



Japanese Students' Studies at the École Centrale des Arts et Manufactures in Paris in the 1870s and its Impact on Urban Planning

Junne Kikata*, Ken Nakae**

* *Ph.D., Department of Architecture, Kagoshima University, kikata@aae.kagoshima-u.ac.jp*

** *D. Eng., Department of Architecture, Kobe University, nakae@kobe-u.ac.jp*

Between 1876 and 1879, young Japanese elites in the field of construction were selected by the government and sent to France to study at the École Centrale des Arts et Manufactures in Paris (hereafter ÉCAM). This study discusses the features of technical education at ÉCAM during that period and reconsiders its impact on the planning history of Japan through the practices of its students after their return. It focuses on the activities of Hanroku Yamaguchi (1858-1900) who finally drafted the Plan for Ōsaka in 1899, unrealized but one of the pioneering Japanese city plans. The Plan was strongly associated with public works which was to be supervised by his Paris colleagues—Kōi Furuichi and Tadao Okino—and with his practice on industrial buildings in Ōsaka. Its distinguished feature was industry-oriented design associated with his learning in France. Moreover, this paper discusses the limitations and scope of the transmission and localization of planning ideas.

Keywords: Japan, Ōsaka, École Centrale des Arts et Manufactures, industrial village, extension plan

Introduction

It is important to recognize that in the early Meiji era (1868-1890s), Japan underwent Western industrialization influenced by multiple sources (England, Holland, France, Germany, the U.S., etc.) and this development was driven by multi-layered structures (public/private, central/regional, authorized/unauthorized). This gives rise to the question whether this involved the transmission of urban planning ideas. If yes, a selection process must have been adopted (consciously or unconsciously) since these countries had different planning traditions. Stephen Ward identified three major concerns regarding the international diffusion of planning and proposed a typology of diffusion¹. Ward identified early twentieth-century Japan's case as an example of 'undiluted borrowing'. Recognizing the context, 'the rapid modernization of Japan from the later nineteenth century, which encouraged a fairly systematic trawling of the advanced Western countries for progressive practices which could be adopted', Ward noted that 'the possibilities of conscious selection or synthesis were quite limited', and pointed that 'Japanese planners...had always looked to the West as a whole'. Although we appreciate this important recognition of the general tendency of the Japanese understanding of the West, we think that it is still important to study specific cases, especially in the early phase, and analyse the limitations of the planning and the reasons they generated historical results as summarized by Ward.

On the other hand, in our previous study, we demonstrated that the Western concept of the industrial village had been accepted in various contexts in Japan². The analysis of business travels, which increased rapidly in the 1890s, suggested that these trips enabled Japanese businesses to assimilate concepts and practical information concerning Western industrial villages. Interestingly, several related practices of industrial development emerged in Japan at the turn of the twentieth century. Simultaneously, the Garden City concept also emerged with the first publication of Ebenezer Howard's *To-morrow* in 1898. The concept of the industrial village was thus acquired from multiple sources by the private business sector on their own initiative.

Japanese Students of the École Centrale des Arts et Manufactures (ÉCAM) in Paris in the 1870s

This paper focuses on the Japanese students who studied at ÉCAM in Paris, between 1876 and 1879. The historical importance of their study is already well known, since the dispatch of Kōi Furuichi (1854-1934), Tadao Okino (1854-1921), and Hanroku Yamaguchi (1858-1900) was the first organized dispatch of students overseas by Monbu-shō (Ministry of Education) of Japan in this field, after the reformation of their scholarship policy. Moreover, because of the fame they achieved after their contribution to the development of 'Doboku Kougaku' (civil engineering/public works)³, the Japan Society of Civil Engineering conducted substantial studies on Furuichi's and Okino's works⁴. Although these studies focused on their work in specific fields, they are helpful to understand the whole picture of their learning and career.



Comparatively speaking, studies on Yamaguchi are quite fragmentary, although he is the most important person in relation to the planning as he drafted the Plan for Ōsaka in 1899. Since the 1980s, the Plan for Ōsaka has been addressed by several authors, for example, Tamaoki (1979)⁵; Miwa (1989)⁶, who tried to establish Yamaguchi as the originator of Ōsaka's planning; Hori (1992), who briefly introduced Yamaguchi as 'the first architect and planner in Japan'⁷; the Planning Bureau of Ōsaka City (1989)⁸ and Nishikawa et al. (1989)⁹, who mainly focused on street planning; and Arai and Ozawa (2014), who focused only on park planning¹⁰. The most precise understanding was obtained by Y. Ishida (2001)¹¹, who recognized the importance of Yamaguchi's learning in France and the context, Ōsaka's industrialization, but it lacks actual proof. Further, the Plan for Ōsaka drafted in 1899 has also been introduced in foreign languages¹², though, as Fouquet (2013) commented, shortage of works written in French hinders accurate discussion¹³.

One important reason for the general lack of studies on Yamaguchi is his illness and death at the young age of 42. This obviously shortened his career and limited his output (practices and writings), as well as hindered the attempts of later generations to completely understand his work. Moreover, his achievements during his illness were relatively underestimated. Another important reason for this lack is probably that some authors emphasized his status as 'the first architect in Japan'¹⁴. Although partly true, this preconception led to the fragmentation of existing studies. Yamaguchi's works on school buildings during his career at Monbushō Eizen Ka (the Construction Department of the Ministry of Education)¹⁵, and his last and most spectacular work of Hyogo Prefectural Office have been highly appreciated; however, his simple works—industrial buildings of factories in the Kansai area—have not been given enough attention. A comprehensive study on Western-style architecture in the Kansai area by J. Ishida (1996)¹⁶ placed Yamaguchi's contribution in historical context, though it also did not focus on industrial buildings such as factories.

Nevertheless, with regard to understanding the learning of Japanese students, including Yamaguchi, at ÉCAM, such works of industrial buildings are important as they more suitably reflect their learning at ÉCAM. Horiuchi's case study (2003) accurately observed and discussed the practical education in France obtained by Yamaguchi and Katsutarō Inabata, the founder of Muslin Mill Co. Ltd., and their collaboration in Ōsaka¹⁷.

Significance of Émile Muller's Teaching at ÉCAM

ÉCAM was founded in 1829. It introduced new theoretical and methodological principles of education in response to the drastic change in social and economic circumstances due to industrialization in France, particularly, the nature of building programs¹⁸. This can be briefly described as the 'invention of Industrial Sciences (Sciences Industrielles)', as the interface between basic principles and industrial practice¹⁹. In the construction field, ÉCAM provided specialized courses on construction technology (including architecture and public works), which was a single, integrated course titled 'Construction Civiles' in the school's foundation year. During the 1877-78 semester, when the Japanese students were at ÉCAM, 'Construction Civiles' was taught by Professor Émile Muller (1823-1889), along with 'Travaux Publics' taught by Antoine Boutiller (1828-1918) and 'Éléments d'Architecture' taught by René Demimuid (1835-1881).

Muller is known as the architect of the workers' housing suburb of Mulhouse (la cité ouvrière de Mulhouse). Its construction started in 1853, and it is regarded as one of the earliest examples of industry-oriented housing development in France. He is also recognized for his contribution to research on workers' housing such as *Les Habitations Ouvrières En Tous Pays: Situation En 1878, Avenir (Workers' Housing in All Countries: Situation in 1878, Future)*²⁰, co-written by Émile Cacheux, an ÉCAM graduate. This book included an international comparison of workers' housing and received an award in the world exposition of 1878. Moreover, he is known as an entrepreneur, the founder of la Grande Tuilerie d'Ivry (the Grand Tile Factory of Ivry) located in Ivry-sur-Seine in the outskirts of Paris at the Seine riverfront²¹. Importantly, Yamaguchi did his apprenticeship at Muller's factory in Ivry in 1880 after his graduation from ÉCAM. One of Yamaguchi's ÉCAM classmates, Tadao Okino, in his biographical introduction of Yamaguchi, states that 'Yamaguchi learned the methods of tile and architectural terra-cotta production under Muller's kind instruction'²².

Muller was a typical reformist engineer who was deeply committed to the social and economic issues of construction. His character is reflected in his commitment to workers' housing and his role in the increasing use of ceramic, motivated by the invention of economic but durable architectural materials to replace stone, the limited natural resource that also has faults. Moreover, he was regarded as a reformer of education at ÉCAM. In 1846, Muller was appointed as the professor of 'Construction Civiles', as the first graduate of the school. Before Muller, former professors of 'Construction Civiles', including Charles Mary (1791-1870), were all from École Polytechnique, known for its highly theoretical education. Muller was considered a model civil engineer, as imagined by ÉCAM's founders, and a social and industrial reformer²³.



Contents of Émile Muller's Course 'Construction Civiles'

The detailed educational contents of ÉCAM can be known today, thanks to the richness of the Archive of l'École Central of Arts and Manufactures²⁴. Even in Japan, we can understand it partly through Kōi Furuichi's handwritten notebook and textbooks preserved at Furuichi Bunko (Kōi Furuichi Archives) of the University of Tokyo²⁵. We consulted Furuichi's notebooks and textbooks on three courses related to construction engineering, especially on the course 'Construction Civiles' taught by Muller, and were able to understand the entire contents. 'Construction Civiles' includes fifty-two lessons, which were taught between 3 September 1877 and 11 May 1878. By referring to Furuichi's notebooks and a historical record of the school, we confirmed that Muller's course included the following contents: *étude des matériaux de construction* (study on construction materials), *charpente* (structural framework), *éléments d'architecture et historique* (architectural elements and history), *étude des locaux d'habitation et des locaux d'industriels* (housing and industrial premises), *hygiène de l'habitation* (hygiene of housing), and *direction des chantiers, devis, cahier des charges*, etc. (direction of construction site, estimation, specification documents, etc.)²⁶.

The first chapter on construction materials started by introducing the physical characteristics of stone, describing its faults, including frost damage (*gélivité*). The materials included mortar, glass, ceramic, wood, paint, plating, etc., and their physical and chemical characteristics, as well as usage, were described. The next chapter on structural framework dealt with wood, steel, and mixed structures, which were explained with examples of traditional and contemporary architecture. The chapter on architectural elements explained the architectural principle with three keywords: *de la solidité* (solidity), *de la commodité* (commodity), and *de la beauté* (beauty). About beauty, Muller stated that 'There is no law or precept to give on the subject of what constitutes beauty. The base of the art is truth'²⁷.

These contents are important when considering the impact of Muller's architectural education on the Japanese students, although regarding planning, the following chapters are more important. The chapter on housing and industrial premises dealt with the following types of facilities: warehouse, dock, spinning mill, textile mill, public bath and wash-house, hospital and hospice, housing, and workers' housing. This clearly shows that Muller's course was industry-oriented. Each building program was explained with numerical evidence, with a notification saying 'one has to consider the economic side'²⁸. Regarding housing, Muller commented that 'the history of housing... gives an idea of each period's civilization'²⁹. On workers' housing, Muller explained the rise of this issue from the 1850s; *Cité ouvrières* (Workers' City) had produced a unique impact. Muller described the impossibility of Workers' City in a big city; however, he indicated that it could achieve success in a provincial city and stated that 'the first idea is to give back the workers their own (house), and this institution acted on the moral situation of the workers'³⁰. Finally, he referred to the Workers' City of Mulhouse.

Here, we can confirm that Muller's planning concept for workers' housing was surely taught in his course. This is probably one of the earliest evidence of the direct introduction of planning ideas for workers' housing.

Influence of Émile Muller's Course on Yamaguchi's Industrial Buildings

Yamaguchi returned to work in the Kansai area in 1894 as an associate at Kuwahara Engineering Office in Ōsaka, which was an association of seven university graduates, Kouno, Fujii, Yamaguchi, Oka, and others. They specialized in architecture, railways, mining, machinery, and were the leading figures in each fields. The office looked 'like a complete advisor of the industrial world of West Japan'³¹. Eleven projects, after 1894, were listed as part of Yamaguchi's works, edited by Tadao Okino in his biographical account of Yamaguchi (**Table 1**). Among them, only Hyogo Prefectural Office is a public building; others are private office buildings or industrial buildings. This paper focuses on three factories in Ōsaka and considers the influence of Muller's course on Yamaguchi's works.

- Nihon Seitō Kabushiki Gaisha (Japan Sugar Refining Co. Ltd., completed in 1898)

The factory of Nihon Seitō was located in the north of Ōsaka on the Yodogawa riverfront. Yamaguchi designed the 1,980-square-meter factory building, constructed with steel-framed brick walls. The Period Reports of Nihon Seitō clarifies the factory construction process and the circumstances of Kuwahara Office's participation in building design, namely, Yamaguchi's participation. The company selected a refining machine for purchase based on the documents and drawings sent from Europe, and finally, when the machine was ordered, Yamaguchi designed the factory building referring to the machine drawings³². Yamaguchi had learnt factory design at ÉCAM in Muller's course and through practices outside of school. In addition, he had also learnt about machinery. The task of building this factory shows how Yamaguchi's learning suited actual practice.



Table 1: Yamaguchi’s Architectural Works listed in *Yamaguchi Hakushi Kenchiku Zushū*

project name	higher normal school	higher school of commerce	college of science, the Imperial Univ.	the first high school	the second high school	Yokohama-Shokin Bank, Kobe branch	factory of Nihon Boushoku Co.Ltd.	Meiji life insurance Co.Ltd., Osaka	factory of Nihon Sugar Refinery Co.Ltd.	the Locomotive Manufacturing Co.Ltd.	the Muslin Mill Co. Ltd.	Nihon fire insurance Co.Ltd.	foreign engineers' house Yahata Steel	Hyakusanju Bank main office	Hyogo Prefectural Hall	Nihon Post Bank main office
location	Tokyo	Tokyo	Tokyo	Tokyo	Sendai	Kobe	Nishinomiya	Osaka	Osaka	Osaka	Osaka	Osaka	Chikuzen, Fukuoka	Osaka	Kobe	Osaka
structural materials	brick	brick	brick	wood/brick	wood/brick	brick	brick	brick	brick/steel frame	brick	brick	brick	wood	brick	brick	brick
floors	1, 2	2	2	1, 2	1, 2	2	1	2	(1)	1	2	1	2	2	2	2
specific materials	-	-	-	-	-	granite (quin, lintel) bronze (cornice) tile roof	brick chimney (height 45m) tile roof	granite (quin, lintel) basement floor slate roof	brick chimney (height 36m) steel sash	granite (quin, lintel) bronze (cornice) tile roof	brick chimney (height 36m) tile roof	granite (quin, lintel) tile roof	tile roof	granite (quin, lintel) bronze (cornice) flat roof	granite (quin, lintel) bronze (cornice) slate roof	bronze (cornice) slate roof
floor areas (㎡)	1270.5 (main building) 564.3 (physics labo.)	349.8 (office building)	1815.0	1910.7 (main building) 1527.9 (phy./che. labo.) 1815.0 (dormitory) 3187.8 (prep. class room)	795.9 (main building) 818.4 (phy./che. labo.) 115.5 (storage.) 570.9 (auditorium) 462.0 (teachers office) 2494.8 (dormitory) 693.0 (heating equip.) 570.9 (gymnasium) 198.0 (armour strage) 402.0 (dissection labo.)	627.0	10309.2	495.0	1980.0	330.0	13530.0 (approx.)	264.0	429.0	660.0	2244.0	396.0
total (㎡)	1834.8	349.8	1815.0	8441.4	7121.4	627.0	10309.2	495.0	1980.0	330.0	13530.0	264.0	429.0	660.0	2244.0	396.0
my of construction starting	Jul/1884	Oct/1885	Nov/1885	Apr/1887	Jun/1888	Feb/1894	Jan/1896	Fev/1896	May/1897	May/1897	Dec/1897	May/1897	May/1898	Oct/1898	Jan/1899	Jun/1900
my of completion	Mar/1887	Jun/1886	Dec/1890	Feb/1890	Oct/1891	Dec/1896	Dec/1896	Jun/1899	May/1898	Jun/1898	Jul/1900	Jun/1898	Aug/1898	Jul/1901	May/1902	Jan/1902
current condition	not existing	not existing	not existing	not existing	not existing except auditorium	not existing	not existing	not existing	not existing	not existing	not existing	not existing	not existing	not existing	existing(restored)	not existing
notes	-	-	-	co-working with Masamichi Kuru	co-working with Masamichi Kuru	design by Shogoro Sige, construction supervising by Yamaguchi	-	design by Magoichi Noguchi, construction supervising by Yamaguchi	-	-	co-working with Shogoro Sige	-	-	-	Kanetoku Akiyoshi succeeded the work after Yamaguchi's death	-

Figure 1 shows the resemblance between Nihon Seitō factory building and a cross-section drawing of an existing factory building in Paris from Mullers’ educational materials (*Croquis de Cours des Constructions Civiles*). This is a visible example of the reflection of Yamaguchi’s learning in France, especially from Muller’s course, in his works.

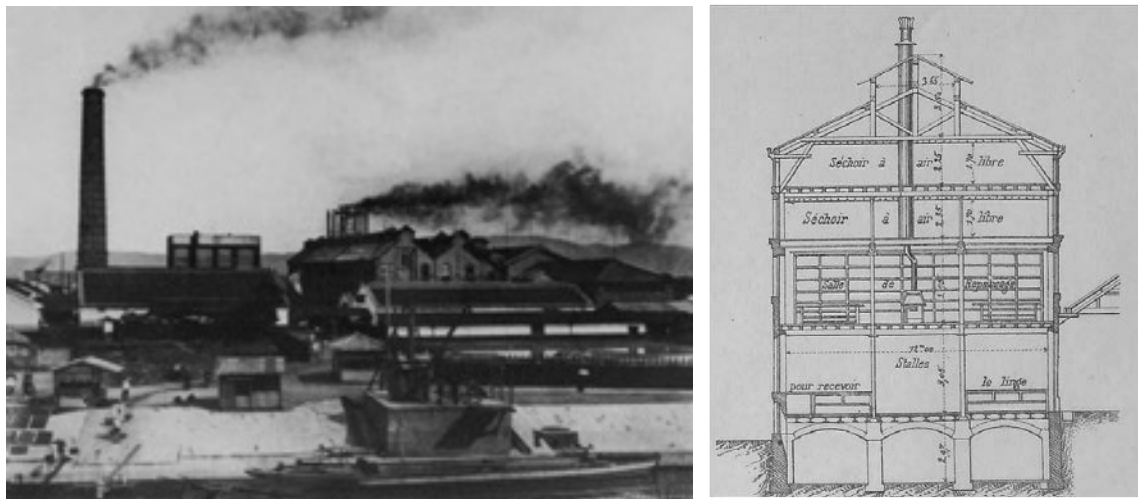


Figure 1: Comparison between the appearance of the Nihon Seitō factory (left) and a drawing from Muller’s educational materials (right)

• Kishaseizō Kabushiki Gaisha (Locomotive Manufacturing Co. Ltd., completed in 1897)

The Kishaseizō factory was located in the west of Ōsaka on the Ajigawa riverfront, next to Nishinari Railways’ Ajigawa Station in the northwest, on 66,000 square meters of land donated by Mr Kichiemon Sumitomo. Of this, 33,000 square meters was designated for the headquarters and factory site. Yamaguchi designed the 330-square-meter main office building, a two-story brick structure, including a granite quoin, arch, and cornice. This building no longer exists, although it survived until the 1980s. It was a simple but stylish building with arched windows. Not much is known about this small building now, so we did not examine it in detail, though we think this architectural design deserves further consideration regarding the design theory taught by Muller.



• Mosulin Bōshoku Kabusiki Gaisha (Muslin Mill Co. Ltd., completed in 1900)

The Muslin Mill factory was located in the north of Ōsaka in front of a newly developed drainage canal (today's Shin Yodogawa). It was founded by Katsutarō Inabata, who was dispatched to France by the Kyoto Prefectural government and studied textile, dyeing, and applied chemistry in Lyon. A previous study by Tatsuo Horiuchi examines the significance of his career in relation to that of Yamaguchi³³. Here, we focus on buildings and their programs. Yamaguchi's Architectural Works listed in *Yamaguchi Hakushi Kenchiku Zushū* reported that Yamaguchi designed more than 13,530 square meters of one-story brick factory buildings. More exactly, there were 11659.6 square meters of brick factory buildings, and 3985.7 square meters of wooden annexes (including housing, welfare facilities); a total of 15645.3 square meters³⁴. The numbers do not match perfectly, though we proceed our discussion with the assumption that Yamaguchi coordinated all construction work³⁵.



Figure 2: Aerial view of the Muslin Mill Ōsaka Factory

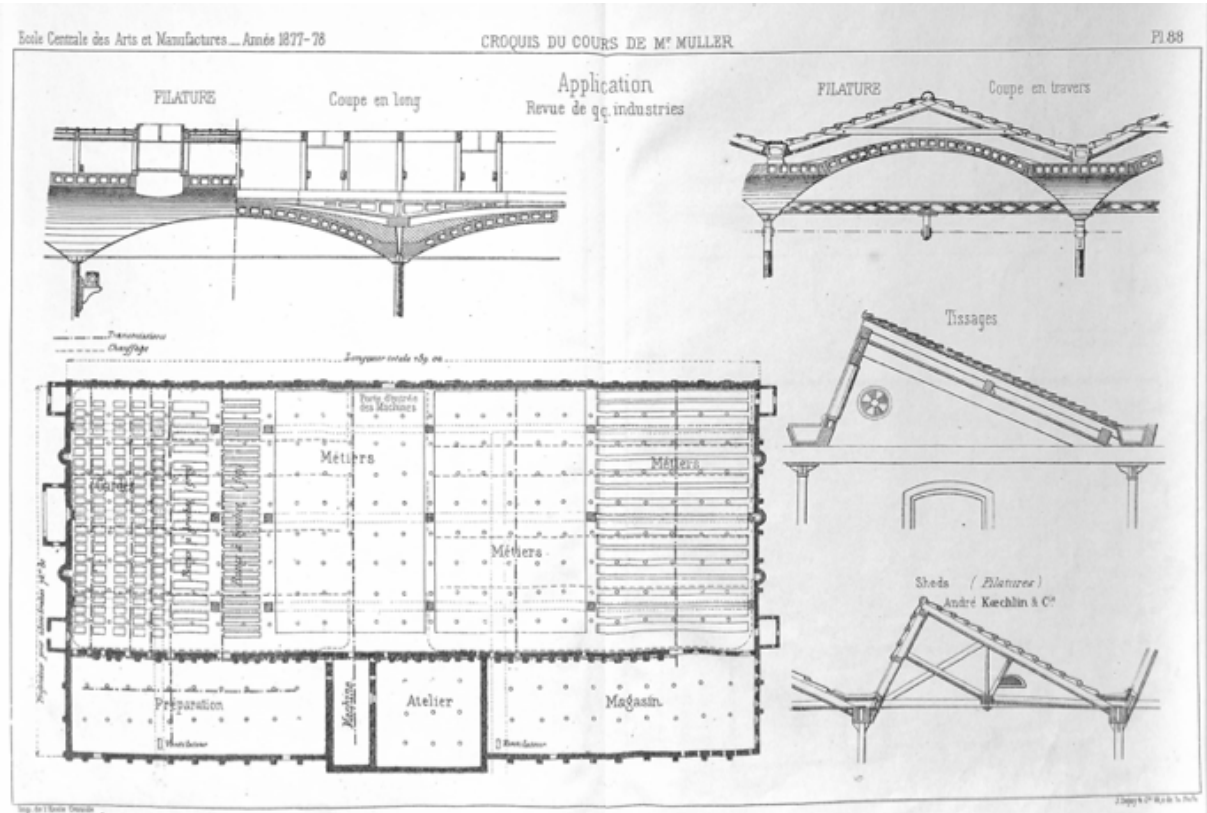


Figure 3: A drawing from Muller's educational materials showing a 'filature' (textile mill)

The factory building was a typical textile mill construction taught in Muller's course (Figures 2, 3). The substantial buildings of housing and welfare facilities are of more interest. There were five two-story buildings for workers'



housing (Figure 4). Reportedly, there were more than 100 rooms of approximately 20 square meters on the ground and first floors for female workers' accommodation³⁶. These and other welfare facilities were connected by covered corridors, equipped with lavatories with hot and cold water³⁷. There were large dining rooms, 14.4 m wide and 61.2 m deep, of wooden truss structure³⁸. Moreover, there were apparently various shops and kiosks which were 'extremely convenient, as if a town is condensed here'³⁹. In addition, there was a company hospital and a cattle farm and aviary (Figure 5). Milk and eggs from the cattle farm and aviary were provided to the hospital for patients' nourishment⁴⁰.

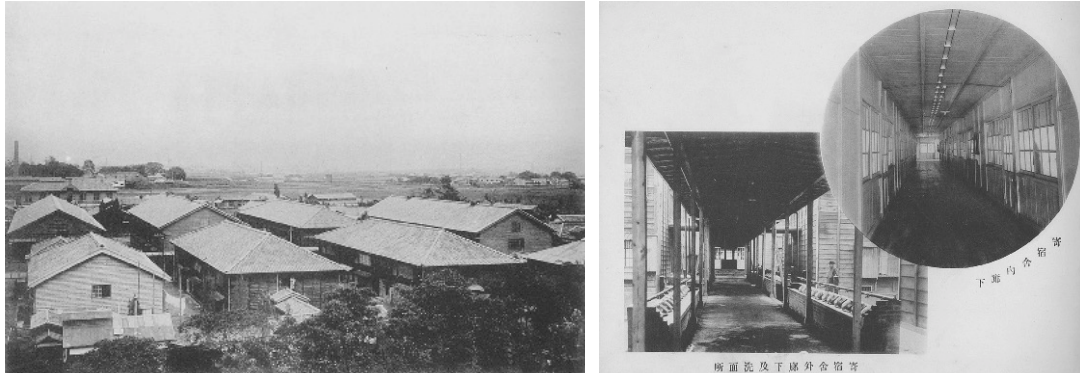


Figure 4: Workers' housing of the Muslin Mill

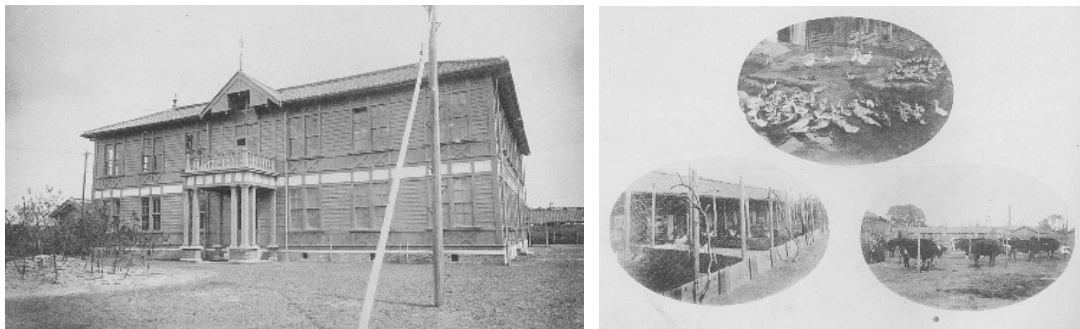


Figure 5: Hospital (left), and cattle farm and aviary (right) of the Muslin Mill

These welfare facilities, responsible for the complete care of workers' life and health, were a typically paternalistic way of managing a factory. Notably, this system was developed by Inabata and Yamaguchi, both trained in France. Undoubtedly, they were both aware of the same kind of existing European practices. Yamaguchi, especially, had surely learnt how to plan workers' housing in Muller's course, although the concept of Muslin Mill's housing and welfare facilities was quite different from that of Muller's Workers' City of Mulhouse. The latter aimed to make workers' families independent by giving them land and house as a reward for their diligence, which made it innovative. As we confirmed earlier, the Japanese students, including Yamaguchi, were surely taught this in Muller's course. Conversely, Muslin Mill's facilities were almost the opposite, as they aimed at offering full patronage to the workers. These two places targeted different workers—Muslin Mill's target was only young, single female workers from the countryside—which can be considered the reason for this difference or for the rejection of the Mulhouse system in Muslin Mill. In any case, it is an important question regarding the impact of learning from Muller's course.

The Plan for Ōsaka in 1899

Regarding Ōsaka, major issues related to public works since the 1870s have been discussed; for example, the improvement of Yodogawa river, which carried large quantities of sand from an upper stream that originated in the Kyoto region. Another issue was the development of a new Ōsaka Port, historically located at the mouth of Yodogawa river, and which was facing problems due to dredge works before encountering a new challenge—the rise of Kobe Port from 1868, located in the same region and designated as a new open-port by the former Japanese government. Moreover, the flood of Yodogawa river in 1885 spurred the public authority to take concrete measures. During that period, in the 1890s, the people in charge of this matter were Kōi Furuichi, Vice President and Chief of the Engineering Affairs of the Ministry of Interior, and Tadao Okino, a specialized and experienced engineer for river improvement at the Department of Engineering. Okino proposed a river improvement plan in 1895 and implemented the new drainage canal (Shin Yodogawa) under Furuichi's approval. Around the same time, Furuichi



approved the new Ōsaka Port plan in 1894, originally proposed by Cornelis Johannes van Doorn⁴¹, with a definite amendment. Naturally, these two projects were closely related, though Furuichi and Okino's final solution was to separate and simplify them (**Figure 6**).

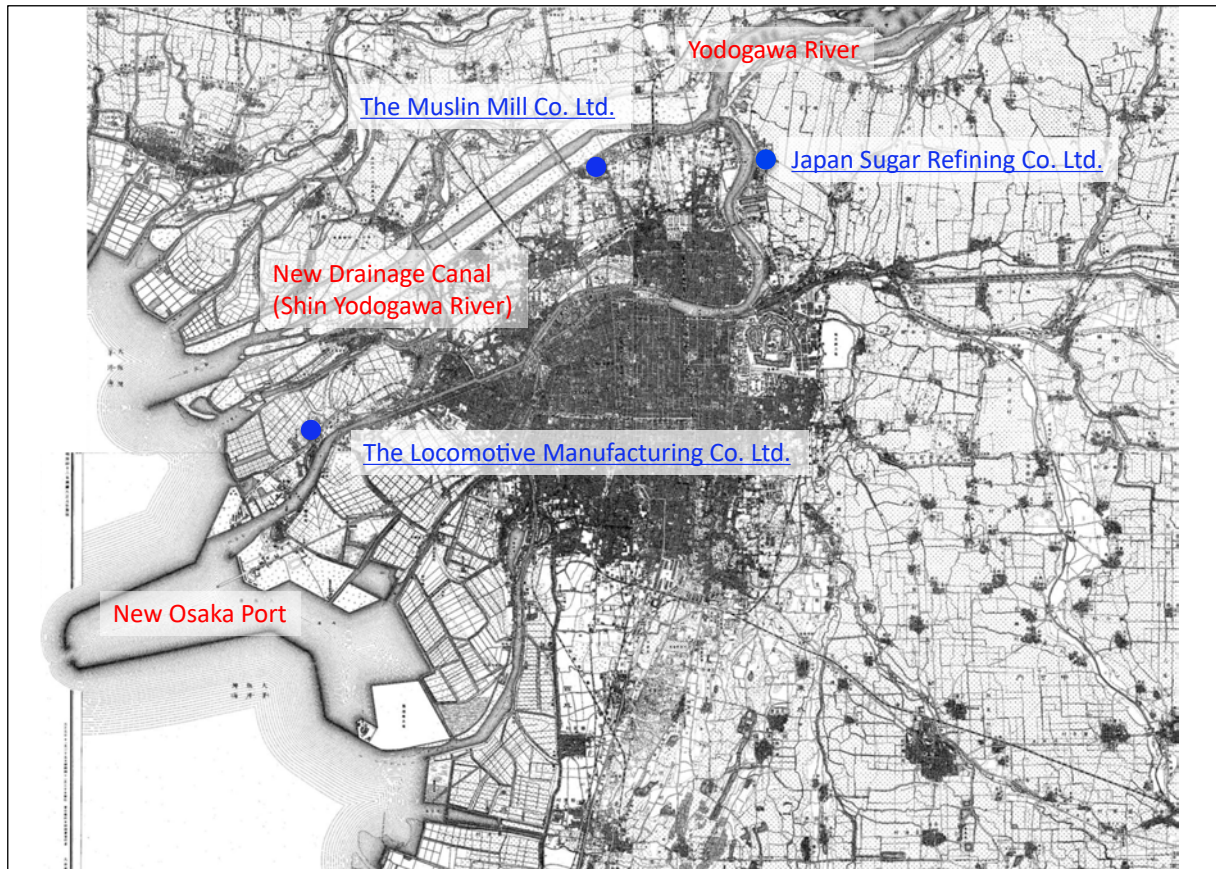


Figure 6: Geographical map of Ōsaka in 1908-1909, showing major public works and locations of Yamaguchi's factory works

We will now return to Yamaguchi's works. The three factories, Nihon Seitō, Kisha seizō, and Muslin Mill, were all located on riverfronts in the outskirts of Ōsaka, and the sites were therefore stable due to the river improvement project. Yamaguchi finally enacted the Plan for Ōsaka in 1899, starting with the new Ōsaka Port. Yamaguchi's works in Ōsaka were strongly associated with his ÉCAM classmates' public works. Original documents reveal the details of Yamaguchi's proposal for the Plan for Ōsaka⁴². Of these, 'Ōsaka Shinsetsu-shigai Sekkei Setsumei Sho (the Description of the Plan for Ōsaka)' by Yamaguchi reveals his planning concept in detail, corresponding to each proposed work—186 lines of streets, 29 areas of parks, and 17 lines of canals.

After comprehensively analysing it, we think that the most important feature of Yamaguchi's proposal is demonstrated in the composition of the planned elements, primarily the distribution of canals and land use of canal fronts (**Figure 7**). In the then newly annexed municipal area between Ajigawa and Shirinashigawa rivers, two lines of first-class canals (width 45 m) running east to west were proposed to connect both rivers. Three second-class canals (width 32.4 m), running north to south at right angles, were proposed. Supported by other second and third-class canals, also at right angles, an extended area was covered by a well-ordered canal network. All canal fronts were opened to future utilization, without locating streets directly along the canal. About the land use of canal fronts, Yamaguchi stated the following:

The canal bank is the most useful space for citizens' utilizations. First, it is necessary for the collection and distribution of freights. It is also the best site to build warehouses. Further, a gentle slope from the waterfront helps load and unload heavy and large ship cargos... Therefore, I decided not to construct streets on the canal front, but to preserve substantial space on the banks... With regard to the location, I set 50 Ken (90 m) or 100 Ken (180 m) in depth of the canal front block⁴³.

This idea shows the most important feature of Yamaguchi's planning, that is, an industry-oriented design. Moreover, we can assume the influence of the education and practical observation at ÉCAM and France, for



example, at Muller's brick factory in Ivry Port, located on the Seine riverfront, where there was a wide bank space with a gentle slope and some factory facilities at the riverfront.



Figure 7: Plan for Ōsaka in 1899 (above), and closeup of the newly annexed area (retouched by authors)

Conclusion

Our findings are as follows. 1) Yamaguchi's works were influenced by his learning at ÉCAM, especially his later works of industrial buildings in Ōsaka. 2) His Plan for Ōsaka in 1899 was strongly associated with public works conducted by his ÉCAM classmates Kōi Furuichi and Tadao Okino, and its distinctive feature was industry-oriented design. 3) Yamaguchi's design for the then newly annexed municipal area of Ōsaka resembles that of Ivry Port in the outskirts of Paris where he did his apprenticeship at Émile Muller's factory. We can assume that not only his studies in school but also such practical learning had helped develop Yamaguchi's professional conviction. However, there is still scope to further our understanding of the whole picture of ÉCAM's off-school education.

Additionally, we observed the outstanding consistency and accuracy of Yamaguchi's design from an architectural to an urban scale. Future research should consider in more detail whether this was a typical outcome of education at ÉCAM or the result of Yamaguchi's personal talent.

Moreover, a general question needs to be discussed further—how can one evaluate the impact of the Japanese ÉCAM students' learning in France on the planning history of Japan? Since Yamaguchi's Plan for Ōsaka was not realized, we should also consider its limitations. These can be divided into *external* and *internal limitations*. External limitations include historical circumstances, such as Yamaguchi's death at a young age, political atmosphere⁴⁴, and lack of social recognition for advanced planning, for example, social and economic requirements (the central government was still interested in the beautification of the townscape) and the importance of extension plan (the main concern in that period was the urban improvement plan). Internal limitations include those regarding the ideas and concepts learned from France. First, the highbrow ideas of ÉCAM, such as '*la science industrielle est une, et tout industriel doit la connaître en son entier*'⁴⁵ (*industrial science is one, and every industrialist must have its knowledge as a whole*), seemed too idealistic and were difficult to adopt in the Japanese industrial world of that period, which struggled to catch up with both imported knowledge and the reformation of traditional technology. Moreover, we could not observe a clear influence of Muller's concept of workers' housing on Yamaguchi's works in this regard. We instead identified another external limitation here—differences in the maturity of industry and labour market—and observed Yamaguchi's powerlessness or disinterest in housing reform, to which his mentor Muller devoted his career.

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Disclosure Statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Junne Kikata serves as a professor at Kagoshima University. He won the CPIJ Research Award in 2004, and the RECAJ Best Writing Award in 2010, for his work on the history of campus planning in Japan.

Ken Nakae serves as an associate professor at Kobe University. He won First Prize at the 19th Nisshin Kogyo Architectural Design Competition in 1993 and received a doctoral degree from Kobe University in 2009. His thesis examined the architectural design theory of Hugo Häring.

Endnotes

¹ “the mechanisms of diffusion, the extent to which ideas and practices are changed in their diffusion, the fundamental causation of diffusion”, Stephen Ward (2000), Re-examining the international diffusion of planning, in Robert Freestone (ed.), *Urban Planning in a Changing World – the Twenty Century Experience*, London: Taylor & Francis, 2000, p.44

² Junne Kikata, Ken Nakae, et al., Assimilation of the industrial village concept by Japanese business circles at the turn of the twentieth century, *International Planning History Society Proceedings*, vol.17 (2) , pp.353-364, July 2016

³ *Doboku Kōgaku* is commonly translated to *Civil Engineering* in English in Japan, though in French sense, the term *Génie Civil* signifies “non-military engineering” more distinctively from military engineering. *Travaux Publics (public works)* is another term commonly used in French. In this paper, we use the right English word in the right place, matched to the original use in French context. See Doboku Toshokan ed. (2004), p. 26

⁴ Doboku Toshokan ed., *Furuichi Kōi to Sono Jidai (Furuichi Kōi and His Times)*, Tokyo: Doboku gakkai, 2004
Doboku Toshokan ed., *Okino tadao to meiji kaishū (Okino tadao and Meiji River improvements)*, Tokyo: Doboku gakkai, 2010

⁵ Toyojirō Tamaoki, *Ōsaka Kensetsu-shi Yawa*, Ōsaka : Ōsaka Toshi Kokai, , 1980

⁶ Masahisa Miwa, *Midōsuji to Yamaguchi Hanroku*, Tokyo: Nihon Fudōsan Kenkyūjo, 1989

⁷ Takeyoshi Hori, Yamaguchi Hanroku -Toshi Keikaku who's who- (32), *City planning review, CPIJ, 1992*

⁸ Planning Bureau of Ōsaka City, *Ōsaka no Machizukuri -Kinou*, Kyou, Asu-, Ōsaka City, 1989, pp. 46-47

⁹ Koji Nishikawa ed., *Machi ni Sumau -Ōsaka Toshi Jūtaku-shi*, Tokyo: Heibon-sha, 1989

¹⁰ Shihona ARAI, Asae OZAWA, Urban design plan for new boundary of Ōsaka city by Hanroku Yamaguchi, *Summaries of technical papers of annual meeting Architectural Institute of Japan (Kinki)*, 2014.9, pp.513-514

¹¹ Yorifusa Ishida, Local Initiatives and Decentralization of Planning Power in Japan, *Comprehensive Urban Studies*, No.74, Center for Urban Studies, Tokyo Metropolitan University, 2001, pp. 23-45

¹² For example, André Sorensen, *The Making of Urban Japan: Cities and Planning from Edo to the Twenty First Century*, Abingdon: Routledge, 2002. p. 77., Annie Lagarde Fouquet, Hanroku Yamaguchi (1858-1900) promo 1879 -Architecte et urbaniste japonais, *Centraliens*, N° 628, août/septembre 2013, p. 54-66

¹³ Annie Lagarde Fouquet, Quand les fils de samouraïs étudiaient à l'École Centrale, [http://www.academia.edu/13370033/ Quand les fils de Samouraï venaient étudier à l'Ecole Centrale des Arts et Manufacture de Paris](http://www.academia.edu/13370033/Quand_les_fils_de_Samouraï_venaient_étudier_à_l'Ecole_Centrale_des_Arts_et_Manufacture_de_Paris)

¹⁴ Hajime Nakamura ed., *[Nihon Saisho no Kenchiku-ka] Yamaguchi Hanroku – documents and notes*, Tokyo : Tōhō Kenkyu-kai, 1980., Kazuo Yamamoto, Nihon Saisho no Kenchiku-ka Yamaguchi Hanroku Syōden, *Sumitomo Shiryōkan Geppō*, Vol.25, Sumitomo Shiryō-kan, 1994 pp.113-133

¹⁵ Miyamoto (1987) clarified the total activity of Monbushō Eisen-Ka, and Yamaguchi's leading role in this organization, Masaaki Miyamoto, *Nihon no Daigaku Kyanpasu Seiritsu-Shi*, Fukuoka : Kyūshū University Press, 1989

¹⁶ Jun-ichiro Ishida, *Kansai no Kindai Kenchiku*, Tokyo : Chuō Kouron Bijutsu Shuppan, 1996



- ¹⁷ Tatsuo Horiuchi, Urbanism and technical education from the viewpoint of history of Japanese-French exchange : Case of Yamaguchi Hanroku and Inabata Katsutarō, *Junbun Kenkyu (Studies in the humanities)*, the journal of the Literary Association of Ōsaka City University, Vol. 53, No.3, 2003, pp. 165-179
- ¹⁸ On the architectural education at the ÉCAM, Françoise Hamon, *Construire pour l'industrie: Enseigner l'architecture industrielle à l'École centrale des arts et manufactures: 1832-1914*, thèse de doctorat présentée à l'Université de Paris IV, 1997, is the most comprehensive work.
- ¹⁹ Ulrich Plafmattner, *The Making of the Modern Architect and Engineer –The origins and development of a scientific and industrially oriented education–*, Basel: Birkhäuser, 2000.
- ²⁰ Émile Muller et Émile Cacheaux, *Les Habitations Ouvrières en tous pays : situation en 1878. Avenir*, Paris : J. Dejeu & Cie., 1879
- ²¹ On Muller's factory in Ivry, see ; *L'Exposition, La Grande Tuilerie d'Ivry, le beau et l'utile*, Archives municipales d'Ivry-sur-Seine, 2009
- ²² *Yamaguchi Hakushi Kenchiku Zushū*, publisher/published year unknown, National Diet Library Digital Collections, info:ndljp/pid/846382
- ²³ Françoise Hamon, Muller, réformateur social et industriel, Jean-François Belhoste dir., *le Paris des Centraliens : Bâtisseurs et entrepreneurs*, Paris : Action Artistique de la Ville de Paris, 2008, pp. 190-195
- ²⁴ Archives de l'École centrale des arts et manufactures de Paris (1820-2016), Archives Nationales
- ²⁵ Furuichi Kōi Bunko, Libraries for Engineering and Information Science and Technology, the University of Tokyo.
- ²⁶ Léon Guillet, *Cent Ans de la Vie de L'École Centrale des Arts et Manufactures 1829-1929*, Paris : Brunoff, 1929 p. 126
- ²⁷ 'Il n'y a ni loi ni précepte à donner ou sujet de ce qui constitué le beau. La base de l'art est la vérité.' Note of Cours de Constructions Civiles par M. Muller, Furuichi Kōi Bunko, the University of Tokyo
- ²⁸ 'Il f.(aut) prendre le côté économique.' *ibid.*
- ²⁹ 'L'histoire des habitations ... , donner à l'idée de la civilisation de chaque époque.' *ibid.*
- ³⁰ 'L'idée première est de rendre l'ouvrier propriétaire, et cette institution a agit sur la situation morale des ouvriers.' *ibid.*
- ³¹ *Kōgyō no Nippon (the Industrial Japan)*, Vol. 9, No. 10 (1 Oct, 1924)
- ³² 2nd Period Report of Japan Sugar Refining Co. Ltd. (from 1 July, 1896 to 31 December), 3rd Period Report of Japan Sugar Refining Co. Ltd. (from 1 January 1897 to 30 June 1897), *Shibusawa Eiichi Biographical Materials*, Vol. 11, pp.191-192 (online)
- ³³ *ibid.* 17
- ³⁴ *Introduction of the Muslin Mill Co. Ltd.* (a commercial pamphlet, c.1902, private collection)
- ³⁵ It is known that another architect/builder named Shōgorō Shige participated to the construction of the Muslin Mill factory (Ishida, *ibid.* 16). Yamaguchi and Shige worked together in other projects too including Kisha Seizō. Therefore the extent of Yamaguchi's participation for each projects remains to be examined further. Nevertheless, as for the Muslin Mill, there was a special background to be considered, the connection between Yamaguchi and Inabata (Horiuchi 2003, *ibid.* 17). Therefore, we assume that Yamaguchi's participation extended over the entire project, especially in the conceptual work.
- ³⁶ *Picture Album of the Muslin Mill Co. Ltd* (c.1903, private collection)
- ³⁷ *ibid.*
- ³⁸ *ibid.*
- ³⁹ *ibid.*
- ⁴⁰ *ibid.*
- ⁴¹ Cornelis Johannes van Doorn (1837 –1906) was a Dutch engineer and foreign advisor to Meiji period Japan.
- ⁴² Hanroku Yamaguchi, *Ōsaka-shi Sinsetsu Sigai Sekkei Setsumei-sho (the Description of Plan for Ōsaka)*, 1899, a collection of Historiographical Institute, the University of Tokyo., Hanroku Yamaguchi, *Ōsaka-Shi Shin Sigai*



Sinsetsu Horikawa, Gairo, Kōen Hayami, 1899, ibid., Hanroku Yamaguchi, Ōsaka Shinsigai Sekkei Tōshinsho oyobi Toshō Mokuroku, 1899, ibid., The City of Ōsaka, Ōsaka-Shi Shin Gairo Sekkei Zenzu, 1899, National Diet Library Digital Collections, info:ndljp/pid/845733

⁴³ *Ōsaka Shinsetsu-shigai Sekkei Setsumei Sho (the Description of Plan for Ōsaka in 1899) ibid.*

⁴⁴ For example, in the academic field of Architecture, dominance of the *English School* (Fujimori 1993) led by Josiah Conder and his pupil Kingo Tatsuno had become decisive when Tatsuno assigned to the professor of Architecture of the Imperial University and the first president of Zouka Gakkai (today's Architectural Institute of Japan) in 1886. However at that moment, the dean of the School of Engineering, Imperial University was Furuichi. It is reported that there were some conflicts between Tatsuno and the School of Engineering on Tatsuno's working condition (Shimizu 2015). And in this atmosphere, a slander about Yamaguchi was presented when he appointed to the Construction Department of the Ministry of Education, saying that he was not educated as a genuine architect (by Kōzō Kawai, qtd. in Tatsutarō Nakamura, 1936).

⁴⁵ *École centrale des arts et manufactures, Prospectus, Paris : Chez Béchét jeune, 1829, p.19 (qtd. in Doboku Toshokan ed., 2004, p.31)*

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Figure 1: Left: Ōsaka Prefectural Government ed., *Picture Album of Ōsaka Prefecture*. 1914. National Diet Library Digital Collections, info: ndljp/pid/966056. Right: *Croquis du Cours de M^r Muller*, Pl 84, École Centrale des Arts et Manufactures, Année 1877-78, Kōi Furuichi Archives, the University of Tokyo

Figure 2: *Muslin Boshoku Kaisha [Muslin Mill]* (a commercial pamphlet), c. 1902, private collection

Figure 3: *Croquis du Cours de M^r Muller*, Pl 88, École Centrale des Arts et Manufactures, Année 1877-78, Kōi Furuichi Archives, the University of Tokyo

Figure 4: *Picture Album of the Muslin Mill Co. Ltd*, c. 1903, private collection

Figure 5: *Picture Album of the Muslin Mill Co. Ltd*, c. 1903, private collection

Figure 6: the Imperial Japanese Army, Official Topographical Map in 1/20,000, 1908-1909 retouched by authors.

Figure 7: The City of Ōsaka, *Ōsaka-Shi Shin Gairo Sekkei Zenzu*, 1899, National Diet Library Digital Collections, info: ndljp/pid/845733. Its closeup retouched by authors.