

Assessment of the Catalytic Effects of Transforming Industrial Heritage: Case Study of Sanbao Street Industrial Historic District in Changzhou

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ABSTRACT Transforming industrial heritage will have internal economic and cultural effects and will also catalyse changes in surrounding urban areas. Transforming industrial heritage is therefore an essential part of strategies to regenerate decayed industrial districts. The aim of this study was to attempt to answer three questions. Can all transformed industrial heritage give catalytic effects? How should the potential for catalytic effects be assessed? What factors prevent catalytic effects? The Sanbao Street Industrial Heritage Historic District in Changzhou, China, was used as an example, and three effects catalysed by transforming industrial heritage were assessed. These were (1) reuse of industrial and non-industrial buildings in and near the historic district, (2) new construction in and near the historic district, and (3) revitalisation of the whole historic district. Failure of the catalytic effect caused by a lack of a conversion mechanism, failure to communicate the value of industrial heritage, and limited cultural industrial capacity was assessed. Formal transformation strategies focused on the connotative value of industrial heritage are proposed, and are expected to support future research and planning practices.

KEYWORDS industrial heritage, urban regeneration, catalytic effect, assessment, connotative value

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Introduction

Industrial heritage means the remains of industrial sites, structures, complexes, areas, and landscapes and also machinery, objects, and documents (TICCIH 2003, 2011). Industrial cultural heritage plays an important role in maintaining or achieving unique national or local characteristics (Palmer 1999). Unlike other types of heritage, industrial heritage sites are large, widespread, and vaguely defined (Liu 2017). There are small numbers of registered (and therefore protected) industrial heritage sites and large numbers of unregistered (and therefore unprotected) industrial sites that could be classed as industrial heritage sites (Long, Liu and Wang 2017). The ability to balance protection and transformation is an important criterion when evaluating the value of an industrial heritage site (Liu, Zhao and Yang 2018). Adaptive reuse is an effective way of balancing protection and transformation, and is considered to offer very positive economic and social

effects (TICCIH 2012; Guo 2017). Transformed industrial heritage sites in Chinese cities are considered to support urban transformation and economic development and even to enhance the cultural influence of a city (Berta, Bottero and Ferretti 2018; Chen, Judd and Hawken 2016).

Transforming industrial heritage has become an important way of transforming and improving industrial cities, so it is important to assess the value of transforming industrial heritage. Recent research on the value of transforming industrial heritage has had two main foci: (1) Assessing the value of transforming and adaptively re-using industrial buildings, including the effects of using new technology, economic growth through cultural activities, continued authenticity, and optimising the landscape (Blagojevic and Tufegdzcic 2016; Cho and Shin 2014; Leary and Sholes 2000; Benito del Pozo and González 2012). (2) Analysing transformation and the development of neighbourhoods and communities in a broader framework to

explore how transforming industrial heritage promotes economic revitalisation, social equity, public participation, cultural identity, and other effects (Jones and Munday 2001; Hospers 2002; Oevermann et al. 2016; Murray 2002). Other effects include catalytic effects, meaning transformation of industrial heritage causes larger cultural industrial clusters to form and trigger the regeneration of decayed industrial districts (Evans 2005; Martinovic and Ifko 2018). Transforming industrial heritage accelerates development in the surrounding area and produces a 'chain reaction' that promotes gradual and sustainable urban development (Hartog 2005; Jin and Chen 2006). Transforming industrial heritage can be used as a tool to upgrade a neighbourhood by attracting well-educated residents, creative sector firms, and tourists (Duijn, Rouwendal and Boersema 2016), to revitalise the local economy (partly through cultural industries becoming established), and to promote industrial transformation and urban regeneration (Zheng 2011; Zhong 2016). However, it is not clear if all transformations of industrial heritage have catalytic effects, how catalytic effects should be evaluated, and what factors influence catalytic effects. Answering these questions will be of both theoretical and practical value.

Many studies of Chinese industrial heritage transformation projects have been performed, but most have been focused on megacities such as Beijing and Shanghai. Few studies of transformed industrial heritage in large and medium-sized cities have been performed. Changzhou is one of the most important large industrial cities in the Yangtze River Delta, and it would be valuable to study the transformation of industrial heritage in Changzhou as a representative large Chinese city. This study is focused on the Sanbao Street Historical Industrial District in Changzhou. The reuse of existing industrial and non-industrial buildings and new construction in neighbourhoods in the Sanbao Street Historical Industrial District and the effects driving the revitalisation of surrounding urban areas are studied here. The challenges faced when transforming industrial heritage is used as a catalyst for urban development are assessed, and the results are expected to be of value both theoretically and in practice.

Urban Catalytic Effects of Transforming Industrial Heritage

What is the Catalytic Effect?

The term 'urban catalyst' needs to be defined before catalytic effects can be evaluated. A catalyst is a substance that increases the rate of a chemical reaction without

itself undergoing any permanent chemical change¹. The urban catalyst theory originated in decaying industrial districts in North American cities, the failure of urban reconstruction projects, and the gradual decrease in large-scale construction after World War II (Chen and Liu 2016). Early urban planners understood the use of urban catalysts. Aldo Rossi described catalysts as the 'primary elements' of a city (Rossi 1982), Kevin Lynch stated that catalysts should be present in existing long-standing inhabited areas (Lynch 1972), and Jane Jacobs stated that it is important to identify catalysts through careful analysis and to base both policy making and spatial design during urban regeneration on appropriate catalysts (Jacobs 1961). Wayne Atton and Donn Logan suggested that urban catalysts are more influential than was previously believed, and stated that catalysts can inspire new ways of living in a city without radically changing the city (Atloe and Logan 1994). It is important to understand that urban catalysis works by design interventions arousing curiosity, which stimulates activity and creates a prosperous economic, social, and cultural scene, and that the fundamental role of a catalyst is to stimulate economic activity in a district with a depressed economy. Urban catalysts can therefore promote development in adjacent urban areas and lead to economic revitalisation (Sternberg 2002; Mengusoglu and Boyacioglu 2013) and even promote economic and social changes in historic districts (Ferilli et al. 2017).

Industrial Heritage as an Urban Catalyst

Urban catalysts can be large sport or commercial facilities, which attract people and funds to revitalise declining urban districts through comprehensive redevelopment (Chapin 2004), or small or medium-sized industrial heritage transformation projects that improve the physical environment and create events through innovation and design based on the cultural industry (Davis 2009; Chen, Judd and Hawken 2016). Transformation of industrial heritage acts as a vehicle for de-industrialisation and can effectively promote economic and social development. This was one of the most important cultural phenomena in Western urban development in the last three decades of the 20th century (Zukin 1982; Rautenberg 2012). Culture-oriented transformation (usually involving embedding creative and cultural industries, urban museums, the tourism industry, and other cultural industries in an area) is an important type of industrial heritage reuse (Bristow 2010; Berens 2012), and such transformations play important roles in strengthening urban social vitality and economic competitiveness (Miles and Paddison 2005; Wang and

Wang 2018). Culture-oriented transformation depends on highlighting the particular historical, cultural, social, and scientific values of industrial heritage, providing flexible and aesthetically pleasing industrial architectural spaces, the cost of reuse being relatively low, and a 'limited scarcity legacy', and combines and balances collective memory with a vision for the future. Describing and protecting the diversity of industrial culture can also effectively promote local empowerment and sustainable development (Hartog 2005) and create specific perceptible advantages by improving local values and image (Kotler, Haider and Rein 1993) to form an identifiable 'place' rather than 'function' (Zukin 1982), which will attract large numbers of people in the 'creative class'. Attracting these people can improve market confidence, establish a city brand with industrial heritage at its core, and help transform an industrial heritage site into an economically and socially vital urban area. Culture-oriented transformation of industrial heritage sites has therefore been a popular model for Western urban development in recent decades (Evans 2009). Transformation of industrial heritage in China started in the late 1990s, when a group of artists in Shanghai moved into abandoned and dilapidated industrial buildings in the inner city and transformed the buildings into studios (Wang 2009). Thousands of industrial heritage sites have been transformed into 'creative industrial parks' in Chinese cities over the past two decades. In large and medium-sized cities, developments such as 'Beichangmen' in Wuxi, 'Hangsilian' in Hangzhou, 'Gusu 69' in Suzhou, and 'Canal No. 5' in Changzhou have been aimed at producing catalytic effects to stimulate changes in the relationships between the existing economy, society, and space (Sun and Zhou 2015).

Assessing Catalytic Effects

This paper is focused on criteria for assessing urban catalytic effects. Sternberg described five characteristics of urban catalysts. These were comings and goings, development patterns, public amenities, investor perceptions, and important buildings (Sternberg 2002). Robertson (1995) proposed the 'Special Activity Generators' theory for urban regeneration, and described three objectives: (1) producing spill over benefits, including the establishment of nearby hotels, restaurants, stores, and tourist attractions, that make the neighbourhood more active than previously; (2) stimulating new construction, for example, the construction of a new hotel; and (3) being located where a blighted area may be revitalized. Chapin proposed three indicators to determine whether a transformation project has catalysed urban

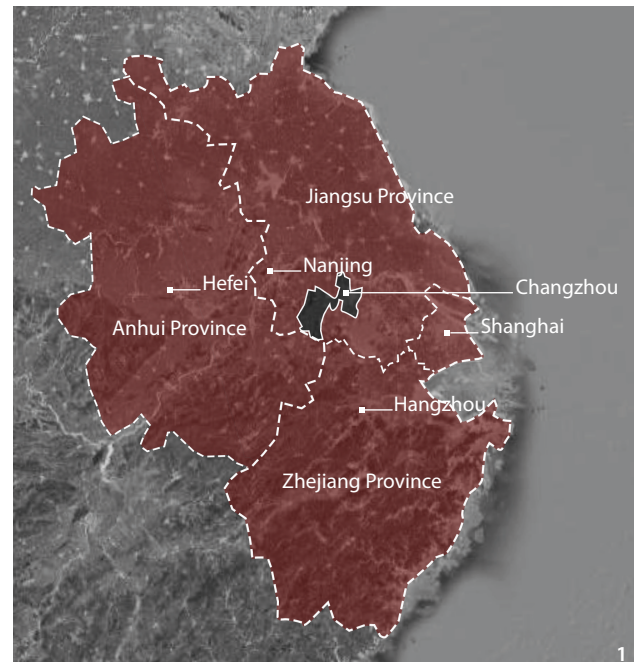


Figure 1 Location of Changzhou (Source: the author).

regeneration: (1) reuse of existing buildings and spaces; (2) new construction in surrounding neighbourhoods; and (3) emergence of a new entertainment or sport district (Chapin 2004). These criteria require the effects of urban catalysts to be measured from the perspective of changes in the physical environment. These observable signs may appear relatively short-sighted and crude when the long-term effects on society and culture need to be evaluated, but officials and planners often use these observable signs as criteria to determine how successful policies and designs have been, and are likely to use them when developing policies (Pagano and Bowman 1997). A new investment will generally be made expecting a return, and a neighbourhood with a materially improved environment is undoubtedly more attractive than an unimproved neighbourhood. The indicators described above can therefore be used as criteria for identifying catalytic effects brought about by transforming industrial heritage sites.

Changzhou: A City that is Representative of Modern Chinese Industry

Emergence, Development, and Decline of Industry in Changzhou

Changzhou, which is in the southern part of Jiangsu Province (Figure 1), is an important industrial and commercial city in the Yangtze River Delta region and one of the birthplaces of modern Chinese industry (Huang 2003; Zhang and Shao 2009; Gu and Zhang 2010). Changzhou

had a comb manufacturing industry as early as the Eastern Jin Dynasty², and cotton spinning, silk reeling, papermaking, and other industries developed after the Tang Dynasty. Changzhou became an important centre for the production and processing of cash crops such as cotton and silkworms and a distribution centre for various industries during the Ming and Qing dynasties. Youru Wu established the Jinyu weaving mill in 1906 using improved handlooms, and this marked the beginning of modern industry in Changzhou (Zhang 2009).

Industry in Changzhou had two peaks during the Republic of China. The 'golden age' of industry was between 1912 and 1920 (Zhao 2016). Local squires founded the Housheng Machinery Manufacturing Factory and a power plant in 1913 and a number of spinning and flour mills in 1919. Comb and silk production for the international market started at the same time³. Yinchu Ma declared 1927–1937 a 'rare miracle decade'. As an example, the 'Dacheng Textile Printing and Dyeing Group' (a combined spin-weave-dye company) was founded at that time by Guojun Liu. This indicated that industry in Changzhou had become modernised (Zhang and Shao 2009; Wang 2016).

Changzhou was known as an 'industrial star city' in the first three decades of the People's Republic of China (Gu and Zhang 2010). Small and medium-sized industries developed in the high-population-density inner city, and large factories were built in the suburbs, so an industrial system gradually formed with light industries in the core urban area. The Changzhou industrial economy was based on the so-called 'eight dragons' (the chemical fibre, corduroy, flower cloth, glass-fibre-reinforced plastic, khaki cloth, plastic, transistor radio, and walking tractor industries), and a *danwei*⁴ urban structure developed.

Changzhou became one of the first pilot cities to use the Chinese mixed ownership economic model after Chinese economic reform in 1978. The 'Sunan Model'⁵, which was guided by local governments and owned by collectives, was followed, and many township factories were established in rural areas outside the city. The manufacturing industry grew explosively (Shi and He 1996; Wei 2011), but industry in the inner city gradually declined.

Transformation of Changzhou Industrial Heritage

Industrial transformation began in Changzhou in 2000. The 'Stepping back from two to three'⁶ policy was promoted and industrial park planning started in 2004. Industries quickly became concentrated in the suburbs. Large numbers of factories closed, and abandoned buildings became idle urban spaces. By the end of 2011, industrial

and storage land in the centre of the city covered 85.08 km² and accounted for 35.4% of land covered with urban constructions (Changzhou Urban Planning and Design Institute 2011). This was much higher than the less than 10% of land covered by urban constructions in most cities in developed countries (Li and Sun 2017). The Changzhou Planning and Design Institute compiled a report entitled 'Planning for the Protection and Utilisation of Industrial Heritage in Changzhou' in 2009. A total of 15 industrial sites (which included 76 industrial buildings, structures, sculptures, products, and traditional crafts) were listed and divided into five historic industrial heritage districts with different lead industries (Figure 2). The plan is still in the demonstration stage and has not been legally implemented, and this has directly allowed some of the industrial heritage sites to disappear. Dacheng factories 1, 2, and 3 and a machine tool factory had been partly or completely demolished by September 2018, and the Housheng iron factory ruins were hard to find. The industrial heritage sites listed in the plan account for <1% of the industrial remains in the city centre, and many industrial remains with historical value have been completely dismantled and redeveloped. Recent adjustments in urban industrial structures have caused the spontaneous transformation of some industrial remains into creative industrial parks because of market forces, and this has gradually increased enthusiasm in the wider society for reusing industrial buildings and landscapes. Transformed industrial remains are often called 'industrial heritage' by the government as well as by private individuals. Such sites are transformed and reused as part of the urban transformation process to improve the industrial sector, develop the economy, and protect industrial heritage, and even in the hope of revitalising surrounding urban areas, especially because the real estate market has been weak since 2015 (Interview 1). The preliminary results of the analysis described above confirmed that transforming industrial heritage sites in Changzhou has caused three related processes: long-term efforts to drive light manufacturing out of the inner city; short real estate market cycles; and the emergence of 'bourgeois chic'⁷ (Zukin 1982).

Methodology

Research Object Selection

Studying the catalytic effects of transforming industrial heritage required us to select appropriate case studies. We assessed the current industrial heritage situation in each of five historic industrial heritage districts. No

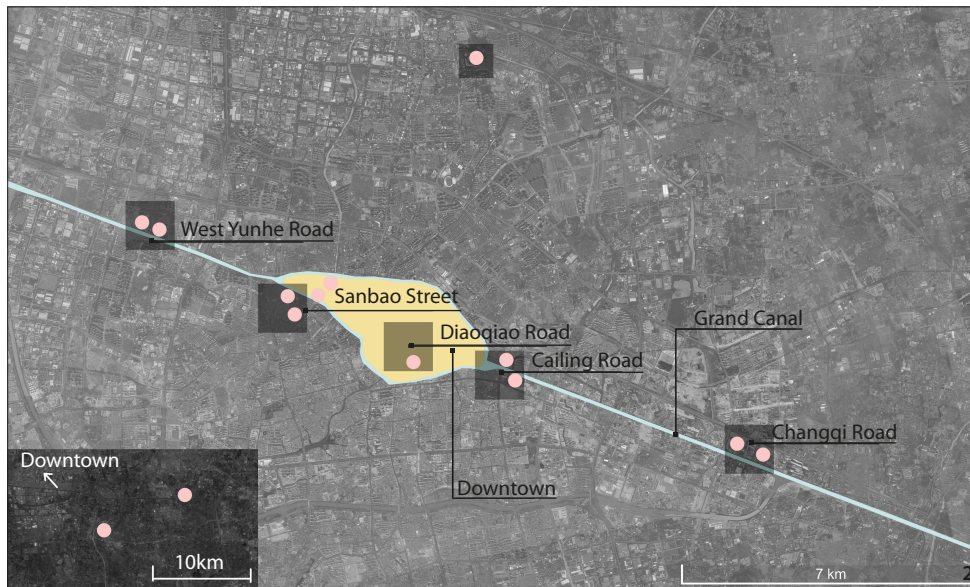


Figure 2 The distribution of Changzhou listed industrial heritage (Source: the author).

transformation activities were found in the Changqi Road District, and most industrial heritage sites in the West Yunhe Road District, Cailing Road District, and Diaojiao Road District have been demolished. Sanbao Street District is the only historic industrial district that is relatively well-preserved and contains multiple industrial heritage sites and industrial heritage transformation projects.

The representativeness of Sanbao Street itself was assessed by evaluating the historical, cultural, spatial, and economic values of the factories in the street to determine if each factory could be classed as an industrial heritage site. Sanbao Street contains factories built between 1930 and 1990. Most of the factories are more than 30 years old. The diverse types of factories and states of preservation reflect historical changes in industrial development in Changzhou. A comb factory and the 'Fifth Woolen Mill' are symbols of industrial cultural tourism in Changzhou and are the earliest transformed industrial heritage sites in Changzhou. These sites promoted the transformation of other factories. Sanbao Street has typical *danwei* industrial characteristics, with many old areas of housing and a few educational and retail facilities around the factories forming a large industrial neighbourhood. Six of the nine factories in the area have been transformed, making Sanbao Street the most concentrated area of transformed industrial heritage sites in Changzhou. Only two factories were included in the industrial heritage list presented in the plan mentioned above, but we believe that the statuses and overall characteristics of all nine industrial sites, and interactions between the effects of the sites, make all nine sites the core of the Sanbao Street Industrial Heritage

Historic District. These industrial remains should therefore be classed as important industrial heritage sites. This was supported by interviews with key local people.

Research Methods and Data Collection

This empirical study was performed using the 'special activity generator' theory and detailed indicators of urban regeneration to assess the catalytic effects of transformed industrial heritage on historic districts. Three indicators were used. (1) Are factories and other non-industrial buildings in the district fully reused? (2) Are there large numbers of new projects in the district? (3) Has the district been gradually developing into a prosperous cultural and tourist destination because of the transformed industrial heritage sites?

The core data used here were mainly obtained by identifying and comparing the physical and economic environments of the historic district in 2009 and 2018. We divided the assessment into three steps. We first established an information system using geographical data, historic and current aerial photographs, planning documents, and data obtained from local civil servants, business executives, and residents. We then drew spatial plans of the district in 2009 and 2018, focusing on changes in properties immediately adjacent to selected industrial heritage sites (using a boundary of 250 m)⁸. We then collected economic and environmental information (e.g., planning data for the surrounding urban areas, data on the current functions of industrial heritage sites, and neighbourhood vitality data from the government, enterprises, and relevant technical institutions) to determine whether the district is showing



Figure 3 The distribution of industrial heritage assets in Sanbao Street Historic District (Source: the author).

signs of revitalisation. Finally, we determined whether the changes in Sanbao Historic District would have occurred without any transformation of industrial heritage sites, after making certain assumptions. The analysis was based on the views of local planning department officials and business executives, news directly related to the case, relevant planning documents, and other data.

Sanbao Street District: The Limited Catalytic Effects of Industrial Heritage

Overview of the District and Transformed Industrial Heritage

Sanbao Street is a district with the 'Fifth Woolen Mill' and 'Nautical Instrument Factory' at its core and many workers' houses and urban villages. Broadly speaking, Sanbao Street District is a triangular area surrounded by the Grand Canal, Middle Huaide Road, and Middle Changjiang Road and containing seven other industrial heritage sites (including the 'Comb Factory', 'Qinye Plastic Factory', and the 'Synthetic Fiber Factory'). The total area of Sanbao Street is 1.72 km². Industrial and storage areas cover approximately 23.8 ha, and other constructions cover approximately 25 ha. Other parts of the district are mainly residential, although there are some public facilities. The Sanbao Street Historic District is on the south-western edge of the inner

city zone of Changzhou, but the urban and rural districts in this area are divided by tortuous boundaries (Figure 3). At its peak, the industrial district on the east side of the Sanbao Street Historic District contained 16 factories, three warehouses, and approximately 40 ha of workers' housing and zidi schools⁹. There were five rural settlements on the west side of the district, where industrial areas and villages were not clearly separated. Most factories gradually closed between 2000 and 2008, leaving large industrial heritage sites within the district.

The 'Fifth Woolen Mill' was transformed into the 'Canal No. 5' cultural tourism district at the end of 2008. The 'Comb Factory Museum' was established in 2009. In September 2010, the Jiangsu Province Development and Reform Commission established an overall project for transforming industrial heritage in historical districts, aimed at creating complete creative districts, integrating scientific and technological innovations and cultural creativity. The overall development of the Sanbao Street Historic District was focused on four projects: (1) developing 'Canal No. 5' as a cultural and creative industrial park; (2) developing the 'Comb Factory' as a cultural exhibition and training centre; (3) developing the 'Qinye Plastic Factory' as a creative leisure block; and (4) developing the 'Navigation Instrument Factory' as a public service complex. The statuses of the four industrial heritage sites at



Figure 4 The Fifth Woolen Mill (Canal No. 5) (Source: the author).

Figure 5 The Comb Factory Museum (Source: the author).

Figure 6 Nautical Instrument Factory (Source: the author).

Figure 7 Qingye Plastic Factory (Source: the author).

the beginning of the project are shown in Figures 4–7. The ‘Synthetic Fibre Factory’ was transformed into offices by a private company in 2015. By 2018, five of the remaining factories in Sanbao Street had been transformed into creative industrial parks, and one into a professional market. One factory remained unused, and two were still in their original uses. However, infrastructure and support facilities in Sanbao Street had not been improved markedly (the bus rapid transit track system had not been improved and the road network had not been optimised). There were insufficient commercial, entertainment, and leisure facilities, and the educational and medical facilities were decaying. The most notable change in Sanbao Street between 2009 and 2018 was the transformation of many industrial heritage sites (Interview 4).

District Impact Analysis

The objective of this study was to determine whether transformation of Sanbao Street industrial heritage sites catalysed the development of the entire historic district

between 2009 and 2018. We assessed the historic and current situation of the district using the three indicators presented by Chapin, and determined whether other new projects and transformation projects would have occurred when they did if the industrial heritage transformation projects had not occurred.

In terms of the first urban catalytic effect indicator, there are many industrial buildings in the study area but few non-industrial buildings have been transformed. Most factories in the historic district had been transformed and fully reused between 2009 and 2018. ‘Canal No. 5’ had an occupancy rate close to 100% in 2018 (Interview 2), and all the rooms in the ‘Comb Factory Museum’ were used for exhibitions or as workshops. The area of transformed factories within 250 m of both heritage sites was 90,000 m², and only approximately 25,000 m² of industrial space was unused. The ‘Synthetic Fibre Factory’ in the north and the ‘Qinye Plastic Factory’ in the south were transformed into creative industrial parks many years ago, and second renovations of both recently began, proving that the real estate

Table 1 Factories data of Sanbao Street Historic District (Source: the author).

Original Name	Current Project name	Year of Construction	Year of Transformation	Area (ha)	Construction Area (m ²)	Land Ownership	Current Function	Listed in Plan
The Fifth Wool Textile Mill	the 'Canal No. 5' Creative District	1930s	2008	3.6	3.2	State-owned	Cultural Tourism	Yes
Nautical Instrument Factory	Nautical Instrument Factory	1960s	None	3.3	2.4	State-owned	Idle	No
Synthetic Fiber Factory	Five Star Wisdom Park	1966	2015	4.7	6.1	State-owned	Office	No
Comb Factory	Comb Factory Museum	1951	2009	1.2	1.7	Private-owned	Museum	Yes
Crane Sauce Factory	Crane Sauce Factory	1960s	None	2.05	2.1	Private-owned	Unchanged	No
Sixth Construction Area	Huimeng Auto Repair, etc.	1980s	Unknown	2.1	2.2	State-owned	Auto repair	No
Aquatic Warehouse	Aiaijia Furniture market	1970s	Unknown	2.5	2.7	Private-owned	Professional market	No
Cement Products Factory	Zhensheng Dingsheng Industrial Park	1960s	2011	2.4	2.1	State-owned	Tutor training	No
Qinye Plastic Factory	No. 1 Rice Dock (to be transformed)	1964	2018	1.9	2.4	State-owned	Commercial leisure	No

market recognises the value of these industrial heritage sites and expects further investment to bring greater benefits (Interview 8). There are other factories with areas approximately 50,000 m² within the historic district, and these have also been transformed into creative industrial parks and furniture markets (Table 1). In terms of non-industrial buildings, there are approximately 1 million m² of old housing in the historical area, and this is mostly north of Dacang Road and Qinye Road. This housing is inefficiently used, of poor quality, and poorly maintained. This housing is cheap (Zhang, Zhao and Tian 2003), so the residents are mainly laid-off, retired, and migrant workers and other people with low incomes (e.g., indigenous people temporarily renting until the housing is demolished) who lack the motivation and ability to transform old houses. There are no large commercial and office buildings built before 2009 available for transformation in the study area.

In terms of the second urban catalytic effect indicator, extremely few new projects had been undertaken since 2009. Between 2009 and 2018, two new large residential areas covering 11.3 ha and with a total construction area of 25.3 ha and a new 8,000 m² office building had been completed. No other developments had occurred. Rapid urban development occurred in Changzhou between 2009

and 2018, but historic districts were developed markedly more slowly than surrounding neighbourhoods. This reduced the risk of industrial heritage being demolished, which would make local residents poorer (Interviews 4 and 6). It is, however, worth noting that a new highway bridge across the South Canal was built in the south-eastern part of the district, and 8 ha of land nearby was retained for development. There remain dozens of hectares of old housing for demolition, so there is great scope for future development in the district (Interview 1). The land distributions of new, transformed, and vacant sites in the district since 2009 and current land uses are shown in Figures 8 and 9.

In terms of the third urban catalytic effect indicator, we found that the historic district had not formed a complete cultural creativity or tourist entertainment cluster. New cultural and creative enterprises were continually emerging in the industrial heritage transformation projects, but the influence of industrial agglomeration did not spread beyond the factory walls (Interview 8). First, the industrial heritage transformation projects are spatially isolated from each other, with 'Canal No. 5' northernmost, 'No. 1 Rice Dock Creative Industrial Block' (originally the 'Plastic Factory') southernmost, and the 'Furniture Market'

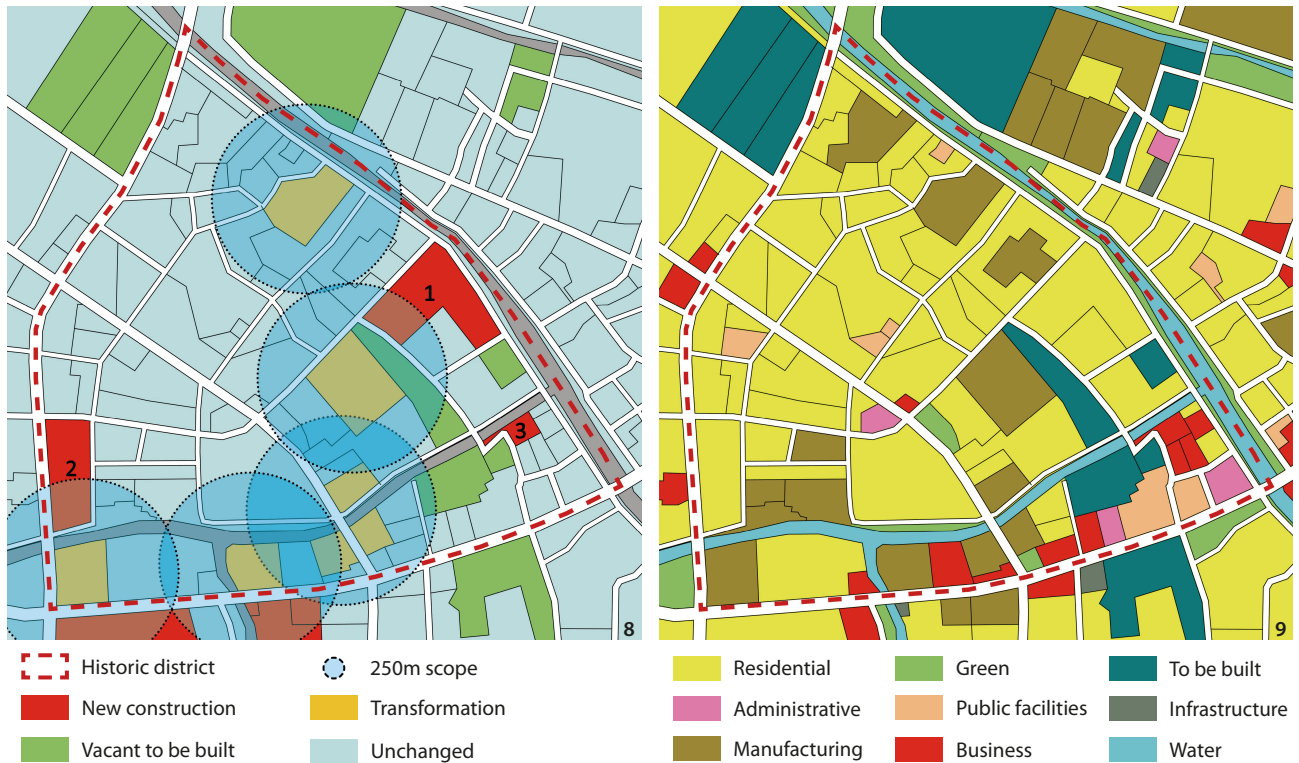


Figure 8 New, transformation and land to be built in Sanbao Street District (2009–2018) (Source: the author).

Figure 9 Current land use situation in Sanbao Street District (2018. 08) (Source: the author).

(originally the ‘Aquatic Warehouse’) westernmost. Each project is an isolated enclave more than 500 m by foot from a neighbouring project (Interview 8). Second, the transformation projects have very different industrial foci, one being a cultural tourism centre, one a design and office centre, one a museum, one an education and training centre, one a furniture market, and one a commercial centre. The lack of a dominant industry is important. Third, the transformation projects are only weakly connected to the surrounding urban areas. Only five or six old buildings on Sanbao Street adjacent to ‘Canal No. 5’ have been transformed into coffee shops, floral arts shops, and specialist catering shops. Shops opposite the ‘Five Star Wisdom Park’ (originally the ‘Synthetic Fiber Factory’) are being renovated, but no changes around other projects have occurred in recent years. Finally, the mean rent for the transformed projects was less than 1 CNY/(m² d) in 2018, and had increased little since 2009. The rent in 2018 was approximately 30% lower than rent in surrounding areas (Interview 7).

Although there are few new and transformed projects in Sanbao Street Historic District, we still needed to determine whether there was a connection between the emergence of new projects and transformation of industrial heritage sites. First, the successful transformation of ‘Canal

No. 5’ and the ‘Comb Factory Museum’ demonstrated the positive effects of industrial heritage transformation projects. These two cases, which did not receive explicit policy support, involved large infrastructure investments and urban design improvements, and had a combined turnover of 63 million CNY per year and attracted more than 500,000 tourists through their market-oriented operating plans, using only small amounts of government subsidies (Changzhou Local Chronicles Bureau 2016). This established confidence for the transformation of other industrial heritage sites, and the concept of culture-oriented industrial heritage reuse was recognised by the government and commercial enterprises (otherwise the industrial heritage sites may have been dismantled long ago) (Interviews 1 and 6). The cultural enrichment and diversification promoted by the cultural industry only slowly improved the old and decaying streets, improved the district vitality, and increased order in the district. Therefore, there was only a limited relationship between the transformation projects and district improvements (Interview 3). The transformed projects did not affect new projects. The large new residential communities that were established had been built on land acquired as early as 2006, and construction started in 2008. Moreover, ‘Canal No. 5’ was transformed in 2008. The highway bridge and new office



Figure 10 Synthetic Fiber Factory after renovation (now Five Star Wisdom Park) (Source: the author).

Figure 11 Shantytowns directly opposite Five Star Wisdom Park (Source: the author).

buildings were constructed because of the overall urban and development plan (Interview 8). These construction activities would undoubtedly have occurred even without the industrial heritage transformation projects.

Development Trends in the District

It is clear that industrial heritage transformation projects in Sanbao Street Historic District did not have marked urban catalytic effects. Commercial enterprises lacked motivation to undertake transformations. The market did not accept the 'Development and Reform Commission Creative District Plan' or the 'Planning Institute Cultural & Creative Industry Cluster' (Zhang, Xu and Hao 2015). In fact, most industrial heritage sites were transformed into offices and catering and entertainment venues, which are aimed at quickly obtaining rental returns for the owners. These projects provide some opportunities for consumption, but are disconnected from the surrounding communities. High-end offices and consumption facilities in the project area contrast sharply with poverty in the urban villages, which are separated from the projects by walls (Figures 10, Figure 11). As property owners, state-owned enterprises tend to keep industrial heritage sites unchanged to provide long-term stable rents, and tend to avoid periods without rents when properties are renovated (Interview 1). This decreases the possibility of further transformations of industrial heritage sites occurring. Most industrial buildings have been poorly maintained for years, have high energy consumptions and decreased structural capacities, and are in danger of being damaged through water leaks (Interview 5).

There has been a lack of overall planning focused on protecting and reusing industrial heritage sites in the historic district. No clear conclusion has been drawn about whether cultural industries or real estate should be developed, and the government has no systematic policy for supporting the transformation of industrial heritage sites. In fact, the area of residential and commercial land to be developed is much larger than the area of industrial land in the district. It is difficult to envisage, in the short term, a dominant industrial chain emerging (Interview 1). Faced with this great uncertainty, it is difficult for investors to become motivated to transform industrial heritage sites.

It should be noted that industrial heritage sites in the study district are threatened with demolition. First, the Sanbao Street Historic District is not included in the scope of the Changzhou Famous Historical and Cultural Cities, and is therefore not protected through that plan (although the plan is not legally binding anyway). Second, most of the industrial heritage sites mentioned above are classed as state-owned industrial land¹⁰, so the property rights are relatively simple and clear. Local governments are bound to prioritise commercial development of such land when finances dictate, and this has been the case since 2016 (Interview 6). According to the 'Changzhou Urban Master Plan for 2011 to 2020', the area near Sanbao Street is mainly designated for high-intensity residential use, with occasional or small amounts of commercial use and green space. Current urban development standards make it inevitable that industrial heritage sites that cannot meet fire prevention and daylight standards will be demolished before the land is redeveloped. Sanbao Street Historic District has played an insignificant role in urban development in Changzhou,

and the government and planning officials will allow the industrial heritage sites to disappear (Interviews 4 and 6).

Failure of the Catalytic Effect Because of Industrial Heritage Being Insufficiently Valued

The transformed industrial heritage sites in Sanbao Street Historic District had limited catalytic effects. The transformed sites encouraged enthusiasm for reusing existing industrial buildings to a certain extent but did not increase the willingness of developers to invest in adjacent plots or cause active cultural neighbourhoods to develop. The projects were focused more on themselves than the surrounding environments, and most transformed industrial heritage sites in China have followed the same pattern (Chen and Hu 2013; Zhang, Xu and Hao 2015). State-owned industries and land control markedly restrict the transformation of industrial heritage sites, but these institutional challenges are similar in almost all Chinese cities. Considerable numbers of successful industrial heritage transformation projects in Shanghai, Wuxi, and elsewhere indicate that transformed industrial heritage sites can have catalytic effects. This was clearly not the case in Changzhou. We believe the root cause of this lies in a failure to fully exploit the value of the industrial heritage, particularly the connotative value, and this can be divided into three parts: (1) there was no conversion mechanism for industrial heritage value, meaning economic value was pursued excessively; (2) records of industrial heritage value have been lost and therefore not communicated to the public and stakeholders, leading to ambiguity in the regional identification of value in the project; and (3) the local cultural industry is too small to occupy most of the transformed space and therefore could not 'spill over' into neighbouring areas. These factors prevented transforming industrial heritage sites from producing marked urban catalytic effects.

Lack of a Mechanism to Convert between Connotative Value and Reuse Value of an Industrial Heritage Site

The connotative value and reuse value of an industrial heritage site are often contradictory aspects of a value assessment. The former focuses on cultural values, including aesthetic, historical, social, spiritual, and symbolic factors, whereas the latter includes direct-use value, non-use value, and external value (i.e., catalytic effects) (Yu, Aoki and Xu 2017). During regeneration, maximising the external value may be restrained by cultural values,

such as a 'relics orientation' of the heritage site because of protection by statute. However, cultural capital can also be converted into economic capital by forming a historic district with associated economic and social activities. There is, however, no mechanism for converting between connotative value and reuse value, and no possibility of increasing the catalytic effect in the Sanbao Street Historic District. There is no conversion mechanism because of a lack of legal recognition of the industrial heritage sites, meaning society is suspicious of its reuse and have contempt for its connotative value, which will clearly affect attitudes during a transformation project. For example, the renovated 'Synthetic Fibre Factory' had many bars, colours, windows, and air-conditioning equipment added and non-architectural elements removed, erasing the original features of the industrial heritage site. The loss of connotative value directly leads to a decrease in the particularity of an industrial heritage site and makes the site less attractive to the creative class, and this markedly decreases the catalytic effect. Ambiguous land-use policy makes the market more inclined to pursue short-term reuse value rather than long-term connotative value. The six transformed industrial heritage sites in Sanbao Street still have the characteristics of industrial land and have been leased to enterprises for development or use for only 10–20 years, which is a de facto 'informal regeneration' system (An 2012). A quick return can be achieved by development and operating companies using short-cycle, low-input, and high-return operating models (Interview 8), whereas the long-term goals of developing the surrounding urban area and maintaining industrial heritage connotative value have not been taken into consideration. Finally, there are insufficient channels for communicating the connotative value of industrial heritage. Only the 'Fifth Woolen Mill' is a well-known heritage site in Changzhou, although there are nine local industrial heritage sites (Interview 4). The 'Comb Factory Museum', the 'Five Star Wisdom Park', and the 'No. 1 Rice Dock' have tended to communicate their new functions rather than the connotative meanings of the industrial heritage sites. Industrial heritage has not become an urban brand, and the precious architecture, production models, technological achievements, social events, and people related to industrial heritage sites have not been focused on. The former director of the 'Fifth Woolen Mill' said (in Interview 5) 'I have been working here for more than 40 years, and I can tell the full story of the factory, its rise and fall, and even the grass and trees. But except me, no one knows or is interested in these, I might be the last person familiar with the history of this factory.'

Records of Industrial Heritage Value Being Lost and Not Communicated

The value of industrial heritage lies not only in its protection and reuse but also in effectively recording and communicating its history to help establish a historic district centred on local industrial culture and to expand the influence of the district in the region. Part of the record of the lives of ordinary people exists in industrial heritage, not only in archives but also in human memory and customs (TICCIH 2003). Industrial heritage is therefore an irreplaceable record of and medium for communicating about the lives of working class people, and it is vital to maintain the continuity of industrial heritage values and strengthen social identification and sense of uniqueness. The loss of records of the lives of working class people and the ability to disseminate industrial heritage values is a serious threat in Sanbao Street Historic District. This is firstly because of dilution by immigrants. About 30,000 people live in old housing in Sanbao Street (Interview 4). These are long-term local residents and migrant workers, but the proportion of migrant workers has been increasing in recent years. The new residents are mostly young, poorly educated, and highly mobile (Wang, Li and Ning 2012), and most do not work in local factories. They therefore do not understand or care about local industrial heritage and are not likely to be able to record and disseminate industrial history. Secondly, local working class people still living in the area are now aging, and the mean age is above 60 years (Interview 5). The children of these working class people have tended to move to new areas with better living conditions. The gradual loss of this major source of historical record and dissemination means the true connotative value of industrial heritage will become increasingly difficult to record. Finally, the frequency residents interact with industrial heritage has decreased rapidly. This is because high factory walls segregate industrial heritage from the wider city, and because once a factory has lost its production function it no longer needs local working class people and instead serves middle class people and tourists. Such visitors do not have a deep relationship with the local area and are unlikely to record and disseminate the connotative value of industrial heritage. However, the high costs of relocation mean the complicated *danwei* structure between residents and factories may have triggered large-scale conflict, making it difficult to integrate industrial heritage with the surrounding residential areas (Interview 1). Therefore, along with the background decrease in the working class population, new residents may be indifferent to the industrial heritage value, and the segregation of industrial

heritage sites and residents may weaken the recording and dissemination of the connotative value of industrial heritage. This will have seriously weakened the catalytic effect.

Cultural Industry Scale Does Not Match the Transformed Industrial Heritage Site Scale

A close relationship between the cultural industry, the creative class, and transformed industrial heritage sites is expected, but the three are not necessary and sufficient conditions for each other. In fact, the transformation of industrial heritage is often preceded by the establishment of cultural industries and a creative class because the market drives many industrial heritage sites into becoming ordinary office spaces. This has led to a paradox in that transformed industrial heritage sites do not necessarily serve the cultural industry and creative class. This is particularly the case in Sanbao Street Historic District. The first reason for this is the limited scale of the local cultural industry. Changzhou lacks large cultural and creative enterprises and research institutes, and the value added by industrial activities is much smaller in Changzhou than in megacities. The small cultural industry is mainly concentrated in one creative industrial cluster in the north of Changzhou but not in Sanbao Street (Interview 8). The transformation of industrial heritage sites has lacked large-scale capital investment and diverse sources of finance, causing the sites to be dominated by restaurants, apartments, and offices that offer fast returns to allow the sites to continue operating. This has caused further decreases in cultural industrial activities in the district. The second reason is the lack of a cultural industry labour force. A few particularly talented cultural workers in Changzhou have preferred to seek jobs in megacities such as Shanghai or in local large cultural companies such as Changzhou Dinosaur Park (Interview 7). The transformed industrial heritage sites in Sanbao Street have therefore lost scientific and technological research capabilities because of insufficient talented people being available. The poorer cultural education of local residents prevents them adapting to creative jobs simply by being trained, so it is not possible to form a large labour force. The capacity for the consumption of cultural products is also limited. Local residents have low incomes and cannot afford to consume cultural products. Furthermore, a lack of public transport (e.g., bus rapid transit) mean insufficient tourists are attracted to the district to support a large cultural industry. This is clearly indicated by there being five times more visitors to 'South Avenue' than 'Canal No. 5' (both are leisure tourism destinations in Changzhou) in 2016 (Changzhou

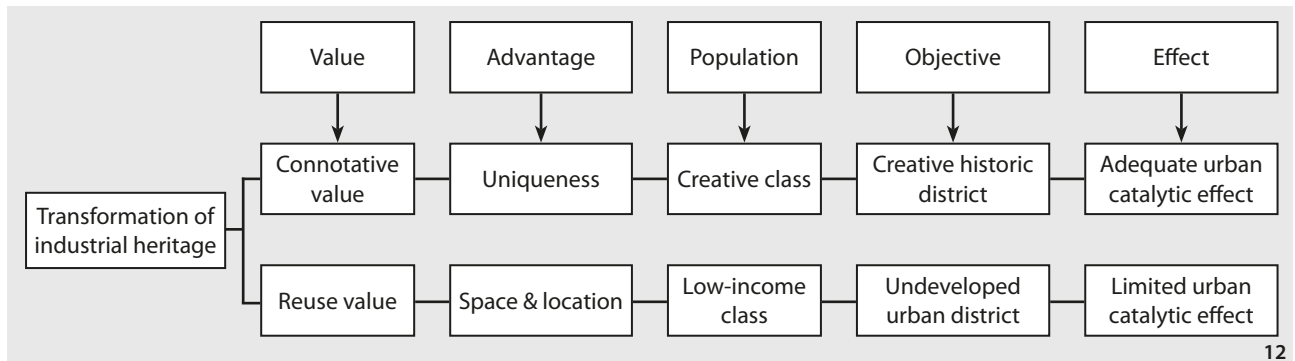


Figure 12 Two diverse routes of transformation of industrial heritage (Source: the author).

Local Chronicles Bureau 2016). In fact, except for ‘Canal No. 5’ and the ‘Comb Factory Museum’, the transformation projects were primarily aimed at earning rental income for industrial and commercial space (Interview 8). This meant the industrial heritage value was used for only limited cultural industries, and the cultural industry chain was fragmentary, meaning there was no ability to spill over into the local area. The development of a cultural industry in Changzhou has been led by the government but lacks top-down policy support, and this is also an important reason for the Sanbao Street Historic District having a poor catalytic effect.

Conclusions

Transforming industrial heritage is expected by policy-makers and planners to catalyse physical environment improvements, introduce middle class people to an area, and encourage the cultural industry to help revitalise decayed industrial districts with good locations but outdated facilities. However, the catalytic effect did not apply to transformed industrial heritage in Sanbao Street Historic District in Changzhou, proving that not all industrial heritage transformation projects can be urban catalysts. We could not deny the considerable economic, social, and exemplary benefits of the developments in the Sanbao Street Historic District, but the weak contribution to promoting overall revitalisation of the surrounding neighbourhoods was still worth exploring. The mechanism through which the urban catalytic effect could occur through transforming industrial heritage sites was analysed, and deficiencies in existing models were assessed. The results will have theoretical and practical value. Accessibility, function, and gentrification may affect the catalytic effect. However, Sanbao Street Historic District, an area with lots of industrial heritage sites, has clearly developed more slowly than surrounding non-industrial districts. This was used to determine

the negative impacts of industrial heritage on the catalytic effect using the model discussed here. We believe that the connotative value of industrial heritage plays a decisive role in the catalytic effect achieved (Figure 12). The lack of appreciation of connotative value in the Sanbao Street Historic District hindered the catalytic effect being achieved.

The lack of connotative value could be attributed to objective constraints of the local economic and social structures, including the fragility of the cultural industry, the evolution of social organisations, and the limited understanding of the entire society of the value of industrial heritage. These need to be improved, but this will be a long process. However, lack of connotative value would also have been affected by subjective factors such as the informality of the industrial heritage transformation, embodied in the ‘three invariants’¹¹. First, property rights remained unchanged. The primary responsibility of a state-owned enterprise is to ensure the integrity of state-owned assets (Interview 1), so such enterprises lack motivation and courage to explore industrial heritage value. Passionate cultural departments, social organisations, and individuals cannot obtain ownership and related documents for industrial heritage sites, so are unable to comprehensively research the connotative values of such sites. Second, the nature of land use remained unchanged. Industrial heritage is attached to industrial land. Under current land policy, transformed sites can only be leased, causing enterprises controlling the sites to pursue short-term rental returns. The cultural capital derived from the connotative value takes a long time to be converted into economic capital. Finally, the shapes of the buildings remained unchanged. Built heritage has ‘limited scarcity’ and needs the connotative value provided by industrial heritage to be communicated by comparing the old with the new. This inevitably leads to static protection ‘in formalin’ without new constructions or reforms, and this can obscure the connotative value of industrial heritage.

We believe that advocating a formal transformation strategy in relation to the prosperity of the cultural industry and activities as an engine for the revitalisation of historic industrial districts (Evans 2009) will help highlight the connotative value of industrial heritage, balance the relationship between connotative value and reuse value, and effectively improve the catalytic effect of industrial heritage on urban regeneration. The first strategy is to formulate a multi-participation mechanism for protecting, managing, and reusing industrial heritage sites. Diversifying property and usage rights will allow more subjects (including social organisations, academics, cultural departments, and local workers committed to exploring the connotative value of industrial heritage) to have stronger voices during regeneration projects. The second strategy is to establish a long-term mechanism for protecting and reusing industrial heritage, to combine industrial heritage and cultural industry policies, and to encourage conditional real estate development. Financial policies such as special loans, tax credits, and easement protection for heritage transformation can allow the connotative value of industrial heritage to be gradually, stably, and safely highlighted. This last strategy will create a more diverse environment for the transformation and design of industrial heritage, break through current planning and management regulations, and give full freedom to the creative thinking of designers. This will allow the connotative value of industrial heritage to be highlighted in combined designs of old and new objects. Achieving the above goals will require changes in current thinking about traditional industrial heritage protection and reuse and our attention to be changed from the reuse value to the connotative value. Systematic strategies for transforming industrial heritage sites should therefore be established, and these should play vital and essential roles in urban regeneration schemes to guide industrial heritage transformation in large and medium cities such as Changzhou.

Interviews

- Interview 1: Enterprise executive 'W' of the Industrial Investment Group Co., Ltd., 20160817
- Interview 2: Enterprise executive 'T' of 'Canal No. 5', 20160817
- Interview 3: Enterprise executive 'J' of the 'Comb Factory', 20160818
- Interview 4: Local Historic and Cultural Scholar 'L' of Changzhou, 20160818
- Interview 5: Former director 'W' of the 5th Woolen Mill, 20160818

- Interview 6: Responsible official 'L' of the Planning Bureau of Changzhou, 20180518
- Interview 7: Enterprise executive 'W' of 'Canal No. 5', 20180831
- Interview 8: Enterprise executive 'S' of the 'Five Star Wisdom Park', 20180904

Notes

1. The Oxford dictionary definition of the term catalyst is 'a substance that increases the rate of a chemical reaction without itself undergoing any permanent chemical change'. <https://en.oxforddictionaries.com/definition/catalyst>
2. The earliest wooden comb found in Changzhou was made during the late Eastern Jin Dynasty (420 AD). According to research into the history of traditional crafts, comb-making in Changzhou began in the Jin Dynasty (260–420 AD).
3. Silkworm cocoons, Menghe crepe, and combs were exhibited at the Panama Pacific World Expo in San Francisco in 1915 and the Philadelphia International Expo in 1926.
4. An industrial district with manufacturing sites as spatial centres and the necessary residential, retail, medical, educational, administrative, and other functions of a complete city surrounding each manufacturing site.
5. Developing township enterprises to promote industrialisation and urbanisation in southern Jiangsu Province.
6. Encouraging manufacturing industries to move out of inner cities and service industries to develop in inner cities.
7. A combination of eco-consciousness, historic preservation, and high-tech domesticity.
8. 250 m is the minimum range that could include all properties adjacent to the selected industrial heritage sites.
9. Schools that only enroll the children of the employees of specific factories.
10. Industrial land freely provided by the state to government, public institutions, and state-owned enterprises.
11. The property rights are unchanged, the nature of the land is unchanged, and the shape of the building remains unchanged.

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