Death and Rebirth: Regional Renewal and Development of Industrial Architecture Heritages in Shanghai

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Abstract. Lots of industrial architecture heritages which remain the utility and aesthetic values at the present times are preserved in Shanghai which is one of the earliest industrial cities in modern China. Shanghai as the most exoteric and cutting-edge city among other countries around the world, has the distinct regional feature of avant-garde. Based on the methodologies of field investigations and case studies, the utility and aesthetic value of industrial architectural heritages in Shanghai are integrated with avant-garde for the purpose of reshaping their physical and psychic space.

1. Introduction
Since the 1950s, due to the post-industrial era in European and American, old industrial enterprises were being phased out or moved to the suburbs to decline. In the 1970s, western scholars began to identify these remains as heritage sites. According to the connotation of industrial heritage in "Nizhny Tagil Charter", it can be summarized as an industrial heritage which contains certain historical culture, scientific technology, architectural value, certain social significance and scientific research value. As a part of industrial heritage, industrial architecture heritage pays more attention to the architectural part which contains both material and non-material elements. In terms of material, it includes the remains of production buildings such as workshops, warehouse buildings, ports and mines, as well as buildings of transportation, trade and management equipped with industrial production. It also includes the new technologies and materials in engineering, as well as social and living buildings related to industrial activities. Non-material heritage includes the production process, technology and other forms of cultural expression, as well as cultural heritage in individual memories and behavioral habits.[1]

2. Shanghai and its regional characteristics in modern times
Since the 1840s, with the establishment of foreign concessions and enterprises in Shanghai, the center of southeast in China gradually shifted from Suzhou and Hangzhou to Shanghai. Shanghai became the center of economic, financial, trade and shipping in China.
The development of the old and new Shanghai originated from openness. The modernization of material civilization had brought about the modernization of consciousness. The public had taken the lead in accepting diverse ideological, cultural and artistic influences from foreign countries. In the first half of the 20th century, old Shanghai was forced to modernize. In the second half of the 20th century, new Shanghai took the initiative to open up under the guidance of reform and opening up. In Shanghai, the western advanced technology, thought and theory collided with the traditional Chinese culture of 5,000 years, forming a unique regional culture and spirit with avant-garde and fashion.

Avant-garde means ahead of time, referring to the technology and ideas[2]. The technology and ideas so called "avant-garde" are experiments that attempt to innovate as a whole. It is unorthodox and regarded as deviating from tradition. The avant-garde of technology is the experiment of the latest scientific research. The avant-garde of thought is embodied in the thought mode and the experiment of avant-garde art. Shanghai's advantageous geographical location, developed economy and open attitude make avant-garde develop rapidly and extensively in all walks of life. In the field of architecture, the avant-garde technology refers to the experiment of new techniques, while the avant-garde ideas refers to the experiment of new theories and aesthetics. The development of avant-garde art and ideology has continuously influenced the practice of Shanghai architecture, making it develop rapidly and widely.

According to statistics from Shanghai third-party exhibition information agency, more than 160 exhibitions related to avant-garde art were held in Shanghai in the first half of 2019, while there were also a large number of high-end brand press conferences and creative exhibitions. It can be seen that avant-garde Shanghai has brought the functional space demands of avant-garde exhibition and fashion conference, as well as the prosperity of relevant businesses.

3. Shanghai industrial architecture heritage

3.1. Composition of industrial architecture heritage in Shanghai

For its renewal, it is the necessary step and preparation to clarify the composition of Shanghai's industrial architecture heritage in two aspects of industry type and time.

3.1.1. Industry type composition. Shanghai, as the core of modern industry in China, has a relatively complete industrial type. So far, the number of industrial heritages which are counted, excavated and sorted has reached 300 items, including heavy, military, shipbuilding and transportation industry, etc. which basically cover all kinds of modern Chinese industries. Among them, the textile, paper, printing, food and tobacco industry are the pillar industries of Shanghai. For example, 15 of the 38 existing industrial buildings involving the textile industry are located in Yangpu District, accounting for 40% of the total. This basically reflects the composition of industrial types in this period. Meanwhile, as one of the earliest ports in China, warehousing is also a major industry of Shanghai.[3]

3.1.2. Time dimension. From the first world war to the 1930s, it is a golden period for the development of industry dominated by machinery manufacturing and light industry which includes food, textile, paper, printing and other industries in Shanghai. Based on the investigation of the distribution of the construction time of modern excellent industrial buildings in Shanghai, at least 25 of the 43 excellent modern industrial buildings were built in this period, accounting for about 60% of the total[4].

Based on the analyses, we can roughly understand the type and time composition of Shanghai's industrial architecture heritage. The industry type is relatively varied, mainly in light industry. Its time dimension is main from the first world war to the 1930s. The analyses provide background resources for the renewal and growth of Shanghai's industrial architecture heritage, which are conducive to further study of the renewal.

3.2. Characteristics and values of Shanghai's industrial architecture heritage

Different from the general public buildings, the industrial buildings form distinct symbols in space, structure and appearance, due to the particularity of technological process. In addition to the unique
cultural, economic, social and political structure of modern Shanghai, the industrial buildings also have distinct regional characteristics.

3.2.1. Spatial and structural features. The spatial characteristics of industrial buildings are usually determined by industrial process and structure technology. According to different technological requirements, the space and structure types of industrial buildings in modern Shanghai can be divided into general type, large space type and special type. General type: for the industrial building without special requirement in technological process, its space is not novel. It is usually single-story or multi-story, and the structure is no different from general public building, mostly the brick and wood mixed structure and frame structure. Large space type: due to the demands of production, such as storage, power plant and so on, and the progress of structure, factories with large spatial span and strong spatial integrity were built in modern Shanghai, and their main structure is truss. Special type: some industries with special process requirements, such as slaughterhouses, power plants, water plants and docks, the particularities of their technological process are often reflected in the diversity and uniqueness of space, structure and appearances, such as Shanghai Matches House, its gas tank is a large spiral steel structures of four layers, each layer height is 9.3 meters, the top cover is bell jar type, spatial characteristic and symbol are extremely obvious.

3.2.2. Appearance characteristics. Due to the special political and social background of modern Shanghai, a variety of styles coexist in architecture appearance. The appearance characteristics of industrial buildings in modern Shanghai can be roughly classified into several types: traditional, western retro and modern style. Traditional style usually appeared in the workshop without special technological requirements, mainly with the sloping roof and the brick wall. Influenced by western colonization, most of the industrial plants were invested by foreigners in modern Shanghai, so retro western or a combination of Chinese and western style was always used. It was characterized by complex decorative elements, such as moldings, window grilles, arches and orders. The modern style with a simple appearance focused on practical functions and the impact of technological processes on the building.

The unique spatial, structural and external features and the political, social and cultural background of modern Shanghai industrial architecture heritage make it has great value in many aspects. Firstly, Shanghai's industrial architecture heritage has a unique social value. From the cultural perspective, its reuse is the reservation and continuation of a special historical background, including aesthetic, spiritual, cultural, historical, symbolic, authenticity values and evaluation standards. Secondly, its renewal and growth are the transfer and continuation of its economic, material and functional values. In terms of economic value, it is mainly reflected in the yields on heritage projects, which can be divided into three parts: use value, non-use value and externality. What's more, its spatial, structural and external characteristics are in line with Shanghai's urban avant-garde spirit and space requirements for avant-garde exhibitions. The internal features of industrial architecture heritage have incomparable values on exerting and constructing avant-garde in contemporary Shanghai.

4. The avant-garde renewal and growth of Shanghai's industrial architecture heritage
Renewal is the basis of avant-garde growth. The macro-level renewal involves the reconstruction of the relationship between industrial architecture heritage and city, such as function, spatial scale, etc. Micro level renewal refers to the reorganization of its functions, space, structure, appearance and other aspects. In contemporary Shanghai, the renewal of industrial architecture heritage needs to implant the outstanding regional feature of avant-garde into its material and spiritual basis at different levels.

4.1. The macro level
On the foundation of avant-garde, each area in Shanghai owns the different characteristics of avant-garde function and spirit. In the functional reconstruction of industrial architecture heritage at the urban or regional level, it is necessary to accurately locate its functional types and spatial structures according to its regional functional and spatial features, so as to integrate the implanted functional types and structures to improve the quality of urban areas. For example, 1933 Old Mill, is located in the
commercial area of Sichuan Road which has a complex urban space structure. According to the original situation, the avant-garde space with multi-scale is implanted, such as fashion performance, display, trading, design, service, business, leisure and so on. As a characteristic product and an important base of living, traveling and consuming for tourists in this region, this kind of implantation interacts with the North Bund of Hongkou District to drive regional economic development.

4.2. The micro level
From the perspective of architecture, the renewal of industrial architecture heritage at the micro level includes the following two aspects: function and space, structure and appearance. Specific renewal strategies need to be reorganized above this two aspects. The design of intervention and non-intervention should be carried out to achieve avant-garde growth.

4.2.1. Function and space. Unique types form unique functions and spaces. The renewal of Shanghai's industrial architecture heritage requires preliminary investigation and classification of its various function and space samples, which are divided into general, special and giant type. Based on the full understanding of the limitations and variability of existing functions and spaces, the feature should be extracted. And then, the original functions and spaces should be replaced adaptively, including translation of old functions and implantation of new functions. In addition, the methods of space integration, separation and expansion can be used to make the update fit with avant-garde spirit. For example, the renovation of 80,000-ton Silo of Minsheng Port, as shown in figure 1, is regarded as giant type. Its original storage space is no longer suitable for advanced grain storage and is abandoned. Its unique high-rise enclosed space cannot be adapted to most small scale functions, such as office, catering and so on, but fits with a large scale exhibition function. Therefore, the renewal fully respects the original space characteristics and replaces it with the function of urban pioneer art exhibition, so as to realize the adaptive reuse of function and space.

![Figure 1. The interior space of 80,000-ton Silo.](image1)

![Figure 2. 1933 Old Mill.](image2)

4.2.2. Structure and appearance. The unique and varied structure and appearance of Shanghai's industrial buildings make most of them the landmarks of the city. It can be considered that the unique structure and appearance have avant-garde characteristics, so in the process of renewal, they should be sorted out first. Through extraction and analysis, the special structure and appearance should be protected, enhanced and highlighted in the design process, and the original avant-garde should be integrated with the current popular avant-garde, so as to achieve the renewal of sculptural charm. For example, in the renovation of the 1933 Old Mill, the structure was repaired by the integrated pouring of concrete, so that its original and unique ramps, pillars and exterior decoration became the highlights, and became a typical example of making full use of the original structures and exterior features to achieve renewal and growth, as shown in figure 2. For another example, the tube of the 80,000-ton Silo and the big chimney of the Shanghai Museum of Contemporary Art are all reserved, as shown in figure 3 and
figure 4. Through the method, this kind of avant-garde reintegration has great significance in the renewal of the structure and appearance of the industrial architectural heritages.

5. Case studies of Shanghai industrial architecture heritage renewal

5.1 1933 Old Mill
1933 Old Mill is a typical example of transforming an abandoned slaughterhouse into an avant-garde fashion center. The main building, built in 1933, was once the largest and most advanced slaughtering factory in the Far East. But with the passage of time, its original function can not match the modern city center function. Building 1, according to the process of slaughtering, formed 26 interleaved corridor bridges in the internal space, as shown in figure 5. Through using the reinforced concrete umbrella-shaped floor without beam, as shown in figure 6, both the space and structure have strong visual impress, and a good match with avant-garde material and spiritual space[5].

The whole transformation is a process of positioning, design and redesign. According to the local function, the space of avant-garde fashion performance, display, design, service, business, leisure and other function with different scales is implanted into Old Mill. At micro level, based on retaining the typical space, structure, spirit and temperament, architect repaired and polished the outdoor and indoor space with cement. With authenticity and discernability, the architect made it form a sculptural unified gray and heavy texture to awaken the body and soul that had been sleeping for decades and to provide a space and platform with avant-garde and fashion temperament [6].
5.2. The Renovation of 80,000-ton Silo of Minsheng Port
Undoubtedly, the most prominent buildings of Minsheng Port are 40,000 tons and 80,000 tons silos, as shown in figure 7. From the perspective of typology, their unique tube sequence structure and space are the result of the combination of historical functions and artistic characteristics. This prominent feature provides citizens a public cultural space with the concept of art, daily life and events. Architect and avant-garde artist presented the three-dimensional traffic between the first and third floors like a ladder which floats outside the silo, as shown in figure 8. With modern materials such as mirror stainless steel and glass, the silo and the ladder of clouds complement each other, creating a work of art that reflects Shanghai's unique avant-garde temperament [7]. As the architect said, "leave more possibilities to the future", the renewal and growth of the old building are highlighted here. This renovation and renewal inspired by artistic and cultural activities has become an effective attempt to renew industrial architecture heritage under typology [8].

Figure 7. Minsheng Port.

Figure 8. The ladder floating outside the silo.

6. Conclusion
As the frontier of China, Shanghai is undergoing a series of avant-garde innovation practices in the transformation of industrial architecture heritage. Industrial architecture heritage with strong historical memory has been redefined. The avant-garde art, creativity and business forms are applied to stimulate the vitality of old buildings, and this kind of theory and practise are being widely discussed and tested. Though the summary and review of the avant-garde growth practice of Shanghai’s industrial architecture heritage have relative limitations on the regional and sample dimensions, they provide typology contribution and preliminary attempt to the renewal of industrial heritage.

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