationalism. Therefore, investigation of the ethos of samurai is essential.

Eiko Ikegami proposes a social viewpoint on investigating the ethos of samurai in her book *The Taming of the Samurai*.⁵⁴ The main purpose of her book is to reveal the formation of culture through the process of changes in the identities of samurai from half-independent warriors to tamed bureaucrats. The seventeenth century was the time, according to Ikegami, at which emerged the problem of honor for

Artisan-Engineers constructed Modern Technologies], Dissertation at Tokyo Institute of Technology, 2005.

⁵² *Ibid.*, pp. 106-108.

⁵³ Kiyoshi Inoue, *Joyaku Kaisei (Revision of the Treaties)* (Tokyo: Iwanami Shoten, 1955).

⁵⁴ Eiko Ikegami, *The Taming of the Samurai—Honorific Individualism and the Making of Modern Japan* (Cambridge: Harvard University Press, 1995). This book was originally published in English, and translated into Japanese by Jun Morimoto, *Meiyo to Junno* (Tokyo: NTT Shuppan, 2000).

samurai. Their sense of honor shows the strain between their ideology of collectivism and individualism.⁵⁵ Ikegami mentions that the national crisis in the encounter with Western Imperialism awoke the ethos of the samurai as warriors at the end of the Tokugawa period. Ikegami asserts that honorific individualism was a major impulse among samurai to revive collective identity as warriors for overthrowing the Tokugawa regime, which did not keep their honor anymore in front of Western powers. However, she does not explore how such a sense of honor worked after the Meiji period. If we deal with the ICE as a form of successive traditional organization of samurai, Ikegami's theory of honor implies that the ethos of samurai became a major source of the motivation to cope with social changes for the Japanese participants at the ICE.

Chie Nakane proposes a theory that the Japanese society places importance on vertical ties, which depend on one's belonging to an organization, rather than horizontal ties, based on one's attributes such as occupation and social class.⁵⁶ Her theory can explain some characteristics seen at the ICE. Most of the participants at the college belonged to feudal clans and formed the hierarchical society with the lord at the top. After the feudal system was dissolved in the process of the Meiji Restoration, students at the ICE strived to achieve the social promotions in the vertical society with the nation of Japan at the top. Their identity of belonging, such as to the ICE or Japan as a nation, generally seemed stronger than their identity of who they were or what they could do as engineers. In addition, once the ICE as a group functions, it gets admirable effects, even though a student may not be able to show his individual spirit. In other words, Nakane's theory explains well that these features were the intrinsic structure of Japanese society and thus maintained at the ICE after the Meiji period. However, her theory only shows a tendency of Japanese society in contrast to international societies, and cannot entirely explain every case of a small organization, such as the ICE. For example, it is difficult to explain the feature of the college gathering former samurai because Nakane treats class-consciousness as a horizontal tie. Furthermore, her theory can explain that the social structure continues as time goes by, but cannot explain the motivations and behavior of people coping with an environmental change. After all, it is not enough to explain the reasons why Japan carried out the

⁵⁵ *Ibid.*, pp. 3-5.

⁵⁶ Chie Nakane, *Tate Shakai no Ningen Kankei (Human Relations in a Vertical Society)* (Tokyo: Kodansha, 1967).

Meiji Restoration, and why the ICE was established.

Benedict Anderson points out that the order of hierarchical system during the Tokugawa period affected the formation of Japanese national awareness in international relations after the Meiji Restoration.⁵⁷ A significant point is that a feature of Japanese nationalism came from the legacy of the isolation policy during the Tokugawa period as well as from the Western impact at the end of the periods. He also mentions the hierarchical attitude of the "supremacy of superior over inferior" among the Restoration leaders and the absence of awareness of equality in international relations. We can see the tendency of Japanese nationalism, which Anderson points out, in a small institution of engineering education such as the ICE. Thus, this thesis verifies Anderson's theory of Japanese nationalism.

Technological developments are deeply related to the political process inside and outside of an institution. Gabrielle Hecht describes the role of French national identity to build nuclear power plants after the Second World War, and how the engineers made use of the political influence of nuclear technology between nuclear related institutions.⁵⁸ Hecht finds a mutual relationship between the nation of France and engineers of nuclear technology. She uses the concept of "technopolitical regimes" to explain inter-connected relations among engineers, technology, ideology, and politics.⁵⁹ These elements existed inseparably to construct the nuclear power plants. Hecht succeeds at deepening our understanding of technological development by analyzing cultural and political themes as related to such development. Her method can be applicable to investigate the development of engineering education. There are similarities in both France after the Second World War and in Meiji Japan as illustrated in the following points: development and progress of technology, consciousness of the rise of the nation and independence, and policies initiated by the government. Among other things, there were political struggles for these participants both in France and Meiji Japan. Students at the ICE had intentions to gain social success, and they utilized the college to get the advantage of an education for that purpose.

⁵⁷ Benedict Anderson, *Imagined Community: Reflections on the Origin and Spread of Nationalism*, Revised Edition (London; New York: Verso, 1991), p. 97.

⁵⁸ Gabrielle Hecht, *The Radiance of France* (Cambridge, Massachusetts: The MIT Press, 1998).

⁵⁹ *Ibid.*, pp. 16-17.

In following three sections, I explore the linkage of national identity and engineering education in the history of the ICE. I specifically focus on the cultural and political backgrounds of the Japanese participants during the development of the ICE. In other words, I am interested in how non-engineering factors affected the development of engineering education in early Meiji Japan. In section 3, I begin with the establishment of the college until its opening by focusing on Yamao and Ito who had gone to study abroad in Britain. I deal with their self-awareness that affected the establishment of the ICE, and their intentions to materialize their desires through establishing the college. In section 4, I review the system of the college, and its reputation inside and outside of Japan. I analyze Dyer's remarks about the college and its students in his works. Exposing Dyer's frank impressions on the students through the observant eye of a Scottish engineer. In section 5, I argue the identity of the students as samurai at the college, and clarify their position in the nation of Japan. Revealing how their political strategies to raise their social status characterize engineering education at the ICE.

3. Before the Imperial College of Engineering—Yamao and Ito

This section traces the changes of attitude of the co-founders of the ICE Yozo Yamao and Hirobumi Ito from members of the Choshu clan to Japanese nationals after visiting Britain. Nevertheless, their standards of behavior were consistent with those of the samurai class in terms of upholding the spirit of rivalry, loyalty, and independence. The characteristics of the college reflected their spirit of honor for overcoming inferiority—the spirit of samurai. The Ministry of Public Works and the ICE were established as results of power politics among former feudal clans. Specifically, the members from Choshu clan were main advocates of industrialization and Westernization in the Meiji government.

The five Choshu blockade runners played significant roles in establishing the Ministry of Public Works and the ICE. *Kyu Kobu Daigakko Siryo* begins with the statement of those roles: "The event was the origin of the Meiji culture and the seeds of the industry in our country. All these five members contributed to industrial education directly and indirectly, but among them, Yozo Yamao was the founder of the Imperial

College of Engineering and a benefactor of our science and industry."⁶⁰ They are mentioned as people deeply related to the ICE: Hirobumi Ito and Kaoru Inoue took part in national politics; Yozo Yamao, viewing industry in our nation as awfully immature and decadent, proposed the government develop industry, and founded the Ministry of Public Works; Masaru Inoue entered the mining and railroad industries; and Kinsuke Endo went to Osaka and established the Mint.⁶¹

These five samurai broke the law that prohibited people from going abroad during the Tokugawa regime, and went to Britain in 1863. Before leaving Japan, they had been extreme advocates of expelling barbarians. For example, Yamao and Kaoru Inoue, with eight other samurai from Choshu domain led by Shinsaku Takasugi, took part in setting fire to the British legation in 1863.⁶² This action was to establish a power advantage among the feudal clans of the anti-Tokugawa shogunate. Their identity was based on samurai of Choshu clan; so that they had loyalty to and the consciousness of the independence of the clan, and rivalry against other clans.⁶³

After visiting Britain, the five blockade runners identified more with being Japanese than with being members of a clan. They recognized the necessity for adoption of Western technology to maintain the independence of the nation. They became promoters of Westernization after returning to Japan. Their nationalism brought about the introduction of Western culture and technology in the Ministry of public works under the initiative of Hirobumi Ito rather than the promotion of Japanese native industry. The ICE, established as a subordinate institution at the Ministry, was also at the forefront of Westernization. The prime policy at the college was to absorb Western technology, specifically from Britain, as soon as possible to construct a civilized nation. Yozo Yamao played a significant role in deciding the primary direction of the college, even though the concrete curriculum was trusted to the first principal, Henry Dyer. By adopting

⁶⁰ *Kyu Kobu Daigakko Shiryo (Historical Materials on the Old Imperial College of Engineering)* (Tokyo: Toranomon Kai, 1931), p. 1.

⁶¹ *Ibid.*, p. 2

⁶² Takaaki Inuzuka, *Mikko Ryugakusei tachi no Meiji Ishin* (Tokyo: Nihon Hosho Shuppan Kyokai, 2001), pp. 106-107. There are two motivations of members of the Choshu clan: One is to overthrow the Tokugawa regime by making Britain angry and driving the regime into a corner. The other is to take initiative among the advocates of *sonno-joi*.

⁶³ "Samurai" literally means a person who serves somebody. Samurai as warriors in service to the lord of the clan.

Western technology through foreign employees, Japanese leaders maintained their goal to carry on all industry including engineering education in the hands of Japanese for the future. Yamao and Ito aspired not only to establish a learning of engineering independent of foreign teachers by emulation, but the independence of Japan from possible colonization by industrialization. Their standard of behavior changed into loyalty to the nation.

Studying Abroad

Under the feudal system, there was no chance for individual pursuits motivated by self-interest. Going abroad was also an action based on public interest. The primary characteristic of Japanese students studying abroad during the Tokugawa period was a national awareness and attitude toward contributing to the public interests of that nation.⁶⁴ The five samurai intended to be human weapons and expel the barbarians. Hirobumi Ito wrote a petition to the lord of Choshu clan to use money for going to Britain. In the letter, the five samurai referred to themselves as "live machines."⁶⁵ Ito also wrote a letter to his father explaining that going abroad was a part of service to the lord. Ito worried that he had potentially put his father in a difficult situation believing that slander directed at him would be harsh, but asked him to understand that Ito had to do an extraordinary thing at an unexpected time.⁶⁶

How did they reach the conclusion to carry out this extraordinary thing? Before these young leaders left Japan, Shoin Yoshida, a samurai from Choshu domain, had attempted an illegal departure with the black ships from the United States when Commodore Perry came to Shimoda in 1854. Yoshida insisted on going abroad to study Western military and technology. However, Yoshida failed, and he was thrown into jail by the Tokugawa government until 1856. At that time, Shozan Sakuma (1811-1864), a samurai from Matsushiro domain (current day Nagano), was also confined. Because of this, Yoshida learned under Sakuma when they were in Edo. Sakuma spoke his mind in a letter to his acquaintances in 1854:

⁶⁴ Ishizuki, *op. cit.*, p. 107, cites Takeji Hayashi, "Bakumatsu no Kaigai Ryugakusei no Seikaku," ("Characteristics of Students Studying Abroad at the End of Tokugawa Period,") *Rekishi Kyoiku (History Education)* 15 (1) (1967): 10-16.

⁶⁵ Hirobumi Ito, *Ito Hirobumi Den*, Vol. 1 (*A Biography of Hirobumi Ito*) (Tokyo: Shumpoko Tsuishokai, 1940), p. 103.

⁶⁶ *Ibid.*, p. 108.

Send capable people to the West to make them search something of the resources of foreign powers and learn military technology, naval defense, and castle construction. There is no measure other than this way. It would take around three years. It is clear how useful the people who learned the Western civilization and technology are.⁶⁷

Yoshida practiced the ideal of his mentor.⁶⁸ When Yoshida went back to Choshu, he became a teacher at a private school, *Shokason Juku*. Young leaders, such as Takayoshi Kido (or Kogoro Katsura), Shinsaku Takasugi, and Hirobumi Ito, learned under Shoin Yoshida. Yoshida's philosophy infiltrated the minds of the young leaders in Choshu domain.

The five samurai who advocated expelling barbarians changed their minds after leaving Japan. On the way to Britain, they stopped by Shanghai, China, and surprised the navy of a Western power. Kaoru Inoue later stated, "I instantly awoke from delusion that I had used to have."⁶⁹ He realized that Japan was virtually defenseless and the ideology of expelling barbarians was reckless. When Inoue recalled the establishment of the Department of Commerce in the government at a later date, he mentioned his impression of Britain: "The reason why we had to promote industry and commerce was very clear when I saw and heard the various situations of the development of industry and commerce in London. I was confident when I looked at the facts rather than read some materials."⁷⁰ Ito was also persuaded to abolish the feudal system in Japan during his visit to Britain. Takaaki Inuzuka points out that the issue of industrialization caused Ito and Inoue to change their feudal value system to a national one.⁷¹

After arriving in Britain, the five Choshu members learned English under Alexander William Williamson (1824-1904), a professor of Practical Chemistry at the University College, London. Then they entered the college with his help. Kaoru Inoue and Ito studied military, politics, and law, and Masaru Inoue,

⁶⁷ Shozan Sakuma, *Shozan Zenshu*, Vol. 4 (*The Complete Works of Shozan*) (Nagano: Shinano Mainichi Shimbun, 1935), pp. 255-256.

⁶⁸ Inuzuka, *op. cit.* (2001), p. 20.

⁶⁹ Ishizuki, *op. cit.*, p. 33, cites Kunihei Nakahara, *Inoue Haku Den*, Vol. 3 (*A Biography of Sir Inoue*) (Tokyo: Nakahara Kunihei, 1907), pp. 16-17.

⁷⁰ Akira Sawada, ed., *Segaiko Jireki Ishin Zaisei Dan (Remarks of Sir Inoue on the History of Finance)*, Vol. 2 (Tokyo: Okahyakusei, 1921), pp. 150-152, reprinted in *Meiji Koki Sangyo Hattatsushi Siryo*, Vol. 264 (*Materials on the History of Industrial Development in the Late Meiji*) (Tokyo: Ryukeishosha, 1995).

⁷¹ Inuzuka, *op. cit.* (2001), p. 103.

Kinsuke Endo, and Yozo Yamao studied natural science.⁷²

While they were staying in London in 1864, a member of the host family shared with them the news that Choshu clan had reportedly attacked a British ship in 1863. Since they were surprised to see arsenals and industrial factories in London, they were convinced that Japan would have perished if Choshu clan had attacked and expelled the Western powers. Ito later recalled his thoughts at that time and spoke, "What can we do without our country, even though we complete learning."⁷³ Ito and Kaoru Inoue decided to go back to Japan and convince the lord and other executives of Choshu clan to abolish the policy of exclusionism. The other three members stayed in Britain to achieve their original mission. When Ito and Inoue arrived in Japan, a Japanese person predicted that "six or seven out of ten that their heads would be cut off, and that we should never see them again" because their opinion of opening the country would make their fellow clansmen angry.⁷⁴ Ito and Inoue survived this occasion, but their opinion was not accepted by their lord.

After Ito and Inoue left Britain, the other three members met students from *Satsuma* domain (current day Kagoshima) in London. The students from both clans felt familiarity to each other as Japanese while maintaining caution amongst members of different clans.⁷⁵ For example, the samurai from Satsuma were using false names. One reason for their caution was their awareness that they were blockade runners who were supposed to hide from the shogunate, and another reason was the rivalry between clans. Thereafter, the relationship between the members of both clans changed from cautious to cooperative while they stayed in a foreign country and their national identity strengthened.

This rivalry between clans was a political factor in sending students to foreign countries; however, national awareness of students surpassed local clan-ism. Ishizuki points out that the principle of competition between clans was the fundamental energy that pushed students to go abroad at the end of the

⁷² Ishizuki, *op. cit.*, p. 34.

⁷³ Hirobumi Ito, *Ito Ko Jikiwa (Remarks of Sir Ito)*, ed. by Midori Komatsu (Tokyo: Chikura Shobo, 1936), p. 130.

⁷⁴ Earnest Satow, *A Diplomat in Japan* (Tokyo: ICG Muse, 2000), pp. 92-93. It was originally published in 1921 by Seely, Service & Co. Limited in London. The prediction is by Kensaku Nakazawa, a Japanese language teacher of Satow.

⁷⁵ Takaaki Inuzuka, *Satsuma Han Eikoku Ryugakusei (Students from Satsuma Han in Britain)* (Tokyo: Chuo Koron, 1974), pp. 66-67.

Tokugawa period.⁷⁶ The students and leaders sent abroad intended to take initiative over other clans toward opening the country. Being surprised by Western technology and meeting Japanese fellows in a foreign country changed the minds of the students about opening the country and deepened their awareness of national identity.

Establishment of the College

The Meiji government promoted Westernization under the leadership of the Ministry of Public Works. The Ministry of Public Works was "established on intercalary October 20, in the third year of the Meiji [1870] owing to the proposal of Yozo Yamao and others."⁷⁷ The ICE was deeply related to the Ministry of Public Works; for example, the college was founded under the control of the Ministry. The curriculum of the college corresponded to the organization of the Ministry, such as mining, civil engineering, and telegraphic engineering.⁷⁸ The students were educated under the policy of the Ministry.

The Ministry was "created, "in fact, as a result of power politics among factions of former clans."⁷⁹ Members from Satsuma and Choshu clans insisted on strengthening the industrial policy of the Meiji government. Toshimichi Okubo (1830-1878), who was from Satsuma, stated, in a letter to Tomomi Iwakura on November 4, 1870, that "the Ministry of Public Works had been planned to be a Department, but Yamao handed in his resignation, and it became a Ministry as a result."⁸⁰

Members of the Kido faction or from Choshu clan occupied the tops of the Ministry.⁸¹ When the Ministry of Public Works was established, the position of Minister was first vacant. Yozo Yamao and Masaru Inoue, who were both from Choshu clan, were heads of Sections. Hirobumi Ito was also eager to promote civil engineering. He himself was at first the vice Minister of Public Works in 1871, and became the first Minister in 1873. The heads of Departments and Sections were told to be well acquainted with

⁷⁶ Ishizuki, *op. cit.*, pp. 35-37, 55.

⁷⁷ *Kyu Koku Daigakko Shiryo*, p. 2.

⁷⁸ Matsumoto, *op. cit.*, pp. 132-133.

⁷⁹ Kimoto, *op. cit.*, p. 21.

⁸⁰ Toshimichi Okubo, *Okubo Toshimichi Monjo*, Vol. 4 (*The Documents of Toshimichi Okubo*) (Tokyo: Hayakawa Junzaburo, 1928), p. 104.

⁸¹ Makoto Nishikawa, "Sasaki Takayuki to Kobusho," ("Takayuki Sasaki and the Ministry of Public Works,") in Jun Suzuki, ed., *Kobusho to Sono Jidai (The Ministry of Public Works and Its Era)* (Tokyo: Yamakawa Shuppan, 2002): 229-260, p. 231. Takayoshi Kido (1833-1877) was also from Choshu clan.

technological knowledge. The top-level executives at the Ministry were expected to know resources of Western affairs and languages. The Meiji Emperor intended to place Takayuki Sasaki as the Minister of Public Works after Ito left the post in 1878. However, Ito sent a letter to the Minister of the Right Tomomi Iwakura, and insisted that the Minister of Public Works should speak a foreign language and be able to negotiate with foreign employees since there were many of them.⁸² As a result, Kaoru Inoue became the following Minister.

Clan-politics of bureaucrats in the Ministry of Public Works was well balanced among Choshu, Hizen (Saga), and Tosa (Kochi) clans until around 1871. After Ito took the position of the Minister, bureaucrats from Choshu clan became the majority in the Ministry. The Choshu group was proficient in English and had connections to Britain, and British engineers became the heads of every Department in the Ministry. In the Department of Mining in the Ministry, non-Choshu bureaucrats left the Department one after another, and the Choshu regime was established.⁸³

The five Choshu samurai were aggressive promoters of Westernization. Their ideals were far from the common sense of the people. Ito recalls that he and other Choshu members who studied in Britain were called the "Arabian group," as an Arabian horse symbolized running fast toward the future, and Ito and Inoue were taking the initiative of Westernization.⁸⁴ Kaoru Inoue was one of the radical leaders of Westernization in the government. When he was the Minister of Foreign Affairs, he constructed Rokumeikan, which was a guesthouse with Western style architecture for VIPs from abroad and held Western style banquets day and night there for revision of the one-sided treaties. The superficial fervor of

⁸² Hirobumi Ito, a letter to Tomomi Iwakura on May 29, 1878, in Takematsu Ohtsuka, ed., *Iwakura Tomomi Kankei Monjo*, Vol. 6 (Tokyo: Nihon Shiseki Kyokai, 1931), reprinted in 1969, pp. 119-121. Nishikawa finds this material and cites it in *op. cit.*, p. 231. Nishikawa asserts that the letter was written in 1878, while Ohtsuka estimates that it was written in 1874.

⁸³ Jun Suzuki, "Kobusho no 15 Nen," ("Fifteen Years of the Ministry of Public Works,") in Jun Suzuki, ed., *Kobusho to Sono Jidai (The Ministry of Public Works and Its Era)* (Tokyo: Yamakawa Shuppan, 2002): 3-22, pp. 12-13.

⁸⁴ Yuko Yamazaki, "Nihon Kindaika o meguru Sokoku—Naimusho to Kobusho," ("Conflict of Methods toward Modernization in Japan: The Ministry of Interior and the Ministry of Public Works,") in Jun Suzuki, ed., *Kobusho to Sono Jidai (The Ministry of Public Works and Its Era)* (Tokyo: Yamakawa Shuppan, 2002): 117-151, pp. 121, 145.

Westernization of the government as symbolized by Rokumeikan caused people's antipathy.⁸⁵

Meanwhile, Okubo was cautious that the Ministry of Public Works was favoring Britain. When Okubo was the Minister of Finance, he met Otto von Bismarck in Prussia in March, 1873. Okubo was convinced of the danger of Britain and France in international relations. The industrial circle of Britain was eager to open the market in the Far East, in opposition to America, which was at a geographical advantage, and Prussia, which produced less expensive products.⁸⁶ While the Ministry of Public Works had the policy to spread railroads in Japan and employed many British engineers, the Ministry of Interior, established by Okubo in 1873, hired many engineers from the Netherlands and promoted water transportation.⁸⁷

The basic ideologies were different between Okubo and Yamao, even though both of them promoted industrialization in the government. While Okubo promoted industrialization with succeeding traditional ideology of the hierarchy, *shi-no-ko-sho* (warriors, farmers, artisans, and merchants from higher to lower), Yamao saw an importance of industry with the idea of *shi-ko-no-sho* (warriors, artisans, farmers, and merchants).⁸⁸ He tried to realign their traditional hierarchy of the class to place artisans higher.

The ICE was established in the Ministry of Public Works by the initiative of Yozo Yamao and Hirobumi Ito. Yamao and Ito turned in the proposal of establishing the ICE to the government in April 1871.⁸⁹ In order to urge the decision of the government, they made the most of the words of nation and civilization to raise national awareness in the proposal:

If you want your nation to accomplish civilization. . . .

. . . [to make Japan] stand in the same place with other nations and to maintain prosperity and strength. . . .

. . . authority of the Emperor will shine outside of this place, and people from top to down will have a

⁸⁵ Yutaka Kasuga, "Inoue Kaoru," *Super Nipponica 2001*, Light Edition, Ver. 1.1, Electronic Encyclopedia (Tokyo: Shogakukan, 2000).

⁸⁶ Takehiko Hashimoto, "Eikoku kara no Shisen—*Engineer* shi ni Miru Meiji Nihon no Gijutsu Jijo," ("Eyes from Britain—Technology in Meiji Japan seen in *Engineer*,") in Jun Suzuki, ed., *Kobusho to Sono Jidai (The Ministry of Public Works and Its Era)* (Tokyo: Yamakawa Shuppan, 2002): 83-94, p. 88.

⁸⁷ Yamazaki, *op. cit.* (2002), pp. 122-123.

⁸⁸ Namio Haga, "Kobu no Seishin to Yamao Yozo," ("The Spirit of Public Works and Yozo Yamao,") *Shizen* 35 (10) (1980.10): 94-97, p. 95.

⁸⁹ The proposal is reprinted in *Kyu Kobu Daigakko Shiryo*, pp. 4-5.

share in the great benefit of civilization . . . if this plan is adopted.⁹⁰

Hirobumi Ito later recalled the time of the establishment of the ICE, and gave a speech in front of the students at a teachers college in Nagano in 1899:

When I was engaged in the Ministry of Public Works in the sixth year of Meiji [1873], I noticed that there was not a foundation under the various industries. I thought we should promote engineering and industry in Japan; otherwise, the country never develops in the world. Then, I invited twelve teachers from Britain and opened the Imperial College of Engineering.⁹¹

Ito recognized that the qualities of industry between Japan and Britain were essentially different, and expressed the difference by stating that Japan did not have a foundation. Moreover, he was aware that the promotion of engineering would be the principal factor in the development of industry, and that industry was the necessary condition to rank Japan among the Western nations. The consciousness of rivalry against the Western powers became the major reason to establish the college.

To adopt the Western style was one of the primary concerns at the ICE. The Ministry of Public Works announced the Outline of the School Rules that consisted of nineteen articles in September 1871. There are three articles that specifically refer to the West. The fifth article states: "Westerners should be selected for the teachers of the two schools without exception." The sixth article states: "All people in the schools regardless of staff or student should adopt Western ways of food, clothing and shelter." Finally, the eighth article states: "Appoint one principal and have the person supervise the teachers at the two schools, and the person should be a Westerner".⁹²

Yozo Yamao asked the government to hire sixteen foreign teachers and technicians, including the principal at the ICE. The plan was approved on February 12, 1872.⁹³ Yamao reports that he and Ito had discussed bringing capable engineers and teachers from Britain right before Ito left Japan as one of the

⁹⁰ *Ibid.*, pp. 4-5.

⁹¹ Ito, *op. cit.*, (1936), p. 326.

⁹² *Kyu Koku Daigakko Shiryo*, pp. 18-20. There had been a preparatory school for the ICE. The phrase "two schools" indicates the preparatory school and the ICE. The preparatory school were for students aged from thirteen to seventeen. The school was closed in June, 1877, because of a budgetary cutback in the Ministry. More than two hundred students had been admitted to enter the school. Also see, p. 121.

⁹³ *Ibid.*, pp. 42-43.

ambassadors of the Iwakura Mission to the United States and European nations.⁹⁴ Consequently, twenty-four-year-old engineer Henry Dyer was selected as the principal.⁹⁵ Henry Dyer also describes, in *Dai Nippon*, an offer from Hirobumi Ito, during Ito's visit to Britain in 1872, looking for a qualified person for the principal of the college: "it was his [Ito's] wish that a College should be organized which would train men who would be able to design and superintend the works which were necessary for Japan to carry on if she adopted Western methods."⁹⁶ Ito was planning to develop industry in Japan with the methods of the West by the hands of Japanese. Dyer wrote a calendar for the college on a ship to Japan, he presented it to the Acting Vice-Minister of Public Works, Yozo Yamao, and in fact, "it was accepted by the Government without change of any kind."⁹⁷ Concerning the school's curriculum, Yamao fully trusted in Dyer.

Dyer's position at the college was called *token* in Japanese and *principal* in English. Dyer explains the style of the administration at the beginning of the college: "Mr. Hayashi became Chief Commissioner of the College, representing the Department of Public Works and managing the finances and the administrative staff, while I, as Principal, was responsible for the educational arrangements."⁹⁸ When Dyer left Japan in June 1882, Edward Divers was appointed as *kγōtō* (teachers head) the following month. In August, the position of *token* was abolished, and the position of *kōchō* (school head) was established. Then, Keisuke Ohtori (1832-1911), who had been the chief administrator since January 1877, became *kōchō* at the college on August 30, 1882.⁹⁹ Therefore, it could be assumed that the characteristic of *token* at the college was closer to a deputy head rather than principal. Indeed, the Ministry of Public Works gave Dyer greater authority to manage the college compared to other foreign employees, but Japanese leaders made all the final decisions.

The operation of the college was virtually at the discretion of Yozo Yamao. He was not, however, at the

⁹⁴ *Ibid.*, p. 43.

⁹⁵ *Ibid.*, pp. 48-50.

⁹⁶ Dyer, *op. cit.* (1904), p. 2.

⁹⁷ *Ibid.* Henry Dyer, *Calendar of the Imperial College of Engineering, 1873-74* (Tokei: Imperial College of Engineering, 1873), is in Nobuhiro Miyoshi, *The Collected Writings of Henry Dyer: A Collection in Five Volumes*, Vol. 1 (Tokyo: Edition Synapse, 2006): 17-59.

⁹⁸ *Ibid.*, p. 3.

⁹⁹ *Kobusho Enkaku Hokoku*, pp. 345, 348-349.

top of the Ministry of Public Works right after its establishment.¹⁰⁰ Ayahiko Ishibashi, one of the first graduates from the college recalls the role and contribution of Yamao in the Ministry:

There was a officer so-called the Minister above him, but he was a court noble so Mr. Yamao was trusted everything in the Ministry. . . . After a while, Mr. Ito was appointed a position that was one-rank higher than the one of Mr. Yamao. However, Mr. Ito went abroad with a Minister Iwakura, and had been outside of Japan for around two years. During that period, Yamao had been in Japan and done everything. In other words, the name of Mr. Ito were written on documents, but Mr. Yamao did everything instead. Especially, Yamao took up the post of the head of the Imperial College of Engineering because of his opinion. Then, he established the foundation of the college.¹⁰¹

Dyer also appreciated the help of Yamao and stated "I wish to bear testimony to the whole-hearted support which he [Yamao] gave to all my proposals for the education of engineers, and to his personal kindness on every possible occasion. To his effort much of the success of the College was due."¹⁰²

Five years after the college opened, the opening ceremony of the college was held in the presence of the Meiji Emperor on April 15, 1878. The reason that the opening ceremony of the college was delayed is not necessarily clear, but there is a description in *Kyu Kobu Daigakko Shiryo* about the background of the ceremony. It states that all the buildings and the system of the college had been completed at last.¹⁰³ Then, the principal Henry Dyer spoke at the ceremony.¹⁰⁴ Remarkably, he understood the intention of the Japanese leaders at the college to have the foreign teachers return to their counties when their terms of employment expired. There seems to be little indication in his statement to stay longer in Japan. He addresses his determination to leave by the end of his term as a good result for the nation of Japan.

Unquestioning Adoption

The government enterprises led by the Ministry of Public Works were eager to introduce Western technology. Importation was indiscriminate in introducing Western technology from raw materials to

¹⁰⁰ The name of Yamao's position in 1870 was *Gondaijo* that was fifth rank from the Minister of Public Works. Yamao became Acting Minister in 1872, and the Minister of Public Works in 1880.

¹⁰¹ Ayahiko Ishibashi, "Kaiko Roku, Part 2" ("Memories,") *Kyu Kobu Daigakko Shiryo, Furoku* (Tokyo: Tranomon Kai, 1931), p. 214. It is not clear whom Ishibashi indicates the "court noble." The five Ministers were all from the samurai class. It was a vacant post from the establishment of the Ministry to the time Hirobumi Ito took the position of the first Minister in 1873. During that time, a court noble might have taken an unofficial position in the Ministry.

¹⁰² Dyer, *op. cit.* (1904), p. 3.

¹⁰³ *Kyu Kobu Daigakko Shiryo*, p. 122.

¹⁰⁴ *Ibid.*, pp. 130-131. Dyer's words are translated into Japanese in this material.

machine tools without a fundamental principle. The foreign employees were pure engineers and not necessarily good at management. The mines, specifically, had been operated at a massive loss. Deficit finances resulted in the dissolution of the Ministry in 1885.¹⁰⁵ Hideo Nagai analyzes the uncontrolled policy of Westernization, and explains that it was technology importation based on political necessity at the time of the formation of the nation.¹⁰⁶ Hirobumi Ito later remarked on the policy of the Ministry of Public Works:

At the Meiji Restoration, since we decided to adopt a strong point of mechanical industry from the West and make up for our weak point in a hurry, from shipbuilding, railroad, telegraph, mining and architecture, to various machine tools, we have imitated the West, produced them in Japan, and prepared the style of a civilized nation. We invited many Western engineers and collected Japanese who know Western learning from various places, and the government managed enterprises and founded a prosperous country and strong army. Since we had to establish the learning of industry, we opened the college. Since we had to spread the result of enterprises to the people, we established the Ministry of Public Works besides enterprises for encouraging industry. We named the Ministry *Kobusho* after the Chinese style; however, it should have been called a Governmental Industry Board as a matter of fact. Later, the government realized if we did not think economic effects of enterprises, it took huge costs, but we could get small effects, thus we began to consider a financial balance. Then, we adopted commercialism, but the deficit was getting bigger, and the effects seemed prolong for a while. The policy to promote engineering and arts after opening the country was changed after all [due to the deficit].¹⁰⁷

The Ministry of Public Works, or at the very least Ito, intended to raise industry in Japan through the complete imitation of Western technology. The Meiji government took the initiative to absorb the Western style of architecture as well as other fields. The government, adopting *bunmei kaika* (civilization and enlightenment) and *fukoku kyohei* (prosperous country and strong army) as the slogans, constructed the Western style of buildings, such as government office buildings, barracks, stations, and schools, to demonstrate national authority both inside and outside the country.¹⁰⁸ Rokumeikan, drawn up by Josiah Conder, a professor at the ICE, and directed by Kaoru Inoue, which was completed in 1883, was one of the symbolic buildings of such an indiscriminate adoption of the West by the government.

¹⁰⁵ Kunimitsu Yoshida, *Zusetsu, Gijutsu to Nihon Kindaika (Technology and Modernization of Japan, Illustrated)* (Tokyo: Nihon Hoso Shuppan Kyokai, 1977), pp. 60-62.

¹⁰⁶ Nagai, *op. cit.* (1990), p. 232.

¹⁰⁷ Yoshida, *op. cit.* (1968), p. 32, cites *Kobusho Shokumu Seiri no Gi*. The source of Ito's words is not clear.

¹⁰⁸ Shigeru Nozaki, in Hiroto Saigusa, et al., *Kindai Nihon Sangyo Gijutsu no Seioka (Westernization of Industrial Technology in Modern Japan)* (Tokyo: Toyo Keizai Shimposha, 1960), p. 103.

On the other hand, this unprincipled attitude later brought about a beneficial result for Japan. The Ministry employed seventy-eight foreigners from Britain, France, Germany, and the United States. Because the mining and metallurgy technologies were developing at that time and no one knew which country was the best, various technologies were randomly introduced from those countries, and Japanese engineers selected and spread technologies in Japan in later years.¹⁰⁹

Unquestioning absorption was predominant during the first twenty years of the Meiji period in the field of architecture. The styles of architecture changed as the leaders from the West who functioned as foreign employees came and went. Kingo Tatsuno, one of the first graduates from the ICE, describes these changes at the beginning of the Meiji era. The trend started from the American style led by Bridgens, and it was followed by the British style of Thomas James Waters, the French style of C. de Boinville, the Renaissance and Romanesque style, the British style of Josiah Conder, and German style of Hermann Ende and Wilhelm Böckmann.¹¹⁰

Meanwhile, elements of the Ministry of Public Works, including the ICE, were active in absorbing the "Western" style, and had a tendency to employ foreign engineers, mainly from Britain. Mitsukuni Yoshida calls the system the "*oyatoi gaikokujin* style;" it imports everything from machine tools to factory systems by hiring foreign directors and engineers.¹¹¹ Tadaaki Kimoto proposes to call the *oyatoi gaikokujin* system the "Hirobumi Ito style" that was brought about as a result of political struggles in Japan.¹¹² Kimoto stresses that the style influenced the policy of industrial education as well as the policy of technology transfer from foreign countries. The Meiji government, specifically Toshimichi Okubo, worried about the aggression of Britain in commerce. On the other hand, Ito favored Britain because his fellows, Yozo Yamao and Masaru Inoue, were adept at speaking English. Ito made the most of employees from Britain. The forty-nine foreign teachers at the ICE throughout its history consisted of forty-one from Britain, seven from Italy, and

¹⁰⁹ Yoshida, *op. cit.* (1968), pp. 39-40.

¹¹⁰ Nozaki, *op. cit.*, p. 102, cites Kingo Tatsuno, *Kenchiku Zasshi (Journal of Architecture)* (229) (1906). Nozaki also shows other explanations of the change of fashions.

¹¹¹ Yoshida, *op. cit.* (1968), pp. 39-40.

¹¹² Kimoto, *op. cit.*, p. 25.

one from France.¹¹³ In the field of the telegraphic industry under the Ministry, more than ninety percent of the foreign employees were from Britain.¹¹⁴ Yuko Yamazaki points out that Ito had only one policy: to import everything from Britain. Ito stayed in Britain only for six months, so he did not seem to have deeply studied the latest technology, but he was familiar with, and trusted in, Britain. Ito left enormous letters and documents but mentioned few technical matters.¹¹⁵

4. The Imperial College of Engineering (1873-1882)—Dyer

This section explores the ethos of the students at the ICE from the viewpoint of the first principal Henry Dyer. Although he was satisfied with the results of his works in Tokyo, he felt uncomfortable in the behavior of the students. His criticism of the students was based on a misunderstanding of their nature. When he was leaving Japan in 1882, he gave the students candid advice in the valedictory speech and said that they should have more fire and energy. Dyer was not necessarily aware of the latent spirit of the students during his nine-year stay in Tokyo. The deficiencies of the students, which Dyer pointed out, were signs of unique qualities of Japanese characteristics. Later, he realized that Japanese people had a strong patriotic spirit. In *Dai Nippon*, Dyer asserted that the inner spirit of Japanese people was the main motivation that led them to devote themselves to the goal of changing Japan, and that spirit was loyalty to the nation.

The management of the school was trusted to Dyer, while the final control of it was in the hands of Japanese leaders. Dyer introduced his original curriculum when the college was established. He often mentioned the components of the curriculum in his writings. As the first principal, Henry Dyer gave a high evaluation of the results of works at the ICE. He was satisfied with his idea of the combination of theoretical and practical courses, and the full support he received from the government. He also enumerated industriousness of the students as a factor of the success of the college. In addition, he believed that the success of the college was one of the significant factors of the sweeping development of Japan.

¹¹³ *Kobusho Enkaku Hokoku*, pp. 408-411.

¹¹⁴ Nozaki, *op. cit.*, p. 156.

¹¹⁵ Yamazaki, *op. cit.* (2002), p. 130.

The First Principal, Henry Dyer

One of the most significant contributors to the ICE was the first principal Henry Dyer. *Kyu Kobu Daigakko Shiryo* summarizes his efforts for the college:

He was a great benefactor who established the foundation of engineering education in our country at the beginning of the Imperial College of Engineering by selecting of various rules besides the curriculum at the college, planning the structure of the building and the arrangement of the classrooms. The number of students who had been under his tutelage was huge; the progress of engineering in our country was owing to his ability.¹¹⁶

Edward Divers, a professor at the college, contributed a letter to *The Engineering*, in which he admired the efforts of Dyer. His remarks are notable because he was also at service with Dyer at the college. Divers states:

Dr. Dyer came to Japan in 1873, not as a professor of engineering only, but to found and organise in all its details, large and small, an institution for the education of engineers in Japan. He was given a salary proportioned to his double duties, and an extent of power in the control of affairs quite exceptional for a foreigner in the Japanese service, whether then or since. The result of his work was the College of Engineering, the first school of engineering of any kind in the country, and such as could hardly have been developed under less favourable circumstances. Its magnitude of plan and completeness of execution soon made it far and away the most prominent educational institution in Japan.¹¹⁷

In regard to the salary, Henry Dyer was paid 660 yen a month throughout his staying in Japan, while Divers was given 500 yen a month.¹¹⁸ Their salaries were exceptionally high in the Meiji government. The monthly salary for Hiroyuki Kato, the first president of the Tokyo University, for example, was 400 yen in 1881, and the first year graduates from the college were employed by the Ministry of Public Works for 30 yen in 1879.¹¹⁹ The salaries for the foreign professors were manifestations of the hope for them by the government. In addition to the salary, the Meiji government conferred a medal of *Kun Santo Kyokujitsu Sho* on Dyer when he was leaving Japan in 1882. The Imperial University of Tokyo gave Dyer an honorary professorship in 1902 for contributing to higher education and the progress of engineering in Japan. The

¹¹⁶ *Kyu Kobu Daigakko Shiryo*, pp. 159-160.

¹¹⁷ Divers, *op. cit.*

¹¹⁸ *Kobusho Enkaku Hokoku*, p. 408.

¹¹⁹ The monthly salary for the president is from Michio Nagai, *Nihon no Daigaku (Universities in Japan)* (Tokyo: Chuo Koron, 1965), pp. 29-30. The students' starting salary is in *Kyu Kobu Daigakko Shiryo*, p. 180.

government awarded a medal of *Kun Nito Zuiho Sho* again in 1908. Kogakukai, which is currently Nihon Kogakukai or the Japan Federation of Engineering Societies, bestowed an honorary doctorate on Dyer in 1915.¹²⁰ The Japanese people appreciated the works of Dyer even after he had left Japan.

Dyer was born in 1848. His father was a foundry laborer in Glasgow, and his family was not one of wealth or privilege. When he was fifteen, he worked an apprenticeship at the James Aitken & Co. foundry. While Dyer was working as an apprentice, he took evening courses at Anderson' College. In 1868, he became a full-time student at the University of Glasgow. Under the guidance of his mentor Professor W. J. M. Rankine, Dyer showed high academic performance at the university. Due to the recommendation from Rankine, Dyer was invited to Japan as the principal and a professor in 1873.¹²¹

Ayahiko Ishibashi, a first year student, mentions that Dyer was kind-hearted. Ishibashi recounts an episode where Dyer won the Whitworth Scholarship when he was a student at the University of Glasgow.¹²² The Japanese students knew that only a high-achieving student could win the scholarship, so they respected Dyer as a diligent teacher. Takeo Iwata, a second year student, recalls an impression of Dyer who had an air of dignity. Iwata states: "He was strictly steady; when he was looking around classes sometimes, solemnly led other teachers in a classroom without looking other places or behind; like a mechanical doll that was tall and walked only forward."¹²³

In a lecture given at the Scientific Society in the Glasgow Technical College in 1905, Dyer enumerates five advantages that brought about ICE advancement. He states:

I have always held that in educational work those responsible for it should have an ideal towards which they were working, and not be content to follow an opportunist policy without any definite plan . . . we had the great advantage of beginning with a clean sheet, and we had no personal or vested

¹²⁰ Nobuhiro Miyoshi, *Meiji no Engineer Kyoiku (Engineering Education in Meiji)* (Tokyo: Chuo Koron Sha, 1983), p. 20.

¹²¹ Dyer's educational background and his family's origin are given in detail in Shoji Katoh, "Henry Dyer, Scottish Teacher at the Imperial College of Engineering, Tokyo (Kôbu-Dai-Gakko)—His Life toward Self-actualization," *Bulletin of Nagoya University Archives* (13) (2005.03): 1-31. Regarding the process of the selection for the principal, see Miyoshi, *op. cit.* (1989), pp. 28-72.

¹²² Ayahiko Ishibashi, "Kaiko Roku, Part 2," ("Memories,") *Kyu Kobu Daigakko Shiryo, Furoku* (Tokyo: Tranomon Kai, 1931): 207-257, p. 215.

¹²³ Takeo Iwata, "Kyu Kobu Daigakko Shiryo Sanko Kiji," ("A Reference Article of Historical Materials on the Imperial College of Engineering,") *Kyu Kobu Daigakko Shiryo, Furoku* (Tokyo: Tranomon Kai, 1931): 9-51, p. 21.

interests to contend with. The Japanese Government gave a most hearty support to all my proposals; the professors were enthusiastic in their work, and the students were diligent and intelligent.¹²⁴

As a result, he continues, "in five years we had one of the most complete and well-equipped colleges in any part of the world, as well as large engineering works in which the students could obtain a practical knowledge of their work."¹²⁵ Dyer made the most of the chances to let the students gain experience under the department and enterprises in the Ministry of Public Works.

System of the College, and its Reputation

Henry Dyer received his engineering education in Scotland, but he was also interested in the curriculum of engineering education. While he intended to improve scientific and engineering education in Britain, he got the opportunity to put his study into practice in Japan. He states:

Fortunately, for some time previously I had made a special study of all the chief methods of scientific and engineering study in the different countries of the world and of the organisation of some of the most important institutions, with the intention of devoting myself to the advancement of engineering education in Britain, so that I had fairly definite ideas both as to what was desirable and what was possible. I little thought that my first experiments would be made in far Japan, a country which, at that time, was almost unknown to foreigners. . . .¹²⁶

According to his study, engineering education in Britain offered technical knowledge while theoretical education is mainly given on the Continent.¹²⁷ Specifically, Dyer was critical of unspecialized teaching methods of engineering. He saw the reality that one professor covered the whole field of engineering at universities in Britain.¹²⁸ Dyer illustrates engineering education in several countries, including Britain, France, and Switzerland, in *General Report by the Principal for the Period 1873-77*.¹²⁹ When Sakuro Tanabe, one of the fifth year graduates, visited Henry Dyer in Glasgow in 1900, Dyer said that he referred to

¹²⁴ Dyer, *op. cit.* (1905), p. 7.

¹²⁵ *Ibid.*, p. 7.

¹²⁶ Dyer, *op. cit.* (1904), p. 2.

¹²⁷ Dyer mentions the tendency of engineering education in Britain and the Continent several times in his various works. For example, Henry Dyer, *Imperial College of Engineering (Kobu-Dai-Gakko) Tokei: General Report by the Principal, for the Period 1873-77* (Tokei: Imperial College of Engineering, 1877) p. 16-17; *The Education of Engineers* (Tokei: Imperial College of Engineering, 1879), pp. 1-2; and, *Dai Nippon* (1904), p. 5.

¹²⁸ Dyer, *op. cit.* (1905), p. 7

¹²⁹ Dyer, *op. cit.* (1877), pp. 4-16.

an institution at Zurich in Switzerland for the establishment of the ICE.¹³⁰

At the ICE, Dyer attempted to introduce advantageous aspects of both the British and the Continental styles of engineering education. He refers to the new system as a "combination of science and practice."¹³¹ His first plan seemed too complicated even for engineers who were educated in Europe. Dyer recalls the situation when he introduced his new idea in Japan: "All my European friends were of the opinion that it was far too elaborate and complete to have any chance of being carried out by the Japanese."¹³² Dyer explains the six-year course at the college in brief:

The general arrangements which I made for the course of training were such as to meet the requirements of the country. It extended over six years, the first and second of which were devoted to the general training required for all departments of engineering. At the beginning of the third year the students selected the special departments which they wished to follow. The technical courses were—(a) Civil Engineering, (b) Mechanical Engineering, (c) Telegraphy, (d) Architecture, (e) Practical Chemistry, (f) Mining, (g) Metallurgy. Naval Architecture was added a few years later. One-half of the third and fourth years was spent at College, and the other half at practical work. The last two years of the course were spent entirely at practical work.¹³³

Practical work was held at the governmental enterprises that were under the control of the Ministry of Public Works. Dyer made the most of this excellent opportunity for combining theory with practice.¹³⁴ Students wrote graduate theses at the end of the six-year course based on their practical work.

Dyer was satisfied with the overall result of his curriculum at the college. He brought back his idea to combine theory and practice to Britain, and hoped to adopt it as the curriculum at the Glasgow and West of Scotland Technical College. Dyer called the method of combining theory and practice in the training of

¹³⁰ *Kyu Koku Daigakko Shiryo*, pp. 50-51. Since Shigeru Nakayama pointed out the issue of a reference model in "Koku Daigakko no Genryu—Suisu Renpo Koka Gakuin," ("The Origin of the Imperial College of Engineering,") *Buturigakushi Kenkyu (Studies on the History of Physics)* 3 (1) (1966): 1-5, several objections have been raised; for example: Akira Tachi, "Nihon ni okeru Koto Gijutsu Kyoiku no Keisei," ("The Formation of Higher Technology Education in Japan,") *Kyoikugaku Kenkyu (Education Studies)* 43 (1) (1976): 13-21, p. 15, and De Maio, Silvana, "The Development of an Educational System at the Beginning of the Meiji Era: Reference Models from Western Countries Transfer of Agricultural Technology from Imperialist," *Historia Scientiarum* 12 (3) (2003):183-199. Tate concludes that the curriculum was considerably depended on Dyer's creativity, even though he referred to other institutions.

¹³¹ Dyer, *op. cit.* (1877), p. 23.

¹³² Dyer, *op. cit.* (1905), p. 7

¹³³ Dyer, *op. cit.* (1904), p. 5. The curriculum is also described in several works. See, *Calendar: Session 1873-74* (1873), and *General Report by the Principal* (1877).

¹³⁴ Dyer, *General Report by the Principal* (1877), p. 22, and *Dai Nippon* (1904), p. 5.

engineers the "sandwich system of apprenticeship."¹³⁵

Nevertheless, Dyer's method was still based on the British style of engineering education that stressed the importance of practice. Dyer states the relations between theory and practice at the college: "In the College itself mere book-work was made of secondary importance, and by means of drawing offices, laboratories, and practical engineering works the students were taught the relations between theory and practice, and trained in habits of observation and original thought."¹³⁶ On the other hand, at the College of Sciences, the University of Tokyo, which was seen as a rival school of the ICE at that time, also offered engineering education, but the curriculum was inclined toward theory. Thus, students at the ICE were conscious of the uniqueness of the college. Ayahiko Ishibashi explains, "The Imperial College of Engineering emphasizes practice rather than theory."¹³⁷

Another typical characteristic at the ICE was that the campus life for students was filled with elements of the Western lifestyle. Life in the college was fully supported by the Ministry of Public Works, and all students were provided with Scotch style uniforms and caps. The four-bed rooms in the dormitory were furnished with chairs and tables (not a traditional Japanese style). Lunch was a European dish. No teacher could speak Japanese. All classes were held in English, and students hardly spoke Japanese on the campus.¹³⁸ The policy of adopting the Western style was thoroughly enforced at the college. Although it was difficult to recruit students who had sufficient English ability when the college was founded, the situation of the students improved in the first year: "I wish to bear the highest testimony to the spirit and zeal with which the professors entered into their work, and as the students were diligent in their studies we were able to show considerable progress by the end of the first year."¹³⁹

The college was reported in major English journals with its establishment in 1873, and gained a high

¹³⁵ Dyer, *op. cit.* (1905), pp. 10-11.

¹³⁶ Dyer, *op. cit.* (1904), p. 5.

¹³⁷ Ayahiko Ishibashi, "Danwa Zoho," ("Conversations, Supplement,") *Kyu Koku Daigakko Shiryo, Furoku* (Tokyo: Tranomon Kai, 1931), p. 205.

¹³⁸ *Kyu Koku Daigakko Shiryo*, pp. 176-179. Also see, Tatsuzo Sone, "Koku Daigakko no Omoide," ("Memories of the Imperial College of Engineering,") *Kyu Koku Daigakko Shiryo, Furoku* (Tokyo: Tranomon Kai, 1931): 66-89, pp. 70-74.

¹³⁹ Dyer, *op. cit.* (1877), p. 21.

reputation outside of the country, even though these journals did not come to analyze attitudes of the Japanese people at the college. Nobuhiro Miyoshi uncovered six articles in *The Japan Weekly Mail*, eight articles in *Nature*, four articles in *Engineering*, and four articles in *The Engineer* that deal with the college in the nineteenth century.¹⁴⁰ He analyzed these articles and concluded that every journal paid attention to the results of work at the college, and introduced the college to Britain with high appraisals for the originality and efforts of Henry Dyer.¹⁴¹

Evaluation of the ICE by Dyer

Dyer was proud of the success of the Imperial College of Education, and linked the effects with the development of the nation. His evaluation of the college's contribution to the nation was, however, mixed with his expectation for the former students. He expressed high appreciation of the college and its results in his writings. For example, when he was leaving Japan in 1882, he gave an address to the students, in which he expressed his expectation for them to work for the nation. He said: "If it is found that the men who have studied at this College have turned out good and true, and have helped to raise Japan to her proper position among the nations of the world, I shall feel amply rewarded. . . ."¹⁴² Later, he attributes the development of the nation to the success of the college in the *Introductory Address* in 1905. He states:

It has been acknowledged by the highest authorities in Japan that the Imperial College of Engineering has been one of the most important factors in the making of New Japan. Its students have proved themselves most efficient in every department of engineering and industry, and have enabled their country to develop her resources for the good of the people, and at the same time to fit her to take her place on a footing of equality with the great nations of the world.¹⁴³

Moreover, *Dai Nippon, the Britain of the East: A Study in National Evolution*, one of his major works, is dedicated to the students of the college. He states: "I dedicate this book to the students of the Kobu-Daigakko who have done so much to make modern Japan. Not only as a memorial of past work, but also in the hope that they may find it helpful in the solution of the problems which lie before their country in

¹⁴⁰ Miyoshi, *op. cit.* (1989), pp. 107-122.

¹⁴¹ *Ibid.*, p. 122.

¹⁴² Dyer, *Valedictory Address: To the Students of the Imperial College of Engineering* (Tokyo: Imperial College of Engineering, 1882), p. 6. This article is reprinted in *The Collected Writings of Henry Dyer: A Collection in Five Volumes* (Tokyo: Edition Synapse, 2006), Volume 1.

¹⁴³ Dyer, *op. cit.* (1905), p. 9.

the future."¹⁴⁴ Of course, it is reasonable to assume that he had high self-esteem for the results of his job in Japan to prepare for a job search after going back to Britain. Indeed, his situation should be taken into consideration, but he recognized that the college was significant for the development of the nation.

Dyer had started to build the college with his ideal of engineering education, but he gradually realized the realities in Japan and the role of the college in the Meiji government and Japan, which aimed to gain an appropriate place in the world. His original intention was to devote himself to engineering education in order to serve engineers rather than to serve a nation. He states that the "engineer ought to be in the same position as, for instance, the lawyer or medical man, if he could prove that he was thoroughly qualified"¹⁴⁵ While Dyer exercised his ability to establish the curriculum, he dealt with the purpose of the college on *Calendar* only as a matter of form at the beginning of the college. He writes: "This College has been established under the orders of the Minister of Public Works with a view to the education of engineers for service in the Department of Public Works."¹⁴⁶ Four years later, he added the description of the role of engineers from the college with an international view. He states that the "College has been established . . . to draw out a scheme of technical education to include everything that is required to enable Japan to occupy her proper place, among the manufacturing nations of the world."¹⁴⁷ Dyer was conscious of a mutual relationship between the nation of Japan and engineers. The nation required engineers, and engineers devoted themselves to the development of the nation. He found that his ideal, which is "the engineer is the real revolutionist," was materialized in Japan due to the effects of the college and works of the former students.¹⁴⁸ According to Shigemichi Fujita, one of the second year graduates, Dyer insisted in his speech at the last class before the Fujita's graduation in 1880 that students should at first contribute to make Japanese industry equal to Western industry, and then make efforts for inventions later.¹⁴⁹

On the other hand, Dyer implies in *Dai Nippon* that the results of his work at the ICE and activities of the

¹⁴⁴ Dyer, *op. cit.* (1904), Dedication.

¹⁴⁵ Dyer, *The Education of Engineering* (1879), p. 8.

¹⁴⁶ Dyer, *op. cit.* (1873), p. 1.

¹⁴⁷ Dyer, *op. cit.* (1877), p. 4.

¹⁴⁸ Dyer, *op. cit.* (1905), p. 20.

¹⁴⁹ Shigemichi Fujita, "Gaijin Kyoshi ni Kansuru Kaikyudan," ("Memories on the Foreign Teachers,") *Kyu Kobu Daigakko Shiryo, Furoku* (Tokyo: Tranomon Kai, 1931), p. 90.

students fell short of his expectations. After deploring the disintegration of taste and ideals among Japanese people, which was coming about in consequence of the developments of industry and commerce, he states that "my consolation has come when I recognise that without that work [of the students of the ICE] Japan as a separate nationality would probably have disappeared under the aggression of Foreign Powers."¹⁵⁰ He shows a mental conflict between his ideal for engineering education and the reality of Japan's need to avoid possible domination.

When Henry Dyer was leaving Japan, he was not fully satisfied with the behavior of the students at the college. Dyer openly discusses defects of education and the students in his *Valedictory Address*, which was a speech he gave when he left Japan in 1882.¹⁵¹ This lecture has a significant bearing on the analysis of Dyer's impression of the ICE because this is the only work in which he frankly speaks about negative aspects of the college. Moreover, it was right before he left Japan that he looked back on the results of his work at the college. Dyer sincerely gave the lecture for the students there. His remarks were fresh and honest. At the beginning of the lecture, he stressed the limitations of education and instruction at a school, and expected the students to show "energies" by comparing them to British students. He said:

. . . my object [of this address] is simply to impress upon you that without more fire and energy you will not accomplish anything great. . . . Some writers have spoken of Japan as likely to become the Britain of the East. I sincerely wish that it may be so, but you must remember that what has made Britain what she is, is not so much mere education or instruction, as that exuberant health and spirits which enable her sons to go anywhere and to do anything. In ordinary British students the constant struggle is to repress their rebellious physical energies, but with Japanese students, such energies are never exerted except under some special spur, and when that is removed they relapse into listlessness.¹⁵²

His words imply that Japanese students were diligent but too obedient as if they devoted themselves to study engineering and science without a sound mind. Then, he continued to talk about the defects, which he had found during his nine-year stay in Tokyo. There are seven other points in the address. He said, "First I would say, that in Japan the main object of education has not yet been clearly realised. Too often it is

¹⁵⁰ Dyer, *op. cit.* (1904), p. viii. See also p. 13, mentioning the independence of Japan from probable domination by the Western powers.

¹⁵¹ Dyer, *op. cit.* (1882).

¹⁵² *Ibid.*, p. 1.

confounded with mere instruction."¹⁵³ The core of his address was that the students were biased toward books in the college rather than having experiences, besides pointing out model attitudes as an engineer.

Among other things, Dyer observed those behaviors of the students closely linked to their samurai identity. While pointing out that the students who had been sent abroad to study after completing a course of study in Japan were in "exceptionally high places" in almost every case in their classes, Dyer admonished the students against the conceited attitude of the excellence of Japanese.¹⁵⁴ He also found the students who neglected assistance from those of greater practical but less theoretical experience than themselves to have an arrogant manner.¹⁵⁵ Furthermore, he was worried about their participation in extracurricular activities.

He said:

I need scarcely remind you that you have not only to act as engineers but also as citizens, for every Japanese student seems a born politician. I am sorry to find that a considerable amount of time has lately been wasted by some of the students in attending public discussions on political matters. . . . I wish you to do this, so long as you are students at this College, chiefly by reading or quiet conversation with friends, for you ought to know that the excitement generated in a public discussion simply unfits you for doing any good work as students. . . . The present Prime Minister of France is an engineer, but he distinguished himself first by doing his duty as an executive officer in the Public Works Department, and I strongly advise you to follow his example.¹⁵⁶

Dyer also mentioned a disgusting manner of Japanese students. He said, "Ever since I came to Japan I have felt that there was one great deficiency in every educational institution with which I was acquainted." Then, he continues:

A great proportion of the students come from the country and are removed from all the restraints and civilising influences of family life, so that I am afraid the tendency of the modern education is to expand the intellect at the expense of the heart, and to divorce wisdom from charity. When that separation takes place nothing is more tyrannical, more insolent than the pride of intellect.¹⁵⁷

Dyer expresses the aristocratic characteristics of students at the ICE, such as obedient, earnest, delicate, cold, and idealistic. As Dyer mentioned at the beginning of the address, he induced that their negative characteristics were formed because they lacked fire and energy. Although he expressed his honest impressions of the students, he could not find their latent spirit, which formed their identities. It took time

¹⁵³ *Ibid.*, p. 2.

¹⁵⁴ *Ibid.*, p. 3.

¹⁵⁵ *Ibid.*, p. 4.

¹⁵⁶ *Ibid.*, p. 5.

¹⁵⁷ *Ibid.*, p. 5.

for Dyer to realize the real spirit of the students at the college. He might not have been able to analyze it during the time he was staying in Japan.

Later, Dyer had a symbolic reunion with his former student Tsurutaro Matsuo right before the Russo-Japanese War, which started in 1904. At the time, Dyer got a new understanding of the minds of Japanese people actually having spiritual qualities. He states:

The success of the Japanese is not to be explained fully by the use which they have made of Western science. Not only their mental, but also their moral and, I may add, their spiritual qualities, require to be taken into account. Shortly before the war between Japan and Russia broke out, Engineer-Captain Matsuo, one of my former students, came to Glasgow to bid me good-bye before returning to Japan, after he had despatched the cruisers, "Kasuga" and "Nisshin," which had been bought in Italy. He found me writing the chapter of my book on Japan dealing with the army and navy; and he asked me to make it quite clear that, while he valued Western ships and appliances, he attached far more importance to the spirit which animated the men in charge of them. If I were attempting to sum up briefly the qualities of the Japanese which have enabled them to make such wonderful developments in such a short time, I would mention as the most important factor the intense loyalty of the people, which compels them to make any sacrifice, even life itself, when they consider it necessary for the honour of their country. This, combined with their great intellectual ability, enables them to take full advantage of the science and organisation necessary for the attainment of the objects of their ambition. Their great power of foresight prepares them for all their enterprises, both of peace and war, with an exact and scientific prevision not excelled by any other nation. While they are permeated by Eastern ideas, they have been able to appropriate much that is best in Western thought; and thus they unite many of the best qualities of the East and the West.¹⁵⁸

Dyer confirmed through the meeting with his former student at the ICE that the spiritual foundation, specifically the intense loyalty of the people for the honor of their country, was the essential factor of the development of technology in Japan.

In contrast to the address when Dyer was leaving Japan, he admires the passion of Japanese people in his works since *Dai Nippon*, which Dyer was writing when Matsuo visited Glasgow. Dyer changed his attitude toward the spirit of Japanese, and he began to emphasize the inner power of Japanese people. For example, he states:

. . . among the main factors in producing the great changes that have taken place, . . . the inner force . . . have been most powerful.¹⁵⁹

One thing . . . is clear, and that is, the fact that the impulse came from within accounts in great part for

¹⁵⁸ Dyer, *op. cit.* (1905), pp. 8-9.

¹⁵⁹ Dyer, *op. cit.* (1904), p. vii.

the rapid progress which Japan has made in Western methods.¹⁶⁰

One thing is very evident, namely, that while the Japanese owe much to their utilization of Western science, appliances, and methods, the secret of their phenomenal success in every department of national life lies in the spirit with which they have been animated.¹⁶¹

In addition, Dyer even insisted that British people should learn the spirit of "Co-operation" toward national objects from Japan.¹⁶²

In *Dai Nippon*, Dyer analyzes the Japanese mind, spirit, and religions, such as Confucian Philosophy, the Buddhist religion, the Shinto religion, and Bushido. To explain the chief motives that urged Japanese people to change their society, Dyer cites Inazo Nitobe's *Bushido* at the beginning of the chapter "The Japanese Mind." He quotes from Nitobe's account: "In a work of such magnitude various motives naturally entered; but if one were to name the principal, one would not hesitate to name 'Bushido'. . . . The sense of honour which cannot bear being looked down upon as an inferior Power—that was the strongest of motives."¹⁶³ Then, he concludes that "the intense loyalty" of the people for the honor of their country was the highest quality of the Japanese.¹⁶⁴ Dyer found Nitobe's explanation of the spirit of samurai consistent with his experience at the ICE in Tokyo.

5. Toward the End of the ICE—Students

In this section, I explore the results of engineering education at the ICE by focusing on how the students behaved to maintain their status. In the chaotic situation during the Meiji Restoration, the students entering the ICE struggled to find their careers, honors, and identity. As well as Yamao and Ito, most of the students were from the samurai class, and they embodied the samurai spirit. The existence of the ICE was linked to their identity as the former samurai.

While the system of the college matured around 1877, the Ministry of Public Works began declining.¹⁶⁵

¹⁶⁰ *Ibid.*, (1904), p. viii.

¹⁶¹ Dyer, "Some Lessons from Japan," *Annual* (Co-operative Wholesale Society) (1908): 146-166, p. 165.

¹⁶² *Ibid.*, pp. 146-153.

¹⁶³ Dyer, *op. cit.* (1904), p. 32.

¹⁶⁴ *Ibid.*, pp. 49-50.

¹⁶⁵ Akira Tachi, "Nihon ni Okeru Koto Gijutsu Kyoiku no Keisei," ("The Formation of Higher

At first, the Ministry controlled governmental enterprises through numerous budgets. When it faced financial crisis, these enterprises were sold to private companies with lower prices. In the process of reducing the Ministry of Public Works, the government exposed its real intention towards the ICE and engineering education. While the government spent ample money on the ICE at first, the budget was decreased as the Ministry of Public works got smaller. Then the Ministry was dismantled at last in December 1885. The control of the college was transferred to the Ministry of Education, and the ICE merged with the University of Tokyo in 1886. The final stage of the college shows the position of the ICE in the nation. The destiny of the ICE depended on the circumstances of the government.

Moreover, the government's support to engineering education was simply a stopgap measure to stand up to the Western powers and absorb their technologies without thinking educational philosophy. There was a huge gap between the education level at the ICE and the public level of science and technology. Tadao Tsuchiya points out that industrial and engineering education in the early Meiji era was not like a mountain style that has the skirt under the governmental schools, but like a telegraph pole that stands alone in the field.¹⁶⁶

The Ministry of Public Works discharged foreign employees and teachers and replace them with Japanese because of financial matters. Japanese participants at the college, consequently, were proud of the independence of engineering and engineering education in Japan. The financial difficulties enhanced national enthusiasm that urged an independence from subordination to foreign teachers at the ICE.

The social origin of most of the students at the ICE was *shizoku*, or former samurai. The students at the ICE struggled to find their identity after their families' stipends and privileges were repealed. They chose the ICE to secure their future jobs at the Ministry of Public Works. It was the political strategy of the students to get an engineering education in order to maintain their social status. The ICE offered a diploma that worked as a license to be an engineer under the Ministry, and a path to satisfy their ambitions. The

Technology Education in Japan,") *Kyoikugaku Kenkyu (Studies on Education)* 43 (1) (1976): 13-23, p. 16.

¹⁶⁶ Tadao Tsuchiya, "Kobu Daigakko o Meguru Shiteki Kosatsu," ("A Historical Study on the Imperial College of Engineering,") *Kyoikugaku Kenkyu (Studies of Education)* 18 (6) (1951): 53-78, pp. 76-77.

origin of the students affected the bureaucratic and lordly feature of the college.

Furthermore, their identity as former samurai affectively imitated Western culture as it was. Kingo Tatsuno, a first year graduate student, recognized that adoption of the European style of architecture was his mission. Imitation of the West was an active action for him for the sake of the independence of the nation. In addition, Ito promoted practical learning to make Japanese industry more independent. They used the most of new technology and culture from the West. The spirit of honor and independence urged Westernization in Meiji Japan.

Scale Down of the Ministry of Public Work

The budget of the Ministry of Public Works was at its maximum in 1874. The budget for the ICE was at its peak in 1875, with decreases afterwards.¹⁶⁷ On January 11, 1877, the name of the college, Kogakuryo, changed to Kobu-daigakko.¹⁶⁸ Right after the college changed its name, the government began to allow students to pay their own expenses because the government faced a financial problem due to the Seinan War, which was the last rebellion against the new government.¹⁶⁹ In 1877, thirty-three students entered the college at the government's expense, and thirteen private-expense students were first allowed to enter the college. In the following year, twenty-six private expense students were accepted to the college, and no new governmental expense students were allowed to enter.¹⁷⁰ The annexed elementary school was abolished in 1877 to reduce costs.¹⁷¹

The Ministry of Public Works also reduced the costs of foreign employees and teachers by replacing them with Japanese. When the Ministry of Public Works changed the salary system in March 1879, the Ministry intended to discharge foreign employees and replace them with Japanese engineers.¹⁷² The Ministry of Public Works also sent a proposal to the government in November 1879, suggesting students study in Europe. The main intention of the proposal was to reduce the expense of foreign employees. It

¹⁶⁷ *Kyu Kobu Daigakko Shiryo*, p. 158. Nakayama points out the budget for the Ministry of Public Works in *op. cit.* (1978), p. 86.

¹⁶⁸ *Ibid.*, p. 120.

¹⁶⁹ *Ibid.*, p. 121.

¹⁷⁰ *Ibid.*, p. 122.

¹⁷¹ *Ibid.*, p. 121.

¹⁷² *Kobusho Enkaku Hokoku*, p. 24.

states:

The foreign teachers whom the Ministry is hiring are many and the expense for them is extremely huge. The Ministry has discharged foreign employees until now owing the order of reducing the expense [from the government]. However, we are still using one hundred thirty foreigners and spend 342,300 yen for their salaries out of 518,600 yen of the fixed amount of annual budget in the Ministry. If we wish to reduce the expense dramatically, we do not have another choice than replacing the foreign teachers with graduates from the Imperial College of Engineering. However, if a graduate does not have an achievement in Europe, he cannot complete the mission. We dare to propose [to the government] to select one graduate from every special field, provide half the amount of the cost for a graduate who wishes to study abroad at his own expense as well, and have them study abroad for three years.¹⁷³

The government immediately approved the proposal. On November 25, 1879, the Ministry of Public Works selected eleven students from the graduates of the college, and ordered them to study in Britain. The leaders of the Ministry recognized that there still was a gap between the levels of technology between Japan and the West, and Japanese need to absorb Western technology to maintain the level of the teachers at the ICE. The financial problem also brought about the employment of Japanese labor in the Ministry of Public Works and the ICE.

While the government was willing to spend extraordinarily high salaries for foreign employees at the beginning, the expenses gradually piled up and brought pressure on the budget of the Ministry and the government. These difficulties enhanced national enthusiasm that urged independence from the subordination of the foreign teachers as soon as possible, and stimulated education in science and technology.¹⁷⁴ Mitsugu Arakawa, one of the second-year students, proudly stated the process of replacing the foreigners with Japanese. He said: "[the government] gradually discharged foreign employees, and [Japanese people] now control whole industry; this is surely because of the result of the Imperial College of Engineering."¹⁷⁵ The school rules, which were revised in March 1877, listed eight Japanese assistants.¹⁷⁶ In

¹⁷³ *Ibid.*, p. 347.

¹⁷⁴ See Noboru Umetani, *Oyatoi Gaikokujin, 1 (Foreign Employees)* (Tokyo: Kajima Kenkyujo Shuppankai, 1968), p. 209.

¹⁷⁵ Mitsugu Arakawa, "Kyu Koku Daigakko Kaikoroku," ("Memorial Records of the Old Imperial College of Engineering,") *Kyu Koku Daigakko Shiryo, Furoku* (Tokyo: Tranomon Kai, 1931): 51-66, p. 62.

¹⁷⁶ *Kyu Koku Daigakko Shiryo*, p. 221.

1878, Koichiro Sugi was the first Japanese instructor at the ICE.¹⁷⁷ Sugi graduated from Shugiko, which was also under the Ministry of Public Works, and studied graphics under Professor Fleeming Jenkin at the University of Edinburgh.¹⁷⁸ The first Japanese professor at the ICE was Naotada Takayama, who took the position in 1882.¹⁷⁹ He was one of the eleven students who graduated from the ICE in 1879 and went to Britain at the government's expense. He studied mechanics at the University of Glasgow. The end of the Ministry of Public Works indicates that the accumulation of Western technology had considerably progressed by 1885 in terms of human resources. Enough engineers and teachers had been trained to replace foreign employees. When the ICE merged with the University of Tokyo and the Imperial University was established in 1886, there were eighteen Japanese and four foreign teachers in the Department of Engineering.¹⁸⁰ Teijiuro Muramatsu asserts that the year of 1886 was the time of independence of engineering in Japan.¹⁸¹

The governmental expense students at the ICE had to enter the service for seven years after graduation from the college. However, the graduates were increasing year after year, so the Ministry allowed graduates to find jobs at private enterprises starting in May 1882.¹⁸² Former Prime Minister Hirobumi Ito gave a speech to students at a teachers college in Nagano in 1899, and mentioned the ICE and the condition of industry. Ito said:

We have educated many engineers at the Imperial College of Engineering, but there emerged few enterprises at first, so they could not be engaged in industrial jobs. We could not give them academic posts either. Later, hundreds industries emerged, such as railroad, mining, silk industry, construction, bridge engineering and so on. Then, graduates could apply what they have learned to their jobs and positions, and contribute to the national interest. The numbers of students who wish to get academic

¹⁷⁷ Kita, *op. cit.* (1984), p. 109.

¹⁷⁸ Silvana De Maio, *Bakumatsu Meiji Shoki Nihon Kogaku Kyoiku no Tenkai ni Kansuru Kenkyu—Yokosuka Kosha, Todairyo Shugiko oyobi Kobu Daigakko no Hikaku Bunseki*, Dissertation at Tokyo Institute of Technology, 1998, p. 34.

¹⁷⁹ Tachi, *op. cit.*, p. 16.

¹⁸⁰ Masaru Sekino and Teijiuro Muramatsu, "Meiji no Kogaku," ("Engineering in Meiji,") Suketoshi Yajima and Kanetaro Nomura, ed., *Meiji Bunkashi*, 5, *Gakujutsuhen (A History of Meiji Culture, Academics)* (Tokyo: Yoyosha, 1954): 179-256, p. 197.

¹⁸¹ Teijiuro Muramatsu, "Kogaku Kotohajime," in Takashi Mukaibo ed., *Tokyo Daigaku Kokai Koza 26—Meiji, Taisho no Gakusha tachi (Scholars in the Meiji and Taisho Periods, Series of Open Courses at the University of Tokyo)* (Tokyo: Tokyo Daigaku Shuppan, 1978): 67-101, p. 96.

¹⁸² *Kobusho Enkaku Hokoku*, p. 348.

posts gradually increased, and demand met supply at last.¹⁸³

The first school rules were proclaimed in February 1874, and have subsequently been revised twice. The first Article of every revision declares the mission of the ICE, and it has changed time to time. Article 1, which was promulgated in February 1874, states, "The Imperial College of Engineering is a school that is under the control of the Ministry of Public Works and educates industrial officers who enter the service of the Ministry of Public Works."¹⁸⁴ Chapter 1, Section 1, which was revised in March 1877, still states that the graduates must enter the service of the Ministry.¹⁸⁵ However, Chapter 1, Section 1, which was revised in April 1885, generally states that the mission of the college was to educate engineers. It states: "This College is a school that belongs to the Ministry of Public Works and educates engineers [bachelors of engineering]."¹⁸⁶

Merger with the University of Tokyo

The control of the ICE came under the Ministry of Education on December 22, 1885.¹⁸⁷ Engineering-related departments were separated from the College of Sciences at the University of Tokyo, and the College of Engineering and Arts was established in 1885. Fifty-eight students graduated from the engineering-related departments in the College of Sciences at the University of Tokyo before merging with the ICE.¹⁸⁸ The ICE merged with the school, and became the College of Engineering at the Imperial University in March 1886. The University of Tokyo had a greater emphasis on theoretical engineering than the ICE.¹⁸⁹

The ICE offered advanced engineering education under the direction of Dyer, while the University of Tokyo was behind the ICE in terms of quality as well as scale.¹⁹⁰ Keisuke Ohtori, a later principal of the

¹⁸³ Ito, *op. cit.* (1936), p. 326.

¹⁸⁴ *Kyu Kobu Daigakko Shiryo*, p. 195.

¹⁸⁵ *Ibid.*, p. 222.

¹⁸⁶ *Ibid.*, p. 254.

¹⁸⁷ *Ibid.*, p. 156.

¹⁸⁸ Muramatsu, *op. cit.*, p. 88.

¹⁸⁹ See Seiji Tsunekawa, *op. cit.*, pp. 71-79. Tsunekawa reports that the University of Tokyo and the Imperial University still offered twice as many practical classes as engineering colleges in the United States, such as Cornell and MIT.

¹⁹⁰ Sekino and Muramatsu, *op. cit.*, p. 195.

ICE, contributed a preface to the first issue of *Kogaku Soshi*. He explains, "learning is tremendously deep in every field, so you cannot master anything unless you start from one field."¹⁹¹ He also states the ICE offered subdivided fields for the students.

The Imperial University was one of the first universities in the world that established the college of engineering within itself. Several people praised the decision of Arinori Mori, who was the Minister of Education and executed the merger.¹⁹² For example, Shuichi Katsuta states: "It was a fine idea that the College of Engineering was placed in a university."¹⁹³ Michio Nagai asserts that the management of the Imperial University was drastically and progressively different from the college of engineering's placement in the beginning of 1886.¹⁹⁴

On the other hand, there were critical arguments against the plan of the merger at that time. Tsunemi Sugawara, a student at the ICE, objected to a plan of merger with the University of Tokyo. He turned in a petition to the Minister of Education, Arinori Mori, on behalf of the students at the ICE in 1886. The petition stated that the six attributes of the college were: (1) graduates from the college are more than two hundred, and have contributed the nation; (2) the excellence of the college is well-known even in European countries; (3) education at the college is not based solely on theory; (4) students at the college are allowed to visit enterprises in the Ministry of Public Works; (5) the policy of the ICE is different from the one of the University of Tokyo; and, (6) the buildings of the ICE are good for engineering education.¹⁹⁵

There are also opinions critical of Mori's policy. According to Tadao Tsuchiya, "both colleges

¹⁹¹ Keisuke Ohtori, "Chogen," ("Introduction,") *Kogaku Soshi (The Journal of Engineering)* Vol. 1 (1881):3-7. This article is carried in *Nihon Kagaku Gijutsu Taikei*, Vol. 1, Tsushi 1 (*An Outline of Science and Technology in Japan*, 1, General History 1) (Tokyo: Daiichi Hoki Shuppan, 1964), p. 166.

¹⁹² Regarding the opinions of the merger, see Tachi, *op. cit.*

¹⁹³ Shuichi Katsuta, *Katsuta Shuichi Chosakushu*, 5, *Gakko Ron, Daigaku Ron (Collection of Writings of Shuichi Katsuta, Essays on Schools and Colleges)* (Tokyo: Kokudoshu, 1972), p. 292.

¹⁹⁴ Michio Nagai, "Chishikijin no Seisan Ruto," ("Routes of Producing Intellectuals,") *Kindai Nihon Shisoshi Koza*, 4 (*Lectures of the History of Thoughts in Modern Japan*) (Tokyo: Chikuma Shobo, 1959): 197-233, p. 209.

¹⁹⁵ Tsunemi Sugawara, "Mombu Daijin Mori Arinori Ko ni Ageru no Sho," ("A Document Sent to the Minister of Education Arinori Mori,") *Kyu Koku Daigakko Shiryo, Furoku* (Tokyo: Tranomon Kai, 1931): 120-126.

respectively conducted meaningful education."¹⁹⁶ Akira Tachi comments on the decision of Mori, and states, "the merger ended the unique education of the combination of theory and practice at the ICE."¹⁹⁷ According to Masao Terasaki, Mori's policy for education was pragmatic for the nation, and far from educational philosophy. Terasaki asserts, "Mori decided to add the colleges of engineering and agriculture without educational philosophy."¹⁹⁸ Dyer analyzed the educational system of the College of Engineering at the Imperial University, and concluded that it did not offer sufficient practical training.¹⁹⁹

When the ICE merged with the University of Tokyo, opponents of the merger pointed to the importance and the uniqueness of the ICE. However, engineering education at the college itself had changed before the time of the merger. The students at the college had been able to work at the forefront of governmental enterprises. The opportunity to work there was decreased as governmental enterprises were sold off. The term of the practical training was gradually diminished before the merger.²⁰⁰ Therefore, the uniqueness of the combination of practice and theory at the ICE was lost owing to the social background of the college rather than owing to the effect of the merger with the University of Tokyo.

Arinori Mori was the person in charge of the merger. He was one of the first blockade runners from Satsuma clan. He went to Britain in 1865, and met Yozo Yamao in London. He executed the reformation of higher education with his philosophy toward the nation. Mori gave an inaugural address in 1885 as the first Minister of Education:

Because the government established the Ministry of Education, and had the Ministry be in charge of education and maintain schools with the expense of the nation for the purpose of the nation, the

¹⁹⁶ Tsuchiya, *op. cit.*, p. 70.

¹⁹⁷ Tachi, *op. cit.*, p. 13.

¹⁹⁸ Masao Terasaki, "Koto Kyoiku Kaikaku no Shisaku to Shiso—Mori Arinori no Shiso to Kyoiku Seisaku, III-4," ["The Educational Thought and Policy of Arinori Mori,"] *Tokyo Daigaku Kyoikugaku Kiyo* [*Bulletin of the Faculty of Education, University of Tokyo*] 8 (1965): 94-107, p. 106.

¹⁹⁹ Dyer, *op. cit.* (1904), p. 90, and *op. cit.* (1905), p. 9.

²⁰⁰ On the other hand, the meaning of laboratory education and practical training should be studied in the context of industrial education at the beginning of the Meiji era. Besides the ICE, there were several industrial schools that offered practical training, such as Denshin Shugiko that raised 1282 engineers and technicians during the same period with the ICE. See Yasushi Kakihara, "Kindai Nihon no Kogaku Kyoiku ni Okeru Kagaku to Jicchi no Sokoku —Kobu Daigakko ni Okeru Denshin Kogaku," ("Science and Practice of Engineering Education in Modern Japan: Telegraphic Engineering at the Imperial College of Engineering,") *Nempo: Kagaku, Gijutsu, Shakai (Annual Bulletin: Science, Technology, Society)* 5 (1996): 1-20.

purpose of learning is no more than for the nation. The Imperial University, for instance, teachers have jobs for academics and for the nation, they must give priority to national matters.²⁰¹

Mori enacted the Imperial University Act on March 1, 1886. The first article of the Act states, "The purpose of the Imperial University was to teach and conduct research in learning and arts to comply with a request of the nation."²⁰² The Imperial University Act declared the relationship between education and the nation, and asked an educational institution to meet the expectations of the nation.

Students from Samurai

While schools under the Ministry of Education offered more general education, the schools under the Ministry of Public Works offered practice-oriented education. Students might have been able to gain their future careers more at these practical schools, which imposed students enter service—virtually securing their jobs at the government—after graduation.²⁰³

Therefore, the graduation rate of students at the ICE was higher than at the colleges of the University of Tokyo. At the ICE, 493 students entered the school and 111 of them dropped out before graduation.²⁰⁴ This drop-out-ratio at the ICE was much lower than the one at the University of Tokyo. Shigeru Nakayama reports that Nanko, a former school of the University of Tokyo, started with 319 students in 1870. In 1878, nineteen students were enrolled in the school and three students have graduated by that time. The others dropped out, besides twenty-one students who were studying abroad in 1875 and 1876 before their graduation from the school.²⁰⁵ Nakayama concludes that the ICE had a more reliable program. The goal and the mission of the college were clearer, and treatment was better at least at the beginning of its history. The students could experience practical works at the departments and enterprises in the Ministry of Public Works. The future jobs under the Ministry were secured for the students at the ICE.

The ICE gave graduates bachelor's degrees in engineering. There were three ranks of diplomas from first to third depending on the academic records of the students. A first rank graduate could receive a

²⁰¹ Arinori Mori, cited in Nagai, *op. cit.* (1965), p. 32.

²⁰² *Tokyo Daigaku Hyakunenshi*, Tsushi 1 (*One Hundred History of the University of Tokyo*, General History 1) (Tokyo: Tokyo Daigaku Shuppankai, 1984), p. 787.

²⁰³ Nakayama, *op. cit.* (1978), p. 14.

²⁰⁴ *Ibid.*, pp. 80-81.

²⁰⁵ *Ibid.*, p. 18.

bachelor's degree. There were first 23 graduates in November 1879, and eight of them were ranked the first grade and received bachelor's degrees in engineering.²⁰⁶ Graduates from the ICE had to enter service at the Ministry of Public Works for seven years after graduation. The salary for a first class graduate was 30 yen a month, while for a second-class graduate it was 25 yen.

The ICE had multiple roles in the Meiji government; the college supplied engineers for the government, and gave posts in the government for the graduates from the college.²⁰⁷ R. P. Dore points out the role of education as a means of social movement: since the early stage of educational history in Japan, one's academic background had become a decisive factor on whether one gets a job.²⁰⁸ Graduation from a college worked like a license or a qualification exam to be an engineer; this pattern was established by industrialization in Japan.²⁰⁹

A first rank graduate from the ICE was hired at a salary of 30 yen a month, while it was 50 yen for a graduate from the University of Tokyo.²¹⁰ There was a petition from a graduate of the ICE, but Yozo Yamao thought if a graduate got a higher salary from the beginning of employment, this would not benefit the graduate.²¹¹ The College of Sciences at the University of Tokyo established the system of *koshinsei* in July 1870, which allowed admittance to excellent students from each feudal clan at the expense of the clan. It was a kind of recommendation system that lasted for one year. Students of *koshinsei* were mainly chosen from the higher-class samurai in each clan. On the other hand, students who entered the ICE were mainly from lower samurai who had to prepare to take the entrance exam.²¹² Instead, the students at the ICE entered the school at the government's expense. After graduation, there was a difference of salaries between the graduates from the ICE and the University of Tokyo in the early days, even though the reason is

²⁰⁶ *Kyu Kobu Daigakko Shiryo*, pp. 133-134.

²⁰⁷ See Matsumoto, *op. cit.*, p. 132.

²⁰⁸ R. P. Dore, translated by Hiromichi Matsui, *Gakureki Shakai: Atarashii Bunmeibyō* (Tokyo: Iwanami Shoten, 1978), p. 54. Ronald Philip Dore, *The Diploma Disease: Education, Qualification and Development* (Berkeley: University of California Press, 1977).

²⁰⁹ Dore, *op. cit.* (1978), p. 62.

²¹⁰ Nakamura, *op. cit.* (2002), p. 107.

²¹¹ *Kyu Kobu Daigakko Shiryo*, p. 180.

²¹² Muramatsu, *op. cit.*, p. 86.

not clear. Seiji Tsunekawa reports that the evaluations of both institutions became equal in the long term.²¹³

It has been recognized that the role of the ICE for the formation of an industrialized Japan was significant.²¹⁴ However, when the first students graduated from the ICE, the Ministry of Public Works was declining.²¹⁵ Until that time, Japanese workers had gained practical knowledge of industrial technology as apprentices under the direction of foreign engineers. The ICE had been intended to educate higher engineers at first, but it could not carry out the function at least in the railroad industry. Replacement of foreign engineers was mainly carried out by graduates from Kogisei Yoseijo, the practical school in the Department of the Railroad.²¹⁶ In addition, the students with experience of studying abroad took higher positions in the Department of the Railroad in the Ministry of Public Works. Moreover, the graduates from the ICE held subordinate positions to graduates from the University of Tokyo in the Department of the Railroad.²¹⁷ The graduates from the ICE did not have a special advantage compared to graduates from other practical schools. Ryoichi Iwauchi points out that there can be various paths to becoming industrial workers besides institutionalized schools, such as the ICE and the University of Tokyo. It is difficult to conclude that these schools supplied sufficient personnel to the industrial domain.²¹⁸ Skilled workers other than the students of the ICE engineered the beginning of the independence of Japanese industry. This should be noted in evaluating the role of the ICE as a pioneer of engineering education in Japan.

Continuous Samurai Mentality

The samurai conservatively held their legacy and tradition, which they maintained during the Tokugawa period. The Meiji Restoration affected the samurai class because the stipends and privileges for their families were cut off. The young samurai had to support themselves after the Restoration. One way to cope with the difficulty they found themselves in was to enroll in higher educational institutions and become

²¹³ Tsunekawa, *op. cit.*, p. 23.

²¹⁴ See Nakayama, *op. cit.* (1978), p. 84.

²¹⁵ Yamazaki, *op. cit.* (1961), p. 22.

²¹⁶ Nakamura, *op. cit.*, p. 103.

²¹⁷ *Ibid.*, p. 114.

²¹⁸ Ryoichi Iwauchi, "Kindai Nihon ni Okeru Gijutsusha no Keisei," *Keieishi Gaku* 7 (3) (1973): 32-63, pp. 39-40.

government officials.²¹⁹ To obtain an engineering education meant to get social success in the early days of the Meiji period.²²⁰ The bureaucratic nature of engineers linked them with their former social class of samurai.²²¹ A majority of engineers was from *shizoku* (former warriors), one fifteenth of the population, specifically former lower class samurai. When the college chose eleven graduates out of twenty-three of the first year students in 1879, and sent them to Britain in the following year, ten of them were from *shizoku* and only Rinzaburo Shida was from *heimin* (commoners).²²² The trend was the same in other institutions. More than eighty percent of the students in science and engineering fields at the Imperial University were from *shizoku* in 1890.²²³ According to Toshio Yamazaki, seventy-four out of the first one hundred doctors of Engineering were from *shizoku*, seven of them were from *heimin*, and the other nineteen were unknown.²²⁴

In 1878, Tomomi Iwakura suggested the idea of vocational aid for *shizoku*, whose stipends had been repealed. Because the lower class samurai had engaged in home manufacturing in their spare time from service in the Tokugawa period, Iwakura thought that it was a good idea to offer industrial jobs to the former warriors.²²⁵ While manufacturing was done at home during Tokugawa periods, it shifted to factories after the opening of the country. Work places were detached from residential areas. Workers began commuting to factories everyday. Mitsukuni Yoshida discusses Iwakura's remarks to explain the qualitative difference of manufacturing systems in the periods of Tokugawa and the Meiji, and argues that Iwakura's account was out of date because he had an image of industry that was only conducted at home.²²⁶ However, Iwakura's remarks seem appropriate in two ways. One, many former samurai found their jobs in the domain of industry, in fact. The other is that the lifestyle of commuting daily seemed natural for samurai. The latest system of industry emerged as a profession of the samurai.

²¹⁹ See Nakayama, *op. cit.* (1978), pp. 10-11.

²²⁰ Sekino and Muramatsu, *op. cit.*, p. 199.

²²¹ Yamazaki, *op. cit.* (1961), pp. 34-37.

²²² *Kyu Kobu Daigakko Shiryo*, p. 137.

²²³ Nakayama, *op. cit.* (1978), pp. 102-103.

²²⁴ Yamazaki, *op. cit.* (1961), p. 33.

²²⁵ Yoshida, *op. cit.* (1968), p. 26.

²²⁶ *Ibid.*

The ICE was like a rescue boat for the samurai, whose stipends and privileges for their families were repealed. In addition, engineering education at the ICE that had the students work at the Ministry of Public Works answered their desires to gain social success. Their sense of loyalty as the samurai brought about bureaucratic feature of the Meiji government, and the nobility stimulated their ambition in the society. At the same time, engineers were merely replacements for foreign engineers in the end.²²⁷ The Ministry of Public Works had kept the foreign employees as advisors and in supporting roles. The Ministry employed them with high salaries, but never let them participate in the process of national decision-making. After replacing foreign employees with Japanese engineers, technocrats remained only as advisory positions in the government.

Some students were torn between their identities as engineers and as samurai. Aikitsu Tanakadate prepared to enter the ICE at the end of 1873. He was disappointed in the training that could be studied at the college, such as constructing a lighthouse and a bridge, and laying electric wires. He wanted to learn information that related to national politics. He changed courses and entered a preparatory school at the University of Tokyo. He consequently became a professor of physics at the Imperial University of Tokyo.²²⁸ Sakuzo Yoshino (1878-1933), who had been a lecturer at the College of Engineering at the Imperial University of Tokyo and later became a professor at the College of Law at the University, recalled that students of engineering wished to find honor in politics rather than in science and engineering fields.²²⁹ R. P. Dore analyzes that the two main functions of samurai in the Tokugawa period, warriors and rulers, were regarded as the most honorable occupations after the Meiji era.²³⁰ Dairoku Kikuchi (1855-1917), the President of the Imperial University of Tokyo in 1898 and the Minister of Education in 1901, stated that many boys wished to be officers and avoid practical occupations.²³¹ Dyer also observed the tendency of the samurai among the students. He insisted, "The engineer is the real revolutionist," but deplored that "every

²²⁷ Shoichi Ohyodo, *Gijutsu Kanryo no Seiji Sankaku (Participation of Technocrats in Politics)* (Tokyo: Chuo Koron, 1997), p. 27.

²²⁸ Seiji Nakamura, *Tanakadate Aikitsu Sensei (Teacher Aikitsu Tanakadate)* (Tokyo: Hobun Shorin, 1943), p. 25.

²²⁹ *Ibid.*

²³⁰ Dore, *op. cit.* (1978), p. 64.

²³¹ Yoshida, *op. cit.* (1977), p. 188.

Japanese student seems a born politician."²³²

The class system of *shi-no-ko-sho* in the Tokugawa period was officially abolished, but it remained for a while in the Meiji era. The goal of social success for young people was to attain positions that were formerly occupied by samurai—politicians or military officers. Occupations of lower classes *ko-sho* (artisans and merchants) in the Tokugawa period cast a shadow on the image of similar jobs in the Meiji era, such as engineers and entrepreneurs. Therefore, these jobs were not socially desirable occupations for young samurai.²³³

Bushido as the Spirit of Samurai

The psychology and behavior of the students at the ICE seem complicated in the chaotic society during the Meiji Restoration. Dyer observed that the spirit of samurai represented the motives of the Japanese. He grounded his argument on Inazo Nitobe's *Bushido*. He found, through his experience at the ICE, that Nitobe's account was true. Dyer cited *Bushido* at the very beginning of the chapter of the "Japanese Mind" in *Dai Nippon*. Nitobe states: "The transformation of Japan is a fast patent to the whole world. Into a work of such magnitude various motives naturally entered; but if one were to name the principal, one would not hesitate to name Bushido."²³⁴

Then Nitobe analyzed the swift industrialization in Japan, and attributed the success to the spirit of samurai. He asserts: "The sense of honour which cannot bear being looked down upon as an inferior power, —that was the strongest of motives. Pecuniary or industrial considerations were awakened later in the process of transformation."²³⁵ Then, he called the spirit "Bushido."

What does Bushido teach? The philosophy of Bushido is different from the concept of monotheistic religious precepts. Bushido does not settle on an object of respect; Christianity, for example, has God. Bushido permeates among the samurai, not by the way of the literal meaning of language, but through experience, customs, and actions. Inazo Nitobe states his motivation to publish the book *Bushido: The Soul*

²³² Dyer, *op. cit.* (1905), p. 20, and *op. cit.* (1882), p. 5.

²³³ Yoshida, *op. cit.* (1977), p. 188.

²³⁴ Nitobe, *op. cit.*, p. 160. Chapter XVI, "Is Bushido Still Alive?" Dyer, *op. cit.* (1904), p. 32.

²³⁵ *Ibid.*, p. 162. Chapter XVI, "Is Bushido Still Alive?"

of Japan, An Exposition of Japanese Thought:

About ten years ago, while spending a few days under the hospitable roof of the distinguished Belgian jurist, the lamented M. de Laveleye, our conversation turned during one of our rambles, to the subject of religion. "Do you mean to say," asked the venerable professor, "that you have no religious instruction in your schools?" On my replying in the negative, he suddenly halted in astonishment, and in a voice which I shall not easily forget, he repeated "No religion! How do you impart moral education?" The question stunned me at the time. I could give no ready answer, for the moral precepts I learned in my childhood days were not given in schools; and not until I began to analyse the different elements that formed my notions of right and wrong, did I find that it was Bushido that breathed them into my nostrils.²³⁶

He goes on to explain Bushido:

Bushido, then is the code of moral principles which the knights were required or instructed to observe. It is not a written code; at best it consists of a few maxims handed down from mouth to mouth or coming from the pen of some well-known warrior or savant. More frequently it is a code unuttered and unwritten, possessing all the more the powerful sanction of veritable deed, and of a law written on the fleshly tablets of the heart. It was founded not on the creation of one brain, however able, or on the life of a single personage, however renowned. It was an organic growth of decades and centuries of military career.²³⁷

In some aspects, Bushido is a collection of thoughts that do not have certain doctrine because it does not have a written code. Therefore, the essence of Bushido can change depending on a person. Nitobe categorized these thoughts in his own way in the book.

Moreover, Nitobe created the argument of Bushido to let foreign people know the spirit of Japanese at the end of the nineteenth century. The word Bushido existed before the Meiji period. However, the samurai did not understand their ethics with the word "Bushido." The ethics of Bushido that currently we recognize was known differently in the Tokugawa period and before: *Hei no Michi* or *Musha no Narai* (the way of warriors), *Yumiya Toru Mi no Narai* (the way for those who take up a bow and arrow), *Yumiya no Michi* (the way of a bow and arrow), *Samurai-do* (the way of samurai), and *Bushi no Michi* or *Shido* (the way of bushi). The thought of Bushido with the title of "Bushido" has spread since the 1900s as involving all and/or part of every thought. Tetsushi Furukawa names it "Meiji Bushido."²³⁸ Koshi Suzuki also suggests that the

²³⁶ *Ibid.*, p. iv. "Preface to the First Edition."

²³⁷ *Ibid.*, p. 24. Chapter I, "Bushido as an Ethical System."

²³⁸ Tetsushi Furukawa, *Bushido no Siso to Sono Shuhen (Thoughts of Bushido and Its Surroundings)* (Tokyo: Fukumura Shoten, 1957), p. 5.

concept of Bushido itself was an invention during the Meiji period.²³⁹ Nitobe explains that the ethical characteristics of Bushido, such as justice, courage, benevolence, politeness, and veracity, come from Chapters 3 to 11 of the 17 chapters in his book *Bushido*. These ethics have different origins of religion and philosophy. Samurai conveniently modified these ethical standards to suit the time and place in feudal society. Such a mixing of attitudes in Japanese people also shows a characteristic of their religious and ethical tendency. Nitobe represented the ethics and atmosphere, which may substitute for a religion, among the samurai by the title of Bushido.

Because of the vagueness of the system, the ethics of samurai has been interpreted conveniently through the word Bushido. Eiko Ikegami points out that the image of the samurai is distorted because extreme nationalists before the Second World War utilized its heroic image to inspire the people, and stressed the spirit of self-sacrifice, stoicism, and loyalty.²⁴⁰ Bushido arouses the image of martyrdom, and the idea comes from *Hagakure*, which was written in the early eighteenth century. The author, Tunetomo Yamamoto was an enthusiastic votary of martyrdom.²⁴¹ However, his words in the book were too radical, so the book was initially considered to be heresy.²⁴² Yamamoto also insisted in *Hagakure* on maintaining the decentralization of power, which opposes the centralized feudalism of the Tokugawa regime. This policy of decentralization of power was also a reason that the book was restricted during the Tokugawa period.²⁴³ There is no evidence that the book spread among samurai, or was used as a textbook at a school. It is rather natural to conclude that the book was forbidden.²⁴⁴ It had not been read widely until the middle of the Meiji era. Nevertheless, the philosophy of Bushido has various forms, and *Hagakure* resembles a part of Bushido. Tsunetomo Yamamoto insisted absolute obedience and loyalty of samurai to their lord. However, the behavior does not mean to be a 'quiet follower,' instead, a samurai was expected to convince his lord of what he believes. Loyalty sometimes emerged as an objection to the lord. Although the lord

²³⁹ Koshi Suzuki, "The Invention of the Bushido in Meiji Japan," *Bulletin of Institute of Health and Sport Science, the University of Tsukuba* 24 (2001): 47-55, p. 52.

²⁴⁰ Ikegami, *op. cit.* (2000), p. 7.

²⁴¹ Furukawa, *op. cit.*, p. 115.

²⁴² *Ibid.*, p. 186.

²⁴³ *Ibid.*, p. 183.

²⁴⁴ *Ibid.*, p. 177.

does not hear the objection, a samurai should try to persuade him patiently. The higher rank a samurai attains, the easier it is for him to propose his ideas to the lord. This fact justifies the promotion of samurai.²⁴⁵ What Tsunetomo Yamamoto paradoxically established was, according to Ikegami, a moral framework to restore individualistic and self-centered egoism of samurai.²⁴⁶

Yukichi Fukuzawa is considered a leader of enlightenment and Westernization in Japan, and a figure that stands farthest from the life of a samurai. According to Nishibe, the essence of Bushido is to find higher *gi* (justice) and devote oneself to materialize it in his life, even though he might pay dearly. For Fukuzawa, justice was the civilization of Japan; he was willing to do anything for that purpose. Therefore, Nishibe believes that Fukuzawa's life was a materialization of Bushido.²⁴⁷ Even a figure like Fukuzawa, who was aggressively critical of the feudal system of the Tokugawa regime, could not escape from the life of samurai. Tawaragi picks out will power of independence as the essence of the Fukuzawa's spirit of Bushido.²⁴⁸

Although Bushido has a certain amount of arbitrariness, it still shows a distinctive feature. Bushido represents the spirit of the elite. The samurai composed one fifteenth of the population, and they had been the privileged class in the feudal society until the end of the Tokugawa regime. Nitobe explains the meaning of Bushido:

The Japanese word which I have roughly rendered Chivalry, is in the original, more expressive than Horsemanship. *Bushi-do* means literally Military-Knight-Ways-the ways which fighting nobles should observe in their daily life as well as in their vocation: in a word, the "Precepts of Knighthood," the *noblesse oblige* of the warrior class.²⁴⁹

The samurai were the fighting nobles and warrior classes. In addition, Nitobe affirms, "Bushido was a trust organized by those who monopolized reserve capital of intellect and culture, fixing the grades and value of moral qualities."²⁵⁰ In other words, Bushido was a special ethics held among people who had a sense of entitlement. Such lordly pride emerges as an attitude that cannot bear being looked down upon as an

²⁴⁵ Ikegami, *op. cit.* (2000), p. 288.

²⁴⁶ *Ibid.*, pp. 287-288.

²⁴⁷ Susumu Nishibe, *Fukuzawa Yukichi—Sono Bushido to Aikokushin (Yukichi Fukuzawa: His Bushido and Patriotism)* (Tokyo: Bungei Shunju, 1999), pp. 62-64.

²⁴⁸ Kotaro Tawaragi, *Shin Shido-ron (New Theory on Bushido)* (Tokyo: Chikuma Shobo, 1992), pp. 200-214.

²⁴⁹ Nitobe, *op. cit.*, p. 23. Chapter I. "Bushido as an Ethical System."

²⁵⁰ *Ibid.*, p. 170. Chapter XVII, "The Future of Bushido."

inferior to others. In order to maintain their privileges, the samurai had put effort into justifying their authority. Bushido is the system of ethics that taught the samurai to behave properly for their positions.

The ethos of samurai inspired the patriotic spirit among the Meiji Restoration leaders. Nitobe found that every leader of the Meiji Restoration was a votary of Bushido:

. . . for Bushido, the maker and product of Old Japan, is still the guiding principle of the transition and will prove the formative force of the new era. The greatest statesmen who steered the ship of our state through the hurricane of the Restoration and the whirlpool of national rejuvenation, were men who know no other moral teaching than the Precepts of Knighthood. . . . No, it was Bushido, pure and simple, that urged us on for weal or woe. Open the biographies of the makers of Modern Japan—of Sakuma, of Saigo, of Okubo, of Kido, not to mention the reminiscences of living men such as Ito, Okuma, Itagaki, etc.,—and you will find that it was under the impetus of samuraihood that they thought and wrought.²⁵¹

Hirobumi Ito recalls, in 1899, the nationalistic goal that he aimed for at the beginning of the Meiji era. He said: "We adopted the policy [of opening the country] not because of aiming the opening of the country itself, but because of wishing to keep independence of the nation, raise an enterprising spirit, and make Japan bigger."²⁵² Moreover, Ito insinuated the spirit of samurai into students at a teachers college in Yamaguchi. He proudly declared that the position of Japan was secured in the international society. He said:

We should pay attention to the position of Japan in the world. Japan is now free from the ties of Asian countries, and by the side of civilized European nations that are at the distance of thousands of kilometers, and is admitted by these nations as a civilized nation. The evidence that our position is admitted is the revised treaties that have been in effect since July 1899.²⁵³

Ito surely held the ethos of samurai.

A characteristic feature of the samurai emerges from the attitude of a student of the ICE and engineers. Sakuro Tanabe, one of the fifth year graduates from the ICE, was leading the construction of waterworks by lake Biwa in 1890. At a planning discussion of the construction held in 1884, someone began to talk about the economic value of the construction, but there was an objection that engineers should not be concerned about financial matters.²⁵⁴ Commerce was still considered to be an occupation for the lowest class in the

²⁵¹ *Ibid.*, p. 160. Chapter XVI, "Is Bushido Still Alive?"

²⁵² Ito, *op. cit.* (1936), p. 323.

²⁵³ *Ibid.*, p. 310.

²⁵⁴ Yamazaki, *op. cit.* (1961), p. 37.

traditional hierarch of *shi-no-ko-sho*. Bushido teaches the samurai to be at the highest status *shi*.

West as Authority

The students at the ICE, who embodied the spirit of samurai, were, at the same time, active imitators of culture and technology from the West. Dyer repeatedly pointed out this tendency in the students. He reported, "the important object of the Japanese student of the present day is to learn the facts that have already been found out in other countries, not to find out new things for himself."²⁵⁵ Their thoroughness of imitation seemed too much for Dyer. He gave the students candid advise:

Hitherto it has been too much the custom to introduce a thing into Japan simply because it is foreign, without considering whether it is suitable to the wants of the people, or whether by taking advantage of something already in the country, the foreign article could not be improved or made cheaper. I have on every occasion protested against the indiscriminate introduction of foreign articles into the country, and the consequent neglect of every thing purely native, and I again take this opportunity of bringing my views under your notice.²⁵⁶

Japanese people at the ICE did not show their creativity. Not only did the staff intend to absorb the system of engineering education from the foreign teachers, the students also tried to absorb engineering. Their attitude led Dyer to surmise that the students did not have fire and energy.²⁵⁷

Dyer tried to interpret, after going back to Britain, the problem that he had felt since he came to Japan. He had good intentions in introducing Japan to the British people. He stood beside the Japanese regarding their tendency of imitation, and tried to defend them in his writings:

The common impression is that the Japanese have wonderful powers of imitation but little or no originality. This impression, however, is as superficial as many others which have been formed of Eastern peoples.²⁵⁸

It is too late in the day to continue to repeat what was a very common saying thirty years ago; namely, that the Japanese were very clever imitators but that they had neither originality nor perseverance to accomplish anything great. Their whole history in the interval has disproved the charge. Their ardent patriotism, their high sense of personal and national honour, their keen intelligence have enabled them to work what is admitted to be the political miracle of the latter part of the nineteenth century.²⁵⁹

Dyer could not assert that Japanese people have originality, but he explained that they could still accomplish

²⁵⁵ Dyer, *op. cit.* (1877), p. 57.

²⁵⁶ *Ibid.*, p. 59.

²⁵⁷ Dyer, *op. cit.* (1882), p. 1.

²⁵⁸ Dyer, *op. cit.* (1904), p. 44.

²⁵⁹ *Ibid.*, p. 48.

something great. When they copy a Western way, they use some consideration. Dyer explained:

We shall see that in every department of national life the Japanese have not been content to copy Western ways of thought and action; they have taken what they believed to be useful to them, but in its application it has been profoundly modified and adapted to the new conditions, thus proving that they are not the servile imitators they are sometimes said to be.²⁶⁰

In education, as in other departments, . . . the Japanese have not been content to copy any system; they have observed what they believed to be the good points in all systems, and they have now evolved an organisation of their own, which is very complete and well suited to the requirements of the country.²⁶¹

Then, he concluded that Japanese have not changed themselves, but they have the natural ability to develop products. He stated:

. . . the appliances of Western industrial invention have worked admirably in Japanese hands—have produced excellent results in those crafts at which the nation had been skilful, in other and quainter ways, for ages. There has been no transformation—nothing more than the turning of old abilities into new and larger channels.²⁶²

The forces acting on Japan from without have been co-operating with those which acted from within and have merely changed their direction; they have created little that is new.²⁶³

Dyer understood that the Japanese have the ability to industrialize the nation their own way, and the criticism was unfair. He generously stated, "The Japanese are not simply book students, but are able to apply their knowledge to the practical affairs of life."²⁶⁴ Nevertheless, his premise in his writings was that imitation is not favorable.

The action of imitation has a negative image because it lacks creativity or originality.²⁶⁵ Historically, "creation" is a newer idea than imitation. "Creation" is an idea that confirms the territory of the self with creative goods, and tries to ensure one's identity or economic interests. Copying in the process of "creation" is hidden, and the created thing is protected from being copied by others. This structure of exclusion of

²⁶⁰ Dyer, *op. cit.* (1908), p. 148.

²⁶¹ Dyer, *op. cit.* (1904), p. 84.

²⁶² Lafcadio Hearn, *Kokoro: Hints and Echoes of Japanese Inner Life* (Boston: Houghton Mifflin, 1896), pp. 9-11, cited in Dyer, *op. cit.* (1904), p. 45.

²⁶³ Dyer, *op. cit.* (1904), p. 46.

²⁶⁴ *Ibid.*, p. 48.

²⁶⁵ See Shoji Yamada, *Nihon Bunka no Mohou to Souzou: Originality toha Nanika (Imitation and Creation in Japanese Culture: What is Originality?)* (Tokyo: Kadokawa Shoten, 2002), p. 15. He explains positive sides of imitation in his book.

copying is an essential principle for the formation of civilized nations.²⁶⁶ In the field of art, Shoji Yamada gives an example and states: "Although fine arts have been build by imitating and being imitated by artists, the action of imitation, which has historically conducted until now, was hidden when creativity got a seat of virtue."²⁶⁷ He then concludes that creativity has a value only in the context of civilized nations. The uncomfortable sense that Dyer felt, in the process of industrialization in Japan, was a wall between Britain as a civilized nation and Meiji Japan as an uncivilized society.

Imitation has a positive meaning in the history of industry. Introducing advanced technology is reasonable to reduce time and cost toward industrialization because it saves repeating the research that lead to that technology inside the country.²⁶⁸ Heita Kawakatsu discusses the similarity of motives toward industrialization. The flash point of industrialization in Japan was the Western impact that urged Japan to imitate Western technology, while the trigger of the Industrial Revolution in Britain was Eastern impact that urged Britain to produce cotton goods imitated from India through developing machinery.²⁶⁹ There is an action of imitation in the process of development, and the action gives impetus to further creation.

In the process of Westernization, consequently, imitation of the West was an emergence of Japanese identity at the ICE. In the case of architecture, Westernization was attained by abandoning Japanese traditional styles. Kingo Tatsuno, one of the first students who went to Britain right after he graduated from the college, recalls his experience in London. An architect asked Tatsuno about Japanese architecture, but he could not answer anything because he had learned only the Western style of architecture under a British professor Josiah Conder. His son Yutaka Tatsuno, who was a professor of French literature at the Imperial University of Tokyo, states: "My father was selected to enter the Imperial College of Engineering, study in Britain, and become a professor at the Imperial University. He seems to have thought that he needed to be

²⁶⁶ *Ibid.*, p. 14.

²⁶⁷ *Ibid.*, p. 61.

²⁶⁸ Hoshimi Uchida, *Sangyo Gijutsushi Nyumon (Introduction to the History of Industrial Technology)* (Tokyo: Nihon Keizai Shimbunsha, 1974), p. 26.

²⁶⁹ Heita Kawakatsu, *Nihon Bunmei to Kindai Seiyo (Japanese Civilization and Modern West)* (Tokyo: Nihon Hoso Shuppan Kyokai, 1991), p. 61.

faithful to his duties in the nation; that is to transfer European architecture into Japan as soon as possible."²⁷⁰

The patriotic spirit of Kingo Tatsuno supported his identity as an engineer. Moreover, he recognized that imitation of the Western style of architecture was his mission.

Ito's emphasis was on the outcome of mastering and controlling a system by the Japanese. Ito was proud of Japan and the effects of practical learning by comparing to China. He said:

Last year, I talked with leaders in China, and they worried that learning in China is only theoretical one. But they cannot change suddenly their learning and import learning from European civilized nations. Fortunately in Japan, there was not such an obstacle, and we could introduce the newest learning into our nation. Due to the power of its inducement, there have emerged various enterprises. For example railroads and the postal system, we can run these systems without help of others because we have introduced practical learning. Chinese people constructed railroads but they cannot run the system by themselves; they still need helps of Western people.²⁷¹

He showed no sign of guilt in the process of imitation. The spirit of independence justifies all other means. Actually, imitation of a system is not an easy undertaking. Miwao Matsumoto points out that the process of technology transfer at the beginning of the Meiji period was not like a transplant of a product that was already made in the Western countries. It was a dynamic performance for Japanese people to absorb developing technologies, like catching moving objects as they are moving.²⁷²

From the position of the samurai, Westernization had two political connotations for the Meiji government; one to those outside and another to those inside the country. The Japanese government wanted to demonstrate to the international society that Japan was a civilized nation. The government assumed that to be a civilized nation would make negotiation of the revision of the treaties favorable. Civilization was considered nothing but Westernization for the leaders in the government. At the same time, the government emphasized results of the new regime and needed to justify the revolutionary restoration as a domestic policy. New Western technology virtually worked to suppress the dissidents owing to the development of a capitalistic economy and the maintaining of public order. Therefore, imitation of the West was a desperate reaction to the risk of their existence.

In addition, while a samurai mentality of Japanese people worked at the ICE by imitating Western

²⁷⁰ Muramatsu, *op. cit.*, pp. 97-98.

²⁷¹ Ito, *op. cit.* (1936), p. 309.

²⁷² Matsumoto, *op. cit.*, p. 125.

learning as it was, their behaviors differentiate engineering from craftsmanship. The word *kogaku* was created as a translation of the word "engineering." It is a combination of two parts; *ko*—art and technique, and *gaku*—learning. Using *gaku* as a suffix played a role in making the word seem academic. That is to say, more than the practical knowledge of the artisan, and the word gets an image of high status. An authoritative image of engineering also came from the fact that it was from the Western civilized nations. Nakayama explains these phenomena and states that "a samurai mentality formed characteristics of engineering in the Meiji era," even though he does not explain what a samurai mentality is.²⁷³ Western learning could now be studied at advanced institutions in the government; therefore, engineering in Japan had obtained an authority, and samurai, who were the elite of society, participated in engineering. Giving a suffix *gaku* as well as *kogaku* academically boosted subcategories of engineering as well. There were textbooks of William Rankine (1820-1872), such as *Strength of Materials*, and *Theory of Structure*, and they were translated into *Zairyō Rikigaku* (Learning of Materials), and *Kozō Rikigaku* (Learning of Structure).²⁷⁴ The principle of honor in the spirit of samurai urged authorities to authorize engineering and engineering education by borrowing from and imitating the West. Westernization was a political process for former samurai to maintain their higher social status.

6. Conclusion and Implications

The Meiji Restoration was a time of encounters between Japan with Western powers. There was an increase in national identity among the Restoration leaders. In this thesis, I investigated how the rise of national identity is linked to the development of engineering education in Japan, and chose the Imperial College of Engineering (ICE) in Tokyo in the late nineteenth century. The ICE was at the forefront of Westernization in the Meiji government. As a result of the investigation, I conclude that the spirit of samurai was the ethos for development and Westernization at the ICE.

Engineering education at the ICE was influenced by political strategies of the Japanese participants on

²⁷³ Nakayama, *op. cit.* (1978), p. 79.

²⁷⁴ *Ibid.* William Rankine was a professor of civil engineering and mechanics at the University of Glasgow, and Henry Dyer studied engineering under him.

two levels inside of Japan: the former feudal clan relations and the former hierarchical class relations. On both levels, the Meiji Restoration was a trigger to change social status for the former samurai. Most of the Japanese participants at the ICE were from the samurai class. The pride of the samurai showed in their spirit of rivalry, independence, and loyalty. The Western powers stimulated the enhancement of Japanese national awareness at the end of the Tokugawa shogunate. After the Meiji Restoration, their identities as members of feudal clans converted to the identity of Japanese. Although their identities had changed, they continued to hold onto their previous ethical standard. The spirit of samurai motivated some active leaders, such as Yozo Yamao and Hirobumi Ito, to emulate Western technology to make Japan a civilized nation. The lordly pride of the students was also the decisive factor that characterized the ICE as a college for the nation. The former samurai students entered the ICE to maintain and raise their status. The Ministry of Public Works and the ICE secured jobs for them at the government, even though the Ministry was dwindling when the first year students graduated from the college.

After I placed the theme of the thesis in the context of related studies in Section 2, I used three sections to examine the ICE from three different viewpoints, from Section 3 to 5; that is Yamao and Ito as the co-founders (Section 3), Henry Dyer as the first principal (Section 4), and the students at the ICE (Section 5). Although there are some overlaps, I discussed these figures in different time periods; that is, before the establishment of the ICE (Yamao and Ito), during its operation (Dyer), and at its closing (students).

In Section 3, I illustrated the establishment of the ICE and its characteristics from the viewpoint of the co-founders Yozo Yamao and Hirobumi Ito. After visiting Britain, they deepened their consciousness of their national culture. Their ethical code spurred them to work for the nation. Nevertheless, their standards of behavior were consistent in terms of the spirit of samurai; that is the spirit of rivalry, loyalty, and independence.

As former members of the Choshu clan, Yamao and Ito aggressively promoted Westernization and industrialization through taking leadership in the Ministry of Public Works. They founded the ICE with a strong rivalry against Western powers. From the beginning, adopting the Western style was one of the primary concerns on the way to making engineering in Japan comparable with Western technology. Their

policy of unquestioning adoption was also their political strategy in former feudal clan relations. Then, they placed the mission of the ICE on the development of the nation. In addition, while he and Hirobumi Ito decided the principle of the college in the beginning, it became clear that Yozo Yamao was the main figure to manage the school after its establishment.

In Section 4, I focused on the first principal Henry Dyer, and traced the changes of his views about the characteristics of the ICE. Dyer had not been aware of, when he was in Tokyo, the ethos of the students, who placed their entire existence in the context of their society and behaved for their nation. Although Dyer commended the grand results of the college, he had a complaint about the attitude of the students adopting Western cultures without a question. At first he asserted that they lacked fire and energy. After going back to Britain, he found that they had a strong patriotic spirit and their loyalty to the nation was the biggest factor to the quick success of industrialization in Japan. The politics-oriented attitude of the students irritated Dyer. Dyer devoted himself to realize his ideal of engineering education in Japan without understanding the social and cultural situations for the students during the Meiji Restoration. The students at the ICE utilized engineering education in their political process to maintain their social status. In Section 5, I discussed the ethos and motivations of the students of the ICE in the changing environment after the Meiji Restoration. The ICE played a role to restore the self-esteem of former samurai, who lost their social status, and gave them the opportunities to work under the government. While replacement of foreign teachers with Japanese was because of a financial difficulty of the Ministry of Public Works, some Japanese were proud of the resulting independence of engineering and engineering education from foreigners. However, the financial and political circumstances of the government affected the fate of the college at last. In this section, I investigate the imitation of a Western style as a manifestation of the identity of the Japanese people at the college, and as an action for the sake of the nation.

This thesis contributed to uncover the Ministry of Public Works and the ICE as significant foundations in the history of technology in Japan from a viewpoint of social history. Specifically, I showed how the spirit of samurai as a non-engineering factor influenced the development of engineering education. As a result, I proposed that the spirit of samurai was a factor to the success of technology transfer in early Meiji

Japan, while there are studies that point out that adopting alien culture succeeded due to Japanese native characteristics, such as dichotomy, Confucianism. Furthermore, I gave an explanation of the inevitability of Westernization and industrialization at the ICE and the Ministry of Public Works, while there are many studies to explain probability of industrialization in Japan. The leaders at the college and the Ministry emulated Western technology to maintain the superiority of their former feudal clan and the nation—it was the biggest of their motivations. Then, I analyzed Westernization at the ICE as a consequence of political strategies among the Japanese participants of the college. This theory implies that other fields of education also involve politics of the participants. Regarding the development of the ICE, we should understand that there were two levels of politics for the former samurai after the Meiji Restorations: the former feudal clan relations, and the traditional class relations. In either case, the spirit of samurai was the ethos of their behavior. In addition, I offered, in this thesis, a new viewpoint of Henry Dyer, a foreign employee, as an observer to verify social and cultural backgrounds of Japanese people in Meiji Japan.

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