

## Article

# A Study of the Typological Connections and Local Adaptation of Modern Clock Towers in Nantong Against the Background of Zhang Jian's Visit to Japan in 1903

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## Abstract

From the late 19th to the early 20th century, clock towers—as key physical manifestations of the modern urban public timekeeping system—gradually took on diverse forms within the urban development of Japan's Meiji period. In 1903, Zhang Jian travelled to Japan to study its industrial and educational systems; upon his return, he promoted the construction of several public clock towers in Nantong, establishing them as a significant spatial typology in the local modernisation process. Drawing on Zhang Jian's itinerary during his visit to Japan and case studies of clock towers in Nantong, and supported by existing literature and historical materials, this paper conducts a typological comparative analysis of clock tower types from Japan's Meiji period and their possible counterparts in Nantong. Through a comparison of architectural forms, spatial organisation and functional attributes, this paper seeks to explore the pathways of translation and adaptive changes in the form of modern Japanese clock towers within local Chinese contexts. The research indicates that, in terms of overall form, the Nantong Clock Tower exhibits a certain degree of comparability with some types of public clock towers from Japan's Meiji period, whilst simultaneously displaying distinct features of localised adaptation in terms of scale, materials and functional integration. The available evidence suggests that this should be understood as a process of adaptive reconstruction of a cross-cultural architectural typology within a local context, rather than a direct correspondence with a single source.

**Keywords:** Zhang Jian; Meiji-era clock towers; Nantong clock tower; modern architecture; localised innovation

## 1. Introduction

Under the planning and development led by Zhang Jian (Zhang Jian: (1853–1926), a prominent industrialist, educator, and constitutional reformer in modern China), Nantong gradually transformed from an ordinary feudal county town into a modern city, demonstrating pioneering and progressive characteristics across multiple fields, including urban planning, industrial development, infrastructure, public services and social systems. This exemplary city, built independently by the Chinese people using modern urban concepts, was hailed in 2002 by Academician Wu Liangyong of Tsinghua University as 'China's First Modern City'. From the late 19th to the early 20th century, the development of modern architecture in China followed the diverse path of 'Western learning spreading eastwards'. As a neighbouring country that had successfully modernised following the Meiji Restoration, Japan became one of the key sources of reference for China's modern industrialists and educators seeking to draw on modern architectural practices.



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In the early 20th century, Japan served as a point of reference in China's modernisation process. Large numbers of Chinese officials and industrialists travelled to Japan on study tours (Lv Shunchang, 1999) [1], whilst numerous Japanese architects and craftsmen came to work in China (Luo Wenjing et al., 2022) [2]. This formed one of the pathways through which modern architectural knowledge flowed via Japan, following the route 'West → Japan → China'. Zhang Jian's visit to Japan in 1903 took place precisely against this historical backdrop. As a pioneer of modern industrial salvation and local self-government in China, he undertook a study tour of Japan in 1903 that lasted more than 70 days. This tour not only provided valuable insights for the development of Nantong's industrial and educational systems, but also introduced him to the clock tower as a type of modern urban public building.

As one of the most recognisable types of public architecture in modern cities, the clock tower serves as a key physical embodiment of the public timekeeping system in the process of urban modernisation. By providing a standardised public time signal, it supports the temporal organisation of industrial production, port operations, school teaching and urban management. To a certain extent, the emergence of clock towers also marked China's transition from traditional 'natural time' to modern 'public time' and 'industrial time', serving as a significant physical symbol of the city's modern transformation.

Against this backdrop, Zhang Jian may have gained an understanding of relevant urban clock tower systems during his study tour in Japan, and upon his return, he promoted the practical application of such structures in Nantong, gradually establishing them as one of the key architectural types underpinning the functioning of the modern local city.

### *1.1. Research Background*

During Japan's Meiji period, clock towers were an important symbol of 'civilisation and enlightenment'. Widely situated in administrative, educational, commercial and industrial settings, they became key manifestations of the temporal order and public space in modern cities. Upon his return to China, Zhang Jian oversaw the construction of five clock towers in Nantong, including the original clock tower in front of the Qiaolou (Qiaolou (Watchtower): A tower built atop ancient city gates for the purpose of surveillance. Inside timekeeping instruments such as night watches (genggu) and water clocks (kelou) were usually installed to mark the hours, following the tradition of "morning clocks and evening drums" (chenzhong mugu)) in Nantong County, the clock tower at the Dasheng No.1 Spinning Mill (Tangzha Dasheng No. 1 Spinning Mill: Located in Tangzha Town, Chongchuan District, Nantong City, this was a private cotton textile enterprise established by Zhang Jian in 1895. The Dasheng Clock Tower was built in 1915) in Tangzha, and the clock tower at the Tianshenggang Customs House (Tianshenggang Customs Clock Tower: Constructed between approximately 1906 and 1910, it is a landmark building symbolizing Zhang Jian's efforts to promote the opening of Tianshenggang as a self-administered commercial port). He also commissioned Sun Zhixia (Sun Zhixia: 1882–1975, one of China's earliest modern architects. During Zhang Jian's efforts to modernize Nantong, he personally discovered and nurtured Sun Zhixia, who participated in the design and construction of numerous iconic buildings in Nantong) to design the clock tower for the Jiangsu Provincial Assembly. This collection of clock towers was truly rare in Chinese cities at the beginning of the 20th century and became a significant physical symbol of Nantong's modernisation.

### *1.2. Literature Review*

In recent years, research on Zhang Jian, modern architecture in Nantong, Meiji-period architecture in Japan, and clock tower architecture have all yielded significant findings,

providing this paper with an important research context and a solid foundation of source material. However, whilst these studies differ in their focal points and analytical approaches, there remains a lack of systematic integration addressing the cross-regional issue of ‘Zhang Jian’s visit to Japan—the introduction of the clock tower form—and its localisation’.

In terms of research content, existing studies can be broadly categorised into three strands, each providing a different analytical foundation for this paper: firstly, research on Zhang Jian has primarily centred on industrial development, educational reform and local governance, with his architectural practices largely focusing on case studies such as the Dasheng Spinning Mill, the Nantong Museum and the Haonan Villa (Luo Jing, 2018 [3]; Xu Yongzhan, 2017 [4]; Yang Ke, 2017 [5]; Zhang Meiyang et al., 2019 [6]; Liu Chang et al., 2013 [7]), providing the intellectual and institutional context for understanding his modernisation practices, though coverage of architectural typologies—particularly the clock tower system—remains relatively limited; secondly, research on modern architecture in Nantong and heritage conservation provides this paper with a foundation of specific spatial materials and architectural genealogy. Studies by Zhao Weihang et al. (2001) [8], Sun Mo et al. (2002) [9], Shao Yaohui et al. (2003) [10] have respectively conducted research on Nantong’s architectural heritage, architectural complexes and the architect Sun Zhixia. Scholars from outside the province, such as Wu Ren’an (2015) [11] and Guo Zenglin (2018) [12], have also carried out supplementary research; however, much of this research has focused on the description of individual buildings and discussions of their conservation value, leaving room for further exploration in the systematic analysis of the clock tower typology. Thirdly, research on Meiji-era architecture and clock towers in Japan provides an important point of reference for understanding the evolution of modern clock tower forms and their functional structures; however, the correspondence between cross-regional dissemination and Chinese case studies remains relatively limited.

Building on this foundation, existing research on concepts of time and industrial heritage has further expanded the analytical dimensions. For example, Jiang Guohong (2023) [13] examined Zhang Jian’s conception of time from the perspective of intellectual history, pointing out that he promoted the construction of a modern temporal order through clock towers and institutional design, thereby providing theoretical support for this paper’s understanding of the social functions of clock towers; research on industrial heritage (e.g., Wen Yitian et al., 2025 [14]; Qiu Weifeng et al., 2025 [15]) has provided methodological guidance and a material foundation for the case studies in this paper.

With regard to research on Meiji-era clock towers in Japan, Adariko (2019) [16] and Asaoka Mai et al. (2017) [17] have revealed the evolutionary trajectory of clock towers within the modern Japanese urban system from the perspectives of architectural form and cultural symbolism, providing an important reference for establishing the typological analytical framework in this paper. However, existing research largely focuses on developments within a single region, and discussion of cross-regional dissemination pathways remains relatively limited. Relevant overseas research has already established a relatively systematic body of work concerning stylistic evolution and cultural symbolism (Philip McAleer, 2001 [18], 2003 [19]; John W. Papworth et al., 2014 [20]), providing the theoretical background for cross-cultural comparison in this paper. By contrast, whilst domestic research has addressed case studies of clock tower architecture, there remains scope for further expansion in the areas of cross-cultural transmission and typological integration.

Building upon this existing body of research, this paper seeks to build on prior findings by introducing typological analysis and a cross-cultural dissemination perspective. It incorporates Zhang Jian’s experiences during his visit to Japan, the architectural forms of clock towers during the Meiji period, and local practices in Nantong into a unified

analytical framework, with the aim of revealing, at the structural level, the mechanisms of translation and the adaptive evolutionary pathways of modern clock towers within different cultural contexts.

### Review of Existing Research and Problem Statement

A review of the literature outlined above reveals that, whilst current research has made some progress in areas such as studies on Zhang Jian, modern architecture in Nantong, and Japanese Meiji-era clock towers and clock tower architecture, it remains largely fragmented across these distinct fields. There is still scope for further integration between different studies in terms of cross-regional connections and typological synthesis.

In light of the shortcomings of existing research, this paper, from the perspectives of architectural typology and cross-cultural communication, attempts to propose the following research focuses: (1) the types of Japanese Meiji-era clock towers with which Zhang Jian may have come into contact during his visit to Japan in 1903, and their principal morphological characteristics; (2) the possible correspondences between Japanese Meiji-era clock towers and the Nantong clock tower in terms of typology and function; (3) the pathways of adaptive transformation of the Nantong clock tower's form within the local context.

Building on this, this paper uses the itinerary of Zhang Jian's 1903 visit to Japan as a contextual framework to conduct a typological analysis of relevant Japanese Meiji-period clock tower types and their spatial characteristics. It then carries out a comparative analysis with the form and function of the Nantong Clock Tower, exploring potential pathways of association and mechanisms of divergence, with a view to providing an analytical perspective for understanding the processes of cross-cultural transmission and localisation in modern architecture.

The main analytical contributions of this paper are reflected in the following two aspects: firstly, it summarises the forms of clock towers from Japan's Meiji period from a typological perspective and attempts to discuss their potential correspondences with the Nantong Clock Tower; secondly, it analyses the process of localisation of the Nantong Clock Tower in terms of form and function, in order to illustrate the adaptive evolutionary characteristics of modern public architecture in different contexts. Furthermore, this paper aims to provide a supplementary interpretative framework for understanding the social function of the clock tower as a modern public timekeeping facility from an interdisciplinary perspective that bridges architectural history and social history.

### 1.3. Research Objectives and Methods

This paper adopts the perspectives of modern and contemporary architectural history and regional architectural studies, taking Nantong—hailed as 'China's first modern city'—as its case study. Drawing on the historical context of Zhang Jian's 1903 study tour of Japan, it analyses the possible connections between clock towers from Japan's Meiji period and related architectural practices in Nantong. The research employs a comprehensive approach combining documentary research, historical verification, typological analysis and comparative studies: (1) Literature Review: By collating Chinese and foreign sources such as *The Complete Works of Zhang Jian* (National Qing History Compilation, 2012) [21] and *A History of Modern Japanese Architecture* (Fujimori, 1985) [22], and combining historical records of Meiji-period clock towers with Nantong's modern industrial archives and local historical chronicles, this study provides the foundational material required for a comparative analysis of architectural types. (2) Historical verification: Drawing on *The Complete Works of Zhang Jian: Diaries* and relevant local gazetteers (such as the "*Nantong County Gazetteer*", the *Gazetteer of Kenmu Township, Tonghai*" and "*the archives of Dasheng Enterprises*"), this study organises and compares, in both spatial and temporal terms, the itinerary of

his visit to Japan and the types of modern public buildings he may have encountered. (3) Moving beyond the limitations of a single region, this study examines three dimensions: architectural form (such as freestanding towers and symmetrical pitched roofs), spatial layout (e.g., attached to a main structure, central clock tower) and functional attributes (e.g., public timekeeping, adaptation to context). We have constructed a unified four-category classification system—A (freestanding tower type), B (symmetrical pitched roof type), C (flat-roofed township type) and D (projecting facade type)—covering modern clock towers in both China and Japan. By distilling the core characteristics and typical examples of each type, we provide a typological framework for subsequent analyses of influence pathways. This four-part classification comprehensively covers all developmental forms of Meiji-era clock towers in Japan. Categories A and B serve as core samples for direct typological comparison with the Nantong clock tower, whilst categories C and D are treated solely as contextual examples of Japanese architectural evolution and are not included in the cross-regional influence analysis. (4) Comparative Research Method: Employing a three-dimensional comparative framework of ‘architectural form–core function–construction technology’, the study focuses on the similarities and differences in scale, materials and spatial composition at the formal level; analyses the logic of expansion from ‘single-function timekeeping’ to ‘multifunctional governance’ at the functional level; and at the technical level, it explores the mechanisms by which the Nantong Clock Tower has adapted to its local context through an integrated analysis of structure, materials and climate adaptation.

Through the integrated application of the aforementioned methods, this paper proposes the concept of ‘associative pathways’, favouring a framework of typological inference and interpretation based on existing historical materials rather than the demonstration of a single chain of transmission in the strict sense.

## 2. A Study of Clock Towers in Meiji-Period Japan and a Framework for Their Typological Classification Against the Background of Zhang Jian’s Visit to Japan

Based on the itinerary of his 1903 visit to Japan as recorded in *“The Complete Works of Zhang Jian: Diaries”*, and drawing on historical sources on clock towers from Japan’s Meiji period such as *“The Legend of the Clock Tower”* (Mitsuo Hirano, 1976) [23], *“Sapporo Library Vol. 6: The Clock Tower”* (Sapporo City Board of Education, 1978) [24], and *“The Evolution of Japanese Clock Towers: Why They Appeared on University Campuses”* (Adachi, 2020) [16] through a comparative analysis of historical sources and spatial routes, it is possible to trace Zhang Jian’s itinerary across cities such as Nagasaki, Osaka, Tokyo, Yokohama and Sapporo, revealing a high degree of spatial overlap between his travels and the distribution of clock towers in Japan during the Meiji period. Although Zhang Jian’s diaries make no direct mention of clock towers, during the Meiji Restoration period, clock towers had become widespread as material symbols of ‘civilisation and enlightenment’ in Japan’s key administrative, educational, transport and commercial hubs. Furthermore, at that time, Japan incorporated clock towers as landmarks of modernisation into the core itineraries of visiting foreign observers. Whilst inspecting various modernised buildings and facilities, Zhang Jian may well have encountered Japanese clock towers that combined contemporary characteristics with functional attributes, he may have accumulated a certain degree of visual experience in this regard. It should be emphasised that the above assessment is based primarily on comprehensive inferences drawn from spatial distribution and historical context, rather than on explicit observational records corroborated by direct historical sources; as such, its interpretative nature remains to some extent open to interpretation.

Building upon Adachi’s classification of Japanese school clock towers, this study goes beyond the scope of her research—which focused solely on such structures—to construct a

typological classification framework (Types A–D) for the comparative analysis of Chinese and Japanese case studies. This framework takes architectural form and spatial layout as its core characteristics, and the timekeeping function and suitability to the context as its functional attributes, with the aim of providing a structured analytical tool for future comparative research.

### 2.1. A Study of Zhang Jian's Visit to Japan and His Encounter with Meiji-Era Clock Towers

Between the fourth and sixth months of the lunar calendar in 1903, Zhang Jian travelled to Japan on a fact-finding mission lasting over 70 days. He visited key cities including Nagasaki, Yokohama, Osaka, Sapporo and Tokyo, with his investigations covering core areas of Meiji-era modernisation such as educational institutions, administrative buildings, transport hubs, industrial facilities and commercial districts. Clock towers in Meiji-era Japan were predominantly situated in educational, administrative and transport hubs. Zhang Jian's itinerary overlapped significantly with the locations of these clock towers, and during his visits to each city, he had the objective opportunity to observe corresponding types of clock towers (Table 1). Although Zhang Jian's diaries do not contain any explicit records of his observations regarding clock towers, there is a high degree of spatial overlap between his itinerary in Japan and the locations of clock towers during the Meiji period; furthermore, he promptly embarked on the construction of clock towers upon his return to China. Consequently, based on the correspondence between his travel routes, chronological sequences and typological characteristics, this paper proposes a 'hypothesis of possible visual contact and experiential translation' to explain the potential influence of Meiji-period Japanese clock towers on the development of modern clock towers in Nantong.

Through historical research into Zhang Jian's itinerary in Japan, it can be established that, whilst inspecting Japan's modernisation facilities, he encountered various types and functions of clock towers from the Meiji period in person. The formal characteristics and functional attributes of these clock towers provided him with direct visual references and practical insights for the construction of the Nantong Clock Tower upon his return.

**Table 1.** A Study of Zhang Jian's Itinerary in Japan and His Visits to Meiji-era Clock Towers (Table Source: Author's own illustration).

| City Visited | Key Sites Visited                                                                                                                                                                                  | Likely Contacted Clock Tower        | Basis for Contact                                                                                                                                                                                                                                            |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nagasaki     | Murakami Elementary School, Iryo Elementary School, Normal School (Zhang Jian's Diary, entry for the 29th day of the 4th lunar month (Nagasaki))                                                   | Nagasaki Hamano-machi Clock Tower   | Hamano-machi was the central commercial district of Nagasaki Port; all the educational buildings inspected by Zhang Jian were located in the vicinity of this area, and the Hamano-machi Clock Tower was a landmark public building in Nagasaki at the time. |
| Osaka        | Umeda Station (Zhang Jian's Diary, entry for the 1st day of the 5th lunar month in Osaka), Higher Technical School, Prefectural Normal School, Expo Venue                                          | Osaka Umeda Parking Lot Clock Tower | Zhang Jian travelled back and forth to Umeda Station on numerous occasions and stayed in accommodations nearby. The Umeda Parking Lot was the central transportation hub of Osaka at the time, and the clock tower was its iconic structure.                 |
| Tokyo        | Kobun Gakuin, Higher Normal School, Higher Technical School (Zhang Jian's Diary, 22nd day of the 5th lunar month (leap month)), Botanical Garden of the University of Science, Hongo-kan Residence | Tokyo Industrial School Clock Tower | The clock tower of the Higher Industrial School, which Zhang Jian inspected, was an educational landmark of the Meiji period and lay within the route of his tour.                                                                                           |

Table 1. *Cont.*

| City Visited | Key Sites Visited                                                                                                                                                                  | Likely Contacted Clock Tower                                                                                   | Basis for Contact                                                                                                                                                                                                                                                              |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Yokohama     | Brief tour in the rain (Zhang Jian's Diary, 2nd day of the 5th lunar month (leap month))                                                                                           | Yokohama Town Hall Clock Tower                                                                                 | The Town Hall was the administrative and commercial heart of Yokohama and a primary destination for visiting observers; although Zhang Jian's tour was brief and took place in the rain, he may still have visited this central district.                                      |
| Sapporo      | Agricultural School (now Hokkaido University) (Zhang Jian's Diary, entry for the 12th day of the intercalary 5th lunar month), Hiragishi Elementary School, Ibarato Village School | Sapporo Agricultural School Drill Ground Clock Tower, Sapporo Agricultural University Lecture Hall clock tower | Zhang Jian conducted an in-depth three-day inspection of the Agricultural School in Sapporo; the Drill Ground Clock Tower and the Agricultural Lecture Hall Clock Tower were central buildings of the school at the time and were situated within the scope of his inspection. |

## 2.2. A Typological Analysis of Modern Clock Towers in China and Japan

To facilitate a comparative analysis of clock towers from Japan's Meiji period and relevant buildings in Nantong, this paper, building on existing research, identifies four analytically significant typological characteristics (Types A–D) from the perspectives of architectural form and spatial organisation. It should be noted that this classification serves primarily as an analytical tool for typological comparison. Categories A and B correspond more directly to the Nantong cases, whilst Categories C and D reflect the developmental forms of modern Japanese clock towers in other contexts and are used primarily as background references rather than direct counterparts.

### 2.2.1. Type A: Free-Standing Tower-Style Clock Tower (Attached to Main Building) + Cubic Form + Public Timekeeping Function

Type A clock towers are characterised by a freestanding tower as their main structure, typically in a cubic or rectangular form, closely attached to the main building. Their typical design features include: an arched doorway on the ground floor serving as an entrance; a structural body on the middle floor; and a belfry on the top floor with clock faces on all four sides, equipped with a mechanical time-keeping mechanism. Their core function is public timekeeping, whilst also serving administrative management, industrial work schedules, and port operations.

The Yokohama Town Hall Clock Tower (Figure 1) is a typical example of a Type A clock tower from the Meiji period. Completed in Meiji 7 (1874), the main structure is a two-storey stone-built building with a flat roof covered in zinc sheeting, with a total floor area of 765 m<sup>2</sup>. The clock tower is situated on the fourth storey above the main entrance; it features a domed design, is constructed entirely of stone, and has a simple facade. Connected to the administrative building of the Town Hall behind it, the top floor features Roman numeral clock faces on all four sides. The clock suspended within the tower follows the Japanese-style temple clock design, whilst the complete timekeeping mechanism was imported from overseas trading posts to serve both administrative offices and the public timing needs of the commercial district [23]. The building no longer exists; its form and dimensions have been estimated based on the diameter of the clock face (2 m) visible in historical photographs, with a total height of approximately 17 m.



**Figure 1.** Clock tower on Honcho-dori in prosperous Yokohama, Late Meiji Period (Image source: Reproduced from the Exhibition Room at the Yokohama Port Opening Memorial Hall).

The former clock tower in front of the Qiaolou in Nantong County (Figure 2), the clock tower of the Dasheng No. 1 Factory in Tangzha (Figure 3), the clock tower of the Dasheng No. 3 Factory in Haimen (Figure 4), and the Tianshenggang Customs Clock Tower (Figure 5) all retained the core design of Type A clock towers: a tall, freestanding tower attached to the main building, with an arched doorway at ground level and a clock chamber on the top floor featuring a Roman numeral clock face. These structures preserved the core function of public timekeeping whilst adapting to the specific requirements of urban governance, industrial production and port operations. Taking the comparison of the elevations in Figures 1 and 2 as an example (Figure 6), the two structures exhibit a high degree of consistency in their design, but the total height of the clock tower in front of the Qiaolou in Nantong is 22.6 metres, making it more imposing than its Japanese prototype, which to some extent reflects the characteristic of ‘borrowing the design whilst adapting the scale to local conditions’.



**Figure 2.** Clock tower in Front of the Former Qiaolou in Nantong County, Republican Era (Image source: Historical photographs from the Nantong Municipal Archives).



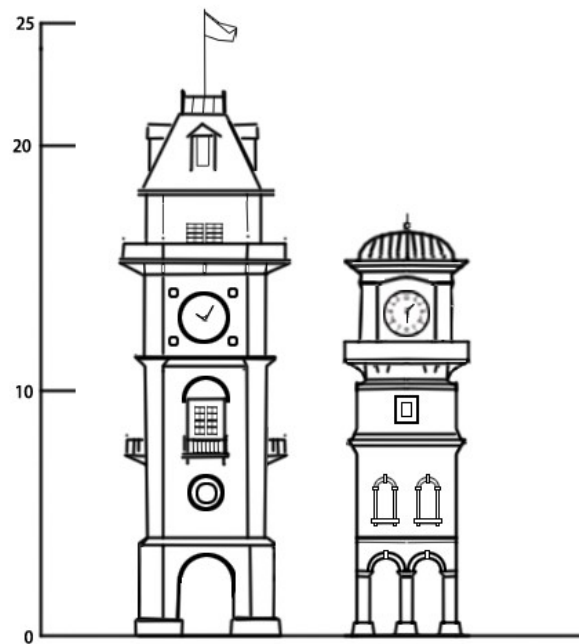
**Figure 3.** Clock tower at the Wharf of Dasheng No. 1 Spinning Mill, Tangzha, Nantong, Republican Era (Image source: Nantong Museum).



**Figure 4.** Clock tower of Dasheng No. 3 Spinning Mill, Republican Era (Image source: Reference [25]).



**Figure 5.** Tianshenggang Customs Clock Tower, Republican Era (Image source: Reference [26]).



**Figure 6.** Right: Elevation of the Clock Tower at Yokohama Town Hall (Meiji 7, 1874); the building has been demolished, but based on the diameter of the clock face (2 m) in historical photographs, its total height is estimated to have been approximately 17 m. Left: Elevation of the Clock Tower in front of Qiaolou, Nantong (1915); its measured total height is 22.6 m. (Image source: Author's own illustration).

#### 2.2.2. Type B: Central Clock on a Pitched Roof + Symmetrical Layout + Time Announcements for Various Scenarios

Type B clock towers do not feature a freestanding tower as their main structure; their defining characteristic is the placement of the clock tower at the centre of the pitched roof of a symmetrical main building. The entire structure is balanced on both sides, with the central clock serving as the visual focal point of the facade. This type serves the basic function of public timekeeping whilst enhancing a sense of spatial solemnity; it is primarily used in administrative and campus settings where order and etiquette are prioritised. This 'symmetrical building with a central clock tower on a pitched roof' form has been exemplified in both Japanese and Chinese modern architecture.

The clock tower of the Sapporo Agricultural School Drill Hall in Japan (Figure 7) is a classic example of a Type B clock tower from the Meiji period; the building is a two-storey, all-timber structure. By positioning the clock tower along the building's central axis and utilising the variations in the pitched roof's form alongside the tapering of the octagonal tower body, it creates a striking visual focal point. The building's structure combines traditional timber joinery with Western construction techniques. The clock tower's core timekeeping mechanism was imported from the American firm E. Howard, whilst the clocks for the hourly chimes were cast separately at a workshop of the Japanese Ministry of Public Works. Furthermore, the clock tower of the Tokyo Technical School (Figure 8) and that of the Imperial University Faculty of Medicine (Figure 9) both adopted the standard form of symmetrical architecture with a central clock tower on a pitched roof, serving the management of campus order with a solemn and orderly style.



**Figure 7.** Sapporo Clock Tower (Image source: Reproduced from the Hokkaido University Library).

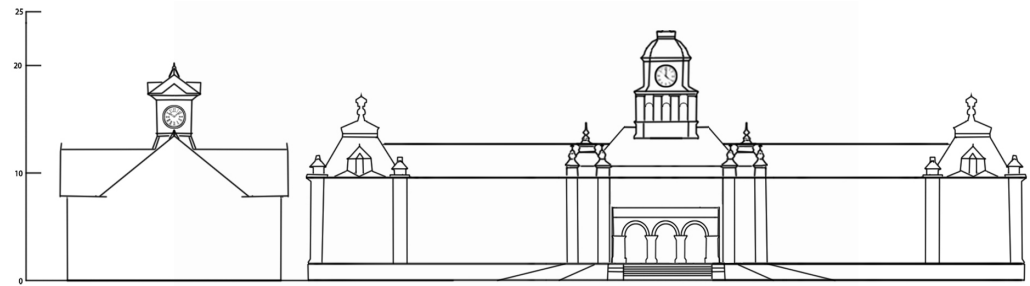


**Figure 8.** The Clock Tower of Tokyo Technical School, Late Meiji Period (Image source: Wikimedia Commons (via Japanese Wikipedia entry for “Kobu Daigakko”).



**Figure 9.** Clock Tower of the Imperial College Faculty of Medicine, The University of Tokyo (Image source: Reference [27]).

In terms of stylistic characteristics, similar buildings in the Nantong region continued the overall paradigm of Type B clock towers. As illustrated in the comparison in Figure 10, the facade composition of the Jiangsu Provincial Consultative Council Clock Tower is similar to that of the Sapporo Agricultural School Drill Ground Clock Tower, both belonging to this architectural type; however, the two differ significantly in terms of scale, structure and spatial character. The main body of the Jiangsu Provincial Consultative Council Clock Tower features a Mansard roof. The building is constructed with blue-glazed brick walls paired with a triangular wooden roof truss, presenting a grand overall volume (Tang Xingzhu, 2024) [28]. In contrast to the light-bodied wooden clock tower in Sapporo, which served to mark the school’s daily schedule, this building employs a heavy masonry structure on a larger scale. Combined with the imposing main administrative building, it further reinforces the dignity and sense of order characteristic of official architecture.



**Figure 10.** Left: The clock tower at the Sapporo Agricultural School Drill Ground, total height 19.825 m; Right: The clock tower of the Jiangsu Provincial Consultative Council (designed by Sun Zhixia), total height 23 m. Both structures belong to the Type B clock tower typology with similar elevation composition (Image source: Author's own illustration).

### 2.2.3. Type C: Flat-Roofed Structure with a Central Clock Tower + Minimalist Design + Time Announcements at the Grassroots Level

Type C clock towers are based on a flat-roofed structure, with a raised clock chamber situated in a specific section of the roof. Their overall form is low-rise and their composition simple, emphasising functionality and spatial adaptability. This type of building is suited to grassroots spaces in towns and villages, ordinary schools and small public institutions; its core function is to provide basic public timekeeping services, whilst also allowing for the integration of certain management and governance functions depending on the context of use.

From a typological perspective, Type C does not correspond to a single, fixed prototype, but rather represents a functional construction method that has gradually emerged in response to modern public demands for timekeeping. Its core characteristic lies in the visualisation of time information and the enhancement of public visibility through the accentuation of specific sections of the roof. In the development of modern Japanese architecture, this form primarily manifested as a gradually evolving functional practice: in certain rural public facilities and educational buildings, simplified timekeeping devices were added to existing flat-roofed structures to meet basic public timekeeping needs [16]. Although no uniform standards had yet been established during this phase, the trend towards a shift from ancillary timekeeping equipment to an integrated spatial organisation was evident.

In the Nantong context, the example of the Tonghai Autonomous Office Clock Tower (Figure 11) shares certain similarities with this typology in terms of spatial organisation, namely the placement of a local clock mechanism atop a flat-roofed building to reinforce the function of public timekeeping. However, its formation is more likely to have stemmed from the practical needs of local grassroots governance regarding time management, combined with the prevailing construction logic of modern public architecture.



**Figure 11.** Clock Tower of the Tonghai Reclamation (Image Source: Reference [29]).

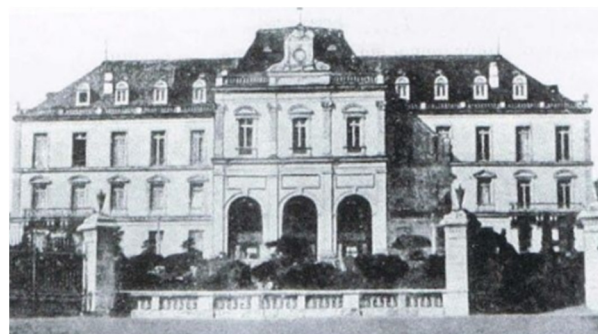
#### 2.2.4. Type D: Clock Mounted on a Projecting Building Facade + Timekeeping for Specific Contexts

In terms of form, the Type D clock tower features a clock face mounted directly on a projecting section of the building facade, blending seamlessly with the structure and adapting its design to the visual requirements of the setting; functionally, it is designed to provide efficient timekeeping for specific contexts, with the clock face positioned prominently for easy reading, whilst also serving as a visual landmark for the area.

The second-generation Osaka Umeda Car Park Clock Tower (Figure 12) and the Tokyo General Staff Headquarters Clock Tower (Figure 13) were designed to meet the efficient timekeeping requirements of transport hubs and government buildings, respectively. The Nantong region did not directly replicate the facade style of Type D clock towers.



**Figure 12.** Umeda Station of Osaka (2nd Generation Osaka Station), 1907 (Image Source: Reference [30]).



**Figure 13.** Clock Tower of the Imperial Japanese Army General Staff Headquarters (Image Source: Reference [31]).

There are certain typological similarities in the forms of modern clock towers in China and Japan. The Type A and Type B clock towers of Japan's Meiji period represent relatively typical forms of public timekeeping facilities, providing basic spatial paradigms such as freestanding clock towers and attached clock towers; in practice, the Nantong clock tower corresponds primarily with Types A and B in terms of basic form and functional organisation, whilst incorporating adaptive adjustments and simplifications in materials to suit local conditions. Types C and D serve more as a typological backdrop to the development of modern Japanese clock towers and are of reference value for understanding the overall evolutionary logic; however, they do not form a direct correspondence in the Nantong case. Overall, the Nantong Clock Tower exemplifies selective absorption and localised adaptation based on the core typological framework.

### 3. Analysis of Typological Correlations and Adaptive Transformation Between Meiji-Period Japanese Clock Towers and the Nantong Clock Tower

Building upon the typological analysis outlined above, this paper conducts an interpretative analysis of the relationship between Meiji-period Japanese clock towers and the modern Nantong Clock Tower from the perspective of architectural form and functional evolution. It should be noted that this analysis aims to reveal the structural similarities and differences that may emerge between the two within the context of modernisation, rather than to establish a linear transmission pathway with a single source.

#### 3.1. *Typological Correspondence and Reconstruction Characteristics at the Morphological Level*

The construction process of the Nantong Clock Tower reflects, to a certain extent, the reference to and reorganisation of architectural experience from Japan's Meiji period. At a macro level, this relationship can be understood across three dimensions.

##### 3.1.1. Typological Parallels with Japanese Precedents

In terms of morphological characteristics, the Nantong Clock Tower exhibits a certain degree of typological similarity to the two types of clock towers from Japan's Meiji period—Type A and Type B. In particular, the freestanding tower-style clock tower (Type A) and the attached or combined clock tower (Type B) are comparable in terms of spatial composition and basic morphological logic. In this specific case, the characteristics associated with Type B clock towers are particularly prominent. Zhang Jian, as Chief Organiser and first Speaker of the Jiangsu Provincial Consultative Assembly, oversaw the overall planning and construction process of this building (Wang Yong et al., 2022 [32]). Meanwhile, the architect Sun Zhixia had undertaken a study tour to Japan, and his research experience provided a certain reference framework for the design (Sun Mo, 2019 [33]). The building's development may have drawn upon references from various sources. Its overall spatial layout exhibits similarities with certain modern Japanese parliamentary buildings in terms of symmetry and central axis organisation, although the original facade of this Japanese parliamentary building featured only a portico and did not incorporate a clock tower (Figure 14). The subsequent addition of the central clock tower, however, bears a certain formal resemblance to the spatial expression of some Type B clock towers from the Meiji period. This similarity is manifested more in a proximity of typological structure than in a direct correspondence with any single example. Considering the practical context of Zhang Jian's efforts to promote public temporal order and the development of local governance systems in Nantong, it can be argued that the introduction and reinforcement of the clock tower's function were driven by clear practical needs. Given the available evidence, whilst it can be confirmed that the clock tower played a leading role at the institutional and planning levels, the specific process of its design development was likely influenced by the collective input of multiple stakeholders, including architects, craftsmen and the local construction system.

Consequently, the building is best understood as the result of an adaptive reorganisation of the modern public building typology under specific historical conditions; its formal characteristics reflect a logic of generation shaped by the interplay of functional requirements and the construction system, rather than a direct replication from a single source.



**Figure 14.** Reconstruction drawing of the facade of the Provisional Chamber of the Imperial Diet during the Meiji period in Japan (Image Source: Reference [34]).

### 3.1.2. Parallels in Construction Strategies

Although Nantong did not simply replicate Japanese stone-masonry and timber-frame techniques, the two share common ground in their approach to construction, characterised by ‘Western-style structures combined with local materials’ and ‘imported core equipment combined with localised main construction work’. This logical synergy enabled Western architectural forms to be realised within the framework of Nantong’s local craftsmanship. Specifically, whilst the mechanical components were imported from overseas, the main structure utilised the locally abundant red and blue bricks; this not only significantly reduced costs but also aligned with local construction capabilities.

### 3.1.3. Multi-Dimensional Local Adaptive Adjustments

This is a particularly notable example of adaptability in Nantong’s practice. Building on the function of public timekeeping from the modern era, Zhang Jian closely integrated the clock tower with specific local contexts in Nantong, such as local self-government, fire safety alerts and industrial production. Through subtle adjustments to its form, the integration of multiple functions and technical improvements, a model of application with distinct local characteristics was gradually established.

### 3.1.4. Three Analytical Dimensions of Local Adaptation

To present the process of adaptive transformation of the Nantong Clock Tower at different levels more clearly, this paper constructs an analytical framework (Figure 15), which provides a structured synthesis of the tower from three dimensions: prototypical characteristics, mechanisms of action, and practical manifestations.

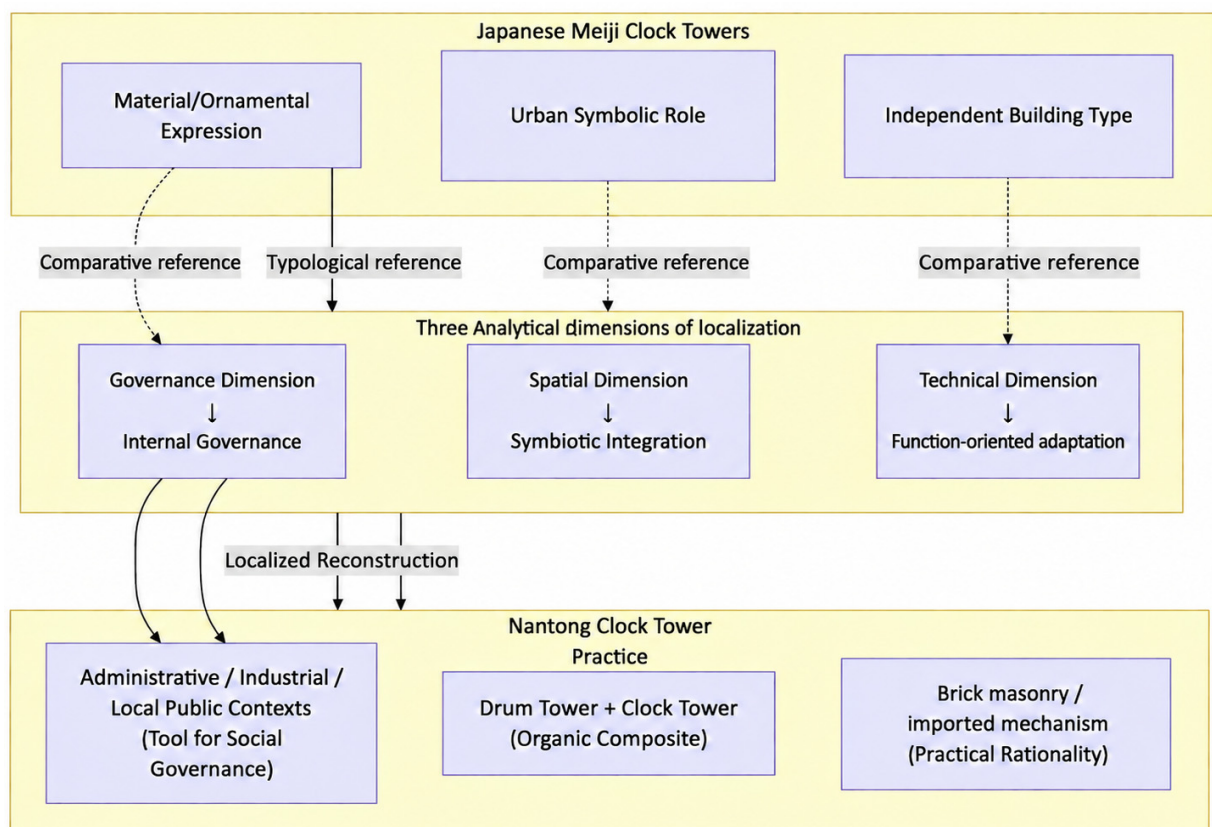
This framework serves primarily to illustrate how, building upon the typological foundations of clock towers from Japan’s Meiji period, Nantong may have exhibited adaptive adjustments in terms of functional orientation, spatial organisation and technical strategies at different levels during the process of introducing modern public building typologies. This process was not a simple linear transformation, but rather a comprehensive outcome shaped by the interplay of multiple factors within a specific historical context.

## 3.2. Formal Parallels and Local Reconfiguration: A Typological Comparison

In terms of form, the reconstruction of the Nantong Clock Tower based on its Japanese prototype is primarily reflected in the retention of typological characteristics and the adaptation of scale and materials.

The Type A clock tower, modelled on the Yokohama Town Hall clock tower in Japan, retains the core feature of a ‘freestanding tower attached to the main building’. However, significant local adaptations have been made in its specific execution. The clock tower originally situated in front of the Qiaolou in Nantong County was constructed using red and blue bricks, which are abundant in Nantong, and incorporated traditional

timber framing and small blue roof tiles. Furthermore, the total height was increased to 22.6 m—approximately one-third taller than the Japanese prototype—thereby reinforcing its status as an urban landmark. More significantly, Zhang Jian positioned the modern clock tower directly adjacent to the traditional watchtower dating from the Hongwu era of the Ming Dynasty; the second floors of the two structures are directly connected, with the north-facing entrance aligned opposite the watchtower’s gateway, creating a composite spatial arrangement that integrates the traditional watchtower with the modern clock tower. This design preserves the ceremonial axis of the ancient city whilst incorporating modern public timekeeping functions, achieving a fusion of traditional space and modern architecture. It stands as a typical example of the reconstruction of the Type A clock tower form.



**Figure 15.** An Analytical Framework for the Adaptive Regeneration of Nantong Clock Tower (Image source: Author’s own illustration).

The Type B clock tower draws upon the compositional principles of a symmetrical main structure with a central tower atop a pitched roof. While retaining the core characteristics of the typology, it has undergone a transformation in character from a practical campus facility to an administrative and ceremonial building, making it better suited to the spatial requirements of local self-governance and official administration in Nantong. The main building of the Jiangsu Provincial Assembly is a brick-and-timber structure, with its exterior walls consisting of blue bricks, a timber roof truss and a pitched roof. The octagonal clock tower stands solemn and upright, presenting an overall sense of the dignity characteristic of official architecture.

In terms of form, Type C clock towers bear some resemblance to the Japanese style of single-storey buildings with an attached clock chamber; however, there are marked differences in terms of spatial scale and urban context. Their application in the towns and villages of Nantong, as well as in grassroots public spaces, places greater emphasis on

adapting the design to practical conditions in order to meet the need for public timekeeping amidst low footfall and within the constraints of limited construction resources.

### 3.3. From Simple Time-Keeping to Comprehensive Governance

The core function of Japan's Meiji-era clock towers was to standardise public time-keeping in cities. Building on this foundation, the Nantong Clock Tower has significantly expanded its functional scope, transforming it into a comprehensive hub for social governance.

Through local initiatives, Nantong gradually established a comprehensive timekeeping network covering both urban and rural areas. The clock tower in front of the former Nantong County Qiaolou served the city centre; the clock towers at Dasheng No. 1 and No. 3 Factories served industrial work schedules; the clock tower at Tianshenggang Customs served port operations; and the clock tower at the Tonghai Autonomous Office served rural life. This multi-tiered, comprehensive timekeeping system propelled Nantong from traditional natural time into modern industrial and public time.

Drawing on the principles of local self-government, Zhang Jian expanded and diversified the functions of the clock tower. Addressing the hidden dangers posed by Nantong's dense concentration of brick-and-timber buildings and frequent fire hazards, the original clock tower in front of the Qiaolou in Nantong County was fitted with a five-storey wrought-iron gallery serving as a fire lookout. Zhang Jian personally inscribed the words "The eyes and ears of fire control respond to commands" and had them carved into stone and embedded on the second floor of the clock tower, thereby linking the tolling of the bell with fire alarm signals (coloured flags and lights). The clock tower of the Tonghai Autonomous Council went a step further by directly linking the clock tower with the fire station and the Public Security Bureau, establishing a composite defence system combining "timekeeping, public order and fire safety". Zhang Jian recorded in his *Chronicles of Kenmu Township*: "In the spring of 1910 (the second year of the Xuanton era) . . . thus were established primary schools, a self-governing council . . . municipal administration under the Public Security Bureau, with the bureau attached to the self-governing council, featuring a clock tower, workshops, a fire station and a detention centre, serving as a model for townships." (In 1924 (the 13th year of the Republic of China), Zhang Jian recorded in his *Chronicles of Kenmu Township*: "In the spring of 1910 (the 2nd year of the Xuanton reign), (omitted) by the end of the year, five or six major embankments were completed. Consequently, a primary school, a self-governance office, (omitted) municipal administration was placed under the Public Security Bureau—with the bureau attached to the self-governance office—a clock tower, a workshop, a fire station, and a detention center were established, serving as a model for other townships." This record is found in *The Complete Works of Zhang Jian*, Vol. 3: Industry, p. 389, *Chronicles of Kenmu Township*, 1924).

Industrial clock towers (such as those at Dasheng No. 1 and No. 3 Factory) served not only as timekeeping devices but also as gatehouses and spiritual bastions for the factories. The arched entrance on the ground floor, as the sole passage for workers' commutes, enforced strict discipline regarding working hours and rest periods. This was intrinsically linked to Zhang Jian's system of 'timekeeping during work hours and punctual attendance and departure', providing a solid physical foundation for the rigorous modern labour regime [13].

This expansion of functions can be regarded as a shift in values from the perspective of modern local governance. Whilst Meiji-era clock towers in Japan often served as visual symbols of civilisation and enlightenment, the Nantong Clock Tower was transformed into a functional vessel serving local self-governance, safeguarding public safety, and supporting industrial development. In his inscription, Zhang Jian explicitly stated that the

purpose of constructing the tower was to “promote the people’s diligence in their work and regulate construction activities, which necessitates first establishing a clear understanding of the passage of time”, thereby elevating a unified temporal order to a tool of governance. The Nantong Clock Tower was no longer merely a replica of Western architecture, but became deeply embedded within the local governance system as the heart driving the functioning of society, thus completing a profound metamorphosis from a “mirror of civilisation and enlightenment” to the “pivot of local governance”.

### 3.4. Materials, Structure and Climatic Responsiveness

To further clarify the differences and transformative characteristics between the Meiji Clock Tower in Japan and the Nantong Clock Tower at the material level, this section selects two typical examples, A and B, and compares them across four dimensions: structure, height, materials and core function (Table 2).

**Table 2.** Comparison of Technical Parameters for Typical Clock Towers in China and Japan (Table Source: Author’s own illustration).

| Comparison Criteria       | Japanese Prototype A           | Nantong Implementation A                                                                                                                                          | Japanese Prototype B                                | Nantong Implementation B                |
|---------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------|
| Representative Buildings  | Yokohama Town Hall Clock Tower | Clock Tower in front of Qiaolou, Nantong County                                                                                                                   | Sapporo Agricultural School Drill Ground            | Jiangsu Provincial Consultative Council |
| Structural System         | Stone masonry                  | Mixed brick and timber                                                                                                                                            | Timber frame                                        | Mixed brick and timber [29]             |
| Total height              | Approx. 17 m                   | 22.6 m                                                                                                                                                            | Approx. 19.8 m                                      | Approx. 23 m                            |
| Main Materials            | Stone                          | Red and blue bricks                                                                                                                                               | Timber                                              | Red and blue bricks                     |
| Source of Clock Mechanism | Imported from overseas         | Imported from Joyce, UK (Nameplate photos and maintenance archives of the clock movement of Nantong Clock Tower from Haohe Scenic Area Administration of Nantong) | Imported from Howard, USA (Sapporo City, n.d.) [35] | Imported from overseas                  |
| Core Function             | Public timekeeping             | Timekeeping + fire watch                                                                                                                                          | Campus timekeeping                                  | Timekeeping + administrative protocol   |

As shown in Table 2, the Nantong Clock Tower exhibits distinct localised characteristics in its physical parameters. The most significant changes lie in the increase in height and the substitution of materials. These adjustments were not made arbitrarily, but were based on a thorough consideration of Nantong’s local construction capabilities and governance requirements.

From a technical perspective, the Nantong Clock Tower demonstrates a high degree of flexibility, having both incorporated Western architectural forms and fully adapted to local construction conditions and the natural environment. The four arched doorways of the original clock tower in front of the Qiaolou in Nantong County and the arched windows of the Dasheng No. 1 Factory are both examples of the mature application of Western arch technology in Nantong. The design of the upper structure of the freestanding tower broke through the height restrictions of traditional Nantong architecture (which was predominantly one or two storeys high); at 22.6 m, the clock tower in front of the Qiaolou once became the tallest building in Nantong, altering the city’s skyline.

The Nantong Clock Tower made full use of the region’s abundant local brick resources. Dasheng No. 1 Factory employed a red-brick ‘pinzi’ (triangular) structure, Dasheng No. 3 Factory featured a blue-brick facade, and the Tonghai Autonomous Council adopted a brick-built castle form. This strategy of ‘primarily brick-and-timber construction with imported core components’ not only circumvented the high costs of imported building materials but also aligned with the brick-laying skills of local Nantong craftsmen.

In response to the rainy and humid characteristics of Nantong's subtropical monsoon climate, the Nantong Clock Tower underwent targeted technical modifications. The clock tower in front of the former Nantong County Qiaolou featured four-sided louvered ventilation towers on the sixth floor, whilst all clock chambers were designed with windows on all four sides, effectively resolving ventilation and moisture control issues for the mechanical apparatus (Nantong Party History Office & Nantong Local Chronicles Compilation Committee, n.d., 2019 [36]).

Furthermore, during the construction of the clock tower at the Tonghai Autonomous Council, Zhang Jian set out fairly specific technical requirements regarding the construction methods. He personally stipulated in a written directive: 'New bricks must be soaked in water; old bricks must be laid one horizontally and one vertically, with the mortar containing three parts lime to ten parts sand.' (Zhang Jian attached great importance to the construction of the Tonghai Autonomous Association. In the handwritten notes (shoudie) he sent to Jiang Zhiyuan, he mentioned the clock tower of the Autonomous Association several times: First, he assigned Chen Shengfuting (Hongmo), a graduate of the Engineering Department, to oversee the construction, and paid close attention to every detail: "The proportions of the wall's height, thickness, and width must correspond to the stability of the foundation (particular care must be taken with the site of the Autonomous Association's clock tower). New bricks must be soaked in water; for old bricks, the laying pattern must be one horizontal and one vertical, and must not exceed two horizontal and one vertical. The mortar must contain three parts lime (so-called "wind-weathered lime") to ten parts water; mixing it with a small amount of fresh water and fine sand is even better. When whitewashing with lime, use fresh water; the lime must be soaked overnight beforehand. The column bases must be level and straight, the eaves must be even, and the walls must be flat and upright. The outer edges of the steps must form a straight line with the upper and lower edges of the railing; they must not protrude or recede. The threshold should not exceed three or four inches in height; three inches is appropriate. This is the general outline. To your younger brother Zhiyuan, Jian, bows respectfully. 9 April." Second: "If I cannot inspect the clock tower at the Autonomous Branch Office in person, would it be acceptable to draw a scaled diagram instead? Jian, bows respectfully. 25 June." Third: "The characters on the Autonomous Association building must be re-engraved; do not fear the trouble. Simply grind and carve them onto the reverse side of the original bricks. If the bricks are too small, purchase larger ones. Jian, bows respectfully. 14 March."). This record indicates that, during the actual construction process, clear and standardised specifications regarding masonry techniques and material proportions had already emerged. This quantitative control over construction details reflects, on the one hand, the trend towards a shift from empirical construction practices to rule-based management in modern building processes; on the other hand, it also demonstrates technical considerations regarding structural durability and construction stability under specific local building conditions.

#### 4. Conclusions

Taking Zhang Jian's visit to Japan in 1903 as a historical starting point, this paper focuses on the typological connections and morphological evolution between clock towers of the Meiji period in Japan and those of modern Nantong. Through a review of the literature, verification of his itinerary, typological classification and comparative analysis, the paper offers a preliminary exploration of the relevant issues.

Firstly, from the perspectives of historical context and typological characteristics, clock towers of the Meiji period, as an important type of modern public architecture, gradually took on diverse forms against the backdrop of Japan's 'Civilisation and Enlightenment'

movement. By combining Zhang Jian's itinerary in Japan with the spatial distribution of relevant structures, this paper conducts a typological synthesis of the clock tower types he may have encountered, based on existing indirect evidence. On this basis, it proposes that Meiji-period clock towers may have served as one of the reference points for Nantong's modern clock towers; however, this relationship requires further verification through additional empirical evidence.

Secondly, in terms of form and construction methods, the Nantong clock tower exhibits, in several instances, selective borrowing of the basic spatial configurations of Type A and Type B clock towers, whilst making adaptive adjustments in terms of scale control and the use of materials. Overall, this reflects a process of synergistic adaptation between imported architectural elements and local construction conditions.

Thirdly, from the perspective of functional evolution, the role of the clock tower in the Nantong context shows a trend of expanding from a single function of public timekeeping to multiple functions of social management; its significance is reflected not only in the establishment of temporal order but also in changes to modern local governance and the organisation of public space.

Set against the historical backdrop of the 'Eastward Transmission of Western Learning' in the modern era, Japan—as one of the key intermediaries in the dissemination of modern architectural knowledge—may have provided certain references at the levels of form and concept during the formation of Nantong's clock towers; however, the specific transmission pathways and mechanisms of influence require further discussion based on additional historical materials. Overall, this case study offers valuable insights into the regional adaptation of modern Chinese architecture during the late Qing and early Republican periods.

This study does have certain limitations. For instance, some historical buildings can no longer be traced or have undergone alterations, which restricts the reconstruction of their original forms; furthermore, there is scope for further exploration of the broader socio-cultural mechanisms underlying the clock tower. Future research could conduct cross-comparisons by incorporating more urban case studies to further refine the typological classification and dissemination pathways of modern clock towers.

**Author Contributions:** Y.L. was responsible for designing the research methodology, analysing the forms of modern clock towers in China and Japan, constructing a unified classification system, conducting literature verification, drafting the initial manuscript, and revising and refining the final draft. Additionally, she participated in integrating historical resources, mapping cross-cultural architectural influence pathways, and distilling the logic behind localised innovations. S.Z. played a key role in establishing the research framework, refining core concepts, and reviewing and editing the manuscript. Furthermore, she was responsible for securing project funding, overseeing the research process, and verifying research results, providing crucial support for the smooth progress of the study. All authors have read and agreed to the published version of the manuscript.

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