Department of Architecture and Built Environment

Faculty of Engineering

Contextual Sensitivity Analysis for Urban Industrial Heritage Quarter Regeneration:

Taking Shanghai as a Case Study

Thesis submitted to the University of Nottingham

for the degree of Doctor of Philosophy

November 2024

Simiao Li

Student ID: 20109965

BArch, MArch

Supervisor: Professor Tim Heath

Abstract

Urban industrial heritage regeneration projects have become increasingly popular in recent years as a means of preserving and repurposing historic industrial buildings and sites for modern use. It is different from other types of industrial heritage regeneration because of its unique connection to the city. Industrial sites located in urban areas are often closely linked to the social, cultural, and economic history of the city, and their regeneration can have a significant impact on the urban fabric and the community. Current research about urban industrial heritage regeneration usually involves a qualitative study about the overall design of the regeneration, which overlooks and downplays these contextual factors about the city, leading to generic and one-size-fits-all solutions that are vague, ambiguous, and less effective for other cases.

A more comprehensive and detailed analysis of urban industrial heritage regeneration with a focus on its contextual connections with the city is needed. Hence, the target of this thesis is to develop a systematic mixed-methods approach that combines both quantitative and qualitative analysis. This research will study the relationship between context and value of urban industrial heritage quarters based on 37 indicators covering the social, cultural, economic, and environmental factors that shape the regeneration of industrial heritage sites.

Firstly, according to the study of industrial heritage, this thesis defined urban industrial heritage quarters as the research subject and developed the value evaluation system to understand the significance of such special urban spaces. Then, a contextually sensitive urban regeneration concept is proposed based on the research of context focuses raised in the field of architecture and urban studies.

Secondly, an analysis process of Contextually Sensitive Analysis (CSA) is developed to understand the relationship between urban context and value variation of urban industrial heritage quarters. By identifying the context factors of an industrial urban environment, the factors have been subdivided into 37 indicators which represent the variation of a specific aspect of factors during the process of urban regeneration.

Thirdly, this study chose Shanghai as the case city and selected 14 samples of heritage quarters. Through data collection and data analysis, a Polynomial Regression model is used to study the relationship between the variation of indicators and values. Finally, the indicators-based model outcomes are analysed in order to illustrate the impact trend of each indicator to values and compare the trend across different indicators for a specific value. In this research, the assessment and value of the urban industrial heritage regeneration projects are collected through a questionnaire survey. Regression models will be operated and analysed in OriginPro 2022.

The final outcome of the analysis will be shown in a series of impact trend diagrams, including both individual indicators and integrated indicator patterns. These individual diagrams illustrate how an indicator's variation influences a specific value's variation. The integrated diagrams illustrate the difference in contribution between different indicators to a specific value or how the variation of one indicator influences all values of the heritage quarter. This analysis will provide a reference during the decision-making process, considering how to be sensitive to the resource input on different indicators to achieve optimal performance and adapt the context indicators when a value target is set.

Key words: Urban industrial heritage quarter, Urban regeneration, Industrial heritage value, Contextual sensitivity, Mixed-method research

Acknowledgement

Without the support of numerous individuals, this thesis would not have come to fruition. First, I would like to extend my heartfelt appreciation to Professor Tim Heath, my research supervisor, for his erudition, which has inspired me a lot and helped me broaden my academic thinking. His conscientiousness, responsibility and invaluable support for my research activities, have assisted me to pursue excellence in my work. I am indebted to Tim for providing invaluable guidance throughout my academic path.

I want to say ‘thank you’ sincerely to my late teacher Wang Qi. His sincerity, dedication, and friendliness have always influenced me, and I will miss him forever.

I would also like to thank my parents for their unwavering love, support, and encouragement throughout my study abroad. They truly made my life comfortable and my research smooth, so I can focus on studying with peace of mind and spend the last part of student life carefree.

Kiss to my boyfriend for the time of chatting, playing, discussing, laughing, crying and accompanying me to so many cities in China for my on-site research. Especially when you surmount difficulties and came to me in the last few months.

I am also grateful to my friends ChengQi, Xinyu and Yunlu. You accompany has always been the colour of my life in UK, and I am never lonely with you guys.

Special thanks to the baby geese, bunny, and squirrel in the campus, you are the little elves in my life and make me happy every day.

Finally, thanks to all that have engaged in my research journey.

Motivation

As an architecture PhD student, my personal interest in urban industrial heritage regeneration is rooted in my past experiences and study. Growing up in a post-industrial city Harbin in Northeastern China, I witnessed firsthand the transformation of former industrial areas into derelict wastelands.

However, I also saw the potential for regeneration and transformation, as these areas were gradually repurposed for new uses, such as cultural institutions, creative spaces, and mixed-use developments. These experiences led me to develop a strong interest in the potential of urban industrial heritage sites as catalysts for urban regeneration and sustainable development. As I pursued my academic studies in architecture, I became increasingly interested in the complex interplay between physical structures, social dynamics, and economic factors that shape the regeneration of urban industrial heritage sites.

My research journey has been driven by a desire to explore the intersection of architecture, urban planning, and community development in the context of urban industrial heritage regeneration. I am interested in understanding how architects and planners can work with local communities to create sustainable and inclusive regeneration strategies that respect the unique cultural and social heritage of these sites.

My original intention in pursuing this research is to contribute to a growing body of knowledge on urban industrial heritage regeneration, and to explore innovative and contextually sensitive approaches to sustainable development. I believe that my background in architecture, combined with a passion for community development, provides me with a unique perspective and skill set that can help to inform future research and practice in this field.

Contents

Abstract ..... *i*

Acknowledgement ..... *iii*

Motivation ..... *iv*

Contents ..... *v*

List of Figures ..... *ix*

List of Tables ..... *xvii*

Chapter 1. Introduction *1*

1.1 Research Background **1**

1.2 Research Gap **3**

1.3 Research Aims and Objectives **8**

1.4 Structure of the Thesis **10**

Chapter 2. Industrial Heritage Quarters in the City *14*

2.1 Defining Industrial Heritage **15**

2.1.1 Industrial Culture and Industrial Civilisation 15

2.1.2 From Industrial Archaeology to Industrial Heritage Study 17

2.1.3 Definition of Industrial Heritage 23

2.2 Value of Industrial Heritage **26**

2.2.1 Value of Industrial Heritage 26

2.2.2 Industrial Heritage Evaluation 34

a) Historical Value 38

b) Scientific and Technological Value 39

c) Socio-cultural Value 40

d) Aesthetic Value 42

e) Economic Value 43

f) Natural Value 45

2.3 Urban Industrial Heritage Quarters **45**

2.3.1 Scope of Urban Industrial Heritage Quarters 46

a) Industrial type 48

b) Spatial layout 49

c) Location 52

d) Current function 54
e) Social relationship 54
2.3.2 Regeneration of Urban Industrial Heritage Quarters 55
a) Methods of regeneration 56
b) Heritage regeneration and value variation 57
2.4 Conclusion 60
Chapter 3. Contextual Sensitivity in Urban Studies 61
3.1 Understanding Context in the Field of Urban Studies 62
3.1.1 Definition of Context 62
Linguistic Definition of Context 62
'Context' in Architecture and Urban Studies 63
'Setting' and 'Context' 64
3.1.2 Evolution of Contextual Thinking in Architecture and Urban Design 65
3.2 Contextual Sensitivity in Urban Design 68
3.2.1 Contextual Sensitivity 68
3.2.2 Context Sensitive Solution (CSS) 71
Definition of CSS 72
Benefits of CSS 73
Application of CSS 74
3.2.3 Context-sensitive Analysis 75
3.3 Contextually Sensitive Urban Regeneration 77
3.4 Conclusion 79
Chapter 4. Research Methodology 80
4.1 Methodology Study – Mixed-method Research 81
4.1.1 Limitation of Current Urban Heritage Studies 81
4.1.2 Mixed-method Research in Urban Studies 82
4.1.3 Research Design 84
4.2 Case Study and Sample Selection 88
4.2.1 Selecting the Case City 88
4.2.2 Selecting the Samples 89
4.3 Data Collection Methods 89
4.3.1 Questionnaire 89
Data form 90
Participants 91
Number of participants 93
4.3.2 Document Analysis 99
4.4 Data Analysis Techniques 100

4.5 Conclusion **104**

Chapter 5. Contextual Sensitivity Analysis (CSA) for Urban Industrial Heritage Quarter Regeneration *105*

5.1 Context Factors for Urban Industrial Heritage Quarters **105**

5.1.1 Context Factors Classification 106

5.1.2 Context Factors for Urban Industrial Heritage Quarters 110

F1. Landform 110

F2. Greenery and open spaces 111

F3. Waterbody 112

F4. Climate and natural resource 113

F5. Pollution 113

F6. Biology 114

F7. Fabric 115

F8. Function 116

F9. Location 118

F10. Infrastructure 118

F11. Heritage and Tradition 119

F12. Regulation 120

F13. Social Life 121

F14. Economic Efficiency 121

F15. Investment 121

F16. Employment Status 122

5.2 Contextually Sensitive Regeneration Indicators **122**

F1. Landform indicators 123

F2. Greenery and open spaces indicators 125

F3. Waterbody indicators 127

F4. Climate and natural resource indicators 128

F5. Pollution indicators 129

F6. Biology indicators 130

F7. Fabric indicators 131

F8. Function indicators 134

F9. Location indicators 137

F10. Infrastructure indicators 137

F11. Heritage and tradition indicators 139

F12. Regulation indicators 142

F13. Social life indicators 143

F14. Economic efficiency indicators 143

F15. Investment indicators 144

F16. Employment indicators 145

5.4 Conclusion **147**

Chapter 6. Case Study - Shanghai 148

6.1 Shanghai as A Case Study 148

6.1.1 Industrial History of the Shanghai 148

6.1.2 The Significance of Shanghai's Industry in China 152

6.1.3 Industrial Development and Urban Development 157

6.1.4 Industrial Heritage Designation 162

6.1.5 The Reason of Taking Shanghai as Case Study 164

6.2 Sample Urban Industrial Heritage Quarters 167

6.2.1 Industrial Heritage in Shanghai 167

6.2.2 Urban Industrial Heritage Samples 176

6.2.3 Brief Introduction of Samples 181

6.2.3 Conclusion 191

Chapter 7. Data Collection and Data Analysis 192

7.1 Data Collection 192

7.1.1 Value Score Data 192

7.1.2 Indicator Data 194

7.2 Data Analysis 214

7.2.1 Independent Relationship Analysis 214

7.2.2 Comparative Analysis 220

7.3 Conclusion 226

Chapter 8. Conclusion 227

8.1 Conclusion 227

8.2 Advantages of the study 230

8.3 Limitations of the Study 233

8.4 Future Research 234

Bibliography 236

Appendices 255

List of Figures

Figure 1. 1 Trends in the number of industrial heritage studies in English and Chinese from 2003-2023 (by author) / Data resource: Google Scholar, NU Search, CNKI 4

Figure 1. 2 Research interests of industrial heritage in English from 2003-2023 / Number of literature, proportion (by author) Data Resource: Google Scholar, NU Search 5

Figure 1. 3 Research interests of industrial heritage in Chinese from 2003-2023 / Number of literature, proportion (by author) Data Resource: Google Scholar, CNKI 5

Figure 1. 4 Trends in the number of evaluations and assessments of urban industrial heritage regeneration study in English and Chinese from 2003-2023 (by author) Resource: Google Scholar, NU Search, CNKI 6

Figure 1. 5 Research interests of evaluations and assessments of urban industrial heritage regeneration study in English and Chinese from 2003-2023 (by author) Resource: Google Scholar, NU Search, CNKI 7

Figure 1. 6 Structure of the Thesis (Drawn by Author) 13

Figure 2. 1 Development of industrial heritage theories from international and Chinese perspectives (by author) / Data resource: Google Scholar, NU Search, CNKI 22

Figure 2. 2 Tianjin Tractor Factory (https://www.archdaily.cn/cn/940439/tian-jin-tuo-la-ji-han-cheng-shi-geng-xin-archiland-zhu-tu-guo-ji Last access 17/11/2024) 50

Figure 2. 3 Tianjin Tractor Factory Buildings (Adapted from google map) 50

Figure 2. 4 Street view of the Jewellery Quarter Birmingham with jewellery manufacturing workshops along streets (Photo by author) 51

Figure 2. 5 Illustrated map of heritage attractions of the Jewellery Quarter (https://tomwoolley.com/jewellery-quarter-illustrated-map/ Last access 17/11/2024) 51

Figure 2. 6 Battersea Powerstation (Photo by author) 51

Figure 2. 7 Masterplan of Battersea Powerstation (Photo by author)..... 51

Figure 2. 8 The old photo of the Birmingham waterways (https://www.birminghammail.co.uk/news/nostalgia/birmingham-canals-old-photos-waterways-6875376 Last access 17/11/2024)..... 52

Figure 2. 9 Old industrial remains along Suzhou Creek, Shanghaim (https://m.thepaper.cn/kuaibao_detail.jsp?contid=2968423&from=kuaibao Last access 17/11/2024)..... 52

Figure 2. 10 Location of King's Cross quarter and the relationship between London's central area (Adapted by author from Google Maps) 53

Figure 2. 11 Location of Shougang Industrial Heritage Park and the relationship between Beijing core and central area (Adapted by author from development masterplan)..... 53

Figure 4. 1 Logic framework diagram (Draw by author)..... 87

Figure 4. 2 Expectation of conference participants (By author) 95

Figure 4. 3 The total year the expert has been working in their profession (By author) 96

Figure 4. 4 Expertise fields of the experts (experts can select multiple fields) (By author) 97

Figure 4. 5 Number of listed projects that a participant has visited (By author)... 97

Figure 4. 6 Number of projects a participant has been involved in both practically and academically (By author)..... 98

Figure 4. 7 The familiarity of experts in the topics of Shanghai industrial heritage and Shanghai urban regeneration (By author) 98

Figure 4. 8 Diagram of the regression model (Akotia and Opoku, 2018) 100

Figure 4. 9 Diagram of correlation coefficiency (Garcia Asuero et al., 2006) ... 103

Figure 4. 10 OriginPro 2022 operation panel (Screenshot by author)..... 103

Figure 5. 1 Coal-drop Yard, King's Cross Quarter, London (Photo by author) .. 110

Figure 5. 2 Yangpu Riverside Green Belt, Shanghai (Photo by author)..... 111

Figure 5. 3 Yangcheng Creative Industry Zone, Guangzhou (Photo by author) 111

Figure 5. 4 Birmingham Old Canal System, UK (Photo by author) 112

Figure 5. 5 Shougang NO.3 Blast Furnace Museum and Lake Xiu (Photo by author) 112

Figure 5. 6 Old picture of industrial pollution of Ruhr industrial district in Germany (https://zhuanlan.zhihu.com/p/36953200 Last access 17/11/2024) 114

Figure 5. 7 Ruhr industrial district after regeneration (https://zhuanlan.zhihu.com/p/36953200 Last access 17/11/2024) 114

Figure 5. 8 Trout migration bio-landscape of Kelham Island, Sheffield (Photo by author) 115

Figure 5. 9 Tianjin tractor factory, China (https://www.archdaily.cn/cn/971988/tian-jin-tian-tuo-han-fang-gai-zao-shen-zhen-hua-hui-she-ji Last access 17/11/2024)..... 116

Figure 5. 10 Jewellery Quarter Birmingham (Photo by author) 116

Figure 5. 11 Street view of Tsingtao Brewery Museum and Factory, China (http://2008.sina.com.cn/other/p/2008-07-31/1157134350.shtml Last access 17/11/2024)..... 117

Figure 5. 12 Beer & Seafood Street near the Tsingtao Brewery Museum (https://www.dailyqd.com/channelzt/2014-08/28/content_117288.htm Last access 17/11/2024)..... 117

Figure 5. 13 Landform change (Diagram adapted by author from https://stackoverflow.com/questions/61779969/r-plotly-show-string-on-contour-plots Last access 17/11/2024)..... 123

Figure 5. 14 Elevation change (Draw by author) 124

Figure 5. 15 Schematic diagram – Selection of surrounding urban quarters (Drawn by author) 133

Figure 5. 16 Schematic diagram – textural calculation of surrounding urban quarters (Drawn by author) 134

Figure 5. 17 Schematic diagram of distribution calculation (Draw by author).... 136

Figure 5. 18 Schematic diagram of distribution calculation (Draw by author).... 136

Figure 6. 1 Industrial history timeline of China and Shanghai from 1840 onwards (Draw by author) 151

Figure 6. 2 Number of Factories Established by national capital from 1840 - 1911 Revolution (By author) Data derived from (Chen, 1961, Chen and Yao, 1957, Quan, 1958) 153

Figure 6. 3 Number of Factories in Operation from 1911 to 1947 in Shanghai and China (Draw by author) Date derived from (Quan, 1958, Du, 2014, Chen and Yao, 1957) 154

Figure 6. 4 Types and quantities of urban industries in China from 1840 – 1949 (incomplete statistics) (Draw by author) Data retrieved from (Chen and Yao, 1957, Chen, 1961, Fan, 1991, Liu et al., 2021, Zhu, 1989) 155

Figure 6. 5 The development of Shanghai and China industrial GDP from 1949 (with math expectation in missing years) (Draw by author) Data retrieved from (Li, 2015, Ma, 2006, Fang, 2018, Li and Shen, 2021, National Bureau of Statistics, 2024, Urban Data Query Platform, 2024, Du, 2014, Chen and Yao, 1957, Chen, 1961) 156

Figure 6. 6 Foreign Settlements Plan of Shanghai in 1919 (Adapted by author from https://www.virtualshanghai.net/Asset/Preview/vcMap_ID-28_No-1.jpeg Last access 17/11/2024) 157

Figure 6. 7 Industrial workforces from 1936-1938 (https://www.virtualshanghai.net/Asset/Preview/vcMap_ID-667_No-1.jpeg Last access 17/11/2024) 158

Figure 6. 8 Docklands in the central area along Huangpu River in 1939 (https://www.virtualshanghai.net/Asset/Preview/vcMap_ID-46_No-1.jpeg Last access 17/11/2024) 159

Figure 6. 9 Industrial distribution in 1992 (https://m.planning.org.cn/zx_news/8095.htm Last access 17/11/2024) 160

Figure 6. 10 Industrial satellite cities (Adapted by author from online map https://m.planning.org.cn/zx_news/8095.htm Last access 17/11/2024) 161

Figure 6. 11 Time span of industrial heritages in China. Different city uses different colour dots to mark the establish time of heritages (Draw by author) 166

Figure 6. 12 Designated industrial heritages of municipality and capital cities in China (Draw by author) 166

Figure 6. 13 Industrial categories of municipality and capital cities in China (Draw by author) 167

Figure 6. 14 Distribution of Shanghai industrial heritages (adapted by author from Google Map) 168

Figure 6. 15 Location of the samples (Draw by author) 177

Figure 6. 16 Scale comparison of the selected samples (Draw by author) 178

Figure 6. 17 Dongjiadu Shipyard in 1853
(https://news.sjtu.edu.cn/mtjj/20190413/100217.html Last access 17/11/2024)..... 181

Figure 6. 18 Ferry Waterfront
(http://www.360doc.com/content/19/1205/20/9570732_877688291.shtml Last access 17/11/2024)..... 181

Figure 6. 19 View inside the building (Photo by author)..... 182

Figure 6. 20 Design of the building
(http://wap.eworldship.com/index.php/eworldship/news/article?id=115727 Last access 17/11/2024) 182

Figure 6. 21 Submarine Museum
(https://jtw.sh.gov.cn/tpxw/20230424/010cc9dd5d7f4425bdf15e63b5071c20.html Last access 17/11/2024) 183

Figure 6. 22 CSSC Pavilio (https://www.kjcxpp.com/HTML/wap/qkgl/1468.shtml Last access 17/11/2024) 183

Figure 6. 23 Old image of Xinhe Factory
(https://www.thepaper.cn/newsDetail_forward_9683234 Last access 17/11/2024)..... 184

Figure 6. 24 Current space inside M50 (Photo by author) 184

Figure 6. 25 Old image of Nanpu Station (https://news.sina.cn/sa/2010-05-22/detail-ikmxzfmk0034247.d.html Last access 17/11/2024)..... 184

Figure 6. 26 Current square of Station 1907
(https://j.eastday.com/p/1701621306035463 Last access 17/11/2024) 184

Figure 6. 27 Old image of the power plant
(https://www.thepaper.cn/newsDetail_forward_4386897 Last access 17/11/2024)..... 185

Figure 6. 28 Heritage Park green path (photo by author) 185

Figure 6. 29 Old image of the factory
(https://www.quzefang.cn/2020/NieJiaPu.htm Last access 17/11/2024).... 186

Figure 6. 30 Bird view of Peninsula 1919
(https://www.shbsq.gov.cn/shbs/bsdt/20231007/372977.html Last access 17/11/2024)..... 186

Figure 6. 31 Current condition of Jingyuan 186

Figure 6. 32 Bird view of the X Tower 186

Figure 6. 33 Historical bird view of the factory district (http://sh.people.com.cn/n2/2023/0128/c134768-40280082.html Last access 17/11/2024)..... 187

Figure 6. 34 Market street within the developed centre (Photo by author)..... 187

Figure 6. 35 Coal Wharf in 2006 (http://www.99ys.com/home/1970/01/01/08/214734.html Last access 17/11/2024)..... 188

Figure 6. 36 Regenerated area in 2015 (https://kknews.cc/zh-sg/culture/rl8y59o.html Last access 17/11/2024)..... 188

Figure 6. 37 Façade of the building (photo by author) 189

Figure 6. 38 Interior of the building (photo by author)..... 189

Figure 6. 39 West Bund Artistic Centre (http://www.deshaus.com/Cn/Index/projectDetail/id/11.html Last access 17/11/2024)..... 189

Figure 6. 40 The Tank Shanghai Art Centre landscape (photo by author)..... 189

Figure 6. 41 Historical image of the granary area (https://m.thepaper.cn/newsDetail_forward_23505366 Last access 17/11/2024)..... 190

Figure 6. 42 Bird view of the silos after regeneration (https://m.jfdaily.com/sgh/detail?id=1256362 Last access 17/11/2024) 190

Figure 6. 43 Square od EVA in the quarter (https://k.sina.cn/article_3916177069_pe96c1ead02700hy4t.html Last access 17/11/2024)..... 191

Figure 6. 44 Bird view of the quarter after regeneration (https://web.shobserver.com/sgh/detail?id=1314327 Last access 17/11/2024)..... 191

Figure 7. 1 Elevation change area of Ferry Waterfront In1 (adapted from google map by author)..... 195

Figure 7. 2 Elevation changes section of Ferry waterfront In2 (adapted from google map by author) 195

Figure 7. 3 Shanghai Yangshupu Power Plant Heritage Park Area (adapted from google map by author) 196

Figure 7. 4 Green space of Shanghai Yangshupu Heritage Park (adapted from google map by author) 196

Figure 7. 5 Power Plant Heritage Park Garden (Photo by author) 196

Figure 7. 6 Green types in Power Plant Heritage Park In4 (Post) (adapted from google map by author) 196

Figure 7. 7 Open space in Power Plant Heritage Park In5 (Post) (adapted from google map by author) 197

Figure 7. 8 Open space types in Power Plant Heritage Park (adapted from google map by author)..... 197

Figure 7. 9 Active waterfront of Shanghai Yangshupu Power Plant (Photo by author) 198

Figure 7. 10 Water active frontage of Shanghai Yangshupu Power Plant (adapted from google map by author) 198

Figure 7. 11 Sun shading facilities of Puxi Expo Area (adapted from google map by author)..... 199

Figure 7. 12 Solar lamps of Puxi Expo Area (adapted from google map by author) 199

Figure 7. 13 Distribution of waste bins and battery recycling point in Station 1907 (adapted from google map by author) 200

Figure 7. 14 Shipyard 1862 openness before regeneration (adapted from google map by author)..... 201

Figure 7. 15 Shipyard 1862 openness after regeneration (adapted from google map by author)..... 201

Figure 7. 16 Original density of M50 Creative Park (adapted from google map by author) 202

Figure 7. 17 Current density of M50 Creative Park (adapted from google map by author) 202

Figure 7. 18 Original fractal condition of Shanghai Yangshupu Power Plant Heritage Park (adapted from google map by author)..... 203

Figure 7. 19 Current fractal condition of Shanghai Yangshupu Power Plant Heritage Park (adapted from google map by author)..... 203

Figure 7. 20 Functional distribution within M50 Creative Park (adapted from google map by author) 204

Figure 7. 21 Functional distribution within Xuhui Riverside (adapted from google map by author)..... 205

Figure 7. 22 Puxi Expo Area stations (Baidu map) 206

Figure 7. 23 Puxi Expo Area bus terminal (Baidu map) 206

Figure 7. 24 Heritage landscape preserved at Yangshupu Power Plant Park (adapted from google map by author) 207

Figure 7. 25 Heritage architecture preserved at Puxi Expo Park (adapted from google map by author) 207

Figure 7. 26 Heritage structure preserved at Cloud Grain (adapted from google map by author)..... 208

Figure 7. 27 Conserved machines at Power Plant Park (adapted from google map by author)..... 208

Figure 7. 28 In17 in original dimension (Generated by author) 220

Figure 7. 29 In17 Normalized [0,1] (Generated by author)..... 220

Figure 7. 30 Integrated impact trend for historical value (By author)..... 221

Figure 7. 31 Integrated impact trend for scientific and technological value (By author) 222

Figure 7. 32 Integrated impact trend for socio-cultural value (By author)..... 222

Figure 7. 33 Integrated impact trend for aesthetic value (By author) 223

Figure 7. 34 Integrated impact trend for economic value (By author) 224

Figure 7. 35 Integrated impact trend for natural value (By author)..... 224

Figure 7. 36 Example of implementation of V6-In3 and V6-In5 from the perspective of construction cost (By author)..... 226

List of Tables

Table 2. 1 Heritage Value Classification in Representative Documents (Summarized by author)..... 29

Table 2. 2 Industrial heritage value classification by TICCIH and the Chinese government (Summarized by author)..... 31

Table 2. 3 Industrial heritage value classification and evaluation by different cities in China /Summarized by author from (Deng et al., 2011, Huang, 2008, Ji and Xu, 2012, Li et al., 2012, Liu and Li, 2008, Liu et al., 2012, BMBEIT, 2009, Qi and Ding, 2008, Tian, 2013, Xu, 2013) 33

Table 2. 4 Industrial heritage value evaluation system (Summarized and refined by author)..... 38

Table 4. 1 Questions design and scores setting of questionnaire (By author) 90

Table 4. 2 Affiliations, number of delivery and collection from the pre-survey stage and evaluation stage (By author) 96

Table 5. 1 Urban context factors categorization based on the representative evaluation system / Summarized by author from (LEED, 2021, LaGro, 2013, Alice, 2012, Højriis et al., 2014, Department for Culture Media & Sport, 2013, Schwartz, 2008, International Rescue Committee, 2017, Woodcraft, 2015, Li and Wu, 2011, Li et al., 2016, Hamedani and Huber, 2012, Cole and Jose Valdebenito, 2013, Abdul et al., 2019, Ameen et al., 2015)..... 109

Table 5. 2 Indicators of urban industrial heritage quarter with units. N refers to number. ¥ refers to money input, which is RMB for Chinese samples. m refers to meter. m2 refers to square meter. f refers to fractal dimension. S refers to spatial dispersion. (By author)..... 147

Table 6. 1 Industrial zones established in Shanghai from 1952 (By author) 160

Table 6. 2 Industrial Satelite Cities established in Shanghai from 1958 (By author) 162

Table 6. 3 Preservation and utilisation status of Shanghai industrial heritages (By author) 169

Table 6. 4 Industrial heritage categories of Shanghai industrial heritages (By author) 170

Table 6. 5 List of industrial heritage in Shanghai (Green colour highlighted are the selected samples) (By author)..... 175

Table 6. 6 Selected samples (By author)..... 177

Table 6. 7 Basic information and key characteristics of samples (By author) ... 180

Table 7. 1 Value variation scores of each sample. Green coloured scores are the highest number of each value, blue coloured scores are the lowest number of each value (By author)..... 193

Table 7. 2 Indicator data. The yellow colour highlights the largest one of the indicator, whose sample is the example to illustrate collection method. (By author) 213

Table 7. 3 Correlation coefficient table: relation between Value and Indicators. Highlighted indicators are the higher coefficient ones that are selected for analysis (By author) 215

Table 7. 4 Impact Trends of Indicators on V1-Historical Value (By author)..... 217

Table 7. 5 Impact Trends of Indicators on V2-Scientific and Technological Value (By author)..... 217

Table 7. 6 Impact Trends of Indicators on V3-Socio-cultural Value (By author) 218

Table 7. 7 Impact Trends of Indicators on V4-Aesthetic Value (By author)..... 218

Table 7. 8 Impact Trends of Indicators on V5-Economic Value (By author)..... 219

Table 7. 9 Impact Trends of Indicators on V6-Natural Value (By author)..... 219

Chapter 1. Introduction

Industrial heritage encompasses the tangible and intangible remains of early production and industrial activities, telling the stories of scientific and technological history and highlighting human ingenuity. Looking into the development of modern cities, the industrial heritage quarters within the urban context can be regarded both as opportunities and obstacles, as it is always challenging to balance urban development and heritage conservation. According to previous research and practices, the regeneration of urban industrial heritage quarters needs a more integrated and comprehensive approach to sensitively respond to the contextual factors during the regeneration process, which promotes the co-achievement of harmonious cohesion between the industrial quarters and existing urban environment while maintains and enhances the value of this unique heritage type.

This chapter will introduce the background of this theme, explaining why this topic is meaningful and prospective. Based on the literature analysis of existing studies, the research gap and research question will be generated, illustrating the importance of engaging mixed-methods research into the urban industrial heritage study. This part will clarify the aims and objectives of this thesis, including the details of how to realize research prospects. The last part will describe the logical structure of how the research is organized and what to expect for each chapter.

1.1 Research Background

Starting in 1950s, many industrial countries experienced significant economic and technological changes, leading to the decline of some traditional industries and their associated supply and distribution chains, such as extractive, processing, manufacturing, etc. (Cassar and Grima, 2013). Such decline was exacerbated by the transformation of industrial structure and rapid urban development over the decades, resulting in a vast number of redundant industrial landscapes, structures and machinery. The term ‘industrial heritage’ emerged at that time with a certain historical awareness.

Industrial heritage refers to the physical remains and cultural legacy of human industry, reflecting the technological, economic, and social changes that have shaped our world. Although industrial heritage seems more commonly associated with the 19th and 20th centuries, it has been present throughout human history *(*Xie, 2015a*)*. Looking into the development of human production activity, the Industrial Revolution served as an unprecedented catalyst for modern prosperity, giving rise to remarkable accomplishments and impressive structures that still influence our lives today. This heritage includes not only factories, mills, and mines, but also infrastructure such as

railways, bridges, and canals that facilitated transportation and commerce (Falser and Yang, 2001). Industrial heritage is a vital aspect of our collective history, reflecting the progress and innovation that have driven human development.

However, many industrial sites and structures have fallen into disrepair or been demolished. This momentum was driven by human ingenuity but seems to inevitably be eventually replaced by new facilities that employ more advanced technology and innovations (Cassar and Grima, 2013). Due to the dynamic and progressing nature of this heritage, it quickly became evident that the surviving evidence of industrial history was increasingly at risk and was often destroyed before it could be preserved or documented. The preservation and interpretation of industrial heritage is therefore an essential task, serving as a means of educating future generations about our industrial past, celebrating human achievement, and promoting sustainable development through adaptive reuse and cultural tourism (Berta et al., 2018).

Fortunately, the significance of industrial heritage has been rehashed these decades, making it an important area of study and practice that involves professionals from a range of fields, including archaeology, architecture, engineering, and heritage management. In contemporary urban studies, industrial heritage sites are increasingly recognized as places of memory, offering opportunities for revitalization and transformation. Rustbelts, brownfields, and former factory areas can be redeveloped into valuable assets, contributing to the creation of new social identities and the promotion of creative industries. Planning practices have begun to focus on the rejuvenation of industrial culture, recognizing that these sites are a testimony to the past and that their multilayered spatiality indicates the potential for a continuous cycle of redevelopment (Xie, 2015a). As such, the preservation and re-interpretation of industrial heritage have become important components of sustainable urban development, promoting cultural tourism, and enhancing the quality of life for local communities.

An industrial heritage, that coexists within urban contexts, usually brings unique challenges to development activities due to their complexity in values. Currently, two dominant approaches can be regarded as heritage-led development which emphasises the cultural values and the tourism potential as an urban attraction, and commercial-led development which focuses on business benefit and economic promotion (Cassar and Grima, 2013). However, the values of industrial heritage are far more abundant than simply cultural and commercial values. As such, the preservation and utilization of these heritage assets during urban regeneration require more comprehensive and sensitive approaches.

Throughout years of industrial heritage research and regeneration practices, people have realized that the most significant concern lies in balancing different values to achieve the most satisfactory outcomes. With the implementation of digital analysis prevailing in many disciplines, the evaluation and assessment of industrial heritage values are gradually undergoing a certain degree of quantitative analysis progress (Rojas-Sola, 2020). Especially for understanding such complicated urban cultural

elements, the attractiveness of applying quantitative methods can provide more intuitive data results out of ponderous text contents. When it comes to practical projects, the utilization of such mixed-method analysis is beneficial in the planning process, indicating the significance of different values and strategies.

These years, mixed-method research has become increasingly popular in architecture and urban studies with considerable attempts in quantifying the value assessment system for industrial heritage. In order to form a more comprehensive understanding of complex urban issues, such research methods can provide integrated and nuanced perspectives of urban context and issues (Gomez et al., 2015). By introducing a framework to synthesise the information on socio-economic, cultural, and environmental factors, researchers are more likely to uncover the relationship between industrial heritage and its embedded urban environment, as well as make a more suitable and feasible revitalization and conservation plan from objective views.

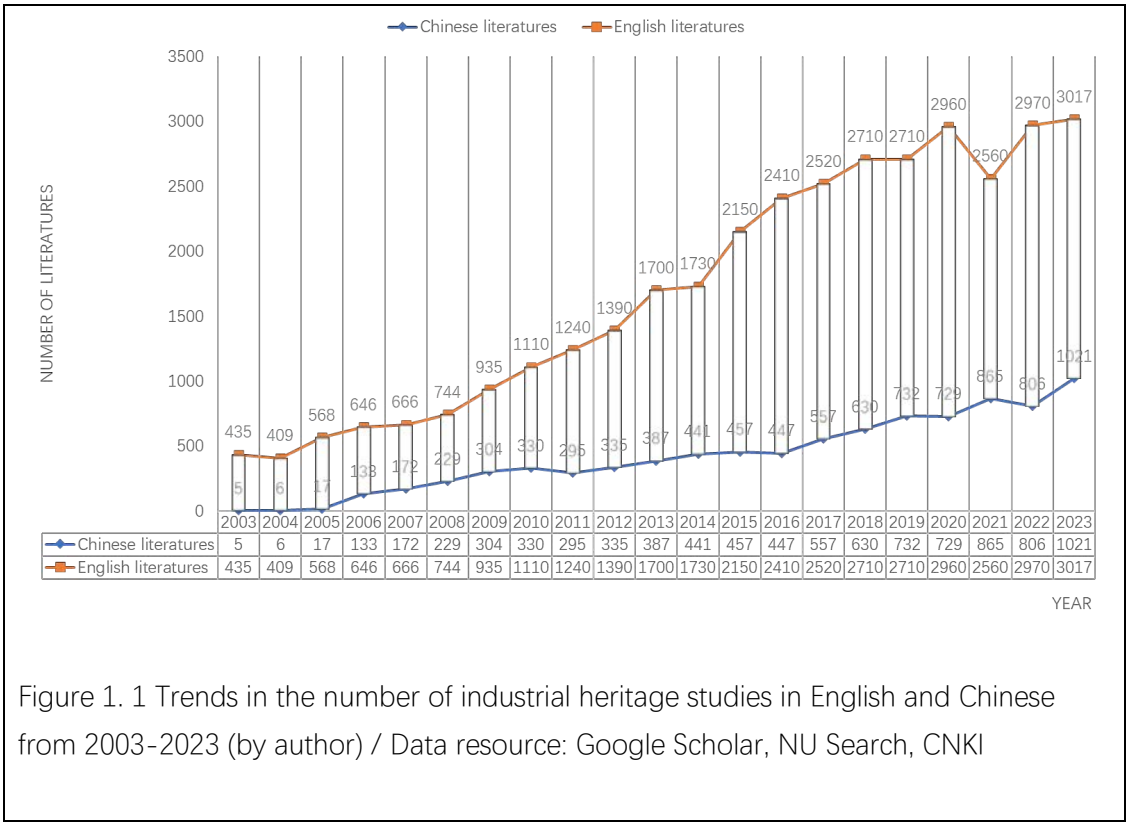
Although the perspectives on how to value industrial heritage have basically become a consensus from the past years of improvement and refinement, specific aspects and significance of the values vary accordingly based on the historical background, sociocultural characteristics and natural environment of the local context. Based on the studies of value assessment, the successful and adaptable conservation and regeneration of urban industrial heritage quarters require a practical and theoretical bridge correlating urban and heritage issues. This thesis is committed to establishing such a bridge, creating a rational and workable framework for such research and design, and focusing on the contextual cohesion between industrial heritage sites and the surrounding urban environment. By showing respect for the urban backdrop and being sensitive to contextual factors, the regeneration is expected to balance the values of industrial heritage under the urban planning scope, achieving communal development and sustainable co-existence.

1.2 Research Gap

Industrial heritage, as an important aspect of our contemporary urban cultural and historical identity, is only cherished recently. The rapid urbanisation of modern cities and the advancement of technology once brought industrial heritage sites great challenges to maintain their vital existence, resulting in neglect, abandonment, and demolition. Although the concept of industrial heritage was brought to the public with the establishment of The International Committee for the Conservation of the Industrial Heritage (TICCIH) in 1973, the most well-accepted definition of industrial heritage and its values were proposed and clarified within The Nizhny Tagil Charter for The Industrial Heritage published in 2003, known as the first official documentation specifically focused on the industrial heritage. Since then, there has been a growing interest in conserving and valuing the significance of urban industrial heritage, catalysing a popular trend of relevant study and research with remarkable outcomes. However, some

research gaps still exist in systematising and detailing the relationship between industrial heritage value and a broader urban context. Due to the constraints of language and time, this thesis only looks into the resources published in English and Chinese during the last two decades to indicate the research gaps in the current industrial heritage study.

There has been a remarkable rise in industrial heritage study during the last twenty years. Based on the existing study focused on industrial archaeology, the UK and European countries led the first wave of in-depth research into the value and preservation of industrial heritage, as well as drafting the relevant policies and carrying out heritage census. Chinese research on this topic appears to have been lagging for several years until the Wuxi Declaration was proposed in 2006, and it also experienced a mild increase onward. (Figure 1. 1)



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Chinese literatures	5	6	17	133	172	229	304	330	295	335	387	441	457	447	557	630	732	729	865	806	1021
English literatures	435	409	568	646	666	744	935	1110	1240	1390	1700	1730	2150	2410	2520	2710	2710	2960	2560	2970	3017

Figure 1. 1 Trends in the number of industrial heritage studies in English and Chinese from 2003-2023 (by author) / Data resource: Google Scholar, NU Search, CNKI

When looking into the details of the industrial heritage topic, research focuses on four leading scopes. The preservation and conservation scope mainly focuses on the cultural and heritage attributes of industrial heritage which maintains and inherits authenticity and integrity synchronically during urban transformation (Oevermann and Mieg, 2015). The scope of industrial heritage tourism refers to a tourist approach to revitalising the industrial tradition through cultural transmission and economic boosting (Xie, 2015b). Industrial heritage is not simply an in-situ legacy as it belongs to a wider range of spatial and temporal contexts. Therefore, industrial heritage tourism also creates connections between different heritages, different cities, and even different

countries, such as industrial heritage trails in the UK and Europe (Besana et al., 2021). Adaptive reuse is a practical scope for exploring the future utilisation of industrial heritage. The advancement of adaptive thinking, compared to traditional reuse, is it is a more effective and sustainable way to adapt to a continuously changing urban development (Clark, 2013), which is gradually becoming an increasingly promising strategy for preserving cultural heritage from both a theoretical and an operational point of view (Plevoets and Van Cleempoel, 2019). The scope of urban regeneration in industrial heritage revitalization is the focus of this thesis. Except for sub-urban industrial landscapes, the redevelopment of industrial heritage within an urban environment is always a topic worth discussing as the interaction between heritage and dynamic context creates a big challenge for harmonious urban development. From the perspective of urban regeneration, heritage landscapes and buildings can be regarded as catalysts and obstacles simultaneously. Research on urban industrial heritage is expected to coordinate the textural, cultural and social contradiction between heritage sites and their urban contexts (Douet and International Committee for the Conservation of the Industrial Heritage, 2012). (Figure 1. 2, Figure 1. 3)

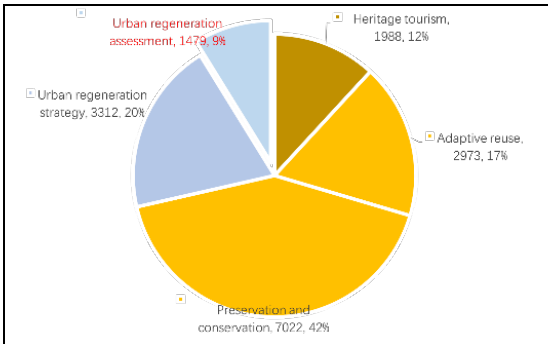


Figure 1. 2 Research interests of industrial heritage in English from 2003-2023 / Number of literature, proportion (by author) Data Resource: Google Scholar, NU Search

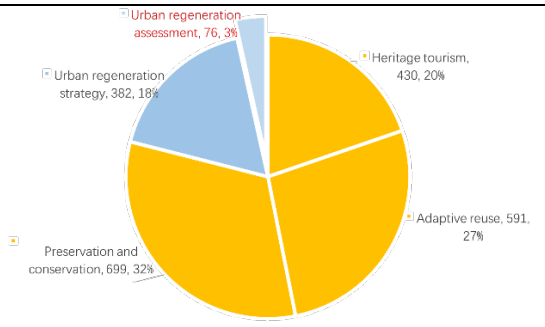


Figure 1. 3 Research interests of industrial heritage in Chinese from 2003-2023 / Number of literature, proportion (by author) Data Resource: Google Scholar, CNKI

With the development in the application of sustainability evaluation and assessment, the research of urban regeneration has attempted to synthesise quantitative analysis with qualitative study, providing a more statistical mix-method approach to understanding urban issues (Figure 1. 4). However, due to the complexity and abstraction of social issues, the cultural and social aspects of sustainability are always more difficult to quantifiability than natural and economic aspects. Such a situation is rather tricky when taking heritage into consideration, as it is more socially complex, more historically unignorable and more culturally identifiable (Loures, 2008).

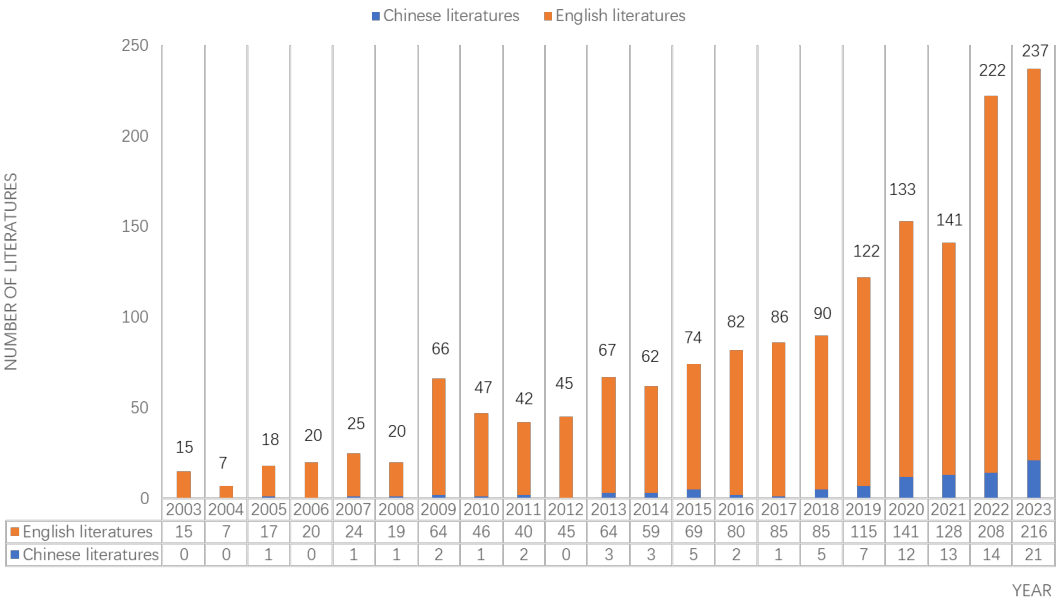


Figure 1. 4 Trends in the number of evaluations and assessments of urban industrial heritage regeneration study in English and Chinese from 2003-2023 (by author) Resource: Google Scholar, NU Search, CNKI

For better conservation of industrial heritage, the primary thing is to clarify the value and the evaluation standard of this heritage kind. This part of the research sets a fundamental theory for understanding the significance of industrial relics and provides a commonly agreed principle to value and preserve relevant cultural elements. When looking into the assessment and evaluation attempts, the most popular topic of industrial heritage study is the achievement of sustainable prospects in regeneration. Following the existing system of sustainability study of BREEAM and LEEDS, major researches focus on the built environment and economic development, which are easily standardised and quantifiable. (Figure 1. 5)

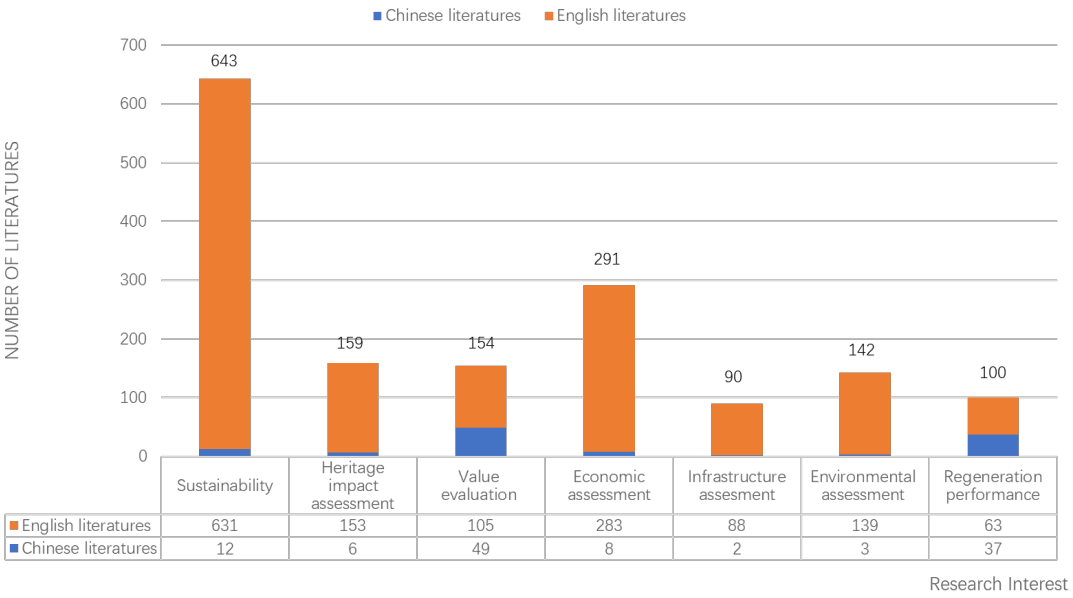


Figure 1. 5 Research interests of evaluations and assessments of urban industrial heritage regeneration study in English and Chinese from 2003-2023 (by author) Resource: Google Scholar, NU Search, CNKI

However, the major research gap is seen as:

> *The lack of a comprehensive and holistic approach that integrates complex and multi-dimensional urban issues with the value of industrial heritage.*

Most of the existing research is either from the perspective of heritage revitalization addressing historical continuity and cultural enhancement *(*Biagini and Arslan, 2018*)*, or from the perspective of urban development highlighting the economic boost or environmental liveability (Zeynep, 2014, Ifko, 2016). Valuable as these approaches, there are rarely consolidated studies linking the dynamic relationship between the changing of contemporary heritage value and transforming urban contexts, highlighting the ways in which heritage and city influence and coordinate with each other to achieve communal development *(*Sun, 2014*)*. Besides, there is also an absence of a more comparative and trans-cultural perspective when studying the regeneration of urban industrial heritage. Despite many specific studies that focus on local and regional industrial heritage characteristics, few studies compare and contrast how the natural, cultural, historical and political backgrounds of different cities or countries influence the practical strategy and actual performance of regeneration approaches.

In terms of urban regeneration, the improvement of the surrounding city environment and the revitalization of industrial heritage sites are never standalone issues.

Throughout years of industrial heritage regeneration practices, we have witnessed many successful and prosperous projects, as well as others that have been carefully preserved but are still gradually declining *(*Ifko, 2016*)*. Especially in China, although existing precedents are inspiring and instructive, they need a more appropriate and adaptable scheme for native issues.

It is time to think about the relationship between the development of urban context and the inheritance of industrial relics. Therefore, the study of urban industrial heritage needs intuitive analysis and comparison with more specific urban indicators and industrial heritage value factors, as well as intake of transnational background information for broader-scaled and evidence-based research. Such comparative studies are expected to provide both statistical and literal insights into the similarities and differences in the regeneration processes, heritage preservation, social relations, and cultural representations of industrial heritage across various contexts.

To summarise, the current research on urban industrial heritage shows a growing trend in mixed-method research respectively on heritage conservation and sustainable regeneration. However, there is lacking an effective and rational bridge to explore the relevance of value evaluation and urban regeneration assessment. This relationship is actually important in revealing the correlations of how urban context influences the continuity and vitalisation of industrial heritage sites and how such sites catalyse the development of the local urban environment.

The harmonious co-development of heritage and city is an important and timely topic that needs an integrated, holistic, comparative, multi-disciplinary, and evidential research perspective. In order to address the research gap discussed above, this thesis attempts to create a feasible and rational mixed-method system for interlinking the values and attributes of industrial heritage with practical and contextual urban factors during the process of regeneration, with the prospect of realising a communal co-existence and co-development between heritage and city. Such analysis is rather beneficial if transnational and transcultural backdrops are taken into consideration, as it is expected to inspire the native government to carry out adaptive and appropriate native plans to appreciate the unique heritage and identifiable living environment.

1.3 Research Aims and Objectives

According to the research gaps indicated earlier, this thesis mainly focuses on the regeneration performance of industrial heritage sites within the urban context. Looking into the precedents of urban industrial heritage regeneration, people can easily notice that the actual performance and regeneration outcomes vary a lot depending on the differences in strategies adopted and the reflections on the surrounding urban environment. Although it is not appropriate to judge the success of a regeneration

project simply from the current status, as regeneration is always a dynamic and ever-progressing process, we can still realize the phenomenon that regenerations being sensitive to the contextual issues seems to work more effectively and appropriately in revitalizing the value of industrial heritage sites *(*Oevermann and Mieg, 2015*)*. Here is the research question:

> *How does the context of the urban environment impact upon the value of industrial heritage sites during the regeneration process?*

From the perspective of this research question, the most important issue that needs to be clarified is how to assess the relationship between the contextual sensitivity of regeneration and the value variation of industrial heritage sites.

> *Fundamentally, this thesis aims to adopt mixed-method research to assess how sensitively industrial heritage site regeneration responds to the urban context that can impact the change of industrial heritage values.*

This analysis will take advantage of quantitative analysis, which is more statistical and demonstrative, to illustrate the relationship between performance and behaviour. In this analysis, performance refers to the value variation of an urban industrial heritage quarter, and behaviour refers to the change of context factors during the regeneration process. With the help of qualitative analysis, this framework may assist in a better understanding of complicated urban issues and their causes. This framework is a multidisciplinary attempt at heritage evaluation research. Although it has limitations due to the difficulty of quantifying context and the insufficient number of samples, it extends the possibility and accuracy of practising a more numeric and scientific industrial heritage regeneration study.

There might be several benefits to conducting this research. The first advantage is to encourage a holistic and robust data system for urban heritage issue analysis. For a better and deeper understanding of urban context, regeneration strategy and industrial heritage value, the mixed-method approach requires comprehensive data collection including different types and forms to ensure the reliability and validity of any further analysis. The second advantage is to establish a rational relationship between abstract elements, which are difficult to be clarified simply by qualitative analysis. For industrial heritage quarters within the urban environment, how people value the regenerated sites relates to massive social, cultural and environmental factors. The application of such a framework can help to reveal the degree of this factor-value influence and figurate the relationships and effectiveness. The third benefit lies in the capability of assisting comparative study and decision-making. While the quantitative analysis provides generalized outcomes, the qualitative information draws the issues into a more specific background. Therefore, a rational and feasible mixed-method framework is more easily adapted for comparative study to reveal the similarities and differences. By comparing the impact across different context factors on different values, the research expected to

identify the top influential or most effective contexts. This combination of context aims to inspire efficient decision-making for future regeneration projects within a similar context background.

In order to achieve the research aim, there needs a series of objectives to help build up the framework in responding to the research question.

1) To understand the meaning and significance of industrial heritage, and clarify the values of urban industrial heritage quarters.

2) To conduct an integrated literature study on the basic theories of contextual sensitivity in urban design and planning, defining what is contextual sensitivity and how to study it for urban regeneration study.

3) To study the detailed context factors for urban industrial heritage quarters from a regeneration perspective, establishing targeted indicators for assessment.

4) To carry out a thorough case city and sample quarters selection, collecting data for the indicators.

5) To process the data and carry out the contextual sensitivity analysis. Analysing the relationship between context indicators and value variation of urban industrial heritage quarters

6) To compare the impact trend between different context indicators on different values. This comparison helps to balance the cooperation between different context indicators and identify effective ways to improve a specific value.

1.4 Structure of the Thesis

The thesis is organized into four parts (Figure 1. 6):

Part 1, comprising the first three chapters, provides a background introduction to the thesis and a thorough literature review on urban industrial heritage quarters and contextually sensitive urban regenerations.

Chapter 1 is the introduction chapter of the thesis, which explains the logic of the research. The research background focuses on the evolution of the industrial heritage topic, illustrating why this topic is meaningful and research-worthy. The research gap and research question will be generated based on the literature analysis of existing studies, demonstrating the importance of engaging mixed-methods research into the

urban industrial heritage study and exploring the relationship between urban context and heritage value in the regeneration process. This part will clarify the aims and objectives of this thesis, including the details of how to realize research prospects. The last part will describe the logical structure of how the research is organized and what to expect for each chapter.

Chapter 2 gives a comprehensive background introduction to the research subject, the urban industrial heritage quarter. Based on the study of how the concept of industrial heritage has been proposed and refined, this chapter explores the value and evaluation of industrial heritage from a regeneration perspective, as well as defines the content and scope of an urban industrial heritage quarter as the research subject.

Chapter 3 focuses on the topic of context in urban studies. This chapter explores the critical role context plays in creating a harmonious relationship between newly designed architectures or urban spaces with their embedded urban environment. The idea of contextual sensitivity, which refers to being sensitive to contextual factors during urban design, has developed with the growing interest in such topics and has begun to prevail as a practical and feasible approach. On top of the existing research, this chapter proposed contextually sensitive urban regeneration as an urban regeneration process that reflects and responds to context issues.

Part 2, including Chapters 4 and 5, uses mixed-method research to analyse the context's impact on industrial heritage value. This study process is called contextual sensitivity analysis (CSA).

Chapter 4 explains the logic of how to adopt mixed-method research. With the study of current research limitations in the field of urban heritage, this chapter pointed out the lack of quantitative evaluation and the importance of mixed-method research in forming a comprehensive understanding of urban heritage issues. Based on the study in Chapter 3, this chapter will use context-sensitive analysis methodology to study the context impact, and this analysis will be referred to as contextual sensitive analysis (CSA) in this study. For the application of the methodology, this chapter introduces principles and methods adopted in the process of sample study, data collection and analysis.

Chapter 5 is the follow-up steps of indicator identification, data collection and data processing. From the study of the contextual factors of urban industrial heritage quarter, this chapter subdivides each factor into impact indicators that are closely related to the unique characteristics of industrial heritage sites.

Part 3 including Chapter 6 and Chapter 7, is to practice the analysis of urban industrial heritage quarters, focusing on the sample selection, data collection, data processing and analysis.

Chapter 6 presents the selection of the case city and sample quarters, starting with the historical background to explain the reason for choosing Shanghai as the case city. Following the selection of Shanghai, the study will select urban industrial heritage quarters as sample quarters for data collection.

Chapter 7 focuses on the process of data collection and analysis, with results generated based on sample data. The analysis will provide the impact trends of contexts on heritage value. By excavating the information shown in the trend diagrams, the results support the comparison between different context indicators and explore effective ways to improve a specific value.

Part 4, Chapter 8, is the conclusion of the thesis which revisits the research questions, aims and objectives and explains the achievements and benefits of the research. Besides, this chapter also reflects on the limitations and proposes the future possibilities of a more advanced study.

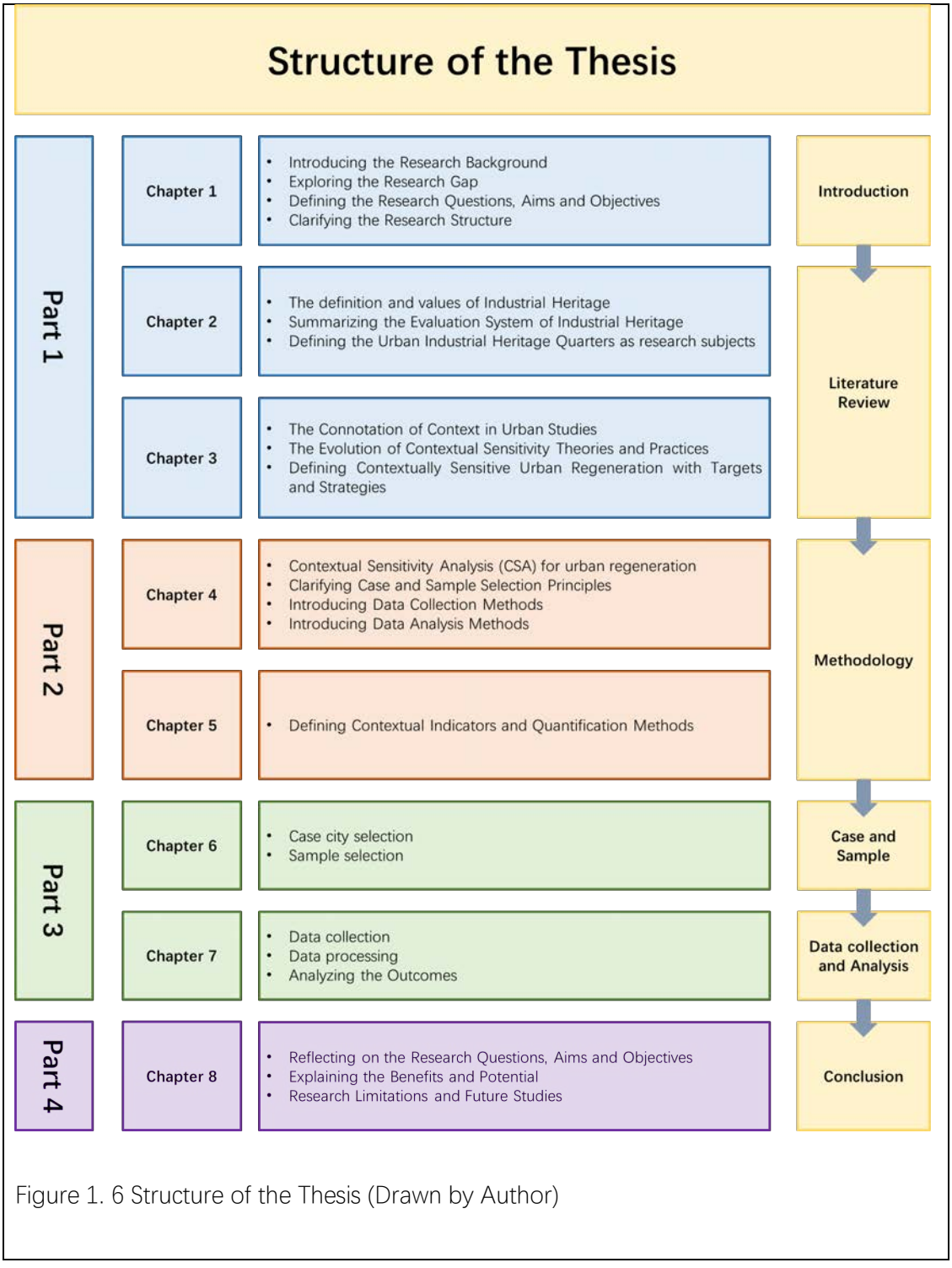


Figure 1. 6 Structure of the Thesis (Drawn by Author)

Chapter 2. Industrial Heritage Quarters in the City

Industrial sites are essential milestones in the history [1] of humanity, recording humanity's dual power of destruction and creation that engenders both problems and progress (Malwitz, 1996). During the last 30 years, there has been increased awareness of the importance of industrial history in understanding heritage from Europe to other countries, especially in the UK. Industrial heritage can be seen as one of the mediums that best reflect the diversity of European culture as it illustrates the economic and social exchanges that have developed between the continent and worldwide for three centuries (Dervoz, 2013). In addition to their function of production (work, technology, production, and goods circulation), industrial sites also have the ability to shape the urban and natural environment physically and socially.

This chapter will give an introduction to the research subject, the industrial heritage quarter in the city. Starting with a literature review on the definition and connotation of industrial heritage, the first section of this chapter illustrates how the concept of industrial heritage is proposed and what industrial heritage is in current studies.

Based on the fundamental background of industrial heritage, the second section of this chapter studies the value of industrial heritage and explores how to value the significance of such historic relics. This chapter plays an important role in this thesis for its summarized value categories for evaluation, which will be used as criteria to score the value variation of industrial heritage quarters during the progress of urban regeneration in contextual sensitivity analysis.

The last section of this chapter will define the content and scope of an urban industrial heritage quarter as the research subject. An urban industrial heritage quarter is an industrial heritage with urban attributes and can be distinguished according to its characteristics.

---

[1] History is defined as the story of 'past events considered together, esp. events or developments of a particular period, country, or subject' (Cambridge Dictionary, 2024d). Or it can also be understood in smaller scale that is 'something that has been done or experienced by a particular person or thing over a long period' (Merriam-Webster, 2024b). Usually, when the history is being referred to, it relates to a specific aspect or period according to the research context. In this thesis, the aspect of history is mainly focused on the past stories and events relating to industrial activities, especially after the First Industrial Revolution in the UK and China.

2.1 Defining Industrial Heritage

Industrial heritage is an indispensable component of the world heritage system, revealing the history of human achievements. It is fragile as it is always easy to be neglected among all the heritage kinds. People might think structures, architecture and items left from old industrial activities are neither as eye-catching as castles, palaces, and temples nor as impressive as culture, custom, and tradition *(*Itzen et al., 2013*)*. Even, it seems that being replaced and erased is their inevitable destiny with the evolution of science and technology. But if we look back from a historical perspective, our modern civilization is actually based on the fruit of industry, which has influenced the way people live and work today. Industrial heritage carries the memory of a specific period or the group of people relating to them, recalling previous social structure, labour formation, and lifestyle. It records human achievements in economy, architecture, and technology, which should not only be valued for their history but also for the future as they have a continuous influence on the world now. From a long-term perspective, the conservation of the industrial heritage should be dynamic in the maintenance of the relics, the survival and continuity of the industrial process, and the technological potential in research and production.

2.1.1 Industrial Culture and Industrial Civilisation

According to the literal definition, culture is a broad concept relating to 'the way of life, especially the general customs and beliefs, of a particular group of people at a particular time' (Cambridge Dictionary, 2024c). It can also be understood from a smaller scope, which means 'the set of shared attitudes, values, goals, and practices that characterizes an institution or organization' (Merriam-Webster, 2024a). In some discourses, culture includes the arts and other manifestations of human intellectual achievement regarded collectively (Spencer-Oatey, 2021). Culture is not static or universal; on the contrary, it is developing within society and is diverse on different scales (UNESCO, 2002). It is not limited to individual behaviours or isolated events and excludes purely biological or genetic traits (Britannica, 2023).

Culture in the field of urban study means the life and social relations within a geographic area, usually a country or region *(*Kim and Kwon, 2020*)*. It is both a product and a producer of urban life. As a product, culture exists in the physical and social environments of cities, such as architecture, public spaces, art, and communities (Zukin, 1995). As a producer, culture also influences the process of urban development, resulting in the form of spatial texture of cities as well as how people live, work, and play in an urban environment (Momchedjikova, 2013).

Civilization is defined as 'human society with its well-developed social organizations, or the culture and way of life of a society or country at a particular period in time'

(Cambridge Dictionary, 2024a). That means a society should reach a certain development degree to be called civilization. Culture exists within civilization as a behavioural expression of specific individuals or groups but is developed earlier than civilization chronologically. Therefore, the scope of civilization is broader than culture, and there can be several different cultures in one civilization (Williams, 2015).

'Industry' in the modern context is always referred to as the manufacturing or technically productive enterprises in a particular field, country, region, or economy viewed collectively, or one of these individually (Cambridge Dictionary, 2024e). It includes the extraction of natural material resources and the processing or reprocessing of raw materials for industrial and agricultural production (National Bureau of Statistics, 2021). Later on, the definition also extended to any general business activity or commercial enterprise that can be isolated from others, such as the tourist industry or the entertainment and creative industry.

When the culture and civilization meet industry, their connotations are also slightly different. Industrial culture started quite early before the industrial civilization, and people used to regard generalized 'industry' as human activities and relevant elements associated with production. Chinese scholars consider that industrial culture originated as early as human-invented tools appeared, which largely promoted efficiency in production, especially for agriculture and animal husbandry, which then significantly improved the quality of life of human beings (Wang and Zhou, 2015). Fundamentally, industrial civilization is also related to the activity of production, just the scale, advancement, efficiency and organization have reached a certain level with systematically economic, political, social and cultural patterns (Holton, 1992).

In the 18th century, the Industrial Revolution in England marked the rise of industrial civilization. Over the last 250 years, the rapid advance of industrialization, industrial technology, and science has made a great impact on human society. Afterwards, systematic and far-reaching changes happened in human society, giving rise to a new type of civilization centred on industry, markets, and common knowledge (Bole, 2021). As a global concept, industrial civilization is thought to be the most significant civilization in the world that can integrate a fragmented world into an entire unit *(*Holton, 1992*)*.

Industrial civilization has greatly impelled the traditional industrial culture, which was mainly established based on agriculture and handicrafts, to develop into the machine-based industrial culture of the current world (Harfst et al., 2018, Görmar et al., 2019). From a more philosophical perspective, the internal impetus for industrial culture is to live, while for industrial civilization is to live better. As a consequence, industrial culture has become a continuous part of history, and industrial civilization has formed a secular state *(*Rauner, 1997*)*.

Industrial culture is complex and multi-dimensional; researchers have illustrated the industrial culture that we mostly talk about from a heritage perspective as tangible and intangible aspects. Tangible industrial culture includes industrial landscapes,

architectures and structures that constitute the industrial heritage within an area and are usually regarded as the target of preservation activities. Intangible industrial culture includes other abstract aspects such as expertise, attitudes, values, traditions, and interlinked social factors beyond the physical elements (Görmar et al., 2019, Harfst et al., 2018, Bole, 2021). Therefore, industrial heritage is the product of industrial civilization, as well as the physical carrier of industrial culture.

2.1.2 From Industrial Archaeology to Industrial Heritage Study

After World War II (1939-1945), architecture and infrastructures in many UK cities were badly damaged and waiting to be recovered. Post-war reconstruction aimed not only at restoring the destroyed built environment but also at replanning the city to meet the developing requirements of the coming future socially and economically (Larkham and Adams, 2023). The planning and development of modern cities took over many abandoned surrounding industrial sites, which are early industrial landscapes and industrial building clusters that were experiencing a period of destruction *(*Buchanan, 1989*)*. Industrial remains were at serious risk in the rapid urban transition, and the development of industrial archaeology seems to have appeared right at the time to save and protect relevant evidence.

The term 'industrial archaeology' was first proposed by Michael Rix in 1955 in the UK and was focused on appreciating the beauty and historical value of industrial relics, as well as raising public awareness of preservation and conservation *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012*)*. From an academic perspective 'industrial archaeology is the systematic study of material evidence associated with industrial history after the First Industrial Revolution (1760–1840)' *(*Palmer and Sissons, 2012,6*)*. The scope of industrial archaeology incorporates a wide range of disciplines including archaeology, architecture, construction, engineering, historic preservation, museology, technology, urban planning, and other specialities, in order to piece together the history of past industrial activities *(*SIA, 2018*)*. With the process of comprehensive research on industrial archaeology, the term 'industrial heritage' emerged to describe pieces of evidence in this historical study.

Public attention to industrial remains started from such a history study. In 1955, Michael Rix published an article in The Amateur Historian, called for the need to study and preserve industrial sites and relics of the British Industrial Revolution in the 18th and 19th centuries *(*Rix, 1967*)*. Industrial archaeology soon became a hot topic in the academy, and it had great research potential.

In 1959, the Council for British Archaeology (CBA) established an industrial archaeology research committee and created the National Record of Industrial Monuments (NRIM) in 1965 *(*Stratton, 1990*)*. Later on, many local industrial archaeology groups formed successively in the UK (The Association for Industrial Archaeology, 2024). Those

groups aimed to record the remains of industrial history, especially those deemed to be most at risk during the process of urbanization.

In 1963, British journalist Kenneth Hudson published the first industrial archaeology monograph, named Industrial Archaeology: An Introduction *(*Hudson, 1963*)*. He then brought the idea to America four years later in 1967. One heritage study outcome in 1964, known as the Venice Charter, talked about the importance of heritage 'authenticity and integrity[2]' *(*ICOMOS, 1964*)*. The scope of the field of industrial archaeology was gradually extended during the next 20 years, when the factors of social archaeology began to be considered in the research of industrial sites. Instead of mainly focusing on the recording of the technical aspects of sites and artefacts, the Venice Charter has inspired researchers to believe that a broader contextual system is important and contributive while studying and preserving industrial remains.

In this context, the term 'industrial heritage' emerged as a general concept to describe the industrial past. Since 1990, there has been an ever-increasing awareness of the importance of industrial heritage, confirmed most prominently by the addition of numerous industrial sites to the UNESCO World Heritage List. In 1973, The International Committee for the Conservation of the Industrial Heritage (TICCIH) was established. The same year, the British Association for Industrial Archaeology (AIA) was also established. Industrial archaeology can be seen as the theoretical and methodological foundation for industrial heritage study, contributing a lot to the later practices of preservation, conservation and revitalization. With further explorations on industrial heritage preservation and regeneration, the work of TICCIH has brought the significance of these and their value forward to the world stage.

In 1995, Operational Guidelines for the Implementation of the World Heritage Convention of UNESCO demonstrated the concept of 'living heritage[3]', adding a time

---

[2] Authenticity talks about the true presentation of a heritage site in preservation, respecting its original context (including environment, texture, material, design, workmanship, etc.) to avoid misinterpreting the values (such as historical, artistic, cultural, social, etc.) of the heritage site. Integrity refers to maintaining the completeness of a heritage site, that all elements contributing to the site's significance are preserved in their entirety (including the physical, functional, and visual aspects of the site). (ICOMOS, 1964, Alberts and Hazen, 2010)

[3] Living heritage refers to culture, knowledge, skills, and expressions related to a heritage that can be passed down through generations. UNESCO first proposed to highlight the continuity of intangible aspects

dimension to heritage and also enlighting that industrial heritage can also include industrial landscapes, architectures, and facilities that are still in use (UNESCO, 1999, Jang and Mennis, 2021). Later on, many preserved industrial sites have become a vital part of heritage tourism, including the European Route of Industrial Heritage (ERIH), established in 1999. However, the widespread appreciation of the importance of industrial heritage by the general public is still lacking in many areas, as the subject often maintains the perception of being 'not old enough' to truly be considered archaeology. In 2003, the Nizhny Tagil Charter was adopted by TICCIH at its XII Congress in Nizhny Tagil, Russia. It is the first official definition of industrial heritage and the international instruction for the study, documentation, conservation, and interpretation of industrial heritage. By stating the definition, value, and preservation necessity of industrial heritage (TICCIH, 2003, Kaya, 2017), this document was essential in illustrating industrial heritage professionally. The effort of relevant research continues during the next several years, with focuses on the cultural identification and heritage tourism (Shackel, 2004, Mann, 2003, Oglethorpe, 2005, Xie, 2006).

In the same year, UNESCO adopted the concept of 'tangible and intangible[4]' heritage in the Convention for the Safeguarding of the Intangible Cultural Heritage, which helped to understand the technological, historical and social value of industrial heritage *(*United Nations Educational Scientific Cultural Organization, 2003*)*.

The next significant document named The Dublin Principles was published in 2011 by ICOMOS. The main concern of this principle is the integrity and intangibility of industrial heritage, such as emphasising the significance of local context and the necessity of preserving the overall landscape and environment of industrial heritage *(*Joint ICOMOS & TICCIH, 2011*)*. In the following year, TICCIH put forward the Taipei Declaration for Asian Industrial Heritage. Setting the background in the Asian countries, the declaration

---

of heritage, while its connotation has extended to tangible elements as well. Living heritage in the current context includes both tangible and intangible aspects of a heritage that are continuously practised or adapted in response to changing environments and societal needs. This concept plays an important role in contributing to the sustainable preservation and management of heritage. (UNESCO, 1999, Poulios, 2014)

[4] Tangible heritage includes physical artifacts, buildings, monuments, landscapes, and other material objects with historical, cultural, or aesthetic significance. Intangible heritage encompasses practices, expressions, knowledge, skills, and traditions recognized by communities, groups, and individuals as part of their cultural heritage. Clarifying the tangible and intangible aspects of heritage is essential for achieving authenticity and integrity in preservation practices. (United Nations Educational Scientific Cultural Organization, 2003, Vecco, 2010)

affirmed the significant role of Asian industrial heritage and advocated creating an international system of relevant study *(*TICCIH, 2012*)*.

The most recent outcome was the Seville Charter of Industrial Heritage published in 2019. This charter is based on the 2018 international conference about industrial landscapes and 21st-century industrial challenges held by TICCIH. By paying attention to the documentation and interpretation, the main concept of the charter is to discuss the attempts of critical intervention according to the value of heritage and the potential of preserving industrial heritage through adaptive reuse in the changing world *(*Sobrino and Sanz, 2019*)*.

The same as many different kinds of heritages, the recognition of industrial heritage depends on its particular national and cultural context. The protection of Chinese industrial heritage started around the 21st century. Learning from the theoretical framework of Western countries, China has quickly started the research and practice of industrial heritage preservation. Notably, during the last ten years, more and more regeneration projects have appeared, and there has been an increase in academic focus. Nevertheless, the prosperous trend of industrial heritage practices in China still has its limitations. The ambiguity of definition and scope, the absence of fundamental theoretical research, the repetitiveness of heritage types, and the neglect of vernacular cultural context are the research gaps in industrial heritage preservation and regeneration fields and deserve more thoughtful and convincing strategies considering further developments *(*Sun, 2014*)*.

For a long time, the protection of old industrial architecture was absent in historical architecture protection in China. Before the 1990s, people simply dismantled discarded old industrial buildings. After the 1990s, Some artists began occupying warehouses and factory buildings, transforming them into their studios. In the 21st century, the protection and utilization of industrial buildings have become popular research topics for academicians working on architecture protection. China lags behind in terms of theories for industrial building preservation. The earliest attempt was begun in July 2002, Shanghai Municipal Regulations on the Protection of Outstanding Historical and Cultural Sites and Prominent Historical Buildings proposed the protection of industrial buildings in China.

In April 2006, at the first China Industrial Heritage Protection Forum in Wuxi, the Wuxi Initiative—Attaching Importance to the Protection of Industrial Heritage during High-speed Economic Development was proposed, aiming to awaken common attention from the public. This forum draft was regarded as the first official document on industrial heritage preservation, pointing out the scope and necessity of protecting the industrial remains after the Opium War. Later in 2010, the Wuhan Initiative and Beijing Initiative were put forward successively. The Wuhan Initiative mainly focused on the relationship between industrial heritage sites and urban regeneration. And the Beijing Initiative raised the urgency of protecting the industrial heritage at risk in China. The same year, National Office for Philosophy and Social Sciences (NOPSS) has launched foundation

support for Chinese industrial heritage preservation and conservation research. Afterwards, the Hangzhou Consensus came into being in 2012, as the official instruction for living industrial heritage preservation *(Yu, 2006)*.

The evaluation and designation work were launched in China for the next several years. From 2017 to 2021, the Ministry of Industry and Information Technology of the People's Republic of China (MIIT) released five batches of National Industrial Heritage Lists according to the historical significance and contribution to Chinese industrial history, including 197 designated industrial heritages in total. Meanwhile, the Urban Planning Society of China (UPSC) involved urban planning and social development perspectives in industrial heritage study, also published three batches of China Industrial Heritage Protection List in 2018, 2019, and 2023, with 300 industrial heritages in total. The two list systems have heritages overlap, but both are important references to clarify the significance of industrial sites. In 2020, the National Development and Reform Commission (NDRC) published an official document to promote the protection and utilization of industrial heritage in an urban context, especially old industrial cities. In 2021, the outcome of the 2010 foundation-supported research was published as a series of books named Comprehensive Research on the Preservation System of Modern Industrial Heritage Sites in China (中国城市近现代工业遗产保护体系研究), which provide a thorough study about the evaluation, preservation and regeneration potential of Chinese industrial heritage.

These actions mark a new era of industrial heritage study and preservation in China. Looking through the preservation process, China has first adopted the theoretical system of the world industrial heritage study and is gradually applying the native perspectives to the research. However, there is still an absence of basic industrial archaeology, regional cultural background in different industrial cities, and quantitative study of relevant topics, which are still research gaps that can be filled in the future. (Figure 2. 1)

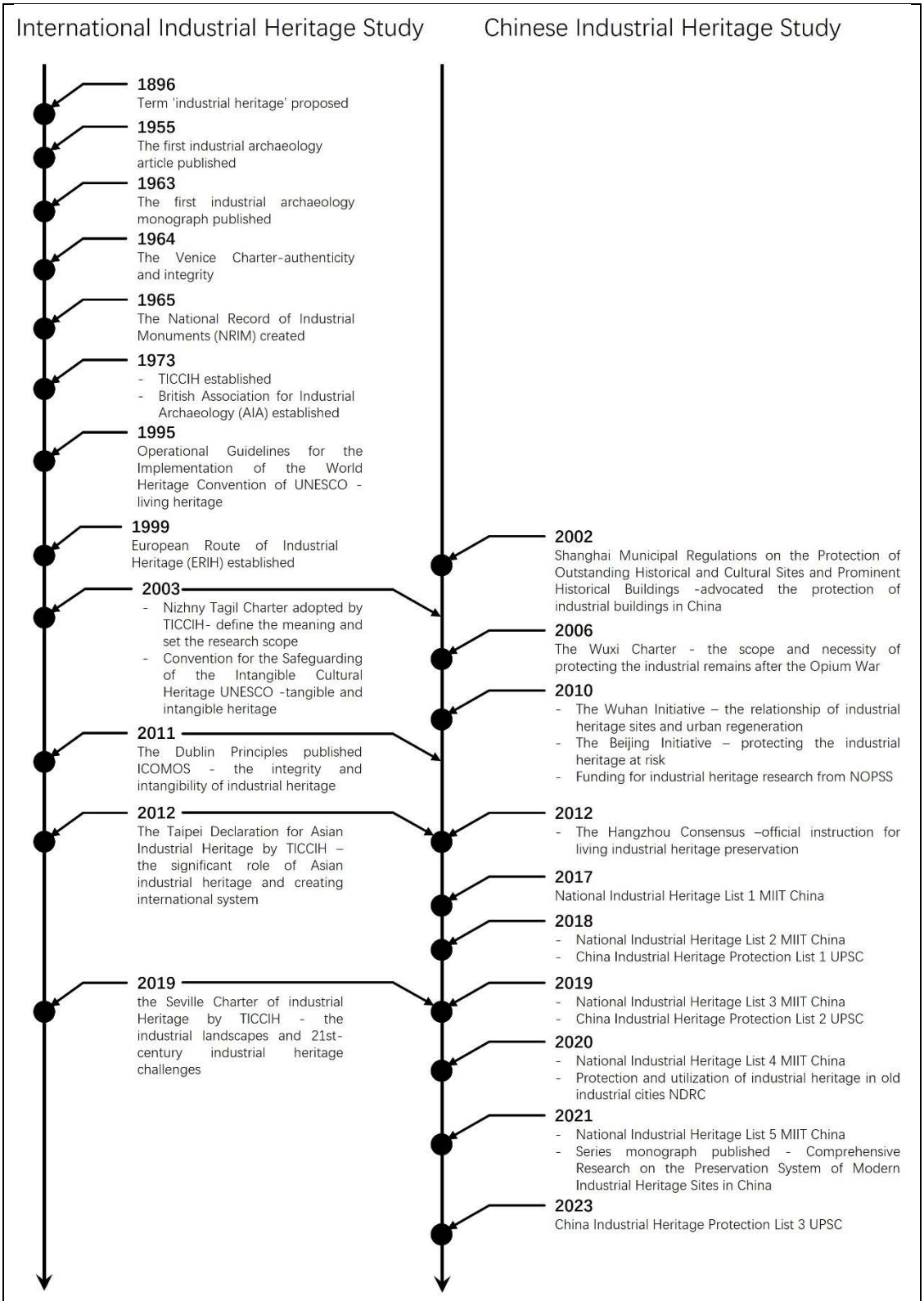


Figure 2. 1 Development of industrial heritage theories from international and Chinese perspectives (by author) / Data resource: Google Scholar, NU Search, CNKI

2.1.3 Definition of Industrial Heritage

In the Oxford English Dictionary, ‘heritage’ is defined as ‘property that is or may be inherited, an inheritance, valued things that have been passed down from previous generations, and relating to things of historical or cultural value that are worthy of preservation’ *(*Oxford English Dictionary, 2021*)*. According to the definition, heritage could be understood by most people as a physical ‘object’ or a piece of property. It can be passed from one generation to the next and deserves to be conserved and inherited (Harrison, 2012).

Later on, the intangible aspects of heritage reveal that most of our inherited associations with the past arise from the connections, activities, ideas, and the emotional relationship with historical places (Historic-England, 2023a). Therefore, an inextricable link between intangible emotional attachments of a heritage and its tangible entities was established *(*Harrison, 2010*)*. Although intangible, the non-physical aspects of heritage can usually be visible or be sensed in customs, habits, and activities related to the physical elements of the heritage, which reminds the related people who they are as parts of which collectives and help to create their shared memories, attitudes, beliefs, etc., what is usually referred to as culture (Graham et al., 2009). ‘We use objects of heritage (artefacts, buildings, sites, landscapes) alongside practices of heritage (languages, music, community commemorations, conservation and preservation of objects or memories from the past) to shape our ideas about our past, present, and future *(*Harrison, 2010*)*‘.

If taking a look from a literal perspective, the term ‘cultural heritage’ can be explained from the ‘cultural’ and ‘heritage’ dimensions. As we have explained in 2.1.1, culture is the way of life in which people live together and form shared beliefs, attitudes, values, etc. The start of culture should date back to the very initial motivation of seeking to survive, which brings people together as a group (Tylor, 1874). Some explanations of culture come with a touch of holiness, such as ‘worship and reverential homage’ (Oxford English Dictionary, 2024b). Actually, the very earliest of worship aims at the process of production, origins in hunting and cultivation activities that people work together for a living *(*Hudson et al., 1967*)*. When this group of people invented tools that could increase the efficiency and effectiveness of the production process, what we have referred to as the early industrial culture started to form. In 1973, one cognitive definition of culture was provided as ‘a historically transmitted pattern of meanings embodied in symbols, a system of inherited conceptions expressed in symbolic form by means of which men communicate, perpetuate, and develop their knowledge about and attitudes toward life’ *(*Geertz, 2016,35*)*. Combining the meaning of ‘heritage’, cultural heritage seems like a broad concept that contains evidence from human history that shares a relationship within a certain scale of the group (Historic-England, 2023b).

UNESCO defines cultural heritage as ‘the legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in

the present and bestowed for the benefit of future generations' (Vecco, 2010,322). Cultural heritage should be considered both in time and space. Time shows how heritage is inherited or passed chronologically through generations, which is a continuously dynamic process. And space provides a physical context for cultural properties to exist.

The idea of tangible heritage has now been broadened to include both the human and the natural environment, both architectural complexes and archaeological sites; heritage in the rural district and urban environment; technical or industrial heritage; industrial designs and urban facilities, etc. (Jokilehto, 2005). However, the intangible dimension of cultural heritage is easily neglected and is too fragile to be kept. Later on, the study of cultural heritage now covers the non-physical cultural heritage, which includes the signs and symbols passed on by oral transmission, artistic and literary forms of expression, languages, ways of life, myths, beliefs and rituals, value systems and traditional knowledge and know-how (Vecco, 2010).

Industrial heritage belongs to cultural heritage and has its uniqueness in its focus (Andrieux, 2024). Beyond the tangible aspects, industrial culture, which composes the main intangible aspects of industrial heritage, is what forms the unique characteristic of industrial heritage. A heritage that relates to historical remains always seems a settled object or status, while industrial culture is active in the way it works, which continuously contributes to the improvement of people's lives. That is to say, industrial heritage is alive or partly alive, in their traditional way or another. Understanding industrial heritage is not simply understanding tangible heritage but the intangible industrial culture behind it.

Cities are always under continuous change impelled by social, cultural, and economic factors. Beginning in 1760, the Industrial Revolution can be seen as one of the essential factors in shaping the urban and social formation of the early modern city. It altered the industrial and labour structure, especially in raw material extraction, mineral exploitation, and agricultural production. As a result, the transformation of working and living patterns induces the emergence of new industrial urban fabrics (Falser and Yang, 2001). The remains of industry, such as factory buildings, landscapes, sites, and precincts, as well as structures and spaces, all contribute to forming our cities, towns, and regions and their character (Clark, 2013).

Industrial heritage has gained attention in the UK since the mid-1950s. Physical evidence of industrial history has begun to be valued, causing the growing focus on academic research, protection, and conservation. As a type of highly complex structure, industrial heritage is a significant part of our 'social, spatial, cultural and technological past' (Ifko, 2016,1), which is 'a vivid reminder of how today's world came to be the way it is' (Dervoz, 2013,12).

In 2003, The International Committee for the Conservation of the Industrial Heritage (TICCIH) defined industrial heritage as:

> *what 'consists of the remains of industrial culture which are of historical, technological, social, architectural or scientific value'* (Douet and International Committee for the Conservation of the Industrial Heritage, 2012,2).

Industrial remains include a wide range of different physical forms, known as 'buildings and machinery, workshops, mills and factories, mines and sites for processing and refining, warehouses and stores, places where energy is generated, transmitted and used, transport and all its infrastructure, as well as places used for social activities related to industry such as housing, religious worship or education' *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012,2*)*. In this scope, industrial heritage can be seen as any solid piece of evidence that can illustrate the past or ongoing industrial process of production *(*Kaya, 2017*)*. Besides tangible relics, industrial heritage also contains intangible evidence, acting as a link to the urban cultural, historical, social, economic, technical, and aesthetical context. Those aspects involve industrial communities, activities, production processes, craftsmanship, place identification, labour, lifestyle, etc.

As the theoretical foundation, industrial archaeology has set a time range for the scope of industrial heritage study, that industrial heritage focuses on the period after the First Industrial Revolution (Palmer and Sissons, 2012). This can be understood as the research scope of industrial heritage from when the industrial civilization started. However, according to TICCIH's definition, it's the industrial culture which started much earlier in history. Recently, research by Chinese and British scholars indicates a positive attitude towards expanding the definition of industrial heritage to encompass these traditional industries (Potteries Museum and Art Gallery, 2021, Yan et al., 2021). Therefore, for more precise definitions of the scope, the influence of the Industrial Revolution and the contribution degree of machines should be assessed accordingly. In actual research and practice activities, one specialised research might have its own definition of the scope depending on the focus and condition. As China has defined the scope of industrial heritage research from the First Opium War (which is the starting point of Chinese industrialisation), this thesis will focus on the remains from the beginning of industrial civilisation after the First Industrial Revolution, including some traditional industries which production process was impelled to develop by Industrial Revolution outcomes.

2.2 Value of Industrial Heritage

People may value historic relics for many reasons including utilization, personal preference, distinctive appearance, collective memory and stories they can tell. At the same time, the primary motivation of value is the intention to enjoy and sustain the benefit of a historic environment *(*English-Heritage, 2008*)*. Through the action of value and evaluation, people can form a prospect of the heritage future, even endow a more widely approbate significance to the 'familiar and cherished local scene' *(*English-Heritage, 2008,27*)*. The historical records of past industrial activities provide inspirational and diversified expressions of how the industrial heritage forms modern civilization and why they are valuable and irreplaceable.

The research of heritage value and evaluation originated in the study of art history. Then, in the early 1900s, scholars from different disciplines explored and developed their own views on valuing the significance of heritage and historical relics. To form a thorough understanding, this part will go through the most widely used or commonly agreed documents of heritage research and summarize the definition of value to provide a solid foundation for industrial heritage study.

2.2.1 Value of Industrial Heritage

In the field of Philosophy and Social Sciences, 'value' refers to the importance, worth, or usefulness of something, 'the estimation in which a thing is held according to its real or supposed desirability or utility' (Oxford English Dictionary, 2024d). It is a measure of the significance or benefit that an object, action, or concept holds for an individual or group. In heritage studies, 'value' refers to how significant, worth or useful a heritage can be measured in various perspectives, such as historical, cultural, social, aesthetic, economic, and environmental dimensions (De la Torre, 2002).

At first, experts mainly focus on the basic aspects of heritage value which can be easily visualized, sensed or utilized, such as the historic, artistic and practical significance. Since 1979, the 'Burra Charter' and the following guideline published by ICOMOS are regarded as a milestone in clarifying the value of heritage *(*Kerr, 1983*)*, as well as widening the connotation in social and local perspectives *(*Aoki and Xu, 2021*)*. With the growing attention to heritage preservation, people have realized that the impact of heritage-related activities also has economic and educational influence. The scope of what and how to value a heritage continues to expand with the exploration of the authenticity and integrity of heritage maintenance and delivery. In 1964, the Venice Charter put forward the authenticity and integrity of heritage. Following the explanation in 2.1.2, the authenticity of industrial heritage refers to the accurate representation of the tangible aspects of the heritage site (such as landscapes, architectures, machines, etc.) as well as the intangible aspects (such as the production process, aesthetics,

workmanship, etc.) (ICOMOS Slovenia, 2017). Integrity involves preserving industrial heritage sites complete with all elements that relate to the sound operation of the industry are well-maintained (ICOMOS Slovenia, 2017). In 2005, the 'Xi'an Declaration' of ICOMOS illustrates that the setting and context of heritage also have unignorable value and require an integrated perspective in research and practice (Wang, 2018). This declaration highlights the importance of achieving authenticity and integrity of the industrial heritage sites and that industrial heritage should be valued on a broader scale.

According to the latest edition of the 'Burra Charter' updated in 2013 (first published in 1979), the cultural significance (value) of heritage can be understood from aesthetic, historic, scientific, social and spiritual perspectives, also illustrating the aspects of natural significance. Then, in 'Management Guidelines for World Heritage Sites' in 1993, the values were divided into two categories: cultural values (including identity, rarity, art and technical considerations) and contemporary socio-economic values (including economic, functional, educational, social and political considerations) (Feilden and Jokilehto, 1998). In 2002, the highly rated research report by the Getty Conservation Institute 'Assessing Values of Cultural Heritage' provides a comprehensive study of value characterization and evaluation methodology (De la Torre, 2002). This report divides cultural heritage values into socio-cultural and economic perspectives. Socio-cultural vector composes the historic, symbolic, social, spiritual and aesthetic value, while the economic vector considers the utilization status of the heritage. In 2008, English Heritage published the 'Conservation Principle: Policies and Guidance for the Sustainable Management of the Historic Environment', in which the value of historic and heritage environment is defined as evidential value, historical value with illustrative and associative characters, the aesthetic value created by design, and communal value that have commemorative and symbolic impacts (English-Heritage, 2008). Through the years of heritage research, we can see that most studies have been adjusted based on these outstanding universal significances according to specific research contexts.

Table 2. 1 gives a summary of how the value system varies in the development of heritage study. From the table, we can see that the aspects of evaluation vary according to the aim of different studies, and the categorization hierarchy also changes to highlight the focus value. Overall, the field of heritage value gradually got broader and interweaved with other related fields, such as sociology and economy.

Literature	Classification of Heritage Value Table Description: The three layers represent the classification hierarchy of the values in different literature. The same values are marked in the same colour, so it can show how a specific value is regarded differently when the research focuses vary.		
	First layer	Second layer	Third layer
Burra Charter (1979)	**Cultural Value**	Aesthetic value	
		Historic value	
		Scientific value	
		Social value	
		Spiritual value	
	Natural Value	Ecosystem value	
		Biodiversity value	
		Geodiversity value	
Management Guidelines for World Heritage Sites (1993)	**Cultural Value**	Identity value	
		Relative artistic value	
		Technical value	
		Rarity value	
	Contemporary Socio-economic Value	Economic value	
		Functional value	
		Educational value	
		Social value	
		Political value	
Assessing Values of Cultural Heritage (2002)	**Sociocultural Value**	Historical value	Educational/academic value
			Artistic value
		Cultural/symbolic value	Political/civic value
			Craft/work-related value
		Spiritual/religious value	
		Aesthetic value	
	Economic Value	Use value (Market value)	
		Nonuse value (Nonmarket value) – Existence value	
		Option value [5]	
		Bequest value[6]	
	Evidential Value		

[5] The option value of heritage refers to someone's wish to preserve the possibility (the option) that he or she might consume the heritage's services at some future time.

[6] Bequest value stems from the wish to bequeath a heritage asset to future generations.

Conservation Principle: Policies and Guidance for the Sustainable Management of the Historic Environment (2008)	**Historical Value**	Illustrative value – technological value	
		Associate value[7]	
		Aesthetic Value	
		Design value	
		Artistic value	
	Communal Value[8]	Commemorative value[9]	
		Symbolic value	
		Social value	
		Spiritual value	

Table 2. 1 Heritage Value Classification in Representative Documents (Summarized by author)

As the value of heritage is complicated and interweaving with multiple disciplines, the characterization and classification attempts of value typology always overlap in terms and aspects and vary according to different perspectives. When it comes to one specific type of heritage, the details of value might have additional and extended meanings.

For industrial heritage, value is defined differently in various principles or by different organisations. According to The Nizhny Tagil Charter for the Industrial Heritage by TICCIH in 2003, the value of industrial heritage is mainly about the historical value, social value, technological and scientific value, and aesthetic value *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012*)*. But the explanation of how these values can be sensed or assessed is not clearly defined. Later in the Dublin Principles published in 2011, the importance of human skills and knowledge of industrial activities are stressed in the research and record process. This principle also illustrates the necessity of involving the authenticity, integrity and

[7] Association with a notable family, person, event, or movement gives historical value a particular resonance. Being at the place where something momentous happened can increase and intensify understanding through linking historical accounts of events with the place where they happened – provided, of course, that the place still retains some semblance of its appearance at the time.

[8] Communal value derives from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory. Communal values are closely bound up with historical (particularly associative) and aesthetic values, but tend to have additional and specific aspects.

[9] Commemorative and symbolic values reflect the meanings of a place for those who draw part of their identity from it, or have emotional links to it. Such values tend to change over time, and are not always affirmative. Some places may be important for reminding us of uncomfortable events, attitudes or periods in England's history. They are important aspects of collective memory and identity, places of remembrance whose meanings should not be forgotten.

regionality of industrial heritage, which relates the industrial heritage value with a wider time and spatial context *(*Joint ICOMOS & TICCIH, 2011*)*. Generally speaking, those mentioned values are embedded in the fabric, components, pieces of machinery and landscape, or even extended to any written documentation and intangible records of industry contained in collective memories[10], traditions and customs. Historical value refers to the historical significance of industrial heritage, including its roles in the history of industrial development and its association with important events and people (Rodina, 2018). Social value relates to the contribution of this heritage in creating or transforming the characteristics of specific groups of people (such as local communities, former workers, entrepreneurs, governments, etc.) or relevant places (TICCIH, 2003, Douet and International Committee for the Conservation of the Industrial Heritage, 2012, Joint ICOMOS & TICCIH, 2011). Technological and scientific value can be understood as the innovation and advancement of machinery, production processes, and skills in science and technology (TICCIH, 2003, Douet and International Committee for the Conservation of the Industrial Heritage, 2012, Joint ICOMOS & TICCIH, 2011), as well as the continuous influence on the development of the industry. Aesthetic value is about evaluating the design quality of the buildings and structures, including scale, style, material, decoration, spatial arrangement, etc. (TICCIH, 2003). It also includes the visual impact of the industrial landscape, facilities, and structures that make up the heritage within its surrounding environment.

As the industrial heritage study in China started only 20 years ago, the definition and scale of value are developed on the existing system. With the increasing focus recently, different cities in China have tried to value their industrial remains according to different perspectives, the systems of some representative cities have been listed in Table 2. 3. The evaluation system was discussed in 2018 and has been refined in 2023, focusing on the designation and management of industrial heritage from a national level, which is 'The National Industrial Heritage Management Approach' (Table 2. 2). This principle has some extra focus in the Chinese context based on the existing values. For historical value, this principle points out the importance of studying the contribution of a heritage to industrialization in China. Social value should also consider the influence of the corporation on a local and national scale based on whether it has formed a unique industrial spirit, production regulation, and enterprise culture. Apart from the four values defined by TICCIH, this value system also takes conservation status and management conditions into consideration *(*MIIT, 2023*)*. For conservation status, a heritage is expected to be evaluated from the authenticity perspective according to the

[10] Collective memory for industrial heritage refers to the shared memories and experiences of a community or society based on the common identity associated with its industrial past. It includes the story of events, relationships, customs, and individual experiences that are tied to both the tangible and intangible aspects of the industrial heritage. (Licata and Mercy, 2015)

comprehensiveness and reliability of the record and presentation about the heritage, and the integrity perspective according to whether the significant pieces of the heritage have been kept in their entirety to illustrate representative production layout, process, relevant lifestyle, etc. (MIIT, 2023). For management conditions, this principle focuses on the protection and utilization of the plan, making it feasible and conforming to heritage characteristics; the management system and operation are clear and effective. Besides, the plan should keep up with the time, providing sustainable social and economic benefits (MIIT, 2023).

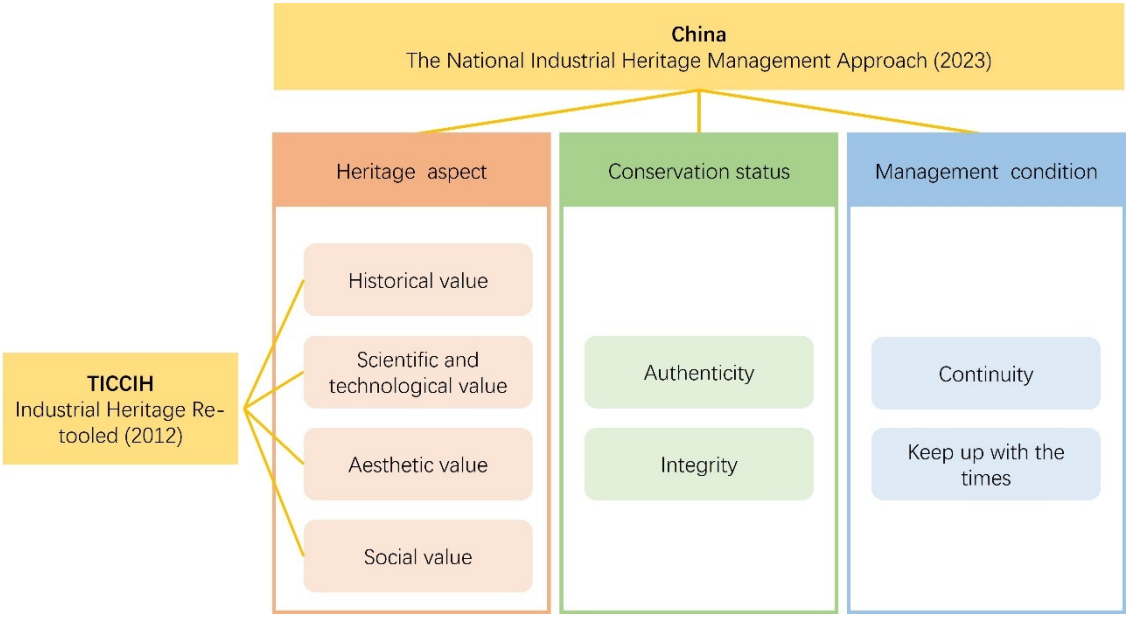


Table 2. 2 Industrial heritage value classification by TICCIH and the Chinese government (Summarized by author)

Table 2.3 below lists the value classification in different cities in China. The same values are listed in the same line. Therefore, the table can compare the contents in one value across different cities and identify different value focuses.

Beijing	Shanghai	Nanjing	Chongqing	Wuhan	Tianjin
Historic Value ● Longevity ● People & events	**Historic Value** ● City- History of urban construction, transformation, and regional culture ● Society and community- History of industrial development and company development ● Architecture- History of industrial building and style evolution	**Historic Value** ● Longevity ● People & events	**Historic Value** ● Longevity ● People & events	**Historic Value** ● Longevity ● People & events	**Historic Value** ● Longevity ● People & events
Technological and Science Value ● Innovation ● Advancement	**Technological Value** ● Design and structure ● Material ● Construction and skill	**Technological and Science Value** ● Innovation ● Advancement	**Technological and Science Value** ● Innovation ● Skill level	**Technological and Science Value** ● Innovation	**Technological Value** ● Innovation of production skills
Aesthetic Value ● Design and construction ● Landscape	**Aesthetic Value** ● Configuration ● Space ● Details and Decoration	**Aesthetic Value** ● Design and construction ● Landscape	**Aesthetic Value** ● Design and construction ● Landscape	**Aesthetic Value** ● Preference ● Design and construction	
Socio-cultural Value ● Emotion and responsibility ● Company culture	**Social and Emotional Value**	**Social Value** ● Emotion and responsibility ● Company culture	**Social Value** ● Emotion and cohesion ● Company culture	**Social Value** ● Impact ● Spiritual value	**Social Value** ● Emotion and cohesion ● Company culture
Economic Value ● Structural adaptiveness ● Spatial adaptiveness	**Economic Value** ● Location ● Functional adaptiveness ● Cost-effectiveness	**Economic Value** ● Structural and spatial adaptiveness ● Location and transportation ● Scale and Status ● Completeness ● Scale and quality	**Economic Value** ● Structural adaptiveness ● Spatial adaptiveness ● Tourism potential		
	Environmental Value ● Symbolic ● Continuity ● Landscape				
Architectural Value ● Survival condition ● Structural Safety					**Architectural Value** ● Style and aesthetics ● Structure advancement

					Landscape Value ● Visual uniqueness
Locational Value ● Location Advantage ● Transportation					
Utilization Value ● Spatial adaptiveness ● Landscape adaptiveness					**Utilization Value** ● Structural adaptiveness ● Spatial adaptiveness
Feasibility ● Potential for reuse ● Feasibility of maintenance					
			Authenticity and Integrity		
			Rarity Value	**Additional Value** ● Rarity of industry ● Rarity of landscape	
			Uniqueness Value		

Table 2. 3 Industrial heritage value classification and evaluation by different cities in China /Summarized by author from (Deng et al., 2011, Huang, 2008, Ji and Xu, 2012, Li et al., 2012, Liu and Li, 2008, Liu et al., 2012, BMBEIT, 2009, Qi and Ding, 2008, Tian, 2013, Xu, 2013)

Being a specific type of cultural heritage, industrial heritage shares the same values as traditional heritage. However, it is difficult to settle a commonly agreed value system because the standard of value classification system remains ambiguous, either too generalized as the TICCIH defined, or too complicated and overlapped as the other listed heritage research documents.

At both the national and local levels, the detailed classification of industrial heritage value aims to evaluate if the old industrial sites can be designated officially as industrial heritage. From the table, it can be seen that the research on industrial heritage value varies across cities, as each city has different focal points, leading to diverse classification methods and reference standards for each type of value.

Since each value can be understood from multiple dimensions and each tangible or intangible element of the heritage includes various values, one evaluation aspect might be classified differently under different values or considered independently.

For example, historical value can be understood through the chronological dimension and related historical events, as in cities like Beijing, or through spatial significance, such as the historical importance of the city, community, or building scale, as in Shanghai. An industrial building's development can be studied from a historical perspective, its construction technology can be categorized under scientific and technological value, its association with local industrial activities contributes to forming social recognition, and its visual effect and design influence the aesthetic value of industrial heritage.

For this study, a clear and comprehensive definition system of industrial heritage value composition is necessary for establishing the assessment system to evaluate the regeneration outcomes and targets of heritage-related aspects.

2.2.2 Industrial Heritage Evaluation

Evaluation is essential in heritage study, as it provides a guide to the protection and utilization of tangible and intangible heritage. ‘From understanding grows valuing; from valuing grows caring; from caring grows enjoyment and inspiration *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012,12*)*.’

Industrial heritage is a kind of cultural heritage with unique characteristics, and the early focus of industrial heritage evaluation was mostly developed on previous studies about cultural heritage. According to Historic England, preservation and conservation works of historic environment mainly follow two guidances: scheduled monuments and listed buildings. Documents of scheduled monuments and listed buildings set general factors for heritage evaluation, with extension files including special considerations of industrial

architectures and landscapes. However, the evaluation aspects and criteria were not clearly classified and systematized.

Looking into the industrial heritage evaluation system of China and Chinese cities, the relationship between evaluation aspects and value is listed relatively clearly, but the details in each system have some mixed concepts and overlap scopes. In order to assist the contextual sensitivity analysis later for industrial heritage quarter regeneration, the very first step is to summarize the evaluation system as a reference.

Currently, the research and evaluation of industrial heritage value, both internationally and in China, has two purposes. Firstly, it works as a reference for deciding whether old industrial sites qualify as officially designated industrial heritage. Secondly, it assesses the degree and potential for the protection and utilization of industrial heritage.

Based on the previous review of value classification, early cultural heritage study usually considers cultural, economic, and social values as the three primary considerations, which can also appear as the combined study of socio-cultural aspects or socio-economic aspects. Although the current industrial heritage evaluation system does not emphasis cultural value, its impact cannot be ignored, as industrial heritage is defined as the remains of industrial culture (Douet and International Committee for the Conservation of the Industrial Heritage, 2012). In this thesis, cultural value will be discussed together with social value as the socio-cultural value.

Historical value, depending on its research focus, can either stand alone as a major category with the aforementioned three or be a sub-category within social or cultural value. Natural value is also an important factor to consider when considering special heritage related to the natural environment.

In the context of industrial heritage, existing value systems often upgrade the scientific and technological value and aesthetic value to the same level of importance as historical and social values (except in Tianjin). TICCIH's value research does not emphasis economic value, whereas Beijing, Tianjin, Nanjing, Chongqing have used economic value to highlight the benefits during the transformation and utilization process, or list the potential and feasibility of heritage utilization as a separate value category. However, economic value in industrial heritage study refers not only to the economic benefits of protecting and reusing industrial heritage. From a historical perspective, the economic value of an industrial heritage can also include its production capacity and contribution to the regional and national economy during its stream period, as well as its continuing influence on its industry (even after closure) (Throsby, 2000). Looking into the Table 2.3, the sub-aspects listed are not accurate enough to represent the comprehensive connotation of economic value. In this thesis, the historical economic influence of industry heritage will be divided into historical values, and the ‘economic value’ in this study will only represent the future benefits of industrial heritage.

In The National Industrial Heritage Management Approach, the authenticity and integrity of industrial heritage are specifically emphasized during evaluation. UNESCO's Operational Guidelines for the Implementation of the World Heritage Convention highlights that heritage protection should maintain the authenticity and integrity of both tangible aspects (such as location, environment, space, texture, form, and materials, etc.) and intangible aspects (such as traditions, customs, functions, craftsmanship, spirit etc.). These two concepts are not defined as the value of industrial heritage but as aspects that affect whether each value can be fully and truly presented or evaluated. Authenticity and integrity should be continuously considered during heritage research, protection, and utilization. In this study, the authenticity and integrity aspects will be broken down into sub-aspects for considering each value.

For the aesthetic value, assessments of Beijing, Nanjing, and Chongqing included the aesthetic of industrial landscapes, and Wuhan suggests that aesthetics should also relate to public preference. Shanghai focuses more on the aesthetic value of industrial buildings and structures, but treats the symbolic and continuity of the industrial landscape separately as environmental value. In this study, industrial landscapes will be considered an integral part of industrial heritage that forms the whole visual impact, and they will be discussed together with architectural and structural heritage.

Moreover, neither TICCIH nor current Chinese industrial heritage evaluations address natural value. Missing this value is mainly because industrial production processes generally do not have a positive impact on the surrounding natural environment, often leading to pollution and resource depletion (Kirkwood, 2001). Many factories were regarded as harmful to the natural system, which has no ‘worth and usefulness’ in this aspect (Martin, 2015). However, long abandoned industrial sites, if not seriously polluted, also have the potential to be re-occupied by eco and bio systems that can provide greenery for the urban environment (Kowarik, 2005). Recent research and practice in the protection and utilization of industrial heritage have recognized the need to address environmental pollution abatement, ecological restoration, green design, and landscape design as significant factors (Iryna and Irina, 2023, Kowarik, 2005).

The summarized value categories and evaluation aspects are listed in the following table. (Table 2. 4)

Value	Evaluation Aspects	Source
Historical Value	Age and Longevity	egkmnopq
	Relates to historical events and people	dekmnopq
	Significance in the history of industrial development	abcdefklmnopq
	Significance in the history of regional and national economy	dcfhijlq
	Significance in the history of urban development	dlfgq
	Significance in the history of architectural development	aghilq
	Records and presents of history true and comprehensive	fgjno
	Rarity and Representativeness	abcdgnoq
Scientific and Technological Value	Innovation and advancement in science	adehikmnopq
	Innovation and advancement in production skills	abcehikmnopq
	Innovation and advancement in production process and management	acehiq
	Innovation and advancement in industrial architectures and structures	alfg
	Records of science and technology true and comprehensive	fgjnoq
Socio-cultural Value	Influence on relevant communities and societies	abcdefklmnopq
	Significance as a symbol of place identification	abcdfglq
	Influence on collective memory	acdefgklmnopq
	Significance in tradition and custom	acdfg
	Influence on policies and regulations	gbcl
	Significance for education and research	bcdeflq
Aesthetic Value	Public preference for industrial remains	dfgoq
	Visual impact of architectures	abcdefhigklmnopq
	Visual impact of structures and facilities	abcdeklmnopq
	Visual impact of landscapes	abcdeklmnopq
Economic Value	Location and transportation	cklm
	Structural and spatial adaptiveness	bcfklmnp
	Potential for tourism promotion	fcfn
	Potential for market promotion	cfb
	Potential for employment promotion	cfjq
Natural Value	Significance of current eco-system and bio-system	dq
	Potential for environmental improvement	fjq

a. Conservation Principles, Policies and Guidance: For the Sustainable Management of the Historic Environment
b. Management Guidelines for World Heritage Sites
c. Assessing the Values of Cultural Heritage: Research Report
d. The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance
e. The Nizhny Tagil Charter for the Industrial Heritage
f. Scheduled Monuments & Nationally Important but Non-Scheduled Monuments Scheduling Selection Guide: Industrial Sites 2018 - Specific Considerations
g. Principles of Selection for Listed Buildings

h.	Industrial Buildings: Listing Selection Guide
i.	Industrial Buildings: Guidelines and Criteria
j.	The National Industrial Heritage Management Approach
k.	The evaluation system of Beijing
l.	The evaluation system of Shanghai
m.	The evaluation system of Nanjing
n.	The evaluation system of Chongqing
o.	The evaluation system of Wuhan
p.	The evaluation system of Tianjin
q.	Research on Value Estimation of Industrial Heritage Sites

Table 2. 4 Industrial heritage value evaluation system (Summarized and refined by author)

a) Historical Value

Historical value of industrial heritage refers to the importance and usefulness of the record relating to industrial activities that is retained for the purpose of history. For industrial heritage, historic value aids the interpretation of the industrial past, the development of modern civilization, and the tradition of human manufacture (Oglethorpe, 2014). Both visible and invisible pieces of evidence, the physical factory sites, relevant structures and pieces of machinery, product activities, and livelihood, contribute to a memorable development history. Based on the current value study, historical value of industrial heritage can be considered from the following aspects:

Age and Longevity: Age and longevity refer to whether the heritage has a long history and the period of its existence, which has the ability to show the origin and the development of industrial practices over long periods (Aoki and Xu, 2021).

Relates to historical events and people: The history of industrial heritage is always highlighted by notable historical events or individuals, which usually mark the meaningful moments of the development of the industrial site (MIIT, 2023).

Significance in the history of industrial development, regional and national economy, urban development, and architectural development: For the history of industrial development, the significance of industrial heritage considers its contribution to the specific and relevant industries, how it impels the form, transformation and development of those industries and whether it has a continuous influence on the condition of those industries now (Historic-England, 2019). Industrial heritage sites, as mentioned before, their original production capacity may have an influence on the regional and national economy, contributing to the increase of investment and local GDP (Gan et al., 2024). Within the urban context, the rise and fall of industrial heritage indicates the transformation of urban texture. Moreover, the configuration and structure of industrial architectures were in continuous development to serve the spatial requirement of the production process, which may influence the design and construction of future industrial buildings and even modern architectures (Abdelhameed, 2019).

Records and presents of history is true and comprehensive: This aspect relates to the authenticity and integrity of an industrial heritage site, whose ability to truly and comprehensively present historical records and physical evidence of the site.

Rarity and Representativeness: Rarity talks about how unique the heritage is, and representativeness relates to whether it can exemplify key characteristics of its kind within a particular period or area (Aoki and Xu, 2021).

b) Scientific and Technological Value

Scientific and technological value is the main value that distinguishes the key characteristics of industrial heritage from other kinds of cultural heritage. *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012,236*)*. Based on previous developments in science and technology, industrial heritage plays a significant role in presenting achievements in skills, knowledge, and experiences. For industrial heritage, conservation and expression of science and technology aspects contribute to the heritage authenticity and integrity. In addition, the preservation and utilization of industrial remains during the heritage redevelopment process, such as restoring facilities and structures, pollution control also need to be considered in a sustainable and technological way.

Innovation and advancement in science, production skills, production process and management, and architectures and structures: The development of industry and the development of basic and applied sciences were mutually promoted, such as material science, engineering, chemistry, etc. These innovations drove industrial efficiency and capacity, leading to widespread technological progress (Mohamed et al., 2022). This attribute refers to the efficiency and effectiveness of production technology and engineering skills, which showcase the ingenuity of craftsmanship, the creation of production methods, and the efficiency of engineering prowess *(*Wang, 2018*)*. The business management models of industrial companies also need to consider creativity and innovation, some of which can also impact the operation and management procedure of contemporary businesses *(*BMBEIT, 2009*)*. Besides, advancements also exist in the design and construction of industrial architecture and structures. Industrial heritage sites include architectural innovations that enabled new forms of industrial activity, such as large-span structures, prefabricated buildings, and integrated complexes (Iñiguez, 2024).

Records of science and technology is true and comprehensive: Accurate and comprehensive records of the scientific and technological development and activities that relate to the production process and development of industrial sites are important to show why the industrial heritage is contributive and what achievements it led to.

c) Socio-cultural Value

Industrial heritages are of social and cultural value as they 'testify to the ordeals and exploits of those who work in them' *(*Falser and Yang, 2001,9*)*. Assessing the socio-cultural value of industrial heritage means considering its contribution to forming place identification, connecting the lifestyle of present generations with the industrial past, and providing intangible evidence for social development. The study of heritage significance often involves complex social and cultural aspects, intertwined with various abstract concepts and theories. This complexity arises from the multifaceted nature of heritage, which encompasses historical, social, cultural, and emotional dimensions that are deeply interwoven and context-specific (Smith, 2006a). Based on existing heritage assessment studies, this value will be considered according to the aspects of community, identification, collective memory, tradition and custom, policies and regulations and educational potential.

Influence on relevant communities and societies: The rise of industries typically led to the formation of new living quarters, towns and cities, attracting workers and their families to settle down around the workplace. Over time, these industrial quarters can transform into communities with unique cultural identities. Industrial heritage quarters relate to the historical and cultural background of a community and generate shared working and living experience, forming a sense of belong among residents *(*Cristobal-Fransi et al., 2020*)*. This sense of belonging contributes to the continuous potential of industrial heritage conservation.

Significance as a symbol of place identification: Place identification refers to the process through which individuals or communities themselves differentiate a specific location from others, acquiring a sense of belonging and meaning from that place (Grey and O'Toole, 2020). Place identification of industrial heritage relates to the emotional connections of society or community to industrial remains and sites *(*Feilden and Jokilehto, 1998*)*. Generally speaking, public understanding of place identification can be influenced by commemorative and spiritual factors which closely relate to the continuity of sociocultural activities, as well as the survival of historic fabric which provides physical evidence of the activities and events. Industrial remains have created a durable and long-lasting emotional attachment with local dwellers, and have established a sense of identity in the memory of people associated with them *(*Clark, 2013*)*. The identification of industrial heritage is largely associated with people who have lived, worked, benefited or even been hurt through the process of production activities. This symbolic place with a unique place identity is essential in preventing the neglect and destruction of industrial heritage. Industrial heritage sites always have impressive characteristics that are easily identified and remembered. For most such quarters, industrial buildings and structures are visually attractive for their massive scale and configuration. They are usually referred to as a symbol of a period of time, a snapshot place of events, or simply a place that people use for location *(*Iqbal et al., 2022*)*.

Influence on collective memory: People and communities that are closely related to or involved in the history of the industrial heritage site have strong emotional links with this specific urban environment, including shared experiences and stories and also consensual values within a specific community *(*Rhodes et al., 2021*)*. Some industrial heritages have deeply impacted the lifestyle of a certain group of people, leaving them with indelible memories (Berger, 2019). Compared with the traditional community, industrial heritage quarters are new models of workplace-centred human settlement, whose development and decay have a deep impact on the formation of the modern urban context. The contribution of regeneration is not only shown in the preservation of physical elements and storage of old memories but is also highlighted in the potential of accumulating and generating new memories among the communities. However, some of the emotional attachment to an industrial heritage is not always positive of former spirit and pride. In fact, it might relate to unpleasant memories, such as safety accidents, pollution issues, job loss, community destruction, or simply fear of the future *(*Iqbal et al., 2022*)*. The negative aspects of the industrial heritage are also important in making people reflect on past mistakes, which is the impel of technological, management and social development.

Significance in tradition and custom: Industrial heritage sites often host cultural events, festivals, community gatherings, and educational programs that celebrate industrial achievements, technological advancements or successful labour movements, reinforcing traditional practices and community bonds (Smith, 2006a). Activities and lifestyles left from the industrial age may also have a profound influence on local customs *(*Rauner, 1997*),* such as the use of tools, food habits, time schedules, special daily ceremonies, etc. It might also generate some long-lasting traditional skills and living habits that are influenced by production and working activities.

Influence on policies and regulations: The political significance of industrial heritage illustrates how the protection and regeneration attempts are impacted by policies, as well as how the actual practices influence the formulation and adjustment of policies. With the growing focus on industrial heritage, many countries and cities have developed conservation and regeneration guidelines, including perspectives on value assessment and list designation, architecture conservation and reuse, and urban development (Rautenberg, 2012). The regulations and principles illustrate the significance of industrial remains and landscapes, promoting local and national actions to maintain the existence of industrial heritage. On the other hand, the development and regeneration of urban industry influence the transformation of land use patterns and labour structure (Chan et al., 2019). During the process of preservation and regeneration, practical experiences also raise guidelines and policies to address previous issues and guide future actions.

Significance for education and research: The original educational and academic significance lies in the capacity to gain knowledge from the industrial past through archaeological techniques. Nowadays, it can also refer to the potential of promoting public awareness of industrial history and the continuity of industrial culture through

tourism, education and training *(*De la Torre, 2002*)*. Besides, the research and educational value of industrial heritage is high in the science and technology of industrial production and management. They are the wisdom left from industrial civilization and are worthy of being inherited and passed through generations *(*Feilden and Jokilehto, 1998*)*. The continuity of technology and skill relies on the opportunity for research and training. The research on industrial archaeology and technological history contributes to the comprehensiveness of heritage records *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012*)*. With training and education activities, knowledge and skills are more likely to maintain their activeness in the long term.

d) Aesthetic Value

Industrial heritage also has aesthetic qualities in terms of architecture, design, and planning. This value tends to be specific to time and cultural context, but not always culturally exclusive as a visual impact.

The beauty of industrial architecture is appreciated as a perfect combination of function and form (Stibral and Faktorová, 2021). 'If we perceive and assess industrial and technical structures from an artistic-symbolic perspective, it is clear that the value of these works is not based only on their functional and technical components, but also derives from their specific poetry, monumentality, and beauty *(*Jevremovic et al., 2012,87*)*.' And this aesthetic value comes from the purity of structure and fabric.

The aesthetic value also exists in other derivative art forms and genres such as artworks, literature, movies and films, etc. The aesthetic style of steampunk is largely derived from the visual and thematic elements of industrial and post-industrial machines, architecture and cities. This includes the co-existence of advanced technology with decaying urban landscapes, reflecting both the rational order of industrial progress and the chaotic beauty of urban decay (Onion, 2008).

The industrial architecture, structure and landscape have outstanding industrial aesthetics. Considering the style, structure, configuration, space, fabric, detailing, etc., the urban quarter with industrial relics is of unique visual attractiveness that figurate the power of technology and machinery. Even though some of the sites have been abandoned, the ruins are also valued for the beauty of dilapidation *(*Jevremovic et al., 2012*)*.

Public preference for industrial remains: Public preference for industrial remains reflects an appreciation for the historical and cultural significance of industrial heritage sites. These preferences can be influenced by the site's historical importance, nostalgia, and social impact. When people value industrial remains as part of their cultural identity and cherish the sites for collective memories, the preservation and regeneration activities are more easily forwarding (Throsby et al., 2021). Such preferences highlight

the importance of engaging local communities and reflecting social requirements in heritage conservation efforts.

Visual impact of architectures: The visual impact of architecture in industrial heritage sites relates to the aesthetic evaluation of the design, form, and details of the buildings (Tweedale, 1992). Industrial buildings, such as factories and warehouses, are often designed into unique architectural styles characterized by functional requirements and robust materials. Their preservation can enhance visual attractiveness and place identification of the heritage site, serving as a recognizable landmark within the urban context.

Visual impact of structures and facilities: The visual impact of structures and facilities at industrial heritage sites relates to the impressiveness of machinery and infrastructure that supports the production process, such as cranes, tanks, silos, pipes, etc. These structures can be visually striking and symbolize productional and technological advancement (Swensen and Granberg, 2024).

Visual impact of landscapes: The visual impact of landscapes in industrial heritage sites relies on the overall aesthetic of architecture and structures, together with the landform characteristics and environmental quality of the surroundings (Stibral and Faktorová, 2021). Industrial landscapes play a crucial role in supporting the production, excavation, and shipment requirements. From the perspective of urban regeneration, landscapes can soften the visual impact of large-scale industrial buildings and structures and provide open space for people (Silva, 2011).

e) Economic Value

In a broad sense, the economic value of industrial heritage can be understood as the benefit generated in the process of heritage-related activities, including research, conservation, regeneration, utilization, etc. One special economic factor that industrial heritage should consider is the productivity of the original function if its original industry is still functioning. This value is more of the profit-lead allocation and utilization of heritage resources, which usually leads to financial results.

The benefit of industrial heritage is ‘included in the modern economic activities being combined with new economic form and highlighting nonnegligible financial value’ *(*Xu, 2013,105*)* during the process of urban transformation. As catalysts for urban development, tangible buildings and landscapes are physical resources for reuse and regeneration. Intangible heritage with outstanding cultural identification also stimulates the creative industry and tourism.

Location and transportation: The location of industrial heritage sites significantly impacts their economic value. The location near functional centres and easy access to transportation hubs promote the attractiveness of redevelopment and increase the land value for the real estate market (Licciardi, 2012). Industrial heritage quarters can benefit if they neighbour commercial, economic and political centres in the urban context. The convenient connection to transportation networks also enhances the tourism, investment and regeneration potential of the site (Licciardi, 2012).

Structural and spatial adaptiveness: A well-preserved industrial heritage quarter is a spatial resource for urban regeneration, as it provides large-scale open areas and completely structured buildings. For one thing, the relatively large-scale spaces of industrial buildings and structures provide the potential for multi-functional development (Clark, 2013). The mixed-use strategy of heritage quarters promotes economic vitality and increases land value. For another, proper reuse of the land, structures and materials can greatly diminish the construction waste and budget *(*Austin et al., 1988*)*.

Potential for tourism promotion: As a unique urban landmark, an industrial heritage quarter is attractive to tourists who are interested in industrial history and culture. During the urban regeneration, the redevelopment of the site is expected to make it more convenient to access and more impressive to experience. Even without considering admission fees for industrial heritage, the consumption of relevant tourism services also greatly boosts the local economy (Berkenbosch et al., 2022). With the idea of encouraging industrial heritage tourism prosperity, the UK and European countries have established industrial heritage trails to revitalize the heritage sites systematically (Kaya, 2017). Many cities in China have also launched industrial heritage tourism programmes to encourage the active development of industrial heritage quarters (Yang, 2017).

Potential for market promotion: In the urban environment, industrial heritage sites can be regarded as a catalyst for the commercial market and real estate market, as the refurbished quarters usually offer ideal places for creative industries and high-end residential blocks *(*Ploegmakers and Beckers, 2015*)*. During the regeneration process, the holistic improvement of the quarter might stimulate the local economy, increase land value and attract investment.

Potential for employment promotion: Developed sites can provide various types of job opportunities. For the development stage, heritage projects require the participation of designers and planners, conservation specialists, construction workers, etc. (Coşkun, 2015). The utilization stage should consider the operation, maintenance, and management of the heritage and property, as well as generate relevant job opportunities. For some living industries, the revitalization of the quarter might increase the scale of the original business and call for more workers. After the adaptive reuse of industrial buildings, many regenerations plan for office properties, inviting new companies and employment. Besides, the development of related tourism also promotes the prosperity of the hospitality industry and creative industry around the quarter (Copic et al., 2014).

f) Natural Value

Industry is a kind of human activity that may have strong environmental impacts. Some production activities relate to the excavation, utilization and processing of raw materials, which closely interact with natural resources and their surrounding environment (Kirovova and Sigmundová, 2014). For those relying on natural resources for transportation and energy, like canal heritage and dock lands, industrial heritage also brings a unique ecological system to the city with water features and greenery.

Many industrial heritage sites are regarded as toxic and polluted brownfields. Therefore, the regeneration of industrial sites is beneficial for reactivating environmental resilience and improving biodiversity *(*Zhu and Zhu, 2012*)*. Heritage quarters that closely interact with natural resources, such as water systems and green lands, contribute to the holistic improvement of the city's living environment.

Significance of current eco-system and bio-system: The significance of the current eco-system and biosystem in industrial heritage sites lies in their ability to support biodiversity and provide ecological functions within the urban context. These sites often resulted from minimal human intervention during the post-industrial period and were gradually reoccupied by various plants and animals (Kirovova and Sigmundová, 2014). These ecosystems contribute to environmental quality and micro-climate adjustment, and serve as green spaces for urban residents.

Potential for environmental improvement: Industrial heritage sites benefit the natural environment by transforming polluted or degraded areas, preserving urban green systems, and providing ecological corridors (Kryder-Reid and May, 2024). Methods such as mitigating site pollution and constructing green infrastructure not only restore ecological balance but also contribute to the overall environmental health of urban areas.

Focusing on both tangible and intangible values, heritage evaluation is expected to capture the essential characteristics of a heritage site and evaluate it from a development perspective. Besides, the evaluation of industrial heritage can benefit the proper maintenance and management of industrial heritage during urban development, assisting decision-making and forming cultural identification.

2.3 Urban Industrial Heritage Quarters

For most industrial countries, urbanization has been a vital consequence of the changes in industrial structure. With the evolution of the industrial production process, facilities of many traditional industries have lost their original function, becoming inactive built environments in the city. However, those left-over places of deindustrialization have

formed and accumulated great historical and social value through their long industrial past *(*Kim and Kwon, 2020*)*.

The significance of the industrial quarters and landscapes has been underestimated for many years as toxic and dangerous urban rustbelts. With the rising attention on this research field, people have realized that industrial quarters and landscapes are actually high-potential heritage resources 'to be reused, regenerating communities, offering real richness and opportunity, reinforcing cultural identity and creating new commercial prospects' *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012,14*)*. This part will define the research scope of urban industrial heritage quarters and briefly introduce the regeneration situation.

2.3.1 Scope of Urban Industrial Heritage Quarters

This thesis focuses on a specific type of industrial heritage that has close interaction with the urban context. Insight into the impact of urban regeneration on industrial heritage, the scope of this research is narrowed down to the industrial heritage quarter that is situated within the urban environment, which will be referred to as an urban industrial heritage quarter.

Urban refers to characteristics, activities, or attributes associated with cities or towns according to the definition of Oxford Dictionary. It includes the dense human settlements with infrastructures, as well as economic, cultural and social activities happening within those settlements. Generally, urban areas relate to higher population densities, diverse communities, developed transportation networks, and a concentration of services such as healthcare, education, and entertainment (Weeks, 2010). Looking into the scale of urban area, we can start from understanding what is city and town.

The terms, 'city', 'village' and 'town', are usually used to describe different scales of human dwellings and often cross-reference each other in definitions. According to the dictionaries, a village is 'a group of houses and other buildings, usually in the countryside' (Cambridge Dictionary, 2024g), which 'forming a centre of habitation' and has 'a simpler organization and administration than a town' (Oxford English Dictionary, 2023). A town, according to the principle sense, is a place larger than a village, with more 'businesses and amenities, and typically has more complete and independent local government' (Oxford English Dictionary, 2024c). Based on the function and scale of a village, a town is a more complex place where people not only live but also work, including houses, shops, workplaces, and entertainment places (Cambridge Dictionary, 2024f). A city is usually regarded as a more upgraded town. Literally, a city is defined as 'a municipality of larger size or population than a town' according to the Oxford English Dictionary (Oxford English Dictionary, 2024a). Besides only focusing on the scale of the physical boundaries, a city is also defined by the functions that facilitate the operation of this system, such as its economic, social and cultural networks. Generally

speaking, a city is ‘a relatively permanent and highly organized centre of population’ which serves as a hub for dwelling, commerce, administration, and services (Lampard, 2024).

As the term ‘urban’ can refer to either a city or town, to narrow the research scope, ‘urban’ in this thesis will only focus on ‘cities’ according to the definitions for the following reasons. Firstly, from the perspective of significance, a city normally has greater economic, cultural and political influence compared to towns. Secondly, the built environment of a city is usually more complicated and diverse in scale, function, and fabric, which is accumulated from a long period of continuous transformation and regeneration (Couch, 2017). Thirdly, compared to towns, the development of cities leads to faster population density growth, resulting in a more urgent need for spatial solutions. Therefore, the preservation and reuse of industrial heritage sites is relatively important to meet the future development prospects (Smith, 2006a).

However, due to the complexity of a city, there is no single definition and description that can cover all the transformations and aspects of how a city came to appear and what exactly a city comprises (Mumford, 1961). Therefore, different countries define their own cities according to various criteria. For the UK and China, the term ‘city’ carries different connotations according to historical and administrative contexts.

In the UK, the definition of a city is ‘a place which has been granted city status by the monarch’ (Sandford, 2022). Historically, a city has been recognized as ‘a designation bestowed upon towns that had a cathedral’ (Yorkshire, 2014), which is ‘of major size or importance having the status of an episcopal see’ and size does not matter (McClatchey, 2011). This criterion adjusts over time when with the changing of population, density and social significance. Currently, except for having a cathedral, the city’s status can also be associated with having a university, ‘a particular form of local government, or having a large population’ (Sandford, 2022). In 1889, Birmingham became the first city from a town without a cathedral, a cathedral is then no longer a required criteria in the UK. Currently, the UK has 36 cities with a population of more than 175,000, including 12 core cities that are major population and economic centres (Baker, 2018).

In China, the term ‘city’, which is called ‘城(Cheng)市(Shi)’, is actually a combination of two concepts ‘城(Cheng)’ and ‘市(Shi)’. The meaning of the term ‘城(Cheng)’, can be regarded as something similar to a town or village, and refers to an area of human dwellings which is an enclosed territory with a defensive function (Zhao, 2009). The term ‘市(Shi)’ is known as a place for the market, the centre of trading and commercial purposes. Therefore, the term ‘city’ in Chinese has both physical and functional connotations. Historically, to distinguish the city from town, village or clusters, a city must be of a remarkable scale with high-density human dwellings; have relatively permanent political, cultural or religious architectures; provide space for trading and marketing; and sufficient essential infrastructure such as transportation system, defence system, drainage system, etc. (Zhuang and Zhang, 2002). According to the official definition, a modern city in China refers to a residential area that is mainly characterized

by non-agricultural industries and non-agricultural population clusters, including cities and towns that are designated by the state administrative system (Ministry of Housing and Urban-Rural Development of the People's Republic of China, 1999). This definition shows that the hierarchy of cities in China is mostly administrative and industrial-based. Tier systems are widely used to classify Chinese cities, which divide cities into 4 tiers based on their administrative hierarchy, economic development, and population. Four major cities Beijing, Shanghai, Shenzhen and Guangzhou are tier-one cities due to their large populations, significant economic outputs, and substantial administrative status.

A quarter, in the context of urban study, usually refers to an area where a particular people work and live or where some particular activities (such as residential, social and commercial activities) happen (Jayne and Bell, 2017). As a physical urban settlement, a quarter can also be characterized by its unique administrative structure, distinct localized community, spatial and functional appearance, industrial and business forms, and boundaries (Hall, 2014, Carmona et al., 2010). An urban quarter in this study, a quarter with urban attributes, is not an isolated piece of land. It should functionally fit in the city and have social, economic and environmental interaction with the surrounding area. Unlike bigger-scaled industrial districts, industrial heritage quarters highlight the attributes of physical industrial space and non-physical social characteristics that relate to industrial activities *(*Huang et al., 2022*)*. Based on the aforementioned introduction, the scope of an urban industrial heritage quarter in this study is defined as:

> *An urban industrial heritage quarter is a physical area within a city characterized by both tangible and intangible industrial heritage. This area can be marked by its historical or ongoing industrial activities and might be accompanied by industrial communities.*

An urban industrial heritage quarter in this study may have physical elements including industrial landscapes, architecture, structures, machinery, infrastructures, equipment, documentation, etc., which present evidence of the production process and related living habits. It is functionally and physically integrated into a broader city area and also have a certain degree of environmental social, cultural, and economic interaction with the surrounding urban area. The characteristics of an urban industrial heritage quarter are multi-dimensional, including industrial type, spatial layout, location and current function and social relationship.

a) Industrial type

Urban industrial heritage quarters showcase a variety of industrial types, each reflecting the original production activities that influence the development of the area. In an urban industrial heritage quarter, the area can be occupied by one specific industry or an integration of several different industries.

Among all industries, the representative types in the urban context are manufacturing industries, storage industries, essential urban infrastructure and transportation industries. Manufacturing industrial heritage in the city mainly includes textile factories, food and beverage processing factories, metal and machinery factories, etc. The architectural style and organization of space of the manufacturing industry rely greatly on the production process of the specific factories. For example, some textile factories are large space buildings to hold a series of spinners with sawtooth roofs designed for better lighting and ventilation; brewery factories are usually seen with groups of large fermentation tanks; heavy-duty metal and machinery works normally accompany structures such as furnaces and chimneys (Aitchison, 2014). Storage facilities of industrial heritage sites include loading areas, warehouses and silos, cranes, etc., which are usually constructed close to convenient transportation. Essential urban infrastructure refers to electricity, energy, water supply, communication, sewage and disposal plants that are assisted by systemically organized equipment and facilities and integrated into larger urban infrastructure systems. Transportation heritage includes railways, docks, airports, tunnels and highways, etc. This heritage usually forms a broader-scaled industrial landscape and influences the surrounding area with more integrated functions.

Studying the industrial type of an urban industrial heritage quarter is important because it provides evidence of how the specific industrial activities operated and shaped the physical environment of the area.

b) Spatial layout

The defining feature of an industrial heritage quarter is the presence of industrial heritage texture that consists of a certain amount of industrial remains, including industrial landscapes, industrial architecture, industrial structures, machinery, production equipment, and infrastructure. Generally speaking, it can be divided into three different types, which can be summarized as a clustered urban industrial heritage quarter (with a cluster of industrial heritage that forms a strongly identifiable space) (Figure 2. 2, Figure 2. 3), a decentralized urban industrial heritage quarter (with a certain amount of industrial heritage distributed and interwoven within the quarter context) (Figure 2. 4, Figure 2. 5), or an industrial urban complex (a large-scaled industrial architecture that forms an urban settlement on its own with complex utilization) (Figure 2. 6, Figure 2. 7) (HKU, 2020, Collazo, 2022).



Figure 2. 2 Tianjin Tractor Factory (https://www.archdaily.cn/cn/940439/tian-jin-tuo-la-ji-han-cheng-shi-geng-xin-archiland-zhu-tu-guo-ji Last access 17/11/2024)



Figure 2. 3 Tianjin Tractor Factory Buildings (Adapted from google map)

Clustered urban industrial heritage quarters: Tianjin Tractor Factory is a representative cluster of industrial heritage architectures situated in the western district of Tianjin. The series of factory buildings have been well preserved and planned as a whole commercial district.

The clustered urban industrial heritage quarter is mainly seen as gathered industrial heritage remains that are closely located and interact with each other due to the requirements of the original production process. The decentralized urban industrial quarter is described as a more hybrid industrial heritage quarter, in which heritage remains are embedded within the urban texture. The industrial urban complex refers to a massive heritage building, whose volume is compatible with an urban quarter in the local context. The spatial character illustrates how the industrial heritage interacts with existing urban texture, which closely influences the identification and regeneration prospect of the site.



Figure 2. 4 Street view of the Jewellery Quarter Birmingham with jewellery manufacturing workshops along streets (Photo by author)

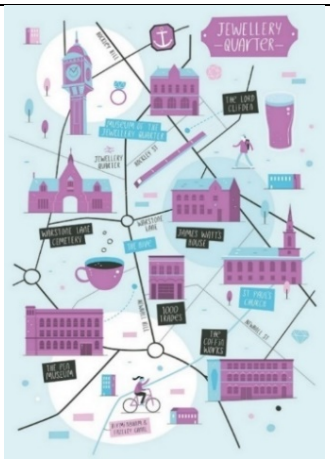


Figure 2. 5 Illustrated map of heritage attractions of the Jewellery Quarter (https://tomwoolley.com/jewellery-quarter-illustrated-map/ Last access 17/11/2024)

Decentralized urban industrial heritage quarters: Jewellery Quarter, as its name indicated, was once a gathering district for manufacturing and jewellery makers. The original workshops and factories, together with residential buildings, have formed a community with unique industrial characteristics, which is now developed into a vibrant and mixed-use community, with shops, bars, museums, restaurants, etc.



Figure 2. 6 Battersea Powerstation (Photo by author)



Figure 2. 7 Masterplan of Battersea Powerstation (Photo by author)

Industrial Complex: This massive industrial architecture is a famous landmark and cultural icon on the south bank of the River Thames, London. Although the exterior of this big complex has been preserved as a whole, the inner space has been

regenerated into a multi-functional and vertical indoor urban space with offices, residential areas, shops, museums, etc. It actually serves the city and the surrounding context as a mixed-use quarter in an iconic configuration.

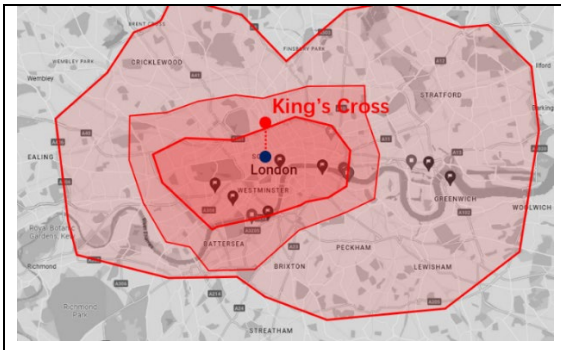
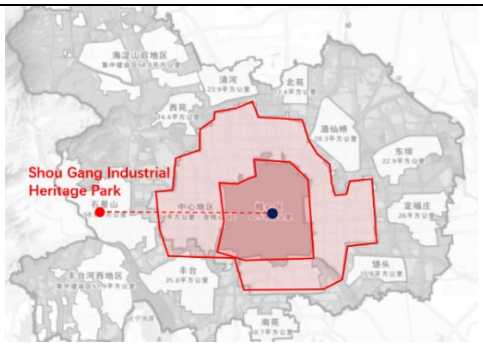
c) Location

This character can be described by the relationship between the urban industrial heritage quarter and other urban locations. The location of traditional industrial quarters is largely impacted by the convenience of transportation, accessibility of resources and the required scale of production space *(*Swensen and Stenbro, 2013*)*. Looking into the transportation of industrial heritage sites, many are closely located near waterway systems and railway systems. Waterfront industrial sites occupy a great proportion as they offer cheap and efficient transportation and easier access to water power resources. The Industrial Revolution promoted the prosperity of the rich waterway system with rivers and canals, leaving diversified types of industrial heritage such as docks, quays, wharves, etc. (Figure 2. 8, Figure 2. 9). With the development and advent of railway and car transportation, the waterway system has gradually declined as industries were not necessarily relied on the close location with canals or rivers.

	
Figure 2. 8 The old photo of the Birmingham waterways (https://www.birminghammail.co.uk/news/nostalgia/birmingham-canals-old-photos-waterways-6875376 Last access 17/11/2024)	Figure 2. 9 Old industrial remains along Suzhou Creek, Shanghaim (https://m.thepaper.cn/kuaibao_detail.jsp?contid=2968423&from=kuaibao Last access 17/11/2024)
The old canal of Birmingham played a vital role in the city's industrial history.	The Suzhou Creek was an important linear industrial settlement in Shanghai. With

As a key transportation route, it stimulated the steel and iron industry of Birmingham, as well as the manufacturing industry.	numerous warehouses, factories and plants along the side, this river served the city as an efficient transportation artery for materials and goods.

Therefore, some bigger and more heavily polluted industries have moved to the suburbs, while other smaller light industries have developed together during modern urbanisation (Figure 2. 10, Figure 2. 11). The location character of an urban industrial heritage quarter reveals the history of how the site has transformed and indicates the preservation and development potential based on the holistic city plan.

	
Figure 2. 10 Location of King's Cross quarter and the relationship between London's central area (Adapted by author from Google Maps)	Figure 2. 11 Location of Shougang Industrial Heritage Park and the relationship between Beijing core and central area (Adapted by author from development masterplan)
The King's Cross quarter was a cluster of many industrial sites with various remains of warehouses, factory buildings, oil tank structures and relative facilities. This quarter has developed into a vital urban neighbourhood within Central London, which is situated between the famous King's Cross transportation hub and the Camden area in the north. The original industrial site has benefited greatly from both the railway station and the Regent's Canal.	The Shougang Industrial Heritage Park is regenerated from the original iron and steel corporation. Due to the spatial requirement and pollution during the heavy industry production process, this site was located off the central area of Beijing. This massive corporation once catalysed the development of its surrounding quarter and created a unique industrial community.

d) Current function

Identifying a regenerated industrial heritage quarter by its current function should consider the reuse condition of historical buildings and the mixed functional development of the site.

Considering the current function, one special kind is the living industrial heritage, which carries forward the production activities. These sites maintain their historical significance by inheriting the physical heritage, the production process and the industrial culture of the company (Rifaioğlu, 2022).

Regeneration projects of industrial heritage quarters usually adopt a mixed-use development strategy that calls for the efficient integration of residential, commercial, cultural, and recreational spaces. This integration helps create a vital urban environment where people can live, work, and interact with historical remains. The functional arrangements of such projects rely on the spatial adaptiveness of architectures and structures and regeneration targets that the quarter expects to serve (Bottero et al., 2019).

Regenerated industrial heritage quarters may also include the design of public spaces and green areas, providing residents and visitors with places for leisure and community activities. Public spaces mainly include parks, plazas, and waterfronts that enhance the aesthetic attractiveness and improve environmental quality of the area (Chiesura, 2004). The design and arrangement of open spaces also relate to visual attractiveness, which influences the extent of public perception of heritage relics.

By evaluating these functional transformations, people can identify and appreciate the ways that industrial heritage lives a new life in a contemporary urban context (Clark, 2013). The performance of current functions also provides practical experience for future development and conservation.

e) Social relationship

From a social perspective, an urban industrial heritage quarter has a strong connection with the local historical backdrop, and there is close interaction between the heritage site and its community. During the development of the city, some industrial remains might have been reused and transformed in order to adapt to contemporary urban requirements. However, traditional industrial activities still have an influence on the surrounding social environment. Historical industrial activities contribute to the local economy and labour conditions, affecting the form and development of relevant industrial communities.

The current relationship between the heritage quarter and its urban environment also has continuous social impacts, including community engagement and creating urban identity during the preservation and reuse process. Heritage is a dynamic concept, depending on how people value the tangible and intangible remains of the past. For industrial heritage, especially in China, many sites are undergoing a process of serialization, which raises the importance of valuing industrial heritage quarters based on not only its past but also its ongoing future potential.

2.3.2 Regeneration of Urban Industrial Heritage Quarters

During the past two hundred years or so, cities have experienced dramatic evolution and expansion and that raises the question of how to deal with industrial heritage sites during the development and regeneration process.

Urban regeneration is a comprehensive and integrated vision and action aimed at the improvement of physical, economic, and social conditions in urban areas from decline or decay (Roberts, 2008). Historically, urban regeneration received public attention in post-war reconstruction efforts, especially in Europe. Originally, it concentrated mainly on physical redevelopment, utilizing destroyed land or demolishing old buildings for new construction. The concept of urban regeneration has then extended with more emphasize on the importance of re-establishing social context and revitalizing economic strength (Tallon, 2010). From the social and economic perspective, urban regeneration should not only refer to creating something new but also to establishing a new connection between the new and old. An effective regeneration plan integrates the existing urban fabric with developing spatial requirements, encouraging community engagement and economic revitalization by preserving historical elements and adapting them for contemporary use (Li and Qu, 2022).

For urban regeneration with industrial heritage sites, one important thing that should not be ignored is those places that used to be places of work. Although many physical pieces of machinery were moved away soon after closure, industrial heritage was not empty shells lacking life and activities. They once had machines and facilities running, people working and living, and skills inherited inside, all of which are the reasons for their existence (Frisch, 1998). Therefore, in situ relics and the stories that happened in history are important as evidence showing how the industry started, developed, produced and declined, as well as how it interacted with individuals and communities. Moreover, regeneration should extend the life of existing structures and buildings which can be saved as heritage relics.

a) Methods of regeneration

In order to effectively reuse the heritage for modern urban requirements as well as maintain its historical significance, there should be proper methods applied during the regeneration process, including heritage conservation, adaptive reuse, community engagement and mixed-use development (Ifko, 2016). These methods usually work in a cooperative way to achieve better regeneration prospects.

Heritage conservation refers to the protection and maintenance of industrial landscapes, buildings, structures, machinery, and other relics to improve the integrity of the heritage site. In terms of tangible urban industrial heritage, the physical remains need refurbishment to inherit cultural and social significance, ensuring the architectural and structural quality meet the contemporary utilization and safety requirements *(*Oevermann and Mieg, 2015*)*.

From the perspective of physical development, the approach of adaptive reuse is feasible and effective. Adaptive reuse is a commonly adopted approach for urban regeneration, which refers to the process of refurbishing and revitalizing a historical architecture and urban space by structural restoration and reinforcement as well as functional transformation *(*Plevoets and Van Cleempoel, 2019*)*. For industrial sites, adaptive reuse introduces a new future into the urban quarter by adapting more adaptive and sustainable functions, while also bringing their industrial past and culture to light.

Although the adaptive reuse of physical relics does contribute to the successful transformation of industrial urban spaces, turning abandoned land and structures into commercially hot properties, there are still some limitations in actual implementations. On many occasions, industrial heritage quarters are 'appreciated as assets-in-waiting, ready to be adapted to another perhaps quite an alien purpose unconnected to their history' *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012,12*)*. However, regeneration is not just about recycling and functional replacement of physical structures; it should reinforce rather than erode the fundamental values of a heritage place based on a comprehensive understanding of its buildings and context.

Compared with physical remains, intangible industrial heritage is more vulnerable as traditional industrial culture is not as valued in modern life due to the development of science and technology. One weakness of recent regeneration practices is that the carefully presented values of a typical project mean little to outsiders. In such a situation, a new dilemma arises about how to ensure the industrial past matters continuously to future generations. To maintain the industrial culture, it is challenging to have the value of industrial heritage sensed and articulated even by people who have no background in its history *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012*)*. Therefore, it is obliged to engage with the local community during the process of preservation and design, reflecting the needs of current users, making them

aware of the industrial history and culture, and showcasing the symbolic characteristics of the site.

Mixed-use development is an important method in urban industrial heritage quarter regeneration, combining residential, commercial, cultural, and recreational spaces within a single area. Through adaptive reuse, a multifunctional development helps the regeneration to achieve a vital and economically effective urban environment by appropriately using old industrial buildings and spaces for new functions while preserving their historical essence (Couch et al., 2011). For many cities, the regeneration of industrial heritage quarters acts as a catalyst for providing better urban space for residential, business and leisure purposes, as well as boosting the local economy through tourism and land development (Xie, 2015b).

The benefits of regenerating the industrial heritage quarter lie in the preservation of 'the tangible and intangible traces of the past to maintain the passage of time and to create a spatial and programmatic environment in which various activities can transpire' *(*Kim and Kwon, 2020,4*)*. This process of regeneration requires a balance between the preservation of heritage and the development of the city. The regeneration of old industrial sites contributes to environmental resilience in dealing with industrial pollution, improves energy efficiency in adaptive reuse and promotes effective resource management during the regeneration process *(*Sýkora et al., 2010*)*. It helps provide better living and working spaces for the local residents and recall the industrial culture through active community engagement *(*Chan et al., 2019*)*. Industrial heritage regeneration also considers the continuity and efficiency of the economy through adaptive reuse, as well as the functional and tourism potential of mixed-use development *(*Landorf, 2009*)*.

b) Heritage regeneration and value variation

Looking into the value of industrial heritage, the regeneration of those urban quarters will influence the condition of tangible and intangible heritage, which, as a consequence, will lead to the variation of the value aspects. This variation does not always mean an increase, and one method does not always lead to the same result.

For historical value, most of the evaluation aspects are based on established facts, such as the year it started, the things it experienced, the people it related to, etc. Those facts exist and are fixed with its site, regardless of whether people see it or know it. However, how people value history is relatively flexible, depending on how complete the history is presented and what aspects can be sensed by the public (Ricci et al., 2024). In practice, regeneration methods that influence tangible and intangible heritage integrity and authenticity will lead to the variation of heritage value. For example, the preservation and maintenance of heritage buildings might contribute to better heritage integrity, and demolishing activity might lead to deterioration (Bullen and Love, 2011). However, in

some cases (such as Highline Park in New York), properly demolishing redundant architecture to emphasis the importance and spatial relationship of main heritage buildings will effectively improve the impressiveness of history (Lindner et al., 2017). Therefore, the actual influence of regeneration on the historical value of the industrial heritage quarter is an integrated consequence based on how the heritage and its surrounding urban context are preserved, exhibited, organized and presented to the public.

For the scientific and technological value of industrial heritage, its advancement and innovation in science and technology are facts in history, such as the machines it invented, the theories it developed, the production flow it created, etc. However, similar to historical value, scientific and technological value can be enhanced among the public through the preservation of production-related relics and the continuity of skills and techniques; it can also diminish these values if such features are lost or overshadowed during the development of industry and city (Pahl, 2015). In practice, the restoration of machines, buildings and infrastructure influence how comprehensive the production process and technological achievements can be distinguished by people, which can also be achieved by AR and VR if some key relics are not applicable (Paulauskas et al., 2023). The continuity of skills and technology relates to the clarity and interactiveness of documentation, demonstrations and experiences, which assist public understanding and the possibility of passing the skills to new generations.

The socio-cultural value of industrial heritage may experience change, which can be considered according to the preservation and continuity of past culture and the creation of future culture. Regeneration methods that revive traditional crafts and practices associated with the industrial past can re-interpretate industrial culture and promote the adaptation of such intangible heritage in the current context (Sun and Chen, 2023). Preservation of symbolic landmarks and community engagement during the regeneration process contribute to place identification and generate a sense of belonging among relevant people and local communities (Smith, 2006a). However, these methods may also remind a particular group of people of bad memories. Whether the value variation is positive or negative also depends on how regeneration treats bad memories, such as whether those memories can be healed or ameliorated or whether they will provide important trial and error that people can learn from (Alberts and Hazen, 2010). This value also needs to consider its potential for future development and research, such as its influence in policy making about heritage and urban issues, and its inspiration in heritage management and urban study.

The aesthetic value of industrial heritage, as we have mentioned before, is fundamentally based on public perception of the architecture and landscape. Elements such as material, scale, proportion, configuration, spatial organization and the surrounding environment contribute to the visual impact and attractiveness that the site presents to people (Jevremovic et al., 2012). Over time, the materials, appearance, and textures of industrial heritage sites evolve with historical imprints that further influence the aesthetic perception of history (Stibral and Faktorová, 2021). These historical traces

interact differently with individuals, shaping diverse perceptions of beauty. During the regeneration of such quarters, the methods employed will influence the visual outcome of the heritage site, altering its overall spatial and architectural appearance. The newly designed modern façade and well-planned open spaces are beautiful and pleasant for some people, while others might prefer a more casual and historical scene that looks not so artificial (Lehtinen, 2022). Additionally, public aesthetics change over time with the evolution of structure and material. In practical cases, the influence of urban regeneration on aesthetic value should also consider specific periods, contexts, and target audiences.

Economic value is valued for its variation, which emphasizes the economic potential during regeneration. The variation of this value is much more objective and clearer compared with other values, simply about the degree of economic improvement or the achievements that can lead to economic improvement. In practice, the methods that improve the infrastructure of the site and the increase in the service function may make it more attractive to visitors and businesses. The development considering multi-functional possibilities will also promote diversity in the market and boost the land value. Usually, in such regeneration projects, the construction, management and utilization activity are closely related to employment opportunity, which influences the economic condition of the local area. However, there are also situations in which the Input-return ratio is not as satisfactory as expected, such as the rental of shops and house prices being raised too high for its targeted users to afford after regeneration, resulting in vacancies (Finio, 2021). Therefore, the economic value of industrial heritage is dynamic within the context of urban development.

Natural value is also a potential focused value, looking at the improvement of environmental quality during the regeneration. For industrial heritage sites that are polluted, regeneration should help decrease the harmful substances in soil, water, and air. The regeneration plan may also provide green spaces and green belts for the city with a bio-diversified plan. At the same time, some long abandoned sites might have already been re-occupied by plants and animals and developed a small ecosystem itself. The intervention of such sites during regeneration should evaluate the influence of this raw natural environment on the city and balance the degree of new construction within the existing environment. (Kryder-Reid and May, 2024)

Overall, the value variation of industrial heritage values is a comprehensive result based on the interaction and balance between different aspects. During the process of regeneration, any small changes relating to the tangible and intangible heritage context impact the presented details of the industrial heritage quarter and result in the variation of actual regeneration performance or people's attitude towards different value categories.

2.4 Conclusion

Looking at the evolution and transformation of modern cities, industrial quarters have played an essential role in shaping the urban texture, economic structure, and social lifestyle. The preservation and regeneration of the industrial heritage sites is important for both the heritage and the city. This chapter introduced the background, the connotation, and the value of industrial heritage, illustrating why, what, and how to cherish industrial heritage as a window into our industrial past.

The study of the fundamental definition and theory of industrial heritage and value reveals its multi-dimensional significance. However, the evaluation work of this special type of heritage varies from country to city. In order to form a comprehensive understanding of industrial heritage, this chapter then studies the various evaluation criteria systems of industrial heritage based on up-to-date documents, and summarises an in-detailed evaluation system for this study.

Besides the value study, this chapter also defined the scope of an urban industrial heritage quarter, which is the kind of industrial heritage site that closely interacts with the urban environment. This thesis focuses on this specific type of industrial heritage site, which is currently a hot but complicated urban topic for regeneration and development. This chapter also points out that, during the regeneration, the values of an industrial heritage quarter will be changed according to applied methods and regeneration plans. From the heritage perspective, the expectation of regeneration is usually to maintain or improve the values of the industrial heritage quarter. However, how regeneration actions contribute to the value of heritage remains unclear.

Later in the contextual sensitivity analysis, the relationship between regeneration and heritage value will be assessed, establishing the relationship between the value variation and urban context factors.

Chapter 3. Contextual Sensitivity in Urban Studies

Contextualism emerged around the 1960s and talks about how new architectures and places should remain harmonious and maintain co-existence with their embedded urban context. This idea then evolved into a comprehensive approach, considering economic, social, and environmental context factors. For the research of urban issues, contextual sensitivity is regarded as a practical and detailed approach to realizing the overly abstract sustainable goal. This approach prioritizes a comprehensive understanding of the complex and dynamic urban contexts, which are shaped by diverse factors, attempting to provide tailored design and plan during regeneration and development.

This chapter aims to illustrate the importance of context in understanding urban environments, with a comprehensive introduction to contextual sensitivity theory from the perspective of the urban study.

The first section will start with the term ‘context’ in urban studies. Exploring the meaning of context will illustrate what exactly should we consider when talking about context. Based on the understanding of context, this section also introduces how the importance of context is gradually valued in the discourse of architecture and urban design.

The second section focuses on the concept of contextual sensitivity, illustrating why the idea of being sensitive to contextual factors during urban design is regarded as a practical and effective approach. This part will introduce the theories relating to contextual sensitivity, including how this concept developed, how urban thoroughfare design proposed Context Sensitive Design, and how context-sensitive study works as a quantitative method to analyse the impact of context factors.

Based on the study of contextual sensitivity concepts, the last section of this chapter will talk about contextual sensitivity from the perspective of urban regeneration, introducing what contextual sensitivity means in this thesis, what is contextually sensitive urban regeneration, the potential benefits of contextually sensitive urban regeneration, and the potential utilization of implementing contextual sensitivity in urban regeneration practice and research. This section lays the foundation for adopting contextual sensitivity analysis in the study of urban industrial heritage quarter regeneration.

3.1 Understanding Context in the Field of Urban Studies

Urban studies are always complicated research works that include a wide variety of contents and perspectives to fully demonstrate and analyse the ever-transforming modern cities. One important concept that highlights the complexity and necessity of such urban studies is the notion of 'context.' In the field of urban study, the connotation of context usually refers to the integration of social, economic, and physical factors that shape and impact the development and functioning of an urban environment.

The significance of context was once underestimated as cities are dynamic and hybrid entities, and no factors are maintained stable throughout the transformation. However, as research about the scheme of urban development raised, people began to realise that contextual factors including economic and social conditions, historical and cultural background, and environmental information actually contribute a lot to the unique identification and prospects of an urban quarter. The understanding of a wider context has a great contribution to the authenticity and integrity of industrial heritage because the public perceptions of heritage are not only based on what the material relics appear to be, but also 'derive from the roots, sentiments and attitudes that lie elsewhere' *(*Douet and International Committee for the Conservation of the Industrial Heritage, 2012,8*)*. Each industrial heritage project should focus on its own context and should be reproduced accordingly with its unique character and value.

3.1.1 Definition of Context

Linguistic Definition of Context

'Context' is a word with an abstract and broad meaning, and it needs to be studied from its own 'context' from an evolutionary perspective. Although the term did not originate in architecture and urban areas, the fundamental initiative of adaptation can help us to understand this inclusive and intelligent philosophy.

Context stems from the Latin word con-texere, which means weaving together. Therefore, in many circumstances, if we would like to describe a 'context', we need to define the entities and their properties with the interweaving of them *(*Kaiyu, 2009*)*. The earlier definition and practice of context originated in linguistics, referring to 'the text or speech that comes immediately before and after a particular phrase or piece of text and helps to explain its meaning' *(*Cambridge Dictionary, 2024b*)*. The notion of 'context' was then extended to describe 'the situation within which something exists or happens, and that can help explain it' *(*Cambridge Dictionary, 2024b*)*. This definition highlights the

setting of a focal event, which should never be cut out from its surroundings for analysis *(*Goodwin and Duranti, 1992*)*.

When discussing the 'context' as an entity, the setting can describe the social and spatial environment in which the interweavings are situated. People can refer to the setting as either background or circumstances surrounding a tangible or intangible item. The essential point is to be aware that all co-related elements should be seen as a whole. The importance of context shows up when it reveals why elements of an item's content are integral and inseparable in forming the entirety.

Besides linguistics and semantics, contextual thinking plays an important role in many non-architectural fields when issues and problems need to be considered based on their setting, such as medicine, philosophy, education and psychology. This thought advocates the self-awareness of all inclusions combining an extensive range of both abstract and concrete notions under one subject *(*Çizgen, 2012*)*.

'Context' in Architecture and Urban Studies

According to the Oxford Dictionary of English, context is 'the circumstances that form the setting for an event, statement or idea, and in terms of which it can be fully understood and assessed' *(*Rogers and Stephen, 2020*)*. For architecture, buildings and structures are the 'event, statement or idea', and the surrounding 'circumstances' are usually regarded as the non-physical setting, including the social, political, economic and cultural environment, as well as the physical setting *(*Architects Design Partnership, 2007*)*. Here, the initiative of focusing on the context of architecture and the city is the expectation of understanding and explaining the place from a comprehensive perspective.

Popular connotations of architectural context might appear as the existing fabric, the locality, tradition and the vernacular. The definition and contents of 'context' may vary according to the scope of architectural design or the specific project. Extending the meaning to the urban scale, details of 'contexts can be topography, vegetations, urban condition including building density, street, sidewalks, and the relations of each other, types and arrangement of materials, buildings distances, regional geography condition, urban traffic density, population, and so on' *(*Liauw, 2019,1*)*. From the perspective of urban design issues, adequate depth of 'context' analysis also contributes to solving or responding to many problems 'such like climate change, health and wellbeing, housing, welfare, equality and inclusivity, all of which transcend both geographical and scholarly boundaries, and which require system-thinking and collaborative, pragmatic approaches' *(*Alvarez, 2021,25*)*.

The State of Victoria Department of Environment, Land, Water and Planning suggests in Urban Design Guidelines for Victoria that 'urban context' refers to '…the broader

setting of an identified area. The context may include the physical surroundings of topography, movement patterns and infrastructure, built form and uses, the governance structures, and the cultural, social and economic environment. The urban context can include the community vision for the area, and preferred future character, form and function' *(*Victoria Government, 2016,13*)*.

Although urban context includes a wide range of elements, it still focuses on the macro factors that influence a specific group of people in a specific area. Therefore, when studying the details in an urban context, the scope will be based on elements that have a relatively long-term and extensive impact on the site and its surrounding environment (Rebecchi et al., 2019), excluding individual preferences, accidental events and temporary phenomena. Moreover, the concrete contents of context in different projects should be identified in a way that corresponds to the actual design background and prospect. In another world, every project has its own distinct context. For example, the definition of urban thoroughfare projects is 'the nature of the natural or built environment created by the land, topography, natural features, buildings and associated features, land use types, and activities on property adjacent to streets and on sidewalks and a broader area created by the surrounding neighbourhood, district, or community. Context also refers to the diversity of users of the environment. *(*ITE, 2006,12*)*'.

'Setting' and 'Context'

When it comes to the historical project, one similar term that needs additional illustration is 'setting'. In the field of heritage-related research in the UK, 'setting' is sometimes separated from 'context' as a newly established concept typically for heritage assets. 'Setting' is used to describe 'the surroundings in which a place is experienced, its local context, embracing present and past relationships to the adjacent landscape. Definition of the setting of a significant place will normally be guided by the extent to which material change within it could affect (enhance or diminish) the place's significance.' *(*English-Heritage, 2008,39*)*. Typically for heritage assets, 'setting' has been clearly defined in the Glossary of the National Planning Policy Framework as 'the surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.' *(*Great Britain Ministry of Housing et al., 2018,71*)*.

The extent and significance of 'setting' mainly lie in the visual consideration, the views of or from an asset. Other associated environmental factors in which the assets are nested also influence how people experience a heritage place, such as noise, pollution, historical background, atmosphere of the vicinity, etc. The spatial boundary of a setting is flexible and dynamic depending on different circumstances, and is always overlapping and integrating.

The context of heritage, based on the British heritage research system, is illustrated as a non-statutory term with a broader scope embracing 'any relationship between a place and other places' *(*English-Heritage, 2008,39*)*. Stressing on the connection among places and people, the context is usually multi-layered and multi-dimensional, including but not limited to the site's cultural, intellectual, spatial, traditional, and functional characteristics. In order to understand context, we need to comprehend the origin and evolution of how the place comes to be, while assessing its significance and uniqueness to the entire circumstances *(*English-Heritage, 2008*)*.

We can see that 'setting' seems to emphasise the tangible factors that relate to the physical cognition of a heritage place, when 'context' is a concept beyond 'setting', extending into the relationship with similar assets of the same region, period, function and even designer *(*Historic-England, 2017b*)*. Actually, either in their linguistic definition or implied definition, 'context' and 'setting' are always mutually justifying and inseparable in their notion. In recent years, the study of heritage conservation and regeneration has experienced an interdisciplinary development, absorbing more site information in the decision-making process. The word 'context' is then more popular as an integrated concept, comprising both tangible settings and intangible issues in the site analysis. An area's context is its character and setting, in which a project scheme will be implemented. As part of a project's context, people are also considered, such as the individuals who live in or near the area, as well as how communities are organized so citizens become active participants *(*Schwartz, 2008*)*.

The Conservation Principles, Guidance for the Sustainable Management of the Historic Environment in Northern Ireland, published by the Historic Environment Division in July 2021, defines context as: 'Any relationship between a heritage asset and its setting, including other places and its past, relevant to the values of that heritage asset.' *(*Historic Environment Division, 2021,21*)*.

3.1.2 Evolution of Contextual Thinking in Architecture and Urban Design

Generally speaking, the development of contextual thinking relies on the public attitude towards technology and nostalgia.

The term 'context' is widely used in the late 20th century with the prevalence of contextualism in the postmodern period (1970-1990) *(*Çizgen, 2012*)*. In fact, the idea of this concept existed even earlier, with the development of modernism in architecture in

the 1920s, although it has not been given enough attention. Modernism in architecture[11], taking advantage of science and technological advancements in construction, often pursued universal design principles that prioritized simplicity, function and technology over the specific context of location and setting (Frampton, 2020). The consequence of such design theory usually leads to an incompatible appearance of new architectures with their surroundings (Frampton, 2020).

Towards the end of modernism, the importance of respecting the comprehensive environment was reverted with the prosperous of postmodernism, which emphasised diversity, reflecting elements in urban context and setting, respecting traditional architectures, and communicating with history through symbolic ornamentations (Historic-England, 2017a, Zhou and Zhang, 2015). The organic theory has emerged, emphasising the importance of environmental adaptation. Architecture and urban design should be based on a complete understanding of nature's roots and notions, thereafter being sensitive to the surroundings and learning from the setting. The importance of context is regarded as the inspiration of nature in organic design, especially in the preference for natural configuration and local material. Designs need to seek a harmonious balance 'between the aim of serving human comfort and the desire for design to be attuned to the scientific and environmental data' *(*Çizgen, 2012,35*)*. Although the design of the organic architecture appeared to be a little formalistic as it emphasised too much the appearance (Schilders et al., 2010), the idea of absorbing the factors of context promoted contextual thinking and the formation of contextualism later in the postmodern period.

With the rise of contextual awareness, the importance of context shows up far beyond the visual and climate aspects *(*Çizgen, 2012*)*. Social and economic aspects also play important roles in forming place identification and securing the success of design delivery. By realizing the importance of context, architectural design and urban planning also show a trend of respecting traditional characteristics and local communities.

What stimulated context revitalisation was the weakness of modernist architecture, whose relationship with local context was regarded as too cursory and discordant as they failed to establish a visual, social and historical connection with its surrounding

[11] Modernism in architecture is an architectural movement that started in the early 20th century (around the early 1920s to the late 1960s). Modernist architecture emphasises the priority of function, simplicity of form and adoption of new technology and material, rejecting ornament in design (Gold, 2007).

urban spaces (Giamarelos, 2022). In this sense, regionalism and critical regionalism[12] emerged as the overture of contextualism, aiming to interpret elements of local context in architectural design and urban planning. It was then a popular trend that designers and planners began to value the prominent interplay between artificial structures and local identification. Therefore, a more sensitive approach that considers the environmental and social factors of the targeted site was highly recommended during the decision-making process of architecture design and urban planning *(*Hoagland, 2000*)*.

The concept of contextualism came to light in the postmodern period. It extended the meaning of architecture and urban space to a quest for establishing a balanced unity. Contextualism was defined as 'an approach to urban planning that considers the city in its totality. According to proponents, all architecture must fit into, respond to, and mediate its immediate surroundings' *(*Burden, 2012*)*. Contextual architectures aim to achieve integrity with the tangible setting and the intangible factors. It is not expected to copy the elements of the settings but calls for respecting the context whilst realising the value and avoiding monotonous spaces.

Not limited to the architectures and structures, broader urban spaces require greater attention to contextual factors in the design process, especially historical urban quarters. We ought to consider how new textures and characters are able to harmonise with the old urban fabric and realise a balanced development and preservation *(*Zhou and Zhang, 2015*)*. When the scope of contextualism is extended to the city scale, contextual design approaches are usually facilitated by a comprehensive contextual analysis. Contextual urban design calls for a cohesive outcome, maintaining and enhancing characteristics. Accordingly, contemporary urban design control principles are largely based on contextual thinking, including the key targets of aesthetics, harmony, compatibility, and congruity *(*Stamps, 1994*)*.

The idea of valuing contextual factors focuses on revealing the relationship and relative hierarchy between different urban elements, thereafter understanding how those elements influence each other *(*Alvarez, 2021*)*. The application of contextual ideas has developed and exceeded its pragmatic origin, mainly used as a guiding principle to ensure visual harmony at the construction practice level (Al-Hammadi and Grchev,

[12] Regionalism in architecture (started around the late 20th century) focuses on utilizing traditional styles, local materials, environment elements, and cultural factors to achieve a design that is harmonious with its physical and social context. Critical regionalism, which started around the 1980s, combined the advantages of modernist architecture with the respect of local contexts. Instead of replicating traditional forms, Critical Regionalism adapts and reinterprets local factors for the design by modern technology and principles, seeking to balance global modernity with local context. (Giamarelos, 2022, Frampton, 2020)

2022). Nowadays, urban context is valued as a comprehensive system that assists a deep and multi-dimensional understanding of a place. Especially in urban design and regeneration research, being sensitive to context influence helps reveal the inherent relationship between physical settings and social backgrounds (Al-Hammadi and Grchev, 2022).

For architectural design and urban planning, context information during the site analysis provides hints that lead the project to fulfil the design expectations. Historical urban spaces are usually a complex mixture of function, culture, art and architecture, where people's activities create the special characteristics of a place. Respecting and reflecting on the context factors during the urban design and regeneration of such historical urban space will increase the users' satisfaction and promote the smooth adaptation of new designs *(*Stamatiadis et al., 2009,26*)*.

Throughout the brief history of contextual thinking, the meaning and scope of context have experienced a gradual extension from the reflection of tangible environmental factors to the respect of intangible social-cultural aspects and from the rational and pragmatic focus to a sensual and humanistic perspective. Context is a dynamic concept because the environment and people of a project keep changing from time to time. Therefore, designs and planning ought to be sensitive to the differences and trends and to be flexible to keep pace with the transformation.

3.2 Contextual Sensitivity in Urban Design

This part focuses on how the contextual sensitivity concept is formed, how it has been adapted to assist urban thoroughfare regeneration and how this concept is used as a quantitative method in other disciplines.

3.2.1 Contextual Sensitivity

The 1970s and 1980s saw a significant de-industrialization[13] in North America and Europe due to the changes in industrial structures and the evolution of technology (Reicher, 2022). Meanwhile, the rapid urbanisation during the de-industrialisation has

[13] De-industrialization refers to 'the process by which a country or area depends less and less on industry to provide most of its work or income' in Cambridge Dictionary.

resulted in issues that greatly influence the urban environment and living conditions, such as abandoned industrial lands and buildings, pressure on infrastructures and services, pollution and loss of greenery, etc. (Edelblutte, 2011). In such circumstances, urban regeneration requires a comprehensive consideration of the urban contexts and dealing with the issues raised during the de-industrialization.

Contextual perspective seems like an attempt to directly and clearly demonstrate the factors of context and the inherent relationship between them. Contextual sensitivity[14] started with a focus on context value. The context, apart from the physical factors of urban projects, includes a wide variety of intangible urban elements, such as tradition, culture, religion, history, etc. Looking into the details of an urban project, 'different contexts of history, geography, social, political, economic and environmental dimensions can matter, as well as seeing through the underlying philosophies, in order to carefully and critically contribute to the broader contextual concept of sustainable development' *(*Lee and Lee, 2014,169*)*. The idea of context looks into the close relationship between the piece of land and its surrounding social and natural environment within urban spaces. In contextualism, the built environment reveals the characteristics of the surrounding context, and conversely, context factors shape the actual existence condition of architecture and urban space *(*Shahbazi, 2016*)*.

From a theoretical perspective, contextualism added the historical vector to the regeneration focus. The contextualistic idea deals with events within their settings, which can be 'interpreted as an ongoing act inseparable from its current historical context' *(*Fox, 2008,1*)*. Contextualism not only focuses on the combination of the past and the present, but also on the potential of predicting the future *(*Liauw, 2019*)*. There is a complex weaving between 'a feeling of futurity' and 'a corresponding feeling of pastness' *(*Pepper, 1942,240*)* in the concept of contextualism. Elements of events and settings keep changing based on their historical context towards the future consequences. Therefore, the development and prospects of the city should not ignore the importance of respecting and reflecting on historical issues.

From a practical perspective, contextualism calls for paying more attention to the details of the context and how to utilise and reflect them. When contextual ideas come to planning and designing the urban environment, context-sensitive site planning is proposed as designing with nature, designing with culture and designing for people. The sensitive concept refers to the responsiveness to on-site and off-site contexts during

[14] According to the Cambridge Dictionary, sensitive is to describe a subject that is 'easily influenced, changed, or damaged, especially by a physical activity or effect'. Sensitivity is the attribute of being sensitive. In this thesis, being sensitive to urban context means the development and regeneration actions actively and effectively respond to the urban context to reflect the influence.

the design process, considering a wide range of physical, biological, cultural, and legal elements *(*LaGro, 2013*)*. Apart from a pre-designed template for general sites, a context-sensitive design encourages tailored and creative reactions towards the site's specific characteristics and situations.

For contemporary urban regeneration, contextualism places more emphasis on social development. Previous efforts focus on protecting the balance between artificial resources and natural resources, which is more practical to handle and leads to straightforward effects *(*Rachel Lombardi et al., 2011*)*. As a result, existing urban development and regeneration evaluation and assessment criteria are mainly designed for environmental indicators. However, successful regeneration initiatives rely more on a comprehensive consideration of social and economic nature. The contextual perspective later in architecture and urban design works as a catalyst to push urban regeneration approaches toward the emphasis on social structures and human behaviours (Højriis et al., 2014) .

In 2016, Prof. Tim Heath proposed his theory of contextual sensitivism as a rethinking of the contemporary top-down sustainability strategy at the 3rd International Conference on Engineering Technology and Industrial Application. There are many regularly heard terms like 'green', 'eco', 'energy-efficient', 'sustainable', 'low-carbon', and 'low-energy', etc. However, this theory sees the reality of sustainability, in many cases, as gradually becoming redundant rhetoric with little backup substance and evidence like a marketing ploy (Heath, 2016). The conventional top-down approach does not always work effectively to solve specific problems, so a more contextually sensitive perspective is necessary. Thus, instead of the traditional declaration of ‘Think global, act local’, he argues a better process should focus more on the particularity of each project, which is ‘Think local, act local, impact global’.

Similar to common context-sensitive focuses, contextual sensitivism also focuses on community improvement and placemaking. Heath defined the contextually sensitive community as ‘the symbiotic relationship between humanity and earth that facilitates social, economic, political, cultural and environmental prosperity, so that quality of life, efficiency and fairness is continually enhanced, whilst simultaneously ensuring all forms of life and resources on earth may be sustained for the enjoyment and creativity of future generations.’ (Li and Heath, 2020)

Based on the theory, contextual sensitivism is more of a holistic approach than just a slogan as sustainability. Relevant urban issues should be analysed from social, economic, political, environmental and cultural aspects, which can be assessed following the criteria of BREEAM. Moreover, the approach of the contextually sensitive design includes the following steps:

• Defining the context(s);

• Analyse the context(s);

• Understand the user(s);

• Design to maximise all potential natural resources;

• Maximise integration of renewable resources;

• Introduce relevant technologies;

• Design for flexibility and adaptability;

• Cradle-to-cradle approach to materials;

• Consider construction methods;

• Prepare building management plan;

• Undertake life-cycle analysis and post-occupancy analysis.

Based on the theory of contextual architecture, contextual thinking in urban studies also considers how physical space and place identification come into being. The objectives of contextually sensitive urban studies are expected to stress respect for historical and aesthetic significance, as well as harmony and balance with urban texture and social background.

Contextual analysis in urban development and regeneration is expected to provide benefits by providing a suitable plan to meet the unique needs and characteristics of the site. This approach researches deep into the detailed aspects of the urban context, providing significant references to assist in positive interaction with residents, adaptive preservation and reuse of historical assets, efficient economic development plans, and long-term natural resilience. Therefore, such practical approaches can greatly contribute to achieving a balance between the interconnected components simultaneously *(*Shahbazi, 2016*)*. The concept of contextual sensitivity is expected to offer a synergetic research approach that combines a balance of economic, environmental and social factors in urban regeneration.

3.2.2 Context Sensitive Solution (CSS)

The context-sensitive theory was originally proposed to support the design process and has been developed and applied in the planning and design of urban thoroughfare systems and their surrounding environment. Compared with larger-scale urban quarter designs, the project targets of urban thoroughfare development are more explicit, and

the design factors are easier to identify and handle. The application of context-sensitive design in designing urban thoroughfares acts as an inspiring attempt to exploit its potential in other kinds of urban environments. The principles and practices of context-sensitive design are based on a macro perspective of balancing new projects and existing urban contexts, which is useful for studying historical urban quarters.

Definition of CSS

Contextual Sensitive Solution (CSS) was originally called Context Sensitive Design (CSD) which refers to a design process that was initially based on the planning and development of urban thoroughfares. There has been a trend of cultural retrospection started in the 1960s, concerning more of the environmental and social impact of urban development *(*Neuman et al., 2002*)*. Gradually, the public has no longer seen traffic projects as simply infrastructure-led processes. In the 1998 Maryland State Highway Administration Workshop, researchers defined CSD as: 'CSD asks questions first about the need and purpose of the transportation project, and then equally addresses safety, mobility, and the preservation of scenic, aesthetic, historical, environmental, and other community values. Context-sensitive design involves a collaborative, interdisciplinary approach in which citizens are part of the design team *(*Neuman et al., 2002,2*)*.' Not only focuses on physical aspects, CSD also emphasises the significance of the economic, social and environmental context of the project. A successful CSD is expected to ensure safe and satisfactory transportation planning, and also add lasting value to the local community. Therefore, the stakeholders' inclusiveness and participation in the decision-making and problem-solving stage and the effective and efficient resource utilisation should be emphasised throughout the designing process *(*DOTs, 2018*)*.

The terminology used express CSD has experienced an evolution based on 'place sensitive design, focusing on topographic, visual, and community surroundings' *(*Neuman et al., 2002,3*)*. However, the success of transportation projects is not limited to the design process but should include the whole cycle of design, construction, management, and maintenance. Therefore, the term 'solution' seems more appropriate to capture the overall prospects of this approach. It can be understood as an integrated and comprehensive concept that emphasises resource management, public engagement, and flexible development *(*Stamatiadis and Hartman, 2011*)*. Later on, the Context Sensitive Solution (CSS) took the place of the CSD, as a more inclusive concept in this discourse.

With the spread of CSS, many states in the USA have published local documents with detailed instructions. CSS definitions vary in theoretical and practical systems, while they share a collective set of tenets. All projects should reach a balanced outcome stressing safety, mobility, community and environmental goals. The development process should have a convincing and continuous community engagement from the

early phase. To meet the needs of stakeholders and to achieve a multi-mode travel system, an interdisciplinary team is needed to address practical solutions. Additionally, it is expected to be flexible in design standards to ensure an adaptive and sustainable prospect (ITE, 2006). Aesthetics should also be stressed even for an infrastructure project.

Based on some commonly agreed tenets, The Federal Highway Administration (FHWA) defined CSS as 'a collaborative, interdisciplinary approach that involves all stakeholders in providing a transportation facility that fits its setting. It is an approach that leads to preserving and enhancing scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure conditions' (DOTs, 2018).

In this definition, context and stakeholders are generalised descriptions. Context refers to 'a project's physical, economic, and social setting', which may 'include the community, ecological, aesthetic, and transportation conditions as well as the political and policy environment'. Stakeholders cover all possible affected people and organisations, such as 'agency staff and elected officials, organised groups, area residents, and business owners' (DOTs, 2020).

The significance of CSS mainly lies in its thorough understanding, respect and reflection of the environment and social surroundings. Some issues might occur when ignoring the influence of contextual aspects, causing incompatibility and adverse community impacts. CSS is not a guarantee of success, but it can minimise potential construction and utilisation problems in project delivery (ITE, 2006).

Benefits of CSS

For the planning and design stage, CSS focuses on inclusive decision-making and efficient resource management. Inclusive decision-making refers to the inclusiveness of public engagement during the development process, aiming for a plan that respects and addresses the requirements of a broad-based public (DOTs, 2020). Efficient resource management considers how to utilise environmental and social resources in an optimised way to reduce potential time and labour waste in practice (Pigman et al., 2005). CSS during development process address the completeness of project delivery and the balance of community impact. The success of a project is largely based on the fulfilment of the design prospects and the performance in community well-being. It calls for creating a community that is safe, liveable and sustainable (ITE, 2010). This concept not only aims to solve transportation issues. It involves a broader scale of urban context along the thoroughfare system, focusing more on achieving the community expectations and improving the quality of the living environment.

Generally speaking, the benefits lie in the aspects of project performance, economic efficiency, and context impact. From the perspective of project performance, CSS approaches are expected to result in better design prospects and a higher-grade assurance of overcoming obstacles because they consider potential issues and their relevant context factors ahead (DOTs, 2018). The economic advantages of considering context sensitivity are resource management efficiency and continuity of investment attraction due to the improved living environment (Akotia and Opoku, 2018). The context impact of CSS is mostly expressed as an integrated social and environmental performance during the project development process. Considering the multi-dimensional context factors helps to minimise the negative influence on people and the natural environment while maximising the profit among residents and stakeholders. Sensitive to the context, the project aims to manage environmental and community resources efficiently, address public requirements and expectations, create inclusive and high-quality living communities, and improve the vitality and attractiveness of the urban environment along the urban thoroughfare systems.

Application of CSS

The application of CSS requires proactive interaction with the social and environmental context during project planning and development while addressing the community's needs. The process of a CSS project usually follows the following steps.

Step 1: Setting the vision and goals of the project from a broader view at a policy level (ITE, 2006). By demonstrating the long-range vision for the project development and community impact, the early investigation will help to define the value and needs of the project. With the design prospect settled, further actions will be more targeted.

Step 2: Understanding the factors of the whole context. Achieving the best result of the CSS approach requires a comprehensive understanding of past, existing, and future contexts. A project is expected to match the context of the area it serves, including both physical and social characteristics. In contexts that are or may be transitioning, the project should be designed to be consistent with the future (Neuman et al., 2002).

Step 3: Developing and evaluating alternatives. The CSS encourages to start with an open mind and a blank sheet. Urban projects are complicated with various context issues, which often involve trade-offs and opportunities that can be better resolved by innovative solutions (Daisa, 2006). A full range of options enhances the flexibility and feasibility of the plan and deals with limitations in different circumstances. To objectively evaluate the trade-offs between various alternatives, assessment process should always relate back to the specific criteria. This step mainly assists the decision-making with comprehensive information and clear reasoning.

Step 4: Developing an optimistic plan. Based on the evaluation of the abovementioned steps, a balanced plan with the best profits is expected to be formed. Integrating CSS in the project development process significantly influences the development of project concepts. Project concepts should emerge from a full understanding of the relationship between the character of the broader urban area. Otherwise, the plan should follow the principle of CSS, reflecting and enhancing the community's visions and values.

Step 5: Encouraging public and stakeholder involvement. In addition to multidisciplinary professional participation, collaboration with members of the community is a key part of making the right diagnosis. This is not only because people know their own communities better, but early participation in the design process can also help build support for the ultimate solutions. CSS is the right approach that is trying to build consensus among diverse participants and profit groups *(*Neuman et al., 2002*)*. The principles of CSS should be integrated into the engagement process from the earliest stage and ensure transparency, inclusiveness, credibility, equity and continuity throughout the development.

Step 6: Implementing CSS during project construction, operation and maintenance. The integration of CSS has profound effects on the completeness of the design vision and goals. Evoluted from the conceptual stage, the development plan has experienced a context-sensitive process to fully reflect the issues and needs. The innovative solution ensures the sustainability of the long-term utilisation and maintenance of the plan, and the long-lasting value of the community.

CSS is a qualitative approach whose principles and application are strategic. It mainly aims to inform people of the context's significance and suggest potential practice methods. Therefore, the project's sensitivity to its context factors and how to achieve the expected sensitivity vary according to the targets and feasibility of the project (Stamatiadis et al., 2009). The practical limitation of CSS lies in the quantification of identifying the context factors, evaluating the strategies and assessing the outcomes. During the years of practice, there have been some studies trying to quantify the benefits of applying CSS, categorizing the significance hierarchy of project outcomes (Stamatiadis et al., 2012). This evaluation is based on the public perception and experience, reflecting the community's attitude towards the project (Daisa, 2006). Future research can deepen the quantification attempts through more data-based measurement of detailing the qualitative factors and establishing the numeric impacts on the benefit.

3.2.3 Context-sensitive Analysis

Context-sensitive analysis is an approach in research that incorporates contextual factors into quantitative analysis to provide a deeper understanding of the phenomena being studied (Creswell, 2023). This methodology has been used in a wide range of

scientific analyses, such as environment, social science, psychology, linguistics and public health. For urban studies, this method recognizes that quantitative data exists within a complex system and that context—such as social, cultural, economic, and environmental factors—can significantly influence the outcomes and interpretations of the data.

Context-sensitive analysis uses a combination of data sources and types (e.g., surveys, statistical data, geographic information systems) to capture a comprehensive view of the research problem, as well as involving iterative data collection and analysis to refine the understanding of contextual influences continuously.

The advantages of this analysis method in an urban study context are the accuracy of research findings and its supportiveness in decision-making. By considering contextual factors, this approach produces more accurate and relevant results that are reflective of the real-world scenario. Also, it provides policymakers and practitioners with insights that are grounded in the specific context, leading to more effective and tailored interventions (Wolf, 2006).

Context-sensitive quantitative methodology involves systematically integrating contextual variables into the data collection, analysis, and interpretation processes (Beukes et al., 2011).

Step 1: Define the Research Question and Context: Clearly articulate the research question, ensuring it reflects the need to consider contextual factors.

Step 2: Data Collection: Develop surveys, questionnaires, or experimental designs that capture both the primary data and contextual variables. Conduct pilot tests to refine instruments and ensure they capture the necessary context.

Step 3: Data Preparation: Structure the data into a dataset suitable for analysis. This typically involves creating a spreadsheet or database with rows representing individual observations and columns representing variables. Address any missing or inconsistent data to prepare for analysis.

Step 4: Multilevel Modelling: Use statistical software for multilevel modelling, referring to effective mathematical models such as correlation coefficients and optimization algorithms. Specify the multilevel model to account for the nested structure of the data.

Step 5: Data Analysis: Use the specified models to analyse the data, taking into account the contextual variables and their interactions. Interpret the results within the context, explaining how contextual factors influence the main relationships.

The widely used quantitative models are Multivariate Regression and Polynomial Regression. The Multivariate Regression model is more suitable for research with

massive data for prediction, and the Polynomial Regression model is more suitable for analysing relationships between variables based on a small sample amount (Martin, 2022). These models allow for the inclusion of multiple independent variables, including context-specific factors, to predict a dependent variable. Interaction terms can be added to assess how different variables interact within the context. For urban study and social science, which are disciplines with complex qualitative information, the accuracy and relevance of the result rely on the comprehensiveness of context indicators, the rationality of indicator quantification, and the quality of collected data (Ewing, 2020).

3.3 Contextually Sensitive Urban Regeneration

From the abovementioned study of context-related theories, the idea of being sensitive to context in the field of urban regeneration is an integration of theory, practice and methodology. Sustainable urban regeneration inspires the emergence of contextual sensitivity and lays the foundation for identifying practical strategies. The CSS is a comprehensive approach to realising contextual sensitivity throughout the whole process of planning, construction, and management. Besides the physical context factors of a project, CSS emphasises the importance of promoting public engagement and reflecting community requirements. Although the current theories of contextual sensitivity have provided a solid qualitative guide concerning why, what, and how to realize contextually sensitive expectations, there are still quantitative methods missing, which fail to support the accuracy of decision-making and result evaluation. The context-sensitive analysis methodology is effective in supporting the possibility of quantification study for urban development projects.

Based on the literature review, this study will focus on the contextual sensitivity of urban industrial heritage quarters during urban regeneration process. Contextual sensitivity, in the thesis, is defined as:

> *The attribute of the process of an urban development or regeneration project describes the extent to which the project respects existing urban contexts and addresses contextual issues.*

Contextual sensitivity relates to dealing with the actual conditions influenced by contextual elements in the process of urban development and regeneration. Being sensitive to the urban context, urban development and regeneration projects should focus on the cooperation between environmental, social, and economic factors, as well as the interaction between urban issues and contextual transformation. Therefore, a contextually sensitive urban project should be adaptable and suitable to its setting, because it encourages an active reflection and response to the context. With the cities facing complex challenges such as rapid urbanization, environmental change, and social transformation, the need for more suitable, adaptive and effective urban

interventions that sensitively respond to the unique characteristics and complexities of dynamic urban environments has become increasingly necessary.

For successful urban regeneration, the original urban quarter usually expects a lasting improvement in economic, social, and environmental aspects. Contextually sensitive urban regeneration, the process of urban regeneration is sensitive to its context, encourages positive interaction with the existing urban environment and achieves a balance between new development and original characteristics. During the practice, being sensitive to context is a planning, design and management behaviour that serves the project's target (Carmona et al., 2010). Therefore, the details of the context the project is sensitive to and how the project addresses the issue of the context change accordingly with different purposes of regeneration. Especially in urban heritage quarters, the key target of contextually sensitive regeneration is the balance between the continuity of local history and culture, and the growing requirement for new development (Oliveira, 2014). Sensitiveness to heritage and cultural context has potential benefits, such as strengthening place identification, forming a sense of belonging among local communities, attracting visitors, and stimulating economic growth. Based on the practices and studies, some other representative targets of an urban regeneration project are as follows: To create inclusive and satisfactory communities, the planning and management process should consider the context of public requirements and community engagement (Stamatiadis et al., 2009). For economic development, the project should focus on the efficient utilisation of resources and optimise the profit of space occupation (Woodcraft, 2015). For improving environmental quality, important contexts should be natural factors and construction interventions. For historical and cultural conservation and continuity, the context of heritage and place identification should be emphasised.

Regeneration strategies make changes to the context factors to address context issues, and the integrated result of context change is the performance of regeneration. In order to study how sensitive the strategies should be to the context; the basic analysis relies on how the change in context leads to the final performance. This thesis will focus on the basic analysis and try to explore how the change in context leads to value improvement as the expected performance for an urban industrial heritage regeneration project. Currently, the relationship between context and project target and the strategies to realize the sensitivity are summarized based on practical experience. The practice-based study supports general guidance for contextually sensitive actions but has limitations in such qualitative approaches. For one thing, the degree of the context impact on the project target is unclear, which reduces the reliability of context-related strategies. For another, the degree of impact between different context factors is not revealed, which limits the efficiency and targeting of regeneration actions. Therefore, it is important to engage quantitative methods in studying the effect and impact of contextually sensitive actions on the fulfilment of regeneration targets during the regeneration process.

3.4 Conclusion

Considering contextual sensitivity in urban regeneration is an effective way to revitalise the historical urban environment and meet the needs of urban development. The advantages of contextually sensitive urban regeneration are the careful consideration of diverse context issues and targeted solutions to achieve the project prospects.

By valuing the historical, architectural, and cultural spaces and customs, being sensitive to context strengthens the sense of belonging and cultural identification. Moreover, preserving local heritage and improving the urban environment stimulate economic prosperity by attracting tourism and boosting land value. By involving public participation, being sensitive to community requirements improves satisfaction among residents and safeguards the long-term vitality of the project.

This chapter introduces how the idea of being sensitive to context has been developed, how Context Sensitive Solution (CSS) works as an implementation approach to promote the effectiveness and adaptiveness of development projects, and how the context-sensitive analysis method is used to quantitatively understand the impact of context. Based on the study of relevant theories and methods, this chapter has proposed the concept of contextually sensitive urban regeneration, which means the urban regeneration project is sensitive to the context factors and addresses context issues during the regeneration process.

Developing from contextual concept, this study focuses on regenerating a specific type of urban quarter with industrial heritage, aiming to understand how the sensitive regeneration to its embedded context influences the variation of heritage value. This part sets the research foundation for developing the study of contextual sensitivity analysis (CSA) to analyse this relationship.

Chapter 4. Research Methodology

In the field of urban studies, researchers are constantly striving to better understand the characteristics, operation schemes, and complexities of urban environments, as well as the predominant factors that influence development. Although many qualitative studies have provided perspectives and experiences into the environmental, social and economic aspects of the urban context, there is a growing concern regarding the limitations of current urban studies from the perspective of lacking quantitative analysis and statistical backups. Based on recent attempts in the mixed-methods research on urban issues, the trend of engaging quantitative analysis has promoted the implementation of contextual sensitivity analysis, which is an analytical approach that emphasizes the importance of understanding and responding to the specific contextual dimensions of an urban environment.

This thesis mainly considers introducing and exploring the possibility of quantitative analysis to reveal the relationship between the value variation of urban industrial heritage quarters and context variation in the regeneration process. This analysis requires a more systematic and rational method to digitalize the relationship and impact of indicators on the values.

Therefore, this thesis will establish the relationship hierarchy (relating value variation of urban industrial heritage quarters with context indicators), which will be assisted by mathematical analysis to provide a series of numeric impact degrees. This series of impact degrees displays the quantitative connection between each level of the relationship hierarchy. This analysis process is called Contextual Sensitivity Analysis (CSA).

This chapter explains the logic of how this relationship is established, how each hierarchy in this relationship is defined and how the analysis operates.

The first section of this chapter starts with the study of current research limitations in the field of urban study, pointing out the lack of quantitative evaluation and the importance of mixed-method research in forming a comprehensive understanding of this field. Based on the understanding of how to adopt mixed-method research in urban study, this section has designed the research of Contextual Sensitivity Analysis (CSA).

This research will take Shanghai as a case study city, selecting urban industrial heritage quarters as samples to carry out the analysis. The second section is a brief introduction to how the case city and the sample quarters are selected. A comprehensive study will be presented in detail in Chapter 6.

The third section talks about the data collection methods of the selected samples, introducing how the questionnaire is designed to collect value variation data and how to extract useful information from mapping and documentation analysis as indicator data.

The fourth section demonstrates the data processing methods utilized to generate the final outcome, explaining the operation logic of the regression model for correlation study.

4.1 Methodology Study – Mixed-method Research

The methods of studying urban heritage and its related issues vary according to different research focuses. With the popularity of concepts like urban big data and digital city these years, more research has begun to focus on integrating quantitative study into current qualitative-based urban and social sciences. Looking into mixed-method research, the advantage of this methodology is its effectiveness in improving the systematic, comprehensiveness, and science of urban heritage study.

4.1.1 Limitation of Current Urban Heritage Studies

One of the main limitations of urban studies lacking quantitative analysis is the potential for subjectivity and bias in interpreting findings. Qualitative approaches, although appropriate for capturing the narratives and stories of urban life, may not provide sufficient generalizability and objectivity that can be achieved through quantitative analysis. Quantitative methods offer rigorous and systematic perspectives to identify patterns, trends, and relationships excavated from urban data, allowing researchers to form hypotheses and summarize comprehensive conclusions.

Another limitation of the current urban studies due to the lack of quantitative analysis is the difficulty in comparing and contrasting regeneration plans and performances within different urban environments and contexts. If not involving quantitative data, it can be challenging to establish benchmarks for evaluating the effectiveness of strategies and interventions, thereby identifying more suitable and adaptive practices *(*Olsson, 2008*)*. Quantitative analysis enables researchers to process comparative studies on a wide range of variables, including demographic indicators, spatial indicators, or socio-economic indicators, facilitating a holistic understanding of the factors that contribute to successful and sustainable urban development (Ewing, 2020).

Additionally, the lack of quantitative analysis in urban studies may also limit the potential for effective and efficient delivery of research findings to broader listeners. Quantitative data can be presented in a more visually and easily digestible format, such as charts,

graphs, and maps, which can be particularly useful for conveying complex information to non-academic audiences. Furthermore, quantitative evidence can be perceived as a more persuasive and convincing resource which is beneficial to be incorporated into urban planning and policy-making processes *(*Sheng et al., 2022*)*.

To address these limitations, it is an effective way to integrate quantitative analysis with urban research and practice, complementing the theoretical findings provided by qualitative approaches. By adopting a more balanced and comprehensive methodological framework, urban researchers can detail complex urban issues into statistical indicators, enhancing the feasibility and generalizability of their findings. Therefore, urban studies will be better equipped to facilitate the urban design and regeneration process and contribute to more sustainable, resilient, and responsible communities.

4.1.2 Mixed-method Research in Urban Studies

In recent years, urban studies have witnessed a growing interest in adopting mixed-methods research approaches, which integrate both quantitative and qualitative methodologies to reflect on multi-dimensional urban environments. As cities continue to transform and face ongoing challenges, the need for more comprehensive and delicate research methods has become increasingly important.

Mixed-method research is widely used to support urban big data analysis. It uses large-scale datasets (e.g., social media data, census data, mobility data) to identify patterns and trends, which are also contextualized and enriched with qualitative study (Du et al., Beştepe and Yildirim, 2022). The current mixed-method urban studies are also adopted in the study of cultural and social dynamics, as well as spatial and environmental quality (Richards, 2013, Tilley et al., 2017, Resch et al., 2020, Gomez et al., 2015, Kaplan et al., 2022, Rodríguez-Núñez et al., 2024, Riazi and Emami, 2018). There are also study trends that apply mixed-method research in comparative studies, combining massive quantitative data with case studies and fieldwork to draw conclusions across different sites, cultures or contexts (Bernardo et al., 2021, Geremew et al., 2023, Ewing, 2020).

Mixed-method research offers several benefits that can enhance the quality and depth of urban studies. Firstly, by incorporating the advantage of both quantitative and qualitative methods, mixed-method research provides a more comprehensive understanding of urban phenomena. Quantitative methods, such as statistical analysis and surveys, allow researchers to clarify relationships, trends and typologies through the analysis of large datasets (Ewing, 2020). Qualitative methods, like interviews, observations, and literature analysis, offer a rich understanding of the historical background, environmental perceptions, and cultural customs that influence the associated relationships *(*Labadi and Logan, 2015*)*. This holistic approach can help to

reveal the complex interplay of factors that shape urban environments and the diverse modes in which the urban backdrops forge the context of the urban spaces.

Another advantage of mixed-method research in urban studies is its ability to validate and cross-compare findings. By using multiple methods and data sources, researchers can cross-check and verify their results, enhancing the reliability of their conclusions and the feasibility of their models. This urban study process can help identify potential biases and limitations in the qualitative study, leading to a more intuitive and accurate delivery of research outcomes and supporting the decision-making process.

Furthermore, mixed-method research can promote a more inclusive and participatory approach to urban studies. By maximizing the benefits of qualitative methods, the research and design process are able to prioritize the voices and experiences of local residents, providing a solid and realistic background for further analysis and recommendations (Wang et al., 2020). This participatory approach also benefits from quantitative methods that can assist in managing and operating public engagement activities, contributing to well-organized and responsive urban planning and policy-making, and addressing the needs and expectations of stakeholders and local communities.

Despite its considerable advantages, mixed-method research in urban studies still has challenges. One key issue in applying this method, especially in urban discourses, is quantifying the urban context, which includes complex and abstract social and spatial information, such as what is eligible to be quantified and to what degree of detail the quantification goes. Therefore, the application of mixed-method research varies according to the research background, objectives, and subjects. Another issue is integrating and synthesising quantitative and qualitative data, which can require considerable time, resources, and expertise. To address the above-mentioned challenges, it is important to clarify the research questions and research scopes, as well as a well-organized research plan that keeps tracing the logic for operating mixed methods and designing suitable and efficient strategies for data collection, analysis, and integration.

For this study, the context of an urban industrial quarter is a complex combination of environmental, social and economic elements. Mixed methods research is expected to provide a comprehensive understanding and digitalized presentation of the regeneration impacts on the heritage quarter and its surrounding urban environment. Especially for the intangible aspects of heritage quarters, the qualitative study provides narrative and perception findings, while the quantitative study is mainly based on the concluded, calculated, and average data based on the historical resources and current situation. The cooperation of both cross-verify the factors and results of regeneration impacts, revealing how and why heritage value variation happens. Besides, the mixed methods research approach is expected to carry out a relatively extensive and generalized data collection through questionnaires and databases, which usually promotes positive engagement with a larger variety and number of participants.

Mixed-method research has emerged as a valuable and prevailing approach in urban studies, offering the potential for more comprehensive and delicate research into complex dynamic factors that shape urban environments and influence cities' future. By taking in the dual benefits of quantitative and qualitative methods, mixed-method research can cultivate a deeper understanding of the interaction between factors, ultimately contributing to more effective and adaptive urban planning, policy-making, and regeneration.

4.1.3 Research Design

There are different types of mixed-methods research designs. The differences between them relate to the aim of the research, the timing of the data collection, and the importance given to each data type.

Convergent design is a type of mixed-methods research in which people collect quantitative and qualitative data simultaneously and analyse them separately. After the analysis, the research combines or compares the results to draw a conclusion. Convergent design is used when there is a need to compare statistical results with qualitative findings to understand the research problem better. Researchers also use this mixed qualitative and quantitative research method to validate and illustrate qualitative findings with quantitative results. Convergent design is suitable when there is a need for both qualitative and quantitative data; there is limited time to collect the data, and the required data should be gathered in one visit *(*Halcomb and Hickman, 2015*)*.

Explanatory sequential design is a type of mixed methods research that first collects and analyses quantitative data and then follows the results with a qualitative phase. In this approach, researchers implement the qualitative phase to explain initial quantitative results in more depth *(*Halcomb and Hickman, 2015*)*. Explanatory design is appropriate if the research problem is quantitatively oriented and the variables and instruments required for the research are available *(*Terrell, 2012*)*.

Exploratory sequential design is a type of mixed methods research design that collects and analyses qualitative data and then follows up the results with a quantitative phase. This mixed qualitative and quantitative research method aims to explore a phenomenon before deciding which variables the research needs to measure quantitatively *(*Terrell, 2012*)*. An exploratory design is better when the variables are unknown and the instruments needed are unavailable. This is also a good mixed-methods research approach if there is no guiding theory for the study.

In the study, the Contextual Sensitivity Analysis (CSA) refers to analysing the impact of contextual changes on the value variation of urban industrial heritage quarter during

urban regeneration. According to this analysis process, the mixed-method approach suitable for the Contextual Sensitivity Analysis (CSA) is mainly the exploratory sequence. In this sequence, the qualitative analysis will first back up the establishment of the relationship between value and context indicators. Once the relationship is settled, the study will be followed by quantitative analysis, which analyses the numeric degree of the relationship, revealing the exact influence of how the context details result in the value change.

The literature review will lay the foundation for identifying the value of urban industrial heritage quarters, selecting the urban context indicators, and explaining how the case city and its industrial heritage quarter samples are selected. The quantitative phase analyses the relationship between values and indicators, which deals with the data collected from the case study. The results of the data processing reveal the relationship between the variation of context indicators and the variation of industrial heritage value. (Figure 4. 1)

1) Establishing the value layer for urban industrial heritage quarters.

According to the aim of this thesis, the target of CSA analysis is to demonstrate the relationship between contextual sensitivity strategies and the value variation of urban industrial heritage quarters. Therefore, the value layer is defined as the change of values of an urban industrial heritage quarter during the process of regeneration. Based on the qualitative analysis, the thesis looks into the classification, definition, and evaluation aspects of each value of industrial heritage.

2) Designing the contextual sensitivity analysis (CSA) in studying urban industrial heritage quarter regeneration.

The CSA is an analysis process adapted from existing research and practice that focuses on contextual and sustainable urban issues. The idea of contextual sensitivity discussed in this thesis can be seen as an applicable principle, emphasising the necessity to focus on contextual impacts and respond to contextual issues in the regeneration process. Contextual sensitivity can be realised through the application of contextual sensitivity regeneration, in which each strategy can result in the variation of context factors in the final delivery of the project.

Usually, the forward logic should be: a project aims to improve the value of an urban industrial heritage quarter, and the regeneration should adopt several effective contextual sensitive strategies to realise this aim. However, as the relationship between strategies and value hasn’t been revealed, the first thing is to analyse the effective strategies and how they contribute to the variation of value. Therefore, CSA is the reverse logic of building the relationship between context factors and value through context indicators and analysing the impact scheme in this relationship based on regenerated samples. This result is targeted at specific contexts and project types,

which can provide reference for similar new projects and assist the regeneration process by following the forward logic.

3) Identifying the benchmark as context factors for urban industrial heritage quarters.

As the urban environment is a complicated synthesis with various elements, the context factors are usually a massive system. When looking into urban study, context factors should be selected based on the target and object of the research. For industrial heritage quarters, the context factors are introduced according to the characteristics and attributes of both industrial sites and heritage sites, highlighting the uniqueness and special consideration for each factor.

4) Quantifying the indicator system for context factors.

The indicator system is the foundation of the assessment process. Based on the context factors, the variation of each factor can be evaluated by various methods. However, due to the feasibility of calculation and accessibility of data resources, the evaluation of each factor can be narrowed down to several representative indicators as quantitative data assisted by qualitative description.

5) Case city and sample selection for data collection.

This thesis only focuses on a representative industrial city in China, which is Shanghai. Shanghai was selected out of all the other Chinese cities for its prolonged industrial history, the tight relationship between urban development and industrial development, rich industrial heritage numbers and types, and high awareness of industrial heritage conservation. The samples are chosen from the official industrial heritage lists published by the Chinese and Shanghai governments, which are regenerated projects meeting the definition of urban industrial heritage quarter proposed in Chapter 2.

6) Quantitative analysis and result analysis.

The quantitative analysis in this stage will undergo the correlation analysis and logistic regression model. First, the regression model will provide impact trend diagrams for indicators and values, representing the impact trend of the relationship. An integrated diagram of those impact trends will show the comparison of the effectiveness of indicators to the specific value. If there are too many indicators, the integrated diagram will be difficult to read. Therefore, for better visualization, the study will select a certain number of indicators as an example to explain how they can be analysed. The selection criteria will use indicators with a higher correlation coefficient, which represents a higher intensity of influence.

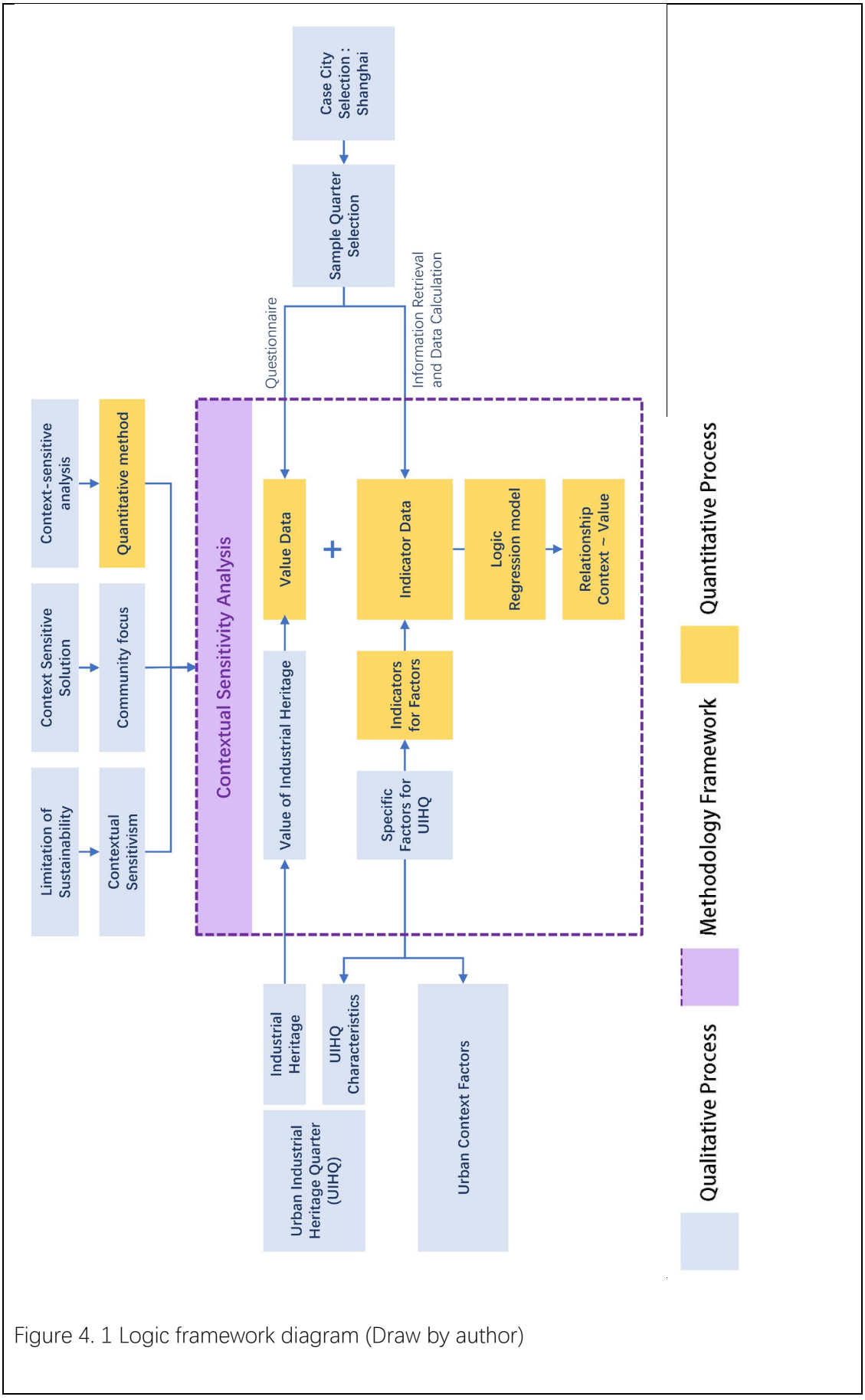


Figure 4. 1 Logic framework diagram (Draw by author)

4.2 Case Study and Sample Selection

Urban studies are a multidisciplinary field that seeks to understand and analyse urban areas' complex socio-economic, environmental, and political dynamics. In order to get meaningful results and formulate convincing context impacts, it is important to set target principles for selecting the case city and sample heritage quarters.

The appropriate selection of the case and samples ensures the validity and reliability of the research findings. Generally, there are two key principles for selection, which should consider representativeness and comprehensiveness.

Representativeness is essential in the case study and sampling strategy, as it ensures that the selected case or sample accurately reflects the characteristics of the larger population or as the best display of the target phenomenon in the study (Gillham, 2000). In urban studies, achieving representativeness can be particularly challenging due to the diverse nature of urban populations and rapid urbanization. Researchers must carefully consider the socio-demographic, economic, and spatial characteristics of the study area (Landman, 2014). Comprehensiveness is another essential principle as it minimizes the risk of selection bias and increases the validity of the findings. By considering all influential factors, the selection should acknowledge the complexity and vitality of the research population and phenomenon (Gillham, 2000). This comprehensive approach ensures that the cases and samples include a wide range of variables and perspectives, offering a holistic expression of the urban context.

4.2.1 Selecting the Case City

This study will analyse the relationship between urban industrial heritage value and urban context. The formation, development, preservation, and utilisation of industrial heritage in cities depend on the city's historical background, development progress, and regulatory policies. The diverse backgrounds of different cities lead to significant variations in context impacted by urban regeneration strategies. The aim of this study is to identify schemes in contextual changes and to use these schemes to inform future regeneration decisions. Therefore, studying the changes in an urban context in a consistent background can ensure the scheme is more targeted and relevant to the specific city.

Research on the conservation of industrial heritage in China started relatively late. Given the substantial existing stock of industrial heritage and the significant potential for future regeneration projects, this study will select a Chinese city as the case city, and choose suitable data samples within the city.

From a representational perspective, the case city should have a long industrial history, a large industrial heritage, and sufficient practical and research experience in urban regeneration and industrial heritage conservation. Based on a comprehensive comparison between Chinese cities, this study will take Shanghai as the case city that has the longest industrial history, the highest industrial significance, the largest number and categories of designated industrial heritage, the earliest city to preserve the industrial heritage and China's most well-developed industrial heritage tourism.

4.2.2 Selecting the Samples

In this study, the samples are urban industrial heritage quarters and should meet the following criteria.

First, the sample should be a designated industrial heritage, which can be identified through national and local heritage lists and protection lists. This is to ensure the sample has experienced the evaluation process and qualifies as a site of significance.

Second, the sample should meet the definition of an urban industrial heritage quarter, as introduced in 2.3.1 of this study. These quarters should be located within the city of Shanghai, including industrial heritage. The quarter should interact with the surrounding urban environment in terms of functionality and human activity and should be a project that has already been regenerated.

Thirdly, 2.3.2 also introduces the characteristics of urban industrial heritage quarters. While it may not be possible to ensure that the final samples cover all characteristics due to the limited number and variety of industrial heritage sites in a single city. However, within the available selections, the samples should try to ensure diversity in different dimensions.

4.3 Data Collection Methods

4.3.1 Questionnaire

In recent years, urban studies have gained increasing importance as a multidisciplinary field. A critical component of conducting research in this domain is the collection of reliable, relevant, and actionable data to inform decision-making processes and drive urban development. One of the most widely used and versatile methods for gathering such data is the questionnaire. This research tool has proven to be invaluable in the

field of urban studies, enabling researchers to tap into the rich perspectives of diverse stakeholders, from residents to policymakers, urban planners, and other professionals.

Questionnaires, as a primary data collection method, can be designed in various formats, including paper-based, online, and face-to-face interviews. The flexibility of this method allows researchers to tailor the questions to suit their specific research objectives, such as assessing the quality of urban services, measuring the impact of policy interventions, or evaluating community perceptions of urban development initiatives (Gillham, 2008). Moreover, the use of standardized questionnaires ensures comparability and consistency across different studies, facilitating the analysis and synthesis of results.

Data form

In this thesis, data collection for the values will be conducted through a formal standardized questionnaire, producing a series of statistics for each value.

Value category	Sample 1	…	Sample n	Score
Historical value				-100 to 100 (integer)
Scientific and technological value				-100 to 100 (integer)
Socio-cultural value				-100 to 100 (integer)
Aesthetic value				-100 to 100 (integer)
Economic value				-100 to 100 (integer)
Natural value				-100 to 100 (integer)

Table 4. 1 Questions design and scores setting of questionnaire (By author)

This thesis outlines an evaluation system for assessing the value of an industrial heritage quarter in Chapter 2 (Table 2. 4). This evaluation system was developed from existing literature and assessment experience; however, the weight relationships among each 'Evaluation Aspect' haven't been studied. Balancing the weights of 'Evaluation Aspect' and synthesizing the final 'Value' score is a subjective process. In this study, participants were not required to score each 'Evaluation Aspect' individually. The evaluation system serves as a reference, included in the Background Information Sheet, to guide participants in considering relevant aspects when scoring each value. Participants were expected to understand these aspects and their meaning, and then,

based on their experience and judgment, to balance the weight of these aspects to finally provide one synthesized score for each ‘Value Category’.

Since this thesis focuses on changes in industrial heritage value due to regeneration, the questionnaire is designed to score participants’ evaluations of the extent to which each value of a sample quarter varies post-regeneration. The questionnaire is easy to follow, with scoring blanks provided for each sample. Background information will explain the values used in this study and the evaluation aspects to consider when assessing value variation. Participants will also receive an introductory document containing basic information about each sample. Each sample will be scored on all values, with scores for value variation ranging from -100 to 100. A negative score indicates a decrease in the specific value of the urban industrial heritage quarter after regeneration, while a positive score indicates an increase. The absolute value of the score reflects the degree of decrease or increase, with larger numbers indicating greater variation. (Table 4. 1) (Appendixes-Questionnaire)

Participants

In the study of urban industrial heritage regeneration, especially the evaluation and assessment research, involving expert participants is an effective way to capture specialized views that support both theoretical advancement and practical implementation (Okoli and Pawlowski, 2004).

Expert participants can assist the research with specialized knowledge and perspectives of professionals who have extensive experience and expertise in urban planning, architecture, policy, and related fields. The study of heritage evaluation and regeneration needs comparison views and a comprehensive understanding of multi-dimensional urban issues. For this study, the participants are expected to understand the meaning of the industrial heritage value and score the value of regenerated quarters from both historical and present perspectives. This process requires a professional study and working background to assist in the digestion of relevant information (Okoli and Pawlowski, 2004, Turoff, 1970). Besides, experts are expected to more easily access professional data resources in their fields of expertise if they would like to get more information about some samples or double-check some definitions or theories, which will ensure the reliability and objectivity of their scores.

Identifying appropriate experts for questionnaires in the context of urban industrial heritage involves several considerations. Experts should be selected based on their specific knowledge, experience, and involvement in the field of urban regeneration and heritage conservation (Creswell, 2023). They are expected to have advanced degrees or sufficient working experience in relevant fields such as urban planning, architecture, heritage conservation, real estate development, or management of urban regeneration.

For this study, the participants will be selected from academic researchers, architects and urban planners, developers, consultants and investors, and government and organization officers in the case study city of Shanghai. The participants should have expertise in the fields of urban industrial heritage quarter regeneration and have living, working or research experiences relating to urban industrial heritage quarter regeneration projects. This combination of participants ensures the vitality and reliability of the data.

After selecting the target affiliations listed in Table 4.2, the study identified one contact person per affiliation from the researcher's network. This contact person was required to be employed at the affiliation during the study, understand the study's aims and process, and be willing to facilitate the smooth administration of the questionnaire.

The questionnaires were delivered and collected through the contact person in each affiliation. For the pre-survey stage, the work of the contact person is to receive the digital questionnaire, print the paper version, number the questionnaires, deliver paper questionnaires to targeted participants, record each person with a specific number, collect the answered questionnaires from the participants, photocopy questionnaires and send them back to the researcher. After the screening of the participants based on the pre-survey, the work will enter the evaluation stage. The work of the contact person is to receive the digital scoring table and the selected number of participants, print the paper version, deliver paper scoring tables to selected participants, collect answered tables, photocopy the answers and send them back to the researcher. To protect personal information, the researcher will not have access to the actual name but will use the number to represent it.

In order to screen qualified experts for the study, there will be a pre-survey questionnaire to ensure the selected participants meet all the following requirements.

Firstly, participants need to be engaged in fields highly relevant to the subjects of this study. To ensure this, the study's questionnaires will be distributed to companies and institutions related to architecture and urban development. Researchers will be selected from faculty members of higher education institutions and their relevant departments in Shanghai. Architects and planners will include designers working in large design and planning institutes, as well as independent design studios. Developers will be selected from the strategy departments of major real estate companies in Shanghai. Investment consulting experts will be chosen from urban renewal project teams of large real estate investment companies. For government and related organizations, the survey will target departments most closely associated with planning, tourism management, and heritage protection. This combination of affiliations covers a wide range of relevant fields, including architecture and urban studies, design and planning, and project investment and management.

Secondly, the expertise of the participants should cover a wide variety of fields. Considering the multiple dimensions of the urban contexts of industrial heritage quarters,

this questionnaire has listed a series of relevant topics for the participants to select (Question 2 in Pre-survey Questionnaire). Through the selection of affiliation, the participants are expected to work in one or more relevant fields. Ultimately, the questionnaire aims for all participants' work fields to comprehensively cover the listed areas, with a relatively even distribution of participants across these fields.

Thirdly, the participants' work and educational backgrounds should ensure that their experience, abilities, and knowledge are sufficient for a comprehensive understanding of the study's subjects and questions, allowing them to provide relatively objective and accurate responses in the survey. Currently, there is no universal standard for assessing participants' professional level, so it needs to be defined based on the specific requirements of the research. In the field of architecture and urban design in China, senior positions in design institutions and studios typically require at least three years of work experience, and academic positions are evaluated on a three-year cycle. Therefore, this study will require participants to have a minimum of three years of work experience (Question 1 in Pre-survey Questionnaire). Additionally, participants should have visited listed projects (Questions 3 and 4 in Pre-survey Questionnaire), been involved in listed projects both practically and academically (Questions 5 and 6 in Pre-survey Questionnaire), and be familiar with related topics (Questions 7 and 8 in Pre-survey Questionnaire).

Based on the received pre-survey questionnaires, the screening process will eliminate participants who have worked for three years or less, have not visited any of the listed industrial heritage sites, have not been involved in academic or practical activities with any of these sites, or are entirely unfamiliar with the topics of industrial heritage and urban regeneration. Invalid questionnaires with missing answers will also be eliminated.

Number of participants

For a general survey, the number of participants can be determined either based on the sample size calculation formula that is commonly used, or the previous experience of relevant studies. The calculation formula is operated as the following steps:

$$n = \frac{N \cdot Z^2 \cdot P \cdot (1-P)}{E^2 \cdot (N-1) + Z^2 \cdot P \cdot (1-P)}$$

Determine the Population Size (N): For this study, the range of the participants are people who work in architecture and urban design and relevant fields in Shanghai. According to the 2023 Statistical Census of Shanghai, this population is 481000 (National Bureau of Statistics, 2023). However, the number of experts, such as

experienced practitioners and professionals, is below this number. Therefore, the calculation will use this number as the maximum reference.

Set the Desired Confidence Level (Z): Common confidence levels are 90%, 95%, and 99%. For most social science research, a 95% confidence level is used for a manageable number of participants.

Set the Margin of Error (E): The margin of error represents the desired precision of the estimate. Common margins of error are 5% (0.05) or 3% (0.03). In social science, a 5% error is an acceptable setting for a manageable number of participants.

Estimate the Population Proportion (P): Population proportion refers to the percentage of targeted participants in the population size. If no prior information is available, social science usually uses 0.5 as it provides the maximum variability and a conservative estimate.

According to the formula, the maximum number of participants is 384.

Reviewing the previous evaluation and assessment works that involved expert participants, the actual number varies according to the research aim and expected accuracy. For expert-based research methods, such as the Delphi technique, 10 to 50 experts are sufficient to reach a consensus and ensure the reliability of the findings (Creswell, 2023, Okoli and Pawlowski, 2004, Liu et al., 2018, Zhao et al., 2023). For industrial heritage evaluation, the monograph of Research on Value Estimation of Industrial Heritage Sites (工业遗产价值评估研究) has invited 30 experts to design value evaluation criteria. The Urban Planning Society of China published three batches of protection lists up to now. These lists were the results of expert evaluation during three national conferences considering the protection and regeneration issues of industrial heritage. Although the official documents didn't demonstrate the exact number of experts, the briefing of the first conference said there were nearly 50 participants, the second conference mentioned more than 80 professionals and entrepreneurs, and the third conference involved around 90 researchers, practitioners and entrepreneurs attended. As the number of conference participants shows an increasing trend, the expected participant count for the next conference will be rounded to 100 (Figure 4. 2).

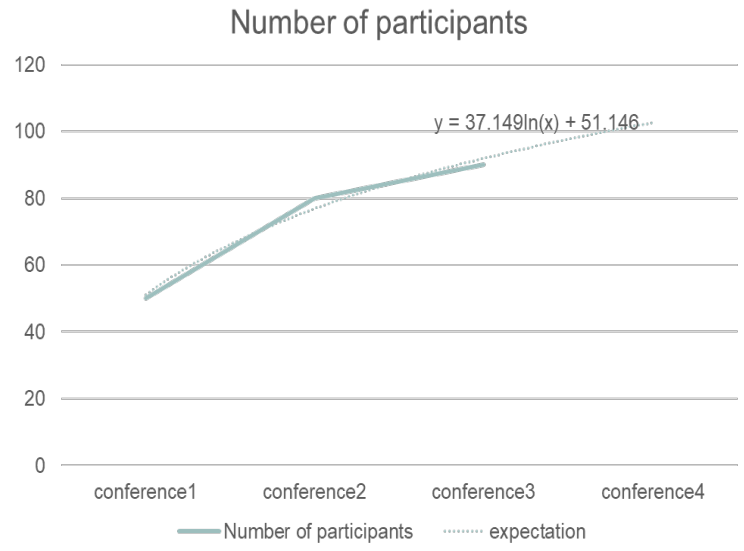


Figure 4. 2 Expectation of conference participants (By author)

According to the calculation formula and previous experience, a final number of questionnaires between 100 and 384 is considered an acceptable participant size range.

Experts' category	Affiliations	Pre-survey	Return	Value form	Return
Researchers	同济大学 Tongji University: 建筑与城市规划学院 The College of Architecture and Urban Planning 管理学院 Department of Project Management	70	64	52	49
	上海大学 Shanghai University: 艺术学院 Fine Arts College 房地产学院 Real Estate College	40	38	31	27
Architects/urban planners	中建集团 China State Construction Engineering Shanghai	60	52	44	38
	上海规划设计院 Shanghai Academy of Urban Planning and Design	40	34	23	20
	设计事务所 Architects and urban planners from design studio	20	17	10	10
Developers	保利地产 Poly Real Estate	30	23	11	9
	万科地产 Vanke Real Estate	40	31	22	20
Consulting/ investors	仲量联行 JLL	10	6	3	3
	上实城开 Shanghai Industrial Urban Development Group Limited	10	4	3	3
Government/ organization officers	上海规划局 Shanghai Planning & Nat Resources Bureau	10	8	8	7
	上海旅游局 Shanghai Tourism Administration	10	5	5	5

	上海工业旅游促进中心 Shanghai Industrial Tourism Promotion Centre	10	6	5	5
Total number		350	288	217	196

Table 4. 2 Affiliations, number of delivery and collection from the pre-survey stage and evaluation stage (By author)

The number of questionnaires distributed in the pre-survey stage is an estimated response count based on the maximum participant availability suggested by the contact persons. In the first stage, 350 pre-survey questionnaires were distributed, and 288 were returned prior to screening. Following an expert screening process, 217 participants qualified for the value evaluation questionnaire. After the screening process, the remaining participants are regarded as experts with sufficient knowledge, work experience, and familiarity with relevant fields and topics. They are qualified to complete the subsequent information-based evaluation questionnaire by reviewing the provided information or seeking additional details if necessary. In the evaluation stage, 217 scoring sheets were sent out, resulting in 196 valid responses. (Table 4. 2)

The following diagrams show the distribution of experts in different aspects. (Figure 4. 3, Figure 4. 4, Figure 4. 5, Figure 4. 6, Figure 4. 7)

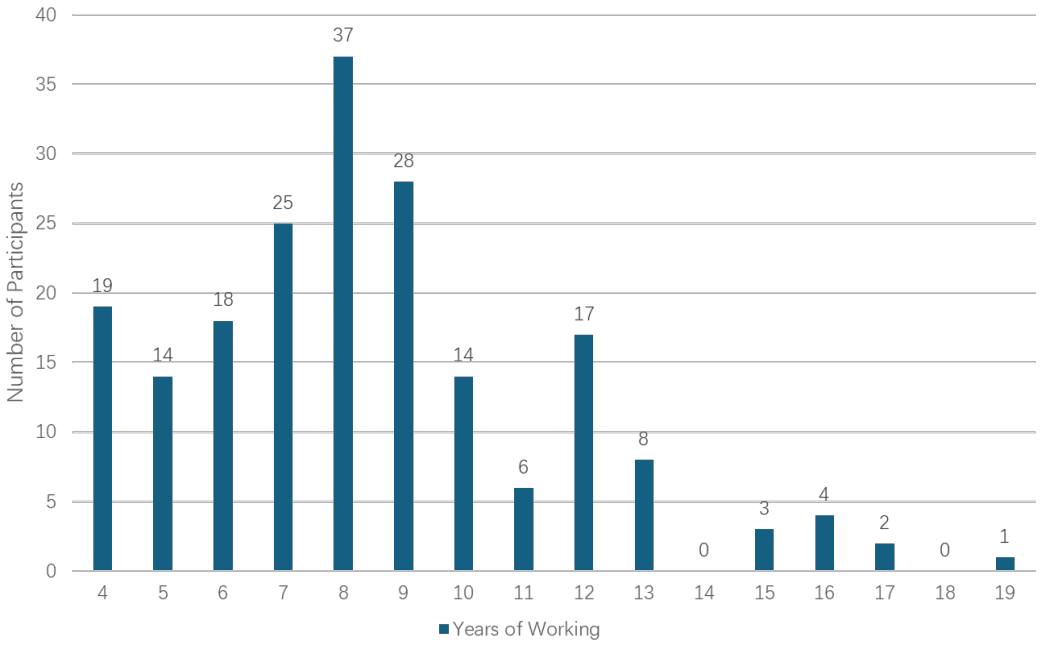


Figure 4. 3 The total year the expert has been working in their profession (By author)

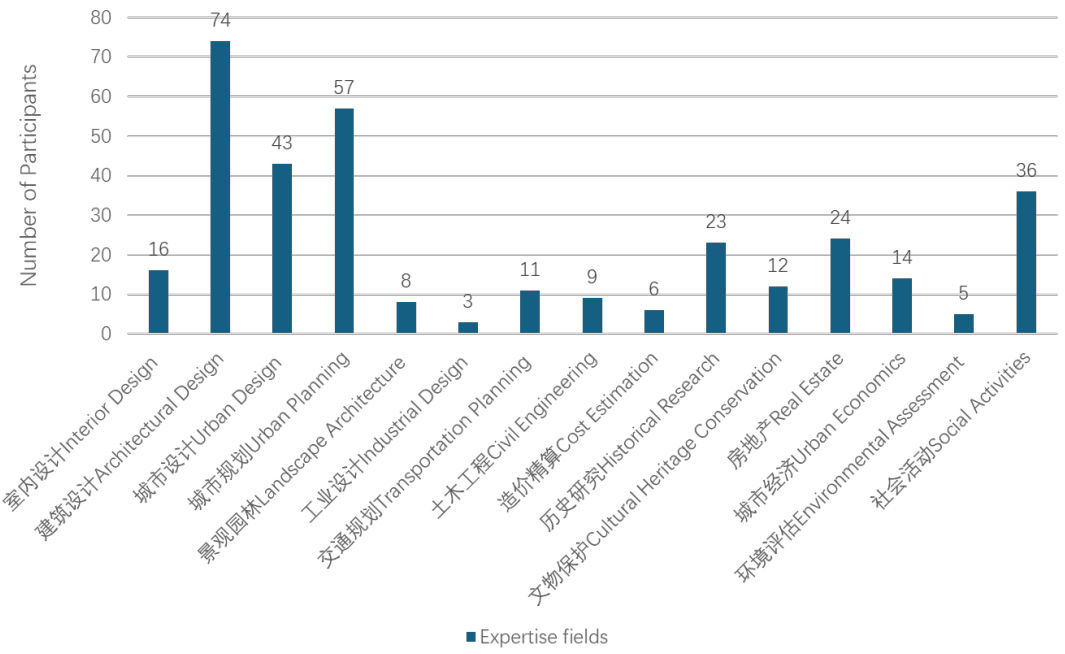


Figure 4. 4 Expertise fields of the experts (experts can select multiple fields) (By author)

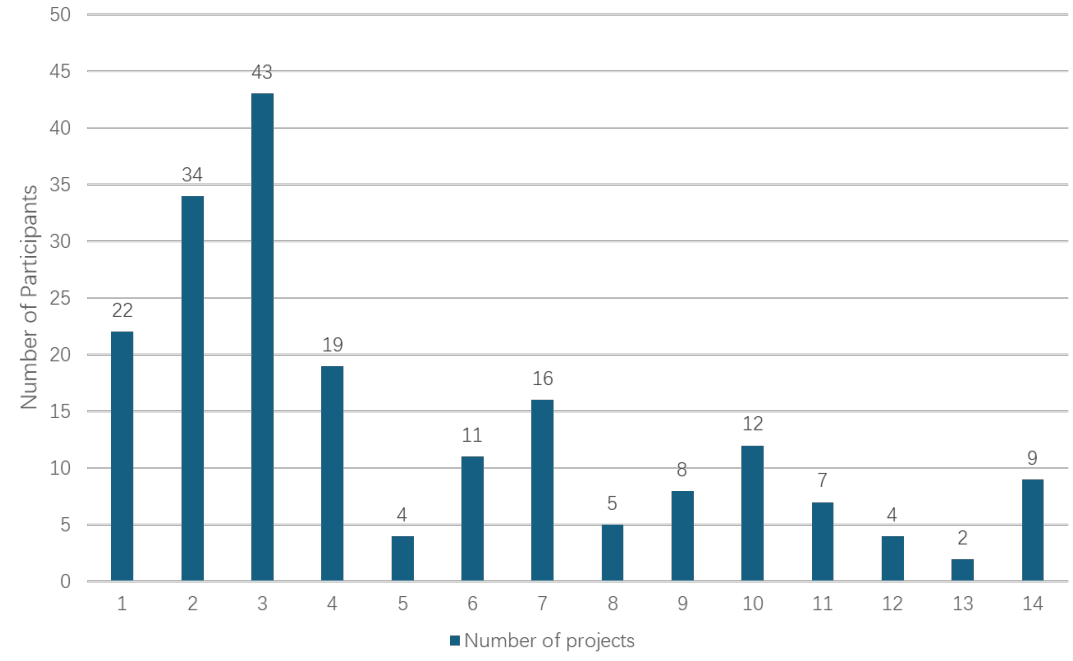


Figure 4. 5 Number of listed projects that a participant has visited (By author)

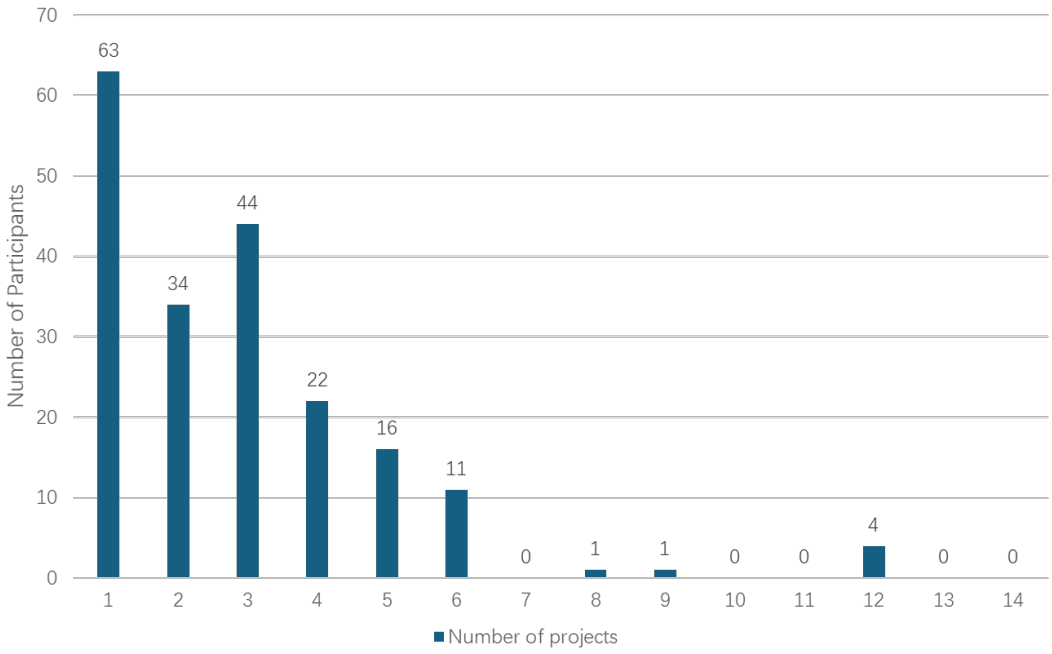


Figure 4. 6 Number of projects a participant has been involved in both practically and academically (By author)

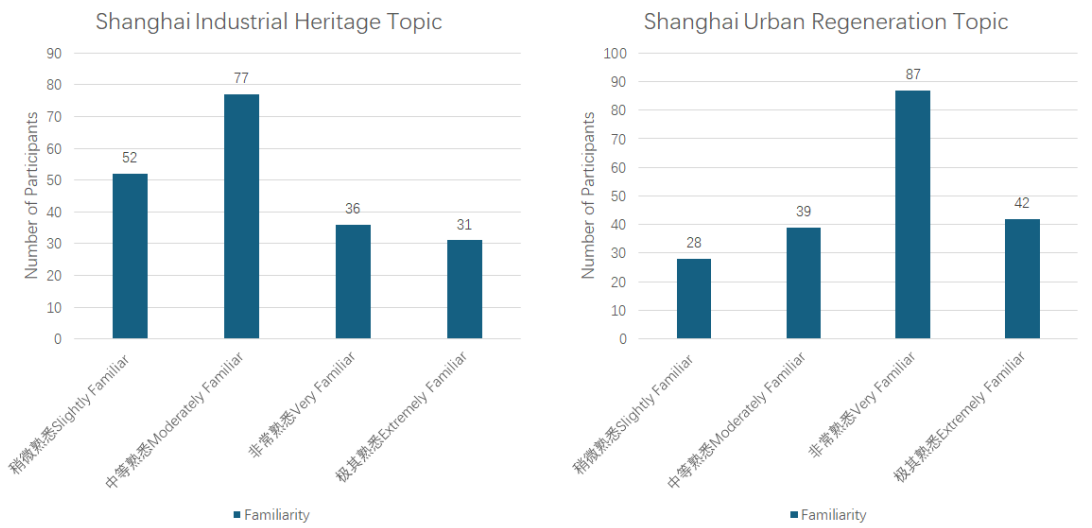


Figure 4. 7 The familiarity of experts in the topics of Shanghai industrial heritage and Shanghai urban regeneration (By author)

4.3.2 Document Analysis

Document analysis involves the systematic examination and interpretation of various types of documents, both published and unpublished, to collect valuable information and draw meaningful conclusions about urban phenomena. The process entails the evaluation of diverse sources, such as government reports, policy documents, urban plans, newspapers, historical records, and academic publications, among others. This method allows researchers to delve into the context of urban issues, trace historical developments, and uncover trends that may not be readily apparent through other data collection techniques.

In the realm of urban studies, document analysis offers several distinct advantages. Analysis of document information provides access to a wealth of information that might be challenging or costly to obtain through primary data collection methods, such as surveys or interviews. This method of data collection enables the researcher to analyse data from different periods and perspectives, facilitating a comprehensive understanding of urban issues and their evolution over time. Moreover, document analysis allows for the triangulation of data, which can strengthen the validity of research findings by cross-verifying information obtained from other sources. In this thesis, documents are used to collect data and information on CSA indicators.

1) Mapping

Mapping, as a data collection method, encompasses a wide range of techniques and tools designed to capture, analyse, and visualize spatial information. By employing mapping techniques, researchers can gain valuable insights into diverse urban issues, such as land use patterns, transportation networks, population distribution, socio-economic disparities, and environmental impacts. The strength of mapping in urban studies lies in its ability to synthesize complex data and the capability of transforming visual information into statistical data which enables researchers to identify and analyse spatial relationships and trends more effectively *(*Akoka et al., 2017*)*. For the data in this study, mapping and diagramming of an urban industrial heritage quarter are expected to assist the data processing of transportation information and spatial information.

2) Information Retrieval

Information Retrieval (IR) is the process of obtaining relevant information from a collection of resources in response to a specific query or need. In the context of data collection, IR is a crucial step in identifying, locating, and extracting useful data from various sources to address a research question or support decision-making processes *(*Schütze et al., 2008*)*. In the context of urban studies, information retrieval plays a significant role in gathering data from a wide range of sources to analyse and understand various aspects of urban environments. This research may use IR techniques to access and collect demographic, economic and political information from

government reports and documents, academic publications, newspapers and media, online databases, and websites.

3) Secondary data analysis

Based on the information and data retrieved from mapping and documents, some of the indicators might also need to undergo an analysis process using existing data sets, such as census data, transportation records, and crime statistics, to transform the information into the required format or explore in-depth findings.

4.4 Data Analysis Techniques

To quantitatively analyse the relationship between value and indicators, appropriate statistical methods are needed. In statistics, regression analysis (Sykes, 1993) is a technique used to determine the quantitative relationship between two or more variables. Depending on the number of variables involved, regression analysis can be classified into simple (one variable) and multiple (more than one variable) regression. Based on the relationship between the independent and dependent variables, it can also be categorized into linear and nonlinear regression.

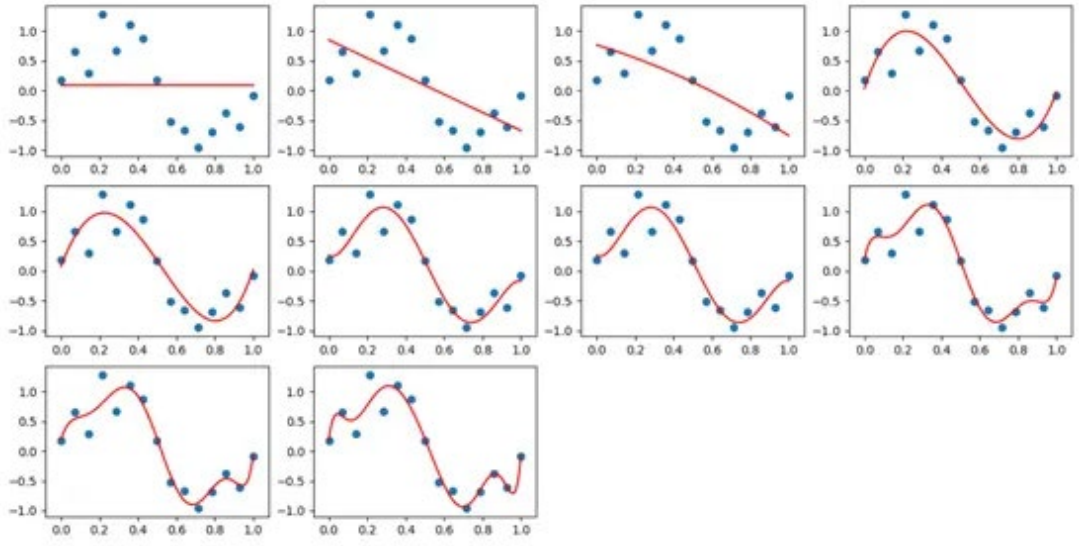


Figure 4. 8 Diagram of the regression model (Akotia and Opoku, 2018)

Linear Regression (Weisberg, 2005) uses the best-fitting line, known as the regression line, to establish a relationship between the dependent variable (Y) and one or more

independent variables (X). The slope of the line represents the impact of changes in one variable on another. This is typically determined using the least squares method (Akotia and Opoku, 2018), which minimizes the sum of the squared deviations of the points from the line. (Figure 4.8)

The scatter plots above indicate that fitting a straight line to the relationship between the two complex variables is ineffective. Instead, an equation with higher-order terms is needed to accurately model the relationship. Polynomial regression (Ostertagova, 2012) is a statistical method that extends the linear regression model to capture nonlinear relationships between variables. Specifically, polynomial regression improves the model's fit by including higher-order terms (such as squares, cubes, etc.) of the variables. The core idea is that any smooth curve can be approximated by a function with higher-order polynomials.

The univariate polynomial regression equation of degree m is:

$$y(x, W) = w_0 + w_1 x + \cdots + w_m x^m = \sum_{i=0}^{m} w_i x^i$$

where y is the dependent variable, x is the independent variable, W is the regression coefficients matrix to be calculated:

$$W = \begin{bmatrix} w_0 \\ w_1 \\ \vdots \\ w_m \end{bmatrix}, \quad X = \begin{bmatrix} 1 & x_1 & \cdots & x_1^m \\ 1 & x_2 & \cdots & x_2^m \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_n & \cdots & x_n^m \end{bmatrix}$$

A polynomial function can be expressed in the form of linear algebra:

$$y(x, W) = XW$$

To obtain the minimum value of the error function, we set the derivative of the function to zero, which gives a unique solution. The error function is:

$$E(W) = \frac{1}{2} \sum_{n=1}^{N} (y(x_n, W) - t_n)^2 = \frac{1}{2} (XW - T)^\top (XW - T)$$

Then take the derivative of it to get:：

$$\frac{\partial E(W)}{\partial W} = X^\top XW - X^\top T$$

Setting the derivative equal as zero to get:

$$W = (X^\top X)^{-1} X^\top T$$

Finally, the objective function W can be obtained through matrix operations:

$$W = (X.T * X).I * X.T * T$$

The calculation was performed using OriginPro 2022 software. For two sets of variables, selecting [Analysis] - [Fit] - [Polynomial Regression] allows for the computation of the polynomial regression equation and the plotting of the curve.

Since we will have curves generated from 37 different indicators, displaying all impact trends on the same chart would lead to a cluttered and less readable image. Therefore, we select a subset of indicators for analysis. The selection method can vary depending on the focus of the model user. Here, we use the correlation coefficient (Garcia Asuero et al., 2006) as the criterion for selection. The correlation coefficient measures the degree of linear relationship between variables.

$$r(X,Y) = \frac{Cov(X,Y)}{\sqrt{Var[X]\,Var[Y]}}$$

$Cov(X,Y)$ is the covariance between X and Y, $Var[X]$ is the variance of X, and $Var[Y]$ is the variance of Y. As shown in the figure below, the correlation coefficient and the degree of impact between variables are not the same concept. For example, although the correlation coefficients r differs in Figures A to F, the trends in Figures D, E and F show the degree to which the variables impact another variable is the same (i.e., the slopes of the fitted curves are identical). (Figure 4.8)

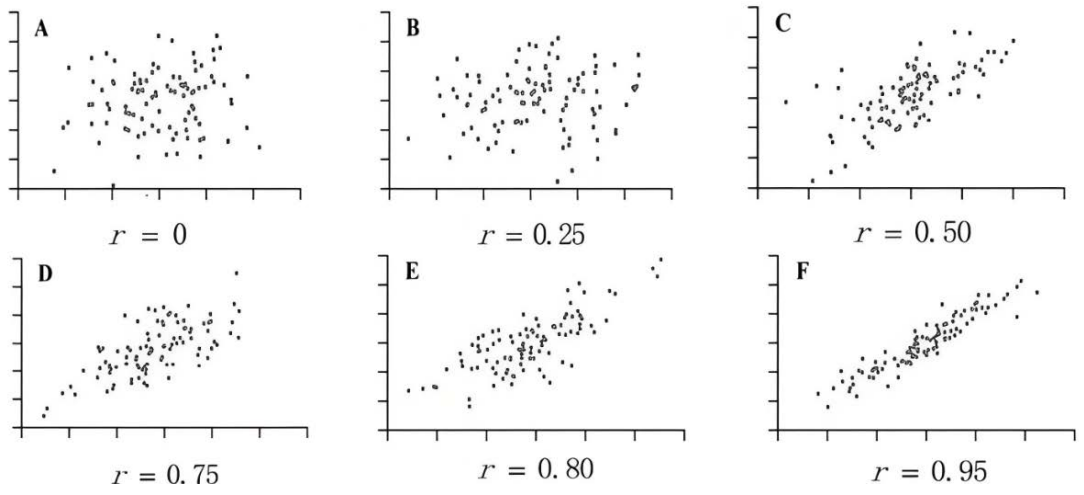


Figure 4. 9 Diagram of correlation coefficiency (Garcia Asuero et al., 2006)

The calculation of the correlation coefficient is performed in OriginPro 2022. For two sets of variables, select [Statistics] - [Descriptive Statistics] - [Correlation Coefficient].

OriginPro 2022 is a scientific plotting and data analysis software developed by OriginLab. Origin supports a wide range of 2D and 3D graphics. Its data analysis features include statistics, signal processing, curve fitting, and peak analysis. Curve fitting in Origin uses nonlinear least squares fitting based on the Levenberg-Marquardt algorithm. (Figure 4.9)

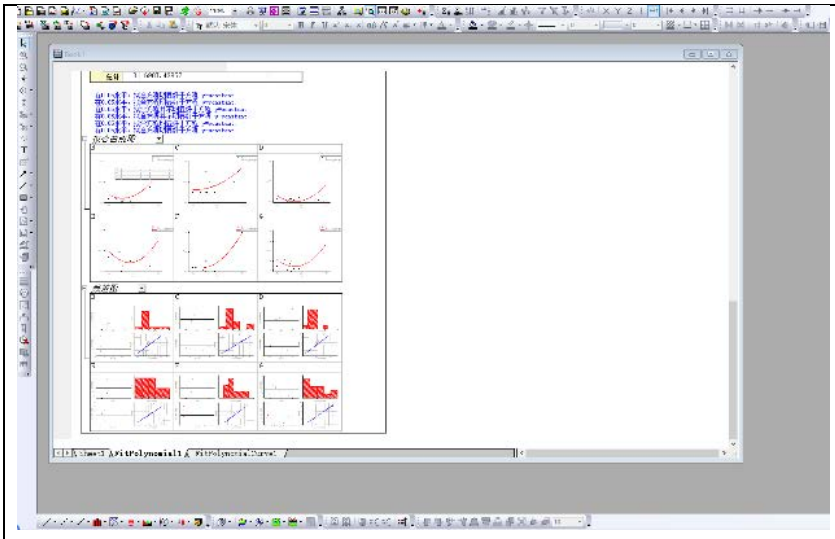


Figure 4. 10 OriginPro 2022 operation panel (Screenshot by author)

4.5 Conclusion

In conclusion, this research methodology chapter has introduced limitations in current urban heritage studies and proposed the Contextual Sensitivity Analysis (CSA) as a mixed-method research process to understand the context (context indicators of the urban industrial heritage quarter) impact on the project or research target (variation of industrial heritage value).

For processing the CSA, this chapter presented the principles of sample selection, which have been carefully designed to ensure the representativeness and reliability of the study's findings. Furthermore, a detailed account of data collection methods has been provided, encompassing both primary and secondary sources, to ensure a diverse and comprehensive dataset that can inform the analysis.

This chapter then introduced the scheme of data analysis, which incorporates the Polynomial Regression model for generating the impact trend and uses a correlation coefficient to select higher relevance indicators to analyses for clearer visual display.

Chapter 5. Contextual Sensitivity Analysis (CSA) for Urban Industrial Heritage Quarter Regeneration

Based on the study of context significance and contextual sensitivity theory, this chapter introduces Contextual Sensitivity Analysis (CSA), an analysis process that uses mixed-method research to explore the relationship between urban context and industrial heritage value during the regeneration process.

The contents of this chapter will look into context indicator identification and quantification methods. Following this chapter, the selected samples will use the methods introduced for data extraction and collection, providing the analysis resource for exploring the relationship.

The first section begins with the study of the contextual features of an urban industrial heritage quarter. By referring to the existing system of categorizing urban environment, this part summarizes the general context factors for urban quarters and provides specific introductions on each factor in the background of urban industrial heritage quarter.

Setting the factors as the foundation, the second part of this chapter subdivides each factor into impact indicators that are closely related to the unique characteristics of industrial heritage sites. In this section, the indicators will be quantified as much to deliver the key information to support CSA and will be given a clear guide on how to calculate and collect the data.

5.1 Context Factors for Urban Industrial Heritage Quarters

The details of urban context are complicated as they cover a wide range of physical and non-physical elements. Especially for urban regeneration projects, how planning and designing activities impact the existing urban contexts mainly depends on the attributes of the site and the project's targets. Therefore, among the massive context factors, urban studies focusing on a specific type must select distinctive and representative factors for a more targeted result.

In this part, the context factors are chosen based on the common context factors of an urban quarter that have been greatly influenced by industrial heritage features. Unlike regular urban quarters, the special features of industrial heritage quarters not only exist in the heritage buildings and structures, but also lie in the social impact. Physically,

industrial heritage quarters have distinguished spatial textures compared with residential and commercial urban environments which usually consist of large-scale factory structures and machinery. For productive and transportive functions, some urban industries also have a tight relationship with inner city waterways and railway systems. However, more complicated factors for industrial heritage quarters are from the social and economic vectors. The industry has a great influence on employment and the economy; some even act as the cohesion of the local industrial community and form an industry-centred living pattern *(*Davies, 2008*)*. In this case, the selection of context factors should highlight both the industrial and heritage attributes of the urban quarters.

5.1.1 Context Factors Classification

Due to the complexity of the urban environment, the context study of the site and the evaluation of sustainability also vary accordingly, for different research or in different organisations. In order to ensure the context factors are chosen comprehensively and authoritatively, this thesis only takes the prevailing site analysis and sustainability assessment publications as references, which have been accredited in academic and practical circles. However, when the factors are scaled down to abstract aspects such as social and cultural contexts, there is always ambiguity between direct and indirect information. This implies the boundary between the basic attributes of the site, which can be obtained from the features of the site, and the secondary attributes, which need to be concluded or extrapolated through one or more rounds of people's evaluation and assessment, is not clearly defined *(*La Rosa et al., 2017*)*.

For this research, the value of industrial heritage quarters is more based on public evaluation and preference. Setting the value enhancement performance as the CSA target, the contextual factors selected during the analysis should be objective to avoid the reuse of data in the information analysis process.

In terms of the classification system, most of the research follows the principle of sustainability as the social, economic and environmental pillars. The work of identifying the factors and indicators of sustainability starts with the aim of a systematic benchmark to realise the prospect of urban design. According to the focuses of such factor classification, 'urban sustainability factors and indicators can be defined as bellwether tests of sustainability and reflect something basic and fundamental to the long-term economic, social or environmental health of a community over generations *(*Sustainable Seattle, 1994,4*)*.' The system of the three pillars works well, especially in terms of the economic and environmental aspects, which are more objective and statistical. The difficult and complex aspect is social sustainability, which is an integration of both physical and non-physical features. Therefore, the social pillar can regularly be split into different sub-factors according to the aim and subjects of different research. For historic heritage quarters, the tangible heritage plays a vital role in defining the characteristics of an urban space and shaping the way of local life. This part of the classification will

consider listing the tangible and intangible context factors separately to illustrate the detailed impacts on the industrial heritage quarters.

Context	No.	Factor	Introduction
Physiographic context	F1	Landform	A landform is a natural or anthropogenic land feature on the solid surface of the Earth (British Geological Survery, 2024). The variation of landform affects the horizontal and vertical layout of buildings, public spaces and circulation systems. For urban design projects, the utilization of landforms can be seen either as an obstacle or an opportunity, depending on the project's prospect and operation feasibility. (LaGro, 2013)
	F2	Greenery / open spaces	Green spaces and public spaces refer to the green-covered area and unoccupied space on the site. In the modern city, green and open spaces are valuable spatial resources, influencing environmental quality, economic profit and human activity (Douglas et al., 2019).
	F3	Waterbody	Water systems and wetlands have a great influence on the spatial distribution and environmental quality in an urban quarter (Schwartz, 2008). It also provides opportunities for urban regeneration as an economically valuable resource under rational utilization.
	F4	Climate	The climate contains massive information that considers the urban context. It might include wind, temperature, humidity, daylight, etc. Understanding the climate condition of the site can assist the environmental sustainability of urban design, realizing the aims of low-carbon and energy saving. Furthermore, the appropriate utilisation of climate resources contributes to the comfort of architectural and public spaces by tuning the lighting and ventilation (LEED, 2021).
	F5	Pollution	Pollution is usually the consequence of production activity and inadequate waste disposal. In the city, there is also light and noise pollution that greatly impacts the quality of life of residents. The development and regeneration plan should not only deal with existing pollution, but also minimize the subsequent pollution during the construction process.
	F6	Biology	Biological factors refer to the site's flora and fauna systems. Urban development is expected to maintain biodiversity (preserving existing habitats and providing bio-facilities), therefore promoting the harmonious co-existence of plants, animals and humans within the city environment (Abdul et al., 2019).
Land use context	F7	Fabric	The fabric information of a site normally talks about the physical forms of buildings and spaces, and the spatial relationship between them. Some of the most frequently referred aspects when describing the fabric of an urban quarter might include the area and boundary of the site, building density and distribution, etc. (Laprise et al.,

			2015). Especially in the research of urban issues, the transformation of urban fabric impacts the development of life, space, and city.
	F8	Function	The original use of the site, either on-site function or peripheral function, is an important factor to be considered in the development and regeneration of an urban quarter. Getting comprehensive knowledge about the functional information, as well as the needs of local community, is beneficial for an effective economic boost and for a convenient and liveable community (Van Noordwijk et al., 2004). In the process of planning, the diversity and flexibility of functional design are important for the vitality and economy of a project.
	F9	Location	In regard to an urban quarter, the relative location of the site has more research and practical value for design. Location reveals the physical relationship between the selected site and other urban quarters. Relative location is popularly described as the distance and orientation towards vital urban functional clusters, such as a city's commercial, political or entertainment centres. (Bottero et al., 2019)
	F10	Infrastructure	Infrastructure of an urban quarter covers the structures and facilities that support the efficient and safe running of the city and people's lives. It is an essential but easily ignored aspect in the early stage of planning and design. However, infrastructure frameworks, especially transportation systems and amenity arrangements influence the development potential of an urban environment (Schwartz, 2008). City spaces with well-designed infrastructure are more likely to adapt to changes in function and serve future prospects with minor alternations.
Socio-cultural context	F11	Heritage and tradition	Heritage in an urban context plays a vital role in enhancing place identification and promoting tourism potential in the development and regeneration process. Urban heritage has both tangible and intangible vectors. Tangible heritage refers to all physical relics, from landscapes and structures to utensils and documentation. Intangible heritage is more abstract, including the relevant traditions, customs, people and memories. The importance of heritage should be understood within a broader historical background, sometimes reading together with other heritages. Heritage should be considered carefully in the city in order to fully respect its significance and maximize its value. (Li et al., 2016)
	F12	Regulation	Regulation can be seen as an interacting factor, which means the regulations can largely determine the development of urban quarters, while the launch of some projects also impelled the proposal and revision of regulations. It is a dynamic interactive relationship based

			on practice (Alice, 2012). For practical aspects, the regulations of construction and land use, and the development guidelines are vital official documents as references.
	F13	Social life	Social life as a factor in the urban context mainly aims to reveal the daily activities of residents and public engagement within the local communities. It might include information about demography besides community and social interactions. The vitality and inclusiveness of social life promote satisfaction and well-being among local people, as well as empower bottom-up urban development. (Woodcraft, 2015)
Economic context	F14	Economic efficiency	Economic efficiency is always the primary consideration in the urban development and regeneration process. Stable development of the economy and a virtuous cycle of capital encourage and ensure the sustainable development of the future city, as well as promote the living quality of the local residents. Efficient economic strategy during urban design and planning contributes to functional and capital aggregation, which mostly benefits the industrial market, tourism market and real estate market (Zhong and Cao, 2013).
	F15	Investment	Successful launching and implementation of urban projects depend on adequate and long-lasting investment and funding (Landorf, 2009). For government-led projects, a good and trustworthy investment environment should be backed up by a promising urban space with investment value. For some bottom-up projects that are community-led, a comprehensive and systematic funding management scheme is essential for the local society to accompany the life-cycle of a project, establishing confidence among relevant stakeholders.
	F16	Employment	Economic development under urban transformation also impacts the labour market and employment status. A positive employment situation is an essential factor in maintaining social stability and increasing public satisfaction (Huub and Pascal, 2015). Urban development and regeneration are expected to provide sufficient company spaces and a pleasant working environment, creating attractive job opportunities.

Table 5. 1 Urban context factors categorization based on the representative evaluation system / Summarized by author from (LEED, 2021, LaGro, 2013, Alice, 2012, Højriis et al., 2014, Department for Culture Media & Sport, 2013, Schwartz, 2008, International Rescue Committee, 2017, Woodcraft, 2015, Li and Wu, 2011, Li et al., 2016, Hamedani and Huber, 2012, Cole and Jose Valdebenito, 2013, Abdul et al., 2019, Ameen et al., 2015)

5.1.2 Context Factors for Urban Industrial Heritage Quarters

When the contextual factors of a general urban quarter come to an urban industrial heritage site, the scope and details of each factor should be adapted to the characteristics of the industrial heritage, maintaining sensitivity to the uniqueness of the heritage and its context. The following description points out some specific aspects that each factor should focus on during the renewal process of an industrial heritage area.

F1. Landform

Topography is the study of shape and features on the surface of the earth. The scale of topographical features of an urban environment is relatively small compared with the natural environment. Normally, in the urban context, topography includes landforms, water bodies, soil and vegetation, and land-based infrastructure (Hamada et al., 2013). This factor only talks about the landform features, while other topographical features will be discussed later in other factors.

The landform of the industrial heritage site provides information on the elevation and slope of the industrial landscape. The original elevation and slope of the site relate to how the production process utilizes the benefit of the landform, such as using the natural slope for coal or goods loading or utilizing the gravitational potential for energy. In the regeneration of an urban industrial heritage site, this factor gives hints of the physical and cultural context of a community or region (LaGro, 2013), which has great influences on the circulation of the site, arrangement of the building complex, visual quality inside and outside the site, and solar and water resources management.



Figure 5. 1 Coal-drop Yard, King's Cross Quarter, London (Photo by author)

Sitting inside a cluster of industrial relics in the King's Cross quarter, the Coal Drops Yard, as its name suggests, is a slope used for coal and goods unloading. By keeping

this elevational feature, the design of this site has utilized a slope to create a two-layered shopping centre and a linear and inward-facing courtyard for bars and restaurants. It reinforces the dynamic vision of the slope, enhancing the industrial identification from the landscape design.

In practice, the actual treatment for existing topography depends on the value of the industrial landscape, construction feasibility and design prospects. For most urban industrial quarters, the site had been artificially trimmed, adapting to the production activity. Therefore, many industrial heritage sites with unique landform features are always regarded as industrial landscapes with heritage values that reveal the process of industrial activities. (Figure 5. 1)

F2. Greenery and open spaces

The greenery of the heritage site is a natural resource for regeneration. The green space shows the natural condition of the original environment and relates to the utilization pattern and space quality of the heritage quarter. Relevant information might include the area, texture and distribution of the green spaces. A variety of studies have proven the benefits of parks, including raising property values, increasing health, strengthening communities, and improving the environment (Tzoulas et al., 2007, Peters et al., 2010, Crompton, 2005, Schwartz, 2008). Compared with other urban functions, an industrial activity normally requires larger-scale outdoor spaces, such as open spaces for transportation and distribution. Those left-over spaces, either hard surfacing or vegetation-covered, have a high potential to be developed into public spaces and architectures or even kept as part of the city green system. (Figure 5. 2, Figure 5. 3)



Figure 5. 2 Yangpu Riverside Green Belt, Shanghai (Photo by author)



Figure 5. 3 Yangcheng Creative Industry Zone, Guangzhou (Photo by author)

This site is part of the industrial heritage trail along Yangpu Binjiang Shanghai.

The Central Station of this industrial quarter has been regenerated from a

The original factory area was abandoned and covered by plants. The regeneration planned a route through the site, while keeping some factory structure relics and the raw landscape alongside. It provides a feeling of a natural hideout in the city, as well as enhances the heritage vibe inside.	factory building into a live house. The square in front of the factory was used for machinery transportation, which is now a landmark in this quarter as the main entrance of the live house, with an open-air café, machine relics and a historical introduction display area.

F3. Waterbody

For many industrial heritage sites, the water system is an indispensable resource for energy, production and transportation (Huub and Pascal, 2015). The relationship and interaction of the industrial heritage quarter with its on-site water feature is important in revealing the historical production process and the water-related regeneration potential. Waterbody in urban industrial heritage sites exists in two forms: waterways such as canals or rivers or artificial lakes and ponds. Water bodies have vital landscape values in regenerating old industrial space and organising pleasant built environments. It also has economic significance when the site is developed into commercial and residential properties, as well-designed water features and interactive waterfront promote living quality and attract investors and residents (Zhang et al., 2022). (Figure 5. 4, Figure 5. 5)

	
Figure 5. 4 Birmingham Old Canal System, UK (Photo by author)	Figure 5. 5 Shougang NO.3 Blast Furnace Museum and Lake Xiu (Photo by author)
The old canal of Birmingham is a precious treasure left from the age of the Industrial Revolution. The system	The design of the No.3 Furnace cluster has made a great effort to engage with the huge water feature. This artificial

serves the factories along the waterways, providing energy, water resources and convenient transportation. During the regeneration, the canal system is designed to be revitalized as a link between different regeneration nodes. Nowadays, walking and cycling along the canal has become enjoyable and relaxing daily entertainment for local residents (Birmingham City Council and British Waterways, 2002). Moreover, the beautiful view and waterside environment have boosted the real estate market of the surrounding residential properties.	waterbody is used to serve the surrounding structures and architectures as a reservoir to store cooling water (Sang and Lin, 2023). After integrating the site context into the design, this reservoir has become the core landscape for the cohesion of the architecture and urban spaces. The visual extension created by the water surface has made the view even more spectacular. Meanwhile, the reflection on the water creates a new way to appreciate the giant structures.

F4. Climate and natural resource

Climate conditions influence the planning and design decisions of industrial facilities and buildings. Climates not only provide energy potential for industrial sites, such as wind and solar energy, but also influence the material and construction of industrial buildings (Zadeh et al., 2020). Sometimes, the natural and built environment on the site also creates a micro-climate around the quarter. Among all the climate factors, the most influential ones are wind conditions and solar access.

Other additional considerations should include the temperature, humidity, rainwater and snowfall (LaGro, 2013). For most of the inner-city industrial heritage sites, the impact of climate on architecture and open spaces is not very strong, except for those near the harbour or in extreme climate areas. However, climate factors still need to be considered carefully in the redevelopment and regeneration for sustainable purposes.

F5. Pollution

Pollution is always an urgent issue when dealing with industrial sites. It includes toxic soil, industrial waste treatment, and pollution of water, dust, and air quality. For an industrial brownfield with heritage relics, the primary thing to recover the accessibility and liveability of the site is to deal with the pollution and recover environmental resilience (Stricker, 2020, Kryder-Reid and May, 2024). Except for pollution caused by

previous production activities, the regeneration process should also try its best to minimize subsequent pollution caused by construction. (Figure 5. 6, Figure 5. 7)



Figure 5. 6 Old picture of industrial pollution of Ruhr industrial district in Germany (https://zhuanlan.zhihu.com/p/36953200 Last access 17/11/2024)



Figure 5. 7 Ruhr industrial district after regeneration (https://zhuanlan.zhihu.com/p/36953200 Last access 17/11/2024)

The Ruhr industrial area has experienced great environmental improvement through ecological strategies in dealing with polluted industrial land and has maintained continuous natural resilience through landscape recreation.

F6. Biology

Biodiversity of vegetation and animals: Biological factors are relatively rare in industrial sites. However, some specific types, like canal and dock heritage, are also biologically beneficial. When interacting with green spaces and water bodies, those quarters can easily form small-scaled habitats for urban or seasonal wildlife *(*LaGro, 2013*)*. One representative example is the fish passage along the Kelham Island of River Devon in Sheffield, which offers an interesting trout migration bio-landscape in the city *(*Don Catchment River Trust, 2020*)*. (Figure 5. 8)



Figure 5. 8 Trout migration bio-landscape of Kelham Island, Sheffield (Photo by author)

F7. Fabric

Fabric is a physical layout that describes the spatial texture of an industrial site (Landorf, 2009). Compared with traditional urban space, the industrial heritage quarter has unique fabric with larger-scaled spaces and organized functional arrangement.

The area and boundary of the site deliver a general pattern of the industrial heritage site, which is closely determined by its type of industry and scale of production. Therefore, the evaluation of industrial heritage usually refers to fabric information to understand the production process (Falser and Yang, 2001). The size and boundary of the site also indicate the potential for redevelopment in the urban area and the feasibility of spatial integration with surrounding quarters.

The density and distribution of architecture form an image of figure and texture for the historical quarter. In a broader urban context, the industrial heritage quarter usually has a distinct texture compared with traditional urban spaces in terms of building scale, typology and arrangement. For many regeneration projects, how to promote an organic integration of urban spatial texture of historic sites is challenging but meaningful. The density of the industrial relics influences the characteristics and public perception of the place. It creates a stronger vibe if physical industrial heritage is integrated and easily visualized and sensed. (Figure 5. 9, Figure 5. 10)



Figure 5. 9 Tianjin tractor factory, China (https://www.archdaily.cn/cn/971988/tian-jin-tian-tuo-han-fang-gai-zao-shen-zhen-hua-hui-she-ji Last access 17/11/2024)



Figure 5. 10 Jewellery Quarter Birmingham (Photo by author)

Taking the design of these two projects as examples, the Tianjin tractor factory is a large-scale industrial quarter with a clearly defined boundary. The buildings are spaces with huge volumes, which are strictly and closely aligned to meet the production requirements of heavy machinery. As a result, all the buildings spontaneously form a cluster that has a very strong industrial identification and is easily distinguished from surrounding quarters. On the contrary, the Jewellery Quarter of Birmingham is a quarter of many heritage sites but with totally different fabrics. As it is a quarter of the manufacturing industry, which is more spatially flexible, heritage spaces and buildings are integrated well within the local community. It is a dispersed heritage group following the original urban context. Therefore, the regeneration plans of the two sites are with different prospects. The Jewellery Quarter has done great community-led regeneration as a liveable urban museum. The Tianjin Track Factory has been developed as a big commercial landmark, stimulating the local economy with new shops, studios, and offices to rent.

F8. Function

The function of an urban industrial heritage quarter largely depends on whether the original industry is still functioning. In the urban regeneration process, the function in and around the targeted quarter should be considered comprehensively in accordance with the development prospects of the city.

The on-site function shows how the spaces and architectures in the quarter are being utilized. Some industrial heritage sites might still have some per cent of traditional production activities, known as living heritage. Living industrial heritage quarter presents

itself as the storyteller of the industrial past. According to the security and privacy of the production process, sites, including in-use industrial heritage, are not always fully accessible to the public (Li and Wang, 2019). However, proper interaction with the living industrial activity can greatly enhance place identification.

When reusing the abandoned industrial heritage site, the functional vitality and distribution of the quarter influence the potential for further regeneration and continuous development. Generally speaking, adaptive reuse and mixed-use approaches can increase the convenience of living and visiting, as they can reduce commute distances of daily life and are environmentally friendly because of their low carbon potential (Smith, 2006b) (Schwartz, 2008). In other cases, when the whole site is developed for one prior function, it will also form a unique place identification and greatly influence local communities.

Apart from the on-site function, the peripheral function is also an essential factor to be taken into consideration. Especially for those with heritage, the spatial, social and economic impact of an urban quarter is never limited to its scale (Li, 2018). Peripheral function reveals general information about the functional relationship between the heritage quarter and the surrounding urban context. In the regeneration process, the development of the industrial heritage site is always expected to benefit a broader-scaled city life. As a part of the urban context, industrial heritage quarters coexist with other kinds of functional spaces. Some factories also spurred the formation of surrounding industrial communities with affordable houses, shopping areas, ancillary facilities, etc. (Figure 5. 11, Figure 5. 12)



Figure 5. 11 Street view of Tsingtao Brewery Museum and Factory, China (http://2008.sina.com.cn/other/p/2008-07-31/1157134350.shtml Last access 17/11/2024)



Figure 5. 12 Beer & Seafood Street near the Tsingtao Brewery Museum (https://www.dailyqd.com/channelzt/2014-08/28/content_117288.htm Last access 17/11/2024)

Tsingtao Brewery Museum is a living industrial heritage redeveloped from the original factory buildings, which is now located within the current headquarters and factory of Tsingtao Brewery Ltd. Except for the traditional brewing process exhibition part in the

heritage buildings, the company also opens a trail of visiting the modern production process of the new factory. The whole tour is designed to tell a dynamic story of the brewery's development from the past to the present era. From the site itself, the museum is an attractive landmark that enhances industrial identification and the propagation of corporate culture. The surrounding blocks have driven the prosperity of the beer and gourmet street quarters with restaurants, bars, and hotels, bringing impressive economic benefits to the government and the local community.

F9. Location

The location of industrial heritage areas is closely linked to the accessibility of urban centres, amenities and transportation hubs. When it comes to the fixed location information, it is common to consider at the planning stage whether the regeneration options for a heritage site are compatible with the overall development goals of the area. The regeneration of a particular quarter should also be spatially and functionally adaptable in the context of broader-scaled urban development.

The relative location focuses on the distance and orientation towards essential urban functional clusters. Industrial sites that are closer to the city or town centre and have easy access to transportation have a natural advantage in attracting investors and tourists. The location also influences the convenience of accessing social and community amenities, such as health facilities (hospital, clinic, dentist, etc.), welfare facilities (nursing centre), educational facilities, religious facilities and leisure facilities (club, cinema, sports, etc.) (Gardiner, 1998). When revitalizing the old industrial quarter, upgrading the positive relationship with the city may increase its popularity, liveability and heritage continuity.

Take the King’s Cross Quarter as an example, which is a cluster of various kinds of industrial heritages. In terms of its location, it is adjacent to central London and Camden Town, which are the most active and famous places. As an important transportation hub, it is easily accessed by railway, underground, and bus from all over the country, even from the European continent.

F10. Infrastructure

There are two types of urban infrastructures, one type refers to the infrastructures that provide basic city circulatory services such as transportation, water, energy, electricity, etc., as well as the other type of amenities that sustain community life and survival as

social institutions and networks *(*Ferrer et al., 2018*)*. To distinguish from the functional factor and locational factor of this contextual categorization, the infrastructure factor here is targeted at the engineering infrastructures, including transportation systems, energy and water supply systems, digital connections, sanitation and disaster prevention systems (Amado and Poggi, 2022). For some urban industrial heritage sites, the previous production activity has left over an organized facility system, which more or less has a connection to the city's infrastructure context. In terms of redeveloping the industrial heritage, the proper utilization of the existing facilities is a two-for-one thing, sustainably increasing the service capacity of the quarter's infrastructure system while giving heritage relics a second life.

One important system that needs a separate explanation is the transportation system. Transportation has a great impact on the redevelopment of the urban industrial heritage site. Considering the regeneration potential, the value of an industrial heritage quarter may more likely be continuity if it is easily accessed and closely interacts with a broader urban context. The road system in and around the industrial heritage site focuses on the transportation network distribution, traffic conditions and road quality, which indicate the original mobility and connectivity of the site. *(*Schwartz, 2008*)*

Public transportation for the urban industrial heritage quarter relates to the accessibility between the site and other offsite functions. From a general view, trains, subways, trams, buses, and shared non-motorized vehicles are all public transportation factors. In some waterside industrial sites, such as canal heritage and dock heritage, boats and ferries should also be taken into account. The potential for parking is an important factor for measuring tourists' and residents' capacity. Except for motor vehicle parking, shared bike and scooter stop points and boat mooring should also be included.

Well-developed public transit systems provide a reliable alternative to private car ownership, offering convenient, efficient, and cost-effective means of transportation, diminishing greenhouse gas emissions and promoting physical fitness (Holmgren, 2020, Schwartz, 2008). The performance of transportation services can greatly influence the economy and quality of life in the city.

F11. Heritage and Tradition

The existence of industrial heritage gives an urban quarter a unique identification, which reveals the production activities of a specific region and the relevant lifestyle of local communities. In this category, tangible industrial heritage includes industrial architecture, structures, machinery, and landscapes, which should be treated carefully for conservation and regeneration.

For industrial heritage architectures, studies should focus on the scale, type, material, structure decoration and survival condition. Industrial architectures are the most

important tangible evidence of their historical significance. The size and volume of factory buildings relate to the spatial potential for functional transformation. Its adaptability and feasibility to reuse largely depend on the survival condition, including the safety of the structure and the quality of architecture and material. Furthermore, industrial architecture is also aesthetically understood through its design, style and decorations. Industrial heritage structures, machinery and facilities are essential relics of industrial heritage as the hint of the production process. However, with the deindustrialization of many factory spaces in the city, many pieces of equipment and machines have been removed from the site, leading to the loss of the industrial atmosphere *(*Aoki and Xu, 2021*)*. Therefore, onsite production relics are especially precious for the site's authenticity and integrity.

Intangible industrial heritage mainly considers the science and technology of production practice, relevant activities and customs left from industrial ages and collective memories. That historical information is of great research value, indicating the evolution of modern engineering technology and the transformation of industrial communities. Through detailed archaeological documentaries and comprehensive investigation records, people can restore the past prosperity of local industry and establish a linkage between current social customs and traditional production activities.

By putting the industrial heritage quarter as part of the local history, its significance and value should be understood within a larger heritage context. The industrial activities in a city usually composite a systematic relationship in location, production and transportation. The entirety of the industrial heritage system in the urban context tells a comprehensive story of how and why the city developed into the present. Conversely, the significance of one industrial heritage site may be greatly enhanced by associated heritages and urban context *(*Department for Culture Media & Sport, 2013*)*.

F12. Regulation

The regulation context talks about how the local principles, guidelines and policies influence the conservation and redevelopment of urban industrial heritage quarters. The regeneration of urban quarters is expected to follow the regional requirements and adapt to the local context by referring to the regulations of land use, ownership, development strategy, construction guide and limitations. Especially for industrial heritage sites, there should be regional and national documents on details about treating heritage relics carefully and sustainably.

Not only is the regulation guiding the regeneration of industrial heritage quarters a recently valued concept, but the reintroduction of industrial heritage also catalyses new regulations and principles. When people begin to focus on this special urban space, there are fresh discussions on how to evaluate its significance, what to expect from conservation and revitalization, and whether existing regulations need adjustment for

its uniqueness. Apart from physical control, industrial heritage even engages with social regulations to maintain its intangible characteristics. The preservation of industrial heritage and the development of related regulations can be seen as a mutually reinforcing process.

F13. Social Life

The context of urban social life in the industrial heritage quarter is closely associated with the activeness and engagement with local communities. For some industrial heritage regeneration projects, the local community and society play an important role in promoting social cohesion and catalysing heritage revitalization by establishing heritage volunteer teams and organizing public participation activities during the design and planning process *(*Li and Heath, 2020*)*. Among local communities, one specific type that should be paid more attention to is the industrial community which is inherited from traditional industrial activities. To efficiently facilitate work and life, a kind of residential area was created that was composed of factory workers and their families. This industrial community has the closest relationship with the industrial heritage and possesses the most related people and collective memories. Although demography changes a lot during urban development, some hints of the past history still live with someone, something and someplace.

F14. Economic Efficiency

Economic efficiency is important for urban regeneration projects, which require healthy and sustainable capital flow to achieve a profitable project. For urban quarters with industrial heritage, regeneration should consider the market condition and prediction from the planning stage. Industrial heritage, whether or not still maintains productivity, is an important economic boost for the city. Looking from the urban vector, the revitalized site provides new opportunities for offices and businesses with an impressive profit of turnover and rental. When integrating the real estate market, a regenerated urban quarter can greatly uplift the land value with a liveable community and remarkable infrastructure. Moreover, as a heritage site, the tourism market is also a high economic contributor.

F15. Investment

Investment finance includes aspects such as access to venture capital, cost and return on investment. During the development, the prospect of the urban industrial heritage quarter is expected to ensure its competitive and convincing capital market with an

attractive strategy and promising prospect. However, the value of heritage cannot be measured exclusively through economic benefits. From a long-term perspective, no matter whether heritage can bring substantial benefits in a short period of time or not, it is always worth sparing effort on its proper protection. Therefore, the conservation and maintenance of industrial heritage also rely on local management with non-profit funding.

F16. Employment Status

Industry is a social factor that is always linked to the labour market. Throughout the evolution of a city's social environment, employment status is closely related to residents' living quality, happiness index and social stability. With the regeneration of such urban quarters, a wide variety of job opportunities relating to the industrial heritage emerge. Including construction activity through development, urban projects stimulate the employment of long-term and temporary workers. The industrial heritage also provides training and educational opportunities for the employment market. Generally speaking, new chances come with new actions.

5.2 Contextually Sensitive Regeneration Indicators

The measurability of urban sustainability is always a challenge as the tension between objective and subjective makes it difficult to quantify the social, cultural and historical urban dimensions *(*Lee and Lee, 2014*)*. The benefit of quantification attempts in urban study is that they improve the knowability and measurability of urban issues, therefore increasing the predictability of urban development. Based on this science-intensive view, contextualism has gone beyond pure rationalism, embracing social and human factors into the urban evaluation system. For this part of indicator identification and calculation, the way of excavating the data out of factor is based on the evaluation and assessment research from different perspectives or urban study and urban heritage study. Due to the complexity and ambiguity of urban factors, the quantification indicators do not have fixed guidelines and will vary according to the information required *(*Guo et al., 2021*).* Therefore, most of the indicators selected here are based on the specific characteristics that are most commonly and frequently valued for urban industrial heritage quarters during the regeneration process.

For this framework, the analysis scheme first establishes the relationship between indicators and value enhancement scores. Therefore, unlike subjective evaluation results for value enhancement, the context indicators should be selected and quantified totally based on objective facts. In the formulas of indicators, the data of an indicator before regeneration will be marked as 'pre', and the data after regeneration will be marked as 'post'.

F1. Landform indicators

The regeneration process often involves a certain number of earthworks, such as excavation, filling, forming slopes, etc., which can alter the original landform features based on the site analysis. Some may have been designed to utilize the elevational differences to create visually interesting places or to highlight their production history, while others may need to flatten or fill the site to facilitate building organization and construction *(*Fragner et al., 2015*)*. For an urban industrial heritage quarter, the landform variation usually displays the condition of earthwork construction, which generally relates to the area of change and the degree of change.

In1. Area proportion of elevation change

This indicator measures the proportion of the area that has experienced changes in elevation to the total area of the site (Chandler et al., 2007). Landform information on the industrial site is an important urban feature revealing the influence of the production process on land use *(*Fragner et al., 2015*)*. The maintenance of this feature may result in the conservation of an industrial vibe but may also cause inconvenience and disconnectivity for the site design. Quantifying the variation area proportion assists in the identification of significant alteration areas of the site. This indicator can be acquired through analysis and comparison of current and historical maps. A higher number of this indicator means a larger area has changed the landform. The lower number of this indicator means a smaller area of change. If the landform maintains the same, the data will be 0. (Figure 5. 13)

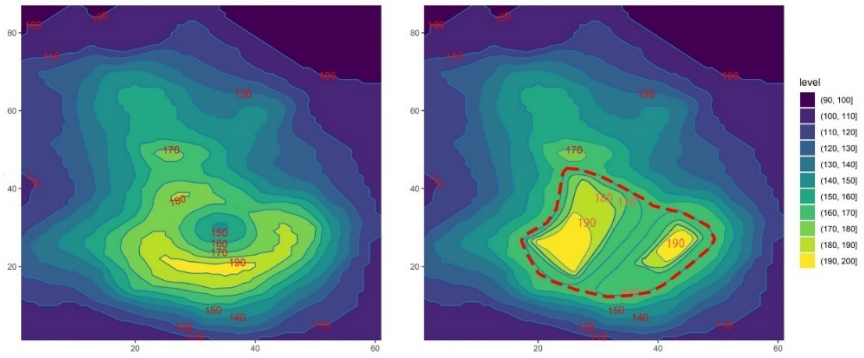


Figure 5. 13 Landform change (Diagram adapted by author from https://stackoverflow.com/questions/61779969/r-plotly-show-string-on-contour-plots Last access 17/11/2024)

$$\text{In } 1 = \frac{\text{Area of elevation change}}{\text{Total area of the site}}\%$$

In2. Average elevation change degree

This indicator refers to how intensely the site has been raised, sloped, trimmed or flattened for construction needs. It provides a detailed measurement of the degree of vertical transformation. The analysis of this indicator is based on the difference between the elevation before and after regeneration earthwork. According to the following diagram, this calculation method divides the site into grids of a certain scale, calculating the absolute elevation change before and after regeneration of each junction of the grid and averaging the total change by the variation area. This calculation method is the basic mathematical scheme behind the DEMs (Digital Elevation Models) in the urban big data analysis field. Currently, the scale of the grid depends on the size of the site and the required accuracy, with the most widely used range from 2 meters to 30 meters (Mesa-Mingorance and Ariza-López, 2020). For general urban regeneration projects, the suitable grid is 5 meters to 10 meters for moderate accuracy (Li, 2005). This study will adopt a 5-meter grid size for a detailed analysis. This indicator can be acquired through analysis and comparison of current and historical maps. A higher number of this indicator means a greater degree of the elevation change on the landform. A lower number of this indicator means a smaller degree of elevation change. If the landform maintains the same, this data will be 0. (Figure 5. 14)

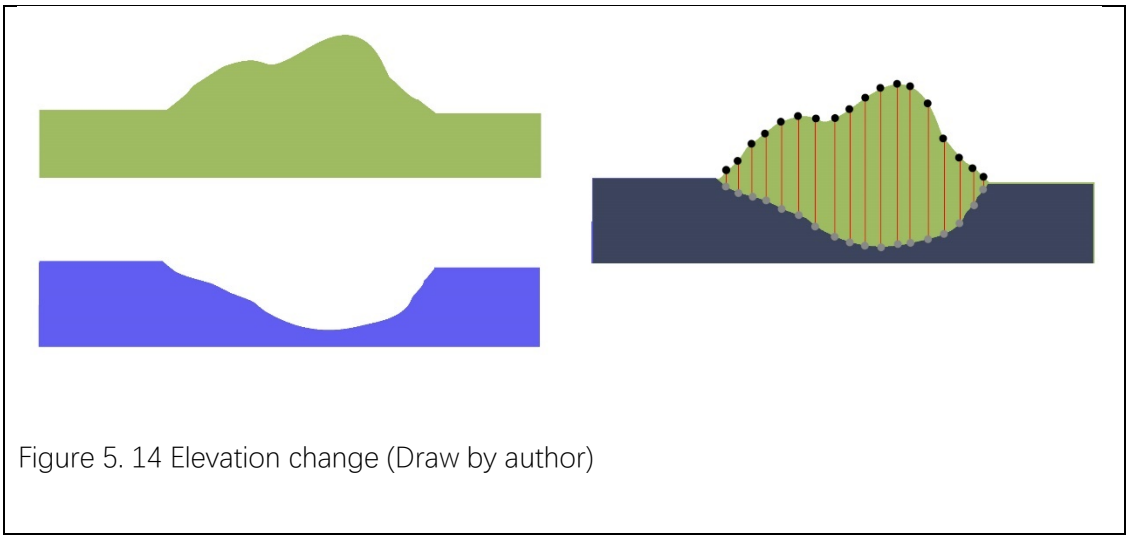


Figure 5. 14 Elevation change (Draw by author)

$$\text{In } 2 = \frac{\text{Total elevation change}}{\text{Area of elevation change}}$$

$$\text{Elevation change (Point n)} = \left|\text{Post Elevation (Point n)} - \text{Pre Elevation (Point n)}\right|$$

$$\text{Total elevation change} = \text{Elevation change(Point 1)} + \cdots + \text{Elevation Change (Point n)}$$

F2. Greenery and open spaces indicators

Regeneration for urban greenery (parks, green belts, landscape greening, etc.) and open spaces (square, plaza, street space, communal open space, etc.) mainly focus on the improvement of the quality and service capacity. The richness and diversity of greenery and open spaces influence the vitality and quality of urban public spaces. To avoid duplicated use of indicator information, indicators in this factor exclude the environmental and facility factors, which will be explained and integrated into the analysis of other related factors.

In3. Variation of green plot ratio

This indicator refers to the change in green space during the regeneration process. Based on a common biological parameter called the leaf area index (LAI), the study of green plot ratio is a simplified calculation method focusing on the greenery coverage ratio on all vertical and horizontal dimensions of the site inspired by the building plot ratio *(*Ouyang et al., 2020*,* Ong, 2003*)*. The increase in green space will contribute to environmental development but might reduce the area of land for more profitable functions. This indicator can be measured by the proportion of greenery to the total quarter area. This indicator can be acquired through analysis and comparison of current and historical maps. A higher number of this indicator means a larger degree of greenery area increased. A lower number of this indicator means a smaller degree of greenery area increased. Negative data means the greenery area has decreased after regeneration.

$$\text{In } 3 = \frac{\text{Post area of greenery} - \text{Pre area of greenery}}{\text{Total area of the site}}\%$$

In4. Variation in the diversity of greenery

This indicator refers to the change in various types of green spaces. For an urban environment, the area and type of greenery are limited by the compact urban texture. The increase in greenery diversity can improve the vitality and attractiveness of the city landscape. However, it may also face a risk of over-fragmented green spaces that reduce the continuity of natural and urban texture, causing a dissatisfied experience for visitors *(*Grahn and Stigsdotter, 2010*)*. Common greenery types in the urban context include parks and urban forests, green roofs and walls, gardens and urban farms, street trees and planter boxes, sidewalks and riparian green belts, etc. (Smardon, 1988, Chiesura, 2004).

This indicator can be represented by the number of greenery types. This indicator can be acquired through analysis and comparison of current and historical maps. A higher number of this indicator means a greater number of newly added greenery types.

A lower number of this indicator means a smaller number of newly added greenery types. Negative data means the types of greenery have decreased after regeneration.

$$\text{In } 4 = \text{Number (post types of greenery)} - \text{Number (pre types of greenery)}$$

In5. Variation in the rate of open spaces area

This indicator refers to the change of open spaces during the regeneration process. Referring to the precedents of urban design, regeneration of heritage space usually aims to stimulate social activities by offering inclusive and adaptive public spaces (Loures, 2008). Effective open space in the city can promote social activities, highlight the visual impact of heritage characteristics, and enhance the place identification of the site (Carmona et al., 2004). There are also possible disadvantages in designing open space, such as reducing development potential, overdrawing the budget, lacking continuous management and inappropriate utilization (Madanipour, 2010). This indicator can be measured by the proportion of open spaces to the total quarter area. This indicator can be acquired through analysis and comparison of current and historical maps. This indicator can be acquired through analysis and comparison of current and historical maps. A higher number of this indicator means a larger degree of open space area increased. A lower number of this indicator means a smaller degree of open space area increased. Negative data means the open space area has decreased after regeneration.

$$\text{In } 5 = \frac{\text{Post area of open space} - \text{Pre area of open space}}{\text{Total area of the site}}\%$$

In6. Variation in the diversity of open spaces

This indicator refers to the change in types of open spaces. The diversity of open spaces promotes the functional vitality of public spaces but will also reduce the development potential for profitable functions, such as commercial and residential properties. The design and arrangement of open spaces also influence the fabric of the urban quarter. Relevant types of open spaces include squares and plazas, sports courts and playgrounds, pedestrian zones, hardscaped platforms and waterfronts, etc. (Project for Public Spaces, 2000). This indicator is measured by the number of open space types. Increasing open space types can increase functional vitality and space flexibility, promoting social inclusion and interaction (Woolley et al., 2004). However, fragmented open spaces also raise the difficulty of management and accessibility, influencing visual connectivity within the urban environment (Mela, 2014). Users can perceive the diversity of open spaces through different spatial experiences they engage in on-site, which closely relates to various types of open spaces (Harun et al., 2013).

This indicator can be acquired through analysis and comparison of current and historical maps. A higher number of this indicator means a greater number of newly added open space types. A lower number of this indicator means a smaller number of

newly added open space types. Negative data means the types of open space have decreased after regeneration.

$$\text{In } 6 = \text{Number (post types of open space)} - \text{Number (pre types of open space)}$$

F3. Waterbody indicators

The regeneration of the waterbody in the industrial heritage quarter mainly focuses on improving the quality of the site's water system and promoting waterfront activities. To avoid duplicated use of indicator information, indicators in this factor exclude the environmental quality and facility factors, which will be explained and integrated into the analysis of other related factors.

In7. Variation in the rate of waterbody area

This indicator refers to the change in size and scale of the waterbody. The regeneration of heritage might work to reduce or increase the area of the whole waterbody for visual aesthetics or waterfront activities, depending on the regeneration plan. The area and variation of surface water are important data in studying urban environments and land patterns, as well as establishing urban scale models (Kafy, 2018, Syafii et al., 2016). In this indicator, the waterbody is measured only for closed-edge waterbody within the site boundaries. It is a quantitative indicator that can be measured by the proportion of the waterbody area to the total site area. This indicator can be acquired through analysis and comparison of current and historical maps. A higher number of these indicators means a greater degree of newly added waterbody area. A lower number of this indicator means a smaller degree of newly added waterbody area. Negative data means the area of the water body has decreased after regeneration.

$$\text{In } 7 = \frac{\text{Post area of waterbody} - \text{Pre area of waterbody}}{\text{Total area of the site}}\%$$

In8. Variation in the rate of water active frontage

This indicator refers to the change in the waterbody riparian having active interaction with people. Active frontage refers to a boundary or interface in the city that allows active engagement with the street users (Heffernan et al., 2014, Gehl, 2010). In some of the research that looks into waterfront architectures, the waterfront boundaries that a building or a public space has active interaction with waterbody is referred to as a part of water active frontage (Shangi et al., 2020). The length of water active frontage relates to the urban natural environment, the vitality of social activity, and the price of waterside real estate. This indicator can be measured by the change in the proportion of water active frontage length to the total site perimeter. This indicator can be acquired

through analysis and comparison of current and historical maps. A higher number of this indicator means a greater degree of newly developed water active frontage. A lower number of this indicator means a smaller degree of newly developed water active frontage. Negative data means the length of water active frontage has been reduced after regeneration.

$$\text{In } 8 = \frac{\text{Post length of water active frontage} - \text{Pre length of water active frontage}}{\text{Total site perimeter}}\%$$

F4. Climate and natural resource indicators

Regeneration strategies about climate conditions mainly focus on the responses to climate change. In the detailed actions, minimizing the influence of climate change can improve the quality of life. Meanwhile, the advantages of climate should also be valued as daylighting, solar and wind energy, natural ventilation, rainwater recycling, etc.

In9. Variation of facilities that reduce climate influence on living environment

This indicator refers to the specific measures on how regeneration has mitigated the impact of climate variation on people. For architecture and built environments, climate influences human behaviours, such as the use of buildings and public spaces, the frequency of outdoor activities and the preferred transportation methods *(*Katapally et al., 2016*)*. The design of buildings, facades and public spaces aims to create a comfortable and safe environment for daily life by adopting suitable ventilation systems, shading and canopies, corridors and pavilions, anti-slip pavements, etc. (Givoni, 1998). The quantitative data is the change of newly added facilities that mitigate climate influence on architectures and public spaces. This indicator can be acquired through analysis and comparison of current and historical maps. A higher number of this indicator means a greater number of newly added facilities. A lower number of this indicator means a smaller number of newly added facilities. Negative data means the number of facilities has decreased after regeneration.

$$\text{In } 9 = \text{Number (post climate mitigating facilities)} - \text{Number (pre climate mitigating facilities)}$$

In10. Variation of facilities that utilize climate resources

This indicator refers to the utilization of local climate factors. This indicator can be expressed by the number of facilities that utilize climate resources. These facilities mainly refer to renewable energy systems and water management installations. Renewable energy generation facilities include sunroofs, solar panels and small-scale wind turbines. Water management considers rainwater harvesting systems, including permeable facades and pavements, rainwater collection cisterns, etc. (Givoni, 1998, Gill

et al., 2007). This indicator can be acquired through document records during the regeneration process and analysis and comparison of current and historical maps. A higher number of this indicator means a greater number of newly added facilities. The lower number of this indicator means a smaller number of newly added facilities. Negative data means the number of facilities has decreased after regeneration.

$$\text{In } 10 = \text{Number (post climate resource facilities)} - \text{Number (pre climate resource facilities)}$$

F5. Pollution indicators

In terms of dealing with pollution at the industrial heritage site, the regeneration process mainly works on remediating the original pollution left from previous production activities while maintaining continuous and active control to minimize further possible pollution. Commonly referred pollution monitoring data includes air quality, water quality, soil quality and noise degree. In this study, functioning sites need to consider pollution discharge relating to air and water quality, as well as noise level during production. Abandoned sites need to consider the toxicity of the soil and water system before regeneration (Kryder-Reid and May, 2024). The pollution management of regeneration construction is also an important aspect of this indicator, considering the waste management effort during construction and utilization (Mussinelli et al., 2020).

In11. Improvement of the environmental quality

This indicator refers to the performance of pollution treatment. It can be expressed as the decrease in the rate of different aspects of pollution amelioration. Sub-indicators include the Comprehensive Pollution Index (CPI) of air quality, water quality and soil pollution, as well as the Noise Figure (NF). This indicator will list all sub-indicators that have valid data. The data for this indicator can be accessed from open-source documentation of a project, including records during investigation and construction, government reports and agent reports. A higher number of these indicators means a greater degree of reducing pollution. The lower number of these indicators means a smaller degree of reducing pollution. Negative data means the pollution has been more serious after regeneration.

$$\begin{aligned}\text{In } 11 &= \text{Average pollution reduction rate } \% \\ &= \text{Average reduction rate (air)}\% \\ &= \text{Average reduction rate (water)}\% \\ &= \text{Average reduction rate (soil)}\% \\ &= \text{Average reduction rate (noise)}\%\end{aligned}$$

In12. Recycling rate of construction and demolition waste (CDW)

This indicator refers to the pollution control during the regeneration process, which can be expressed by the percentage of recycled and degradable construction and demolition waste (CDW). The definition and contents of CDW vary between different governments and agencies. The recycling rate of CDW largely depends on local standards and waste disposal technology (Tao Ding 2014, D. Caro 2024). The data for this indicator can be accessed from open-source documentation of a project, including records during construction, government reports and agent reports. A higher number of this indicator means a greater percentage of construction waste has been recycled to reduce further pollution. The lower number of this indicator means a smaller percentage of recycling. The data is 0 if nothing is recycled.

$$\text{In } 12 = \text{Recycle rate of CDW } \%$$

In13. Waste management input

This indicator refers to the sustainable input in controlling the subsequent pollution during the process of construction and utilization. This indicator can be expressed by the continuous waste management efforts for pollution control during utilization, such as improving waste disposal efficiency and establishing maintenance teams. This indicator can be sensed through the distribution density of waste collection facilities (Domenech and Borrion, 2022). The data of this indicator can be accessed through records and documentation of the site's sanitary arrangements, as well as through map analysis and on-site investigation. A higher number of this indicator means a greater number of waste collection facilities per unit area. A lower number of this indicator means a smaller number of waste collection facilities per unit area. The data of the site with no facilities is 0.

$$\text{In } 13 = \frac{\text{Number of waste collection facilities}}{\text{Total area of the site}}$$

F6. Biology indicators

For an urban environment, bio-diversity and bio-habitat are not as rich as the natural environment. However, the regeneration should try to value more if the original site has such characteristics instead of ignoring them. Biodiversity can be both positive and negative for the urban environment. Regeneration mainly aims to address the positive prospect of improving the quality and vitality of the environment. It can also be negative if the system is not managed properly, causing health and safety issues (Marselle et al., 2021, Leedy and Adams, 1984). Urban regeneration usually aims to create harmony between biological conditions and a liveable urban environment, preserving and maintaining the existing habitat for natural living (Tarsitano et al., 2021). For most of

industrial quarters, the biological situation is not optimistic due to industrial activities and even pollution. Current bio-diversity in urban contexts requires the cooperation of broader-scale urban environment management and small-scale site strategies.

In14. Variation in the rate of biological diversity

This indicator refers to the improvement of species' existence, including both animals and plants. It is a quantitative indicator which can be expressed by the increased rate of species compared with the original site. The data for this indicator can be accessed from open-source documentation of a project, including records during construction, government reports or agent reports. A higher number of this indicator means a greater degree of bio-diversity increase. A lower number of this indicator means a smaller degree of bio-diversity increase. Negative data means the bio-diversity has decreased after regeneration.

$$\text{In } 14 = \text{Increase rate of biodiversity } \%$$

F7. Fabric indicators

For industrial heritage quarters, the spatial characteristics are unique compared with other types of urban environments. Regeneration strategies that focus on the transformation of fabric mainly aim to either enhance the textural identification of industrial heritage quarters or encourage organic integration with the surrounding urban context. The fabric features are normally pictorial information that can be explained according to different research focus. In this study, changes in fabric during regeneration influence the access to the site, the arrangement of the buildings, and the utilization of space. The fabric regeneration can be expressed by three representative indicators, which are boundary, density, and distribution.

In15. Variation of the industrial heritage quarter boundary openness

This indicator refers to the interconnection between the industrial heritage quarter and the surrounding urban environment. Openness in urban fabric study refers to an urban area within a defined boundary is permeable and accessible, both visually and physically (Salingaros and Pagliardini, 2016, Shach-Pinsly et al., 2011, Fang, 2018). A higher level of openness promotes accessible convenience and visual communication with the local context, which is normally more open and inclusive. A lower level means a clearer delineation of the industrial heritage quarter, which is comparatively exclusive but might appear more culturally cohesive. The openness can be regarded as physical openness and visual openness, considering both spatial accessibility and visual permeability (Shach-Pinsly et al., 2011, Fang, 2011). The quantitative data can be expressed by the change in the openness rate of the boundary. For a simplified

calculation, the openness of both physically and visually permeable boundaries is counted as its full length as full openness, and the openness of only visually permeable boundaries is counted as half of its full length as semi-openness (Tara, 2015).

This indicator can be accessed through map analysis and on-site investigation. A higher number of this indicator means a greater degree of increase openness. A lower number of this indicator means a smaller degree of increase openness. Negative data means the length of openness has been reduced after regeneration.

$$\text{In } 15 = \frac{\text{Post length of openness} - \text{Pre length of openness}}{\text{Total perimeter of the site}}\%$$

$$\text{Length of openness} = \text{Length of full openness} + \text{Length of half openness}$$

In16. Variation of building density difference between the site and surrounding context

This indicator considers the building density of the industrial heritage quarter. The difference in density between the site and embedded urban context provides different spatial identification. The level of density difference influences the relationship between the site and the surrounding environment, which determines whether the fabric is more continuous and integrated or more outstanding and identifiable (Peiser, 2015, Godoy-Shimizu et al., 2021, De Bellefon et al., 2021).

The density of the surrounding context in this indicator refers to the average density of the adjacent urban quarters located right outside the selected quarter boundary. The variation of the density differences reveals the change of spatial integration after regeneration.

The quantitative data can be expressed by the variation rate of density data. This indicator can be calculated through a figure-ground diagram based on map analysis and on-site investigation. A higher number of this indicator means a greater degree of increasing density difference. A lower number of this indicator means a smaller degree of increasing density difference. Negative data means the density is getting closer between the site and surrounding quarters after regeneration. (Figure 5. 15)

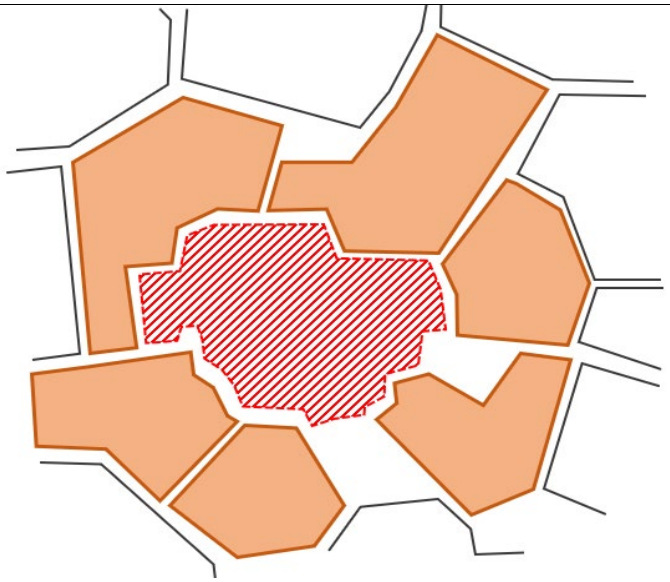


Figure 5. 15 Schematic diagram – Selection of surrounding urban quarters (Drawn by author)

$$\text{In } 16 = \text{Post density difference} - \text{Pre density difference}$$

$$\text{Density} = \frac{\text{Total architectural gross floor area}}{\text{Total area of the site}}\%$$

$$\text{Density difference} = \text{Density of the site} - \text{Density of surrounding area}$$

In17. Variation of the textural difference between the site and surrounding context

This indicator refers to the morphological feature of the industrial heritage quarter. When an urban quarter has a different spatial texture from its context, it is usually more distinguishable with a unique characteristic. The quantitative vector can be expressed by the spatial fractal dimension data (Yang et al., 2017, Ye et al., 2016). The fractal dimension data in the spatial study represents the compactness of architectures based on the boundary. The closer result of the fractal dimension can express the higher similarity of the site and peripheral context, which usually means a higher textural fusion. Therefore, the variation of the textural difference shows how the regeneration has contributed to the spatial integration of the quarter.

This indicator can be calculated through a figure-ground diagram based on map analysis and on-site investigation. A higher number of this indicator means a greater degree of increasing textual difference. A lower number of this indicator means a smaller degree of increasing textual difference. Negative data means the texture is getting closer between the site and surrounding quarters after regeneration. (Figure 5. 16)

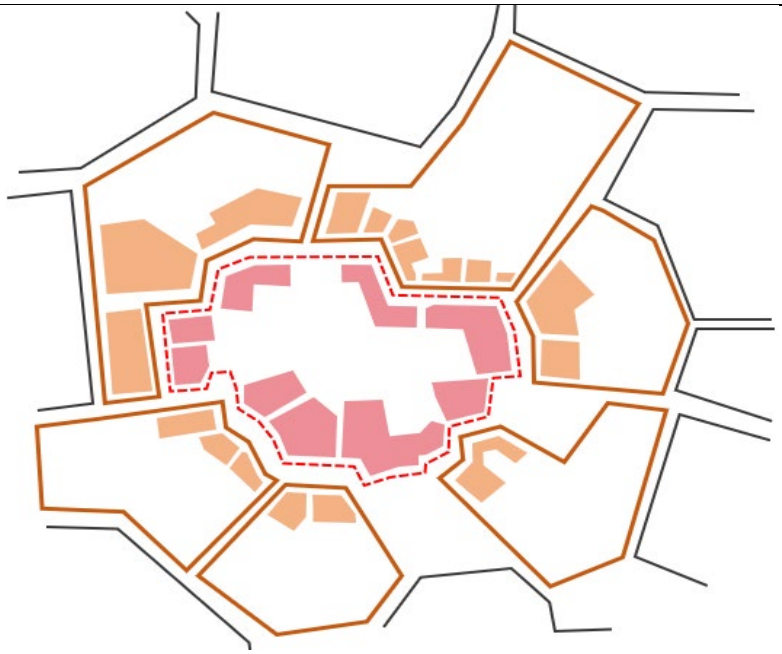


Figure 5. 16 Schematic diagram – textural calculation of surrounding urban quarters (Drawn by author)

$$\text{In } 17 = \text{Post f difference} - \text{Pre f difference}$$

$$\text{f} = \text{fractal dimension} = \frac{2\ln(\text{Total perimeter of the site})}{\ln(\text{Total ground floor area of adjoining architectures})}\%$$

$$\text{f difference} = \text{f of the site} - \text{f of surrounding area}$$

F8. Function indicators

The functional factor of urban regeneration focuses not only on the site itself but also on the impact on a broader urban environment. For the urban industrial heritage quarter, the increased functional richness might improve vitality and convenience of living, but it might also weaken industrial identification to some degree. For surrounding urban quarters, the regeneration of the industrial heritage quarter usually acts as a catalyst to stimulate regional development, which usually influences the development strategy of residential and commercial real estate.

In18. Variation in functional diversity of the urban industrial heritage quarter

This indicator refers to the change in the number and types of new functions within the site, which influence the convenience of daily life and the vitality of the urban environment *(*Amado and Rodrigues, 2019*)*. Diversity indicators can be quantified by the Simpson Diversity Index (SDI), which is a commonly used diversity data. SDI measurement takes into account the number of types present, as well as the relative abundance of each type (Comer and Greene, 2015). The data of this indicator can be accessed through map and document analysis of the site's development process. Higher number of D means higher level of diversity. A higher number of this indicator means a greater degree of increasing functional diversity. A lower number of this indicator means a smaller degree of increasing functional diversity. Negative data means the functional diversity has decreased after regeneration.

$$D = 1 - \sum_{i=1}^{S} p_i^2$$

p_i is the proportion of the site occupied by function i

$$\mathrm{In18} = \mathrm{Post\ D} - \mathrm{Pre\ D}$$

In19. Variation of the functional distribution of the urban industrial heritage quarter

This indicator refers to the evenness of the functions of the regenerated site. The distributed evenness relates to the convenience of functional accessibility and the balanced development throughout the site. The quantitative data is measured as the spatial dispersion. The dispersion is calculated through the adapted variance formula. 'Variance is the expectation of the squared deviation of a random variable from its population mean or sample mean, meaning it is a measure of how far a set of numbers is spread out from their average value' *(*Iversen, 1987*)*. When the formula is applied to the spatial relationship, the deviation refers to the locational distance that each target location has from the average center location. Therefore, the variance outcome shows how far a set of locations is spread out in the site. To simplify the calculation, each function is marked as a point of its architectural plan geometric center.

This indicator can be calculated through a figure-ground diagram based on map and document analysis and on-site investigation. A higher number of spatial dispersion means a more sparse distribution. A higher number of this indicator means a greater degree of increasing spatial distribution. A lower number of this indicator means a smaller degree of increasing spatial distribution. Negative data means the spatial distribution is more concentrated after regeneration. (Figure 5. 17,Figure 5. 18)

$$\mathrm{In19} = \frac{\mathrm{S}^2(\mathrm{Post}) - \mathrm{S}^2(\mathrm{Pre})}{\mathrm{Distance(Average\ center - Geometric\ center)}}$$

$$\mathrm{S}^2 = spatial\ dispersion = \frac{\sum Distance(function\ point\ n - average\ centre)^2}{Number\ of\ function\ points - 1}$$

$$Average\ centre = (Average\ of\ horizontal\ coordinates, Average\ of\ vertical\ coordinates)$$

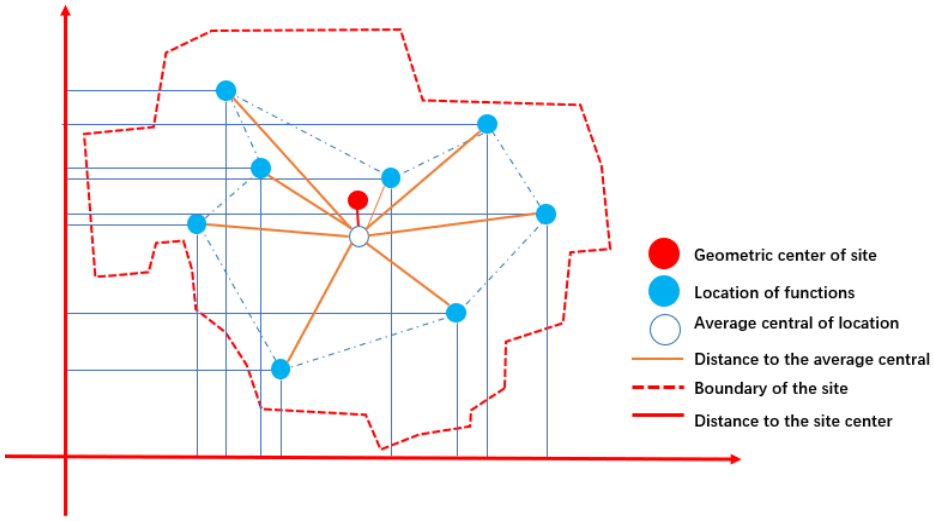


Figure 5. 17 Schematic diagram of distribution calculation (Draw by author)

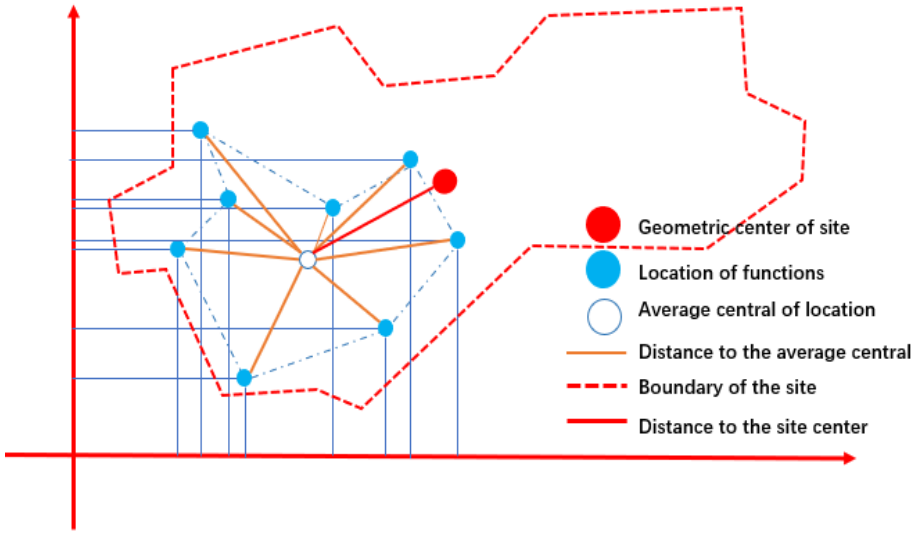


Figure 5. 18 Schematic diagram of distribution calculation (Draw by author)

F9. Location indicators

For most urban studies, location is always regarded as a fixed factor. However, the relative location, focusing on the relationship between the site and other urban areas, is dynamic with the development of the city. In terms of an urban environment, a better relative location normally contributes to a better connection between the site and other functional groups. Locational information is not simply about the spatial relationship, it might reveal how the site is involved in a broader development plan. It also has a great influence on the easiness and convenience of resource accessibility from the site. Therefore, the potential of an industrial heritage quarter closely interacts with the rise and fall of surrounding urban clusters.

To split this factor into detail, the relative location of a heritage quarter influences the accessibility, social integration, environmental quality, cultural significance, and economic prosperity of the site (Historic-England, 2017b). The absolute location of industrial heritage quarters within a city is a fixed attribute, while changes in their relative location to other urban elements are a comprehensive result of overall urban development (Frantál et al., 2013). Current research on location and urban regeneration primarily focuses on assessing the redevelopment potential and subsequent influence of a quarter through the analysis of locational factors (Eom and An, 2018, Kreislova et al., 2013, Adair et al., 2000). This study, however, focuses on the impact of regeneration activities on the context of industrial heritage quarters. The relationship between the development of other urban areas and the regeneration of specific heritage quarters remains unclear. Nevertheless, the influence of broader regional development is reflected in corresponding environmental, infrastructural, and economic indicators. Therefore, the locational factor is a comprehensive consequence shown in the heritage quarter from different perspectives, which can be integrated into other factors.

F10. Infrastructure indicators

From the previous study, the infrastructure factor mainly focuses on the urban circulatory network as well as the social amenities to support a more efficient, safe and convenient life. Looking into the speciality of urban transportation systems compared with other circulatory networks (such as water, energy, and electricity), this factor puts the transportation system as a separate study to highlight its importance in urban mobility and accessibility *(*Ferrer et al., 2018*)*. Considering the difficulty of data acquisition, the regeneration performance of urban infrastructure systems is simplified as three major indicators.

In20. Financial input rate of the urban circulatory system

This indicator refers to the rate of effort that regeneration has input on the improvement of the circulatory network including water, energy and electricity, transportation, etc. It is a quantitative indicator that can be expressed by the proportion of the budget. In most quantitative analyses of urban studies, financial indicators are analysed in conjunction with project scale. In real estate and urban infrastructure management, researchers often perform comparative analyses of fixed assets (property, plant, equipment) using output or input per unit area (Grafe and Mieg, 2019, Bunich, 1962, Griffin, 1979). Accordingly, this study will also calculate similar indicators based on data per unit area. Information of this indicator can be accessed from records of the projects. A higher number of this indicator means a greater input spending on circulatory system construction per unit area. A lower number of this indicator means a smaller input spending on circulatory construction per unit area.

$$\mathrm{In20} = \frac{\text{Budget spent on the circulatory system}}{\text{Total area of the site}}$$

In21. Variation in the public transport connectivity

This indicator highlights the improvement of transportation service that benefits from regeneration. Public transport coverage is a complex research field that takes multiple transportation data such as accessible stations, urban density, service scale of different sizes of stations, travel time, etc., into consideration *(*Higgins and Kanaroglou, 2018*)*. For urban development, the government plans the scheme of transportation from a macro perspective. However, even though a specific urban quarter has a limited capacity to influence the general transportation scheme, there are still cases that the success of a newly designed site promotes the increase of transportation around it, such as Shougang in Beijing, Puxi expo district in Shanghai, etc. This quantitative indicator can be expressed by the increased number of public transportation stations in and around the site boundaries. The modes of public transportation included are bus, underground, tram and train (counted as stops and stations), boat and ferry (counted as piers and docks), and shared bike and scooter (counted as parking points). A higher number of this indicator means a greater number of public transportation access to the site. A lower number of this indicator means a smaller number of public transportation access to the site.

$$\mathrm{In21} = \text{Number of increased public transportation}$$

In22. The number of essential life service amenities within the site

This indicator refers to the convenience of accessing life service amenities on the site. Different types of amenities include medical amenities, safety and security amenities, leisure and relaxational facilities, accessible facilities, transportation hubs, etc. (Smith, 1978). Information of this indicator can be calculated through map and

document analysis and on-site investigation. The pre-regeneration data is usually 0 if the original industry was closed and moved out, leaving a functional empty site before regeneration. A higher number of this indicator means a greater number of amenities available in the site. A lower number of this indicator means a smaller number of amenities available on the site.

$$\mathrm{In22} = \text{Number of increased essential life service amenities}$$

F11. Heritage and tradition indicators

For urban regeneration projects, heritage is the most sensitive character, which gives the site its own identification and stimulates the spiritual revitalization of a place. Therefore, the appropriate preservation and reuse of existing heritage is the most effective catalyst for local development. Strategies for treating heritage relics normally focus on the tangible and intangible perspectives, calling for both physical preservation and social sustaining. Besides, a comprehensive scope considering the whole heritage system also contributes to better authenticity and integrity.

In23-26. Conservation of tangible industrial heritage

These indicators refer to the protection and revitalization of physical industrial heritage during the regeneration process. For a more economically beneficial regeneration outcome, most heritage relics might undergo the strategy of adaptive reuse, which might result in a certain degree of identification loss. During regeneration, it is important to focus on conservation strategies to save representative industrial heritage spaces and items and maintain the industrial atmosphere. Therefore, the completeness of physical conservation promotes the integrity of the industrial heritage. According to the study of industrial heritage, tangible heritage here includes landscapes, architecture, structures, machinery and small items *(*Clark, 2013*)*. The quantitative data can be expressed by the conservation rate of industrial heritage architectures and structures, measured by the proportion of architectures and structures that have been well maintained and preserved. The proportion is calculated by the preservation status of each heritage, depending on how much of the original plan, façade, material, structure and items are left *(*Li et al., 2016*)*.

These indicators can be accessed from the plan and map analysis, as well as the development and management record of the project. A higher number of these indicators means a greater percentage of heritage preserved. A lower number of these indicators means a smaller percentage of heritage preserved.

In23. Heritage landscape.

$$\text{In23} = \frac{\text{Conserved area of heritage landscape}}{\text{Total heritage landscape}}\%$$

In24. Heritage architecture

$$\text{In24} = \frac{\text{Conserved floor area of heritage architecture}}{\text{Total floor area of the heritage architecture}}\%$$

In25. Heritage structure

$$\text{In25} = \frac{\text{Conserved amount of physical structure}}{\text{Total amount of physical structure}}\%$$

In26. Heritage machinery

$$\text{In26} = \text{Number of conserved machines and items}$$

In27-30. Conservation of intangible industrial heritage

These indicators refer to the historical and cultural aspects that were inherited and revitalized through the regeneration. Industrial heritage has a profound social influence on its intangible characteristics, including the technology and skills, the historical story, continuing traditions, related people and collective memories. The conservation and revitalization of intangible heritage usually considers the following aspects: cultural and traditional practices, educational and training programs, documentation and recording, and community participation (United Nations Educational Scientific Cultural Organization, 2003). Major considerations of the above-mentioned aspects include the events of relevant culture and tradition, the interaction with local heritage context, the educational programs of the history and skills, and the documentation and interpretation of the intangible heritage contents. Although the comprehensive study of intangible factors requires sufficient qualitative study, quantitative indicators can still provide a direct presentation of the progress condition in which conservation strategies work. In this factor, representative indicators are selected relating to the effort input or the improvement in the performance of the pre-mentioned aspects.

In27. Cultural and traditional events frequency

Events can be regarded as an effective way to link a place with people and reactivate the life of a place. According to current studies of events' impact on urban regeneration, the frequency of targeted events indicates the regeneration efforts in revitalizing social life and forming place identification (Smith, 2012, Willekens and Lievens, 2016). When counting the frequency, the unit interval varies accordingly based

on the research requirements, and most cultural events studies use one year as the calculation unit (Smith, 2012, Johansson et al., 2001). This indicator refers to the number of events related to industrial activity, such as festivals and celebrations of industrial achievements, memorial events of industrial history, gatherings of traditions inherited from industrial communities, etc. This indicator is the average frequency of events held each year after regeneration until the date of the study, which can be accessed from the development and management record of this heritage site. The pre-regeneration data is usually 0 if the original industry was closed and moved out with no activities inside. A higher number of this indicator means a greater frequency of events held per year. A lower number of this indicator means a smaller frequency of events held per year.

$$\text{In27} = \frac{\text{Total events held until research date}}{\text{Total years after regeneration until research date}}$$

In28. Educational and training programme events frequency

This indicator refers to the frequency of educational and training programmes held each year relating to the history, technology and skill of the industry. Representative programmes include lectures, short-term classes, study studios, skill workshops, etc. Similar to In27, this indicator is also the average frequency of events each year after regeneration until the research date, which can be accessed from the development and management record of this heritage site. A higher number of this indicator means a greater frequency of events held per year. A lower number of this indicator means a smaller frequency of events held per year.

$$\text{In28} = \frac{\text{Total events held until research date}}{\text{Total years after regeneration until research date}}$$

In29. Museum of industrial heritage

An industrial museum is an effective way of presenting and interpreting industrial heritage and culture through comprehensive historical narratives, important production remains display, interaction with historic buildings and providing a place for relevant skill training (Kift, 2011). Many industrial museums are also responsible for researching heritage, updating the record and documentation of heritage, maintaining and managing heritage sites, and planning exhibitions and events (Swensen, 2023). This indicator refers to whether the site possesses industrial museums to showcase its own industrial history. The number of industrial museums is recorded as this data.

In 29 = Number of industrial museums

In30. Enhancing the interconnection with the local heritage system

This indicator refers to the enhancement of inter-heritage bonding between the site and other related heritage sites. The story and significance of industrial heritage should be understood within a broader-scaled historical backdrop, contributing to the communal improvement of the regional heritage context *(*Barile and Saviano, 2015*)*. A heritage trail is a designed walking route that connects a series of heritage sites as a system, which is regarded as an effective way of highlighting the relationship between heritage sites and stimulating the development of heritage tourism (Boyd, 2017, Xie, 2015b). Nowadays, the scope of industrial heritage trails is not limited to walking routes, which extend to the range of the whole urban context, even across different cities and countries. This indicator refers to whether the heritage is designed as a part of a heritage trail after regeneration or has an active connection (introduction, signage, pathway, shuttle bus, etc.) with other heritage sites. As a quantitative indicator, if the heritage interconnects with other heritage sites, it will be marked as 1; if not, it will be marked as 0. This data can be accessed from the introduction on the official websites of the project and the city's heritage trail.

In 30 = 1 (with interconnection) / 0 (without interconnection)

F12. Regulation indicators

Regulation and regeneration performance is a mutually reinforcing relationship. Practical regeneration strategies are limited, regulated and supported by local guides, construction regulations, development prospects, heritage conservation principles, etc. On the contrary, the progressing theory of urban design and heritage management with the dynamic urban development also catalyses the modification and proposal of the regulations.

In31. Regulation contents that relate to the conservation and regeneration of industrial heritage sites.

This indicator can be expressed by listing the relevant regulations that impact the practical action towards industrial heritage sites. The quantitative data can be calculated by the number of such regulatory content. This data can be accessed from government websites, official documents and news reports during the development and management process. A higher number of these indicators refers to more related regulations proposed based on the sample.

In31 = Number of relevant regulatory contents

F13. Social life indicators

The social life factor mainly highlights public engagement and social activities, which influence local satisfaction and a sense of belonging. For an urban development project, successful and sustainable regeneration relies not only on physical and spatial improvement but also on the enhancement of the industrial heritage community with better public participation and social interaction. According to context-sensitive design, the regeneration should address the needs of local communities during the regeneration through public participation communications, where the local community has the opportunity to propose their attitude and requirements. Other social aspects influencing regeneration performance relate to environmental and functional factors, which are intertwined and considered in other factors.

In32. Public participation during the regeneration process

This indicator refers to social engagement during the regeneration process. The aim of public participation is to reflect the needs of local communities, promote the transparency of decision-making, and increase the sense of belonging. Some helpful events for encouraging public participation are community meetings and workshops that involve the local community in the design stage, surveys and questionnaires for gathering general attitudes and ideas about the project, and online interactive platforms for displaying the progress and collecting feedback on the project (Sanoff, 2000). This quantitative indicator can be presented by the total number of people who participated in the above-mentioned events during regeneration. Data of this indicator can be accessed from the document record of the project development and management. A higher number of these indicators means more people are involved in the project process

$$In32 = \text{Total number of participants}$$

F14. Economic efficiency indicators

The economic factor is the financial propulsion that backs up long-term urban development. The regeneration of the industrial heritage quarter mainly expects a satisfactory performance on the efficient utilization of the project budget and the improvement of land value. Besides, heritage is a great stimulation for boosting tourism prosperity, which benefits the local economy in many related industries.

In33. Variation in the real estate market

This indicator refers to the variation of land value influenced by regeneration focusing on the commercial and residential properties. The impacts of regeneration on real estate are normally shown in the variation of residential and commercial property prices *(*Kutut, 2017*)*. It is a quantitative indicator expressed by the average variation rate of the real estate market before and after the regeneration of the site and its surrounding quarters. Data of this indicator can be accessed from the statistical record of property prices on real estate websites. A higher number of this indicator means a greater degree of increase in land value. A Lower number of this indicator means a smaller degree of increase in land value. A negative number means the regeneration decreased land value.

$$\mathrm{In33} = \frac{\text{Post average property price} - \text{Pre average property price}}{\text{Pre average property price}}\%$$

In34. Average tourism revenues of the heritage quarter

This indicator refers to the boost of the tourism market that is catalysed by regeneration. It is a quantitative indicator expressed by the increase in tourism revenue per year per urban unit area (km^2), presenting as the profit efficiency of the tourism industry *(*Prifti and Zenelaj, 2013*)*. Data of this indicator can be accessed from the statistical record of property prices on real estate websites. A higher number of this indicator means greater profit of the site per unit area. A lower number of this indicator means smaller profit of the site per unit area.

$$\mathrm{In34} = \frac{\text{Tourism revenues per year}}{\text{Total area of the site}}$$

F15. Investment indicators

The investment factor of urban regeneration focuses on the benefits of previous investments and the potential for attracting further investment. Better performance of the urban projects is expected to build confidence for investors and stakeholders and encourage continuous investment and funding.

In35. Budget for the regeneration process

This indicator refers to the investment attractiveness of the project. By rational financial resource distribution and appropriate reuse, the regeneration process is expected to minimize the overrun of budget expenditure and achieve a highly efficient economic performance, which is attractive to investors and stakeholders. As the budget

greatly depends on the scale of the project, the amount of the total budget does not have comparative value and should be replaced by the average budget per urban unit area (/km^2) (WCMC Biodiversity Series, 1999). It is quantitative data expressed by the budget saving rate, which can be assessed from the records of project stakeholders, such as the developers and investors. A higher number of this indicator means greater input in the project per unit area. A lower number of this indicator means smaller input in the project per unit area.

$$\text{In35} = \frac{\text{Total budget of the project}}{\text{Total area of the site}}$$

F16. Employment indicators

The employment factor can be seen as a sub-benefit related to economic improvement, which will benefit social well-being and community satisfaction (Jones and Watkins, 1996). The increase in employment firstly relies on the regeneration process, throughout planning, construction, management and maintenance stages (Ifko, 2016). It also enjoys great stimulation when the site can provide a high-quality working environment for new offices and companies. The quantification of employment data is closely related to the scale and size of the project, indicating the workload of the regeneration project and the economic expectation of further utilization (Hochman and Hochman, 1980). According to the previous study, this thesis will use the unit area to present the degree of employment increase (Gibbons et al., 2021).

In36. Jobs provided during regeneration process

This indicator refers to the number of jobs provided due to the launch, planning and construction of the regeneration process. Relevant jobs cover a wide range of designers, engineers, consultants, workers, community staff, etc. It is a quantitative indicator expressed by the number of jobs involved throughout the lifecycle of the project. Data of this indicator can be accessed from the record of the project during planning, design, construction and management progress. A higher number of this indicator means more jobs involved per unit area during regeneration. A lower number of this indicator means smaller job potential per unit area during regeneration.

$$\text{In36} = \frac{\text{Number of jobs provided during regeneration progress}}{\text{Total area of the site}}$$

In37. Job opportunities provided by the site utilization after regeneration

This indicator refers to the job potential provided by the newly regenerated working area. It is a quantitative indicator expressed by the number and scale of newly occupied companies, retailers and organizations that offer working opportunities after the

redevelopment of commercial property. This indicator can be accessed from local statistics, heritage quarter websites and the occupation status records of properties. A higher number of this indicator means greater job potential per unit area after regeneration. A lower number of this indicator means smaller job potential per unit area after regeneration.

$$\mathrm{In37} = \frac{\text{Number of job opportunities provided after regeneration}}{\text{Total area of the site}}$$

The full set of indicators is listed in Table 5.2. The factors of urban context assist the identification of the indicators, and the subsequent study will focus on the relationship between indicator data and value variation data. In this stage, the units of the indicators vary according to their specific data forms. The units will not influence the relationship between one value and one indicator when studied independently. If comparing the relationship between different indicators for a value, the data will be normalized into the range of 0 – 100% so that the impact trends of indicators can be visualized and compared within the same scale.

No.	Factor	No.	Indicator	Unit
F1	Landform	In1	Area proportion of elevation change	m^2/m^2 %
		In2	Average elevation change degree	m/m^2
F2	Greenery / open spaces	In3	Variation of green plot ratio	m^2/m^2 %
		In4	Variation in the diversity of greenery	N
		In5	Variation in the rate of open spaces area	m^2/m^2 %
		In6	Variation in the diversity of open spaces	N
F3	Waterbody	In7	Variation in the rate of waterbody area	m^2/m^2 %
		In8	Variation in the rate of water active frontage	m/m %
F4	Climate	In9	Variation of facilities that reduces climate influence on living environment	N
		In10	Variation of facilities that utilize climate resources	N
F5	Pollution	In11	Improvement of the environmental quality	%
		In12	Recycling rate of construction and demolition waste (CDW)	%
		In13	Waste management input	N/ m^2
F6	Biology	In14	Variation in the rate of biological diversity	%
F7	Fabric	In15	Variation of the industrial heritage quarter boundary openness	m/m %
		In16	Variation of the density difference between the site and surrounding context	m^2/m^2 %
		In17	Variation of the textural difference between the site and surrounding context	f/f %
F8	Function	In18	Variation in functional diversity of the industrial heritage urban quarter	%
		In19	Variation of the functional distribution of the industrial heritage urban quarter	S^2/m
F9	Location			
F10	Infrastructure	In20	Financial input rate of the urban circulatory system	¥/m^2
		In21	Variation in the public transport connectivity	N
		In22	The number essential life service amenities within the site	N
F11	Heritage and tradition	In23	Heritage landscape	%
		In24	Heritage architecture	%
		In25	Heritage structure	%
		In26	Heritage machinery	N
		In27	Cultural and traditional events frequency	N/Year
		In28	Educational and training programme events frequency	N/Year
		In29	Museum of industrial heritage	N

		In30	Enhancing the interconnection with the local heritage system	0/1
F12	Regulation	In31	Regulation contents that relate to the conservation and regeneration of industrial heritage sites	N
F13	Social life	In32	Public participation during regeneration process	N
F14	Economic efficiency	In33	Variation in the real estate market	¥/¥ %
		In34	Average tourism revenues of the heritage quarter	¥/m^2
F15	Investment	In35	Budget for the regeneration process	¥/m^2
F16	Employment	In36	Jobs provided during regeneration process	N/m^2
		In37	Job opportunities provided by the site utilization after regeneration	N/m^2

Table 5. 2 Indicators of urban industrial heritage quarter with units. N refers to number. ¥ refers to money input, which is RMB for Chinese samples. m refers to meter. m^2 refers to square meter. f refers to fractal dimension. S refers to spatial dispersion. (By author)

5.4 Conclusion

Building on the foundation of context significance and contextual sensitivity theory, this chapter thoroughly explored the contextual features of an urban industrial heritage quarter, subdivided context factors into impact indicators, and quantified the indicator with feasible instructions.

The CSA, which includes indicator identification, data collection, and data analysis, contributes to the exploration of the impact relationship between context and performance of a regeneration project, offering a clear display of how changes in context indicators during regeneration influence the value variation of industrial heritage sites.

By focusing on the unique characteristics of these sites, this chapter lays the groundwork for future research and practical applications.

Chapter 6. Case Study - Shanghai

This study selects Shanghai as the target city for a case study, focusing on the contextual sensitivity of industrial heritage quarters (as sample quarters) that have already been regenerated within the city. The analysis aims to understand how the application of contextual sensitivity strategies impacts the value of these industrial heritage quarters.

This chapter will provide a detailed introduction to the case city and the sample quarters, discussing the reason for choosing Shanghai from three perspectives: the long industrial history, the close relationship between industrial development and urban development, and the current status of rich industrial heritages. It will also provide the basic information and occupation status of the sample quarters, laying the groundwork for subsequent data collection and quantitative analysis.

6.1 Shanghai as A Case Study

Shanghai, as the birthplace of modern industry in China, has been foundational in the development of industries such as textiles, shipbuilding, machinery, tobacco, and rubber. It holds a significant position in China's industrial history, and in the 1960s, it represented the peak of the nation's light industry. Following the economic reforms and opening up, many major industrial projects were also established in Shanghai. Today, Shanghai is dominated by high-tech manufacturing and simultaneously promotes the growth of various types of newly emerging industries. As a modern city with a prolonged industrial history, Shanghai has continuously carried the memory of China's industrial development, documenting the progress of industrial advancement.

6.1.1 Industrial History of the Shanghai

In this research, the chronological scope of industrial heritage is the industries that emerged in and after the First Industrial Revolution in the 1760s. For China, the influence of industry started with the First Opium War in 1839. With the signing of the Treaty of Nanjing in 1842, China was forced to open its trade channels to Western countries. Concurrently, a growing consciousness has emerged regarding the urgency of learning contemporary industrial technologies and skills. Looking into the history of China, the international trade and legal institutions in treaty port cities have greatly impelled the process of modern industrialization and enhanced the efficiency of the

capital market (Keller and Shiue, 2021) . Shanghai, as one of the first five Chinese cities to open as treaty ports (Shanghai, Guangzhou, Fuzhou, Xiamen, Ningbo), is also a pioneer in the acquisition and integration of Industrial Revolution advancements. In 1865, the establishment of the Jiangnan Manufacturing Bureau in Shanghai marked a significant milestone, representing the inception of China's earliest and biggest military manufacturing factory according to the record of Shanghai Municipal People's Government. Subsequent to this, under the support of the late Qing government, Shanghai witnessed the development of an extensive range of light and heavy industry, and became one of the busiest international trade port cities with the most significant number of enterprises and the richest diversity in industrial categories. Therefore, Shanghai is always referred to as the cradle of China's modern national industry (Yan, 2023).

Generally speaking, the development of industry in Shanghai is chronologically connected to the development of the modern history of China. It came to form in the period of the Late Qing Dynasty after the First Opium War, became prosperous during the Republic of China Era, experienced an unhealthy boost in heavy industry during the early socialist period of the newly founded People's Republic of China, and restructured to a mainly tertiary industrial city from the Reform and Opening Up until now. (Figure 6. 1)

Pre-1842: The Foundations

Shanghai was primarily a fishing and textile village before the First Opium War. The local economy mainly relied on small manufacturing industries such as silk weaving and cotton production, catering to local demands (Zhu, 1989).

1842-1911: Late Qing Dynasty

The Treaty of Nanjing in 1842 marked the beginning of Shanghai's transformation. As a treaty port, the city became a centre for international trade. The influx of foreign investments and technologies catalysed the establishment of various manufacturing sectors, including textiles, shipbuilding, and machinery (Liu et al., 2021). This era saw the birth of Shanghai's cotton milling industry, which then grew into one of the city's major economic pillars.

1912-1949: Republican Era and Industrial Expansion

During the Republican era, Shanghai developed into the biggest industrial city in China. The establishment of the Chinese Nationalist government in 1927 further stimulated industrialisation, with policies encouraging foreign investment and the upgrading of urban infrastructure. By the mid-20th century, Shanghai was at the peak of its industrial capacity, hosting a multitude of factories and being regarded as the cradle of China's early chemical, steel, and automobile industries (Yan, 2023).

1949-1978: Socialist Transformation and Restructuring

The establishment of the People's Republic of China in 1949 initiated a period of socialist transformation. The ownership of Shanghai's industries was nationalised, and the city mainly focused on heavy industry according to the national requirement. During the Great Leap Forward (1958-1961) and the Cultural Revolution (1966-1976), despite the downturn of the national economy, Shanghai kept its industrial significance, contributing significantly to China's self-sufficiency in steel, shipbuilding, and machinery (Yan, 2023).

1978-present: Reform and Opening-up

The beginning of China's reform and opening-up policy in 1978 marked a new era for Shanghai's industrial development. Embracing market reforms, the city transitioned from a focus on heavy industry to a more diversified economy, emphasising finance, real estate, and high-tech industries. The development of the Pudong New Area, initiated in 1990, indicated Shanghai's development prospects of becoming a global financial hub. Concurrently, traditional manufacturing industries were either upgraded with modern technologies or relocated to peripheral areas, reducing pollution and facilitating urban development. The establishment of the Shanghai Free Trade Zone in 2013 shows the city has planned its industrial future towards an innovation-driven economy, attracting foreign investments in high-tech sectors such as biotechnology, renewable energy, and information technology (Liu et al., 2021).

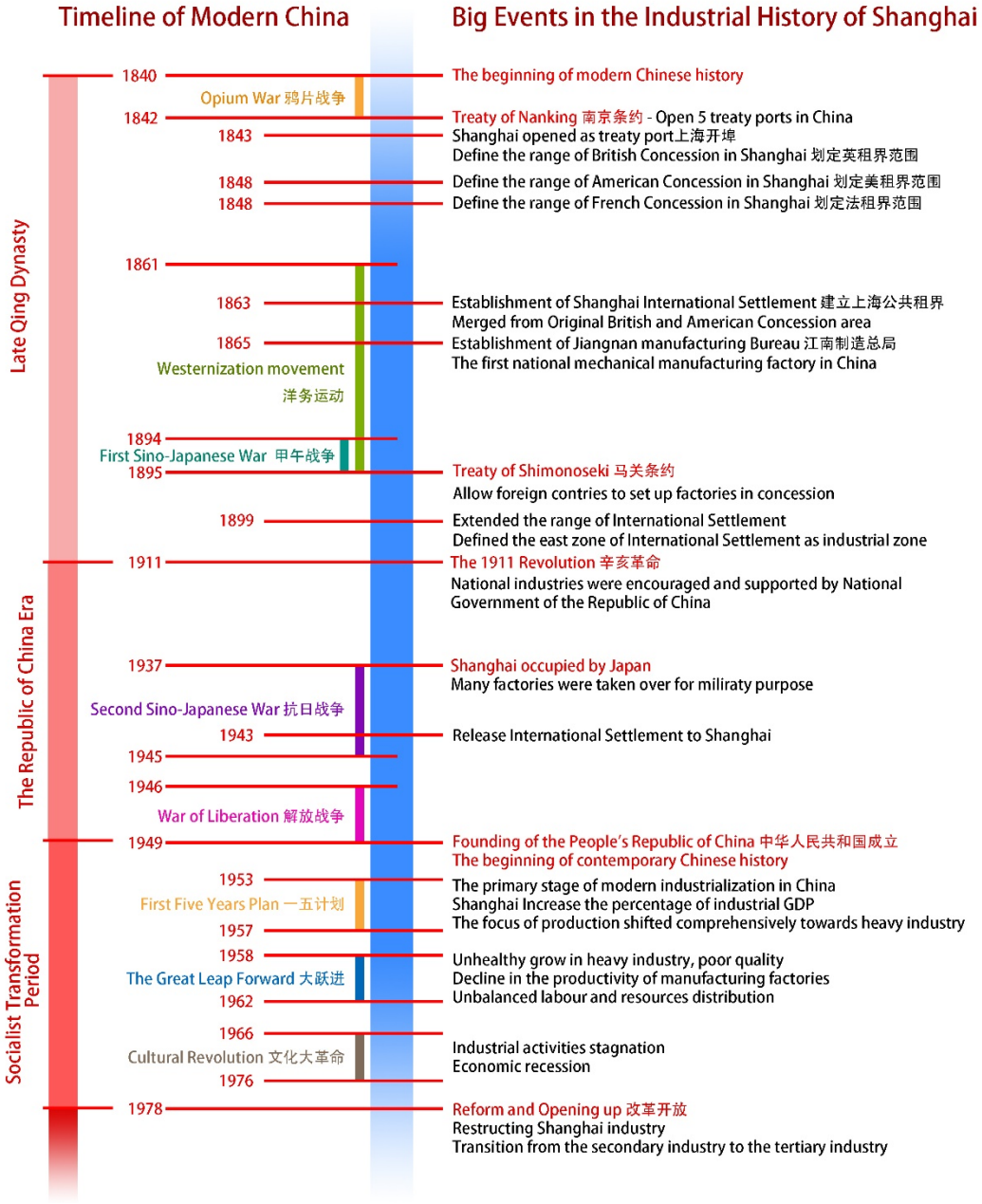


Figure 6. 1 Industrial history timeline of China and Shanghai from 1840 onwards (Draw by author)

6.1.2 The Significance of Shanghai’s Industry in China

According to the statistical record of the early industrial development in China after 1842, Shanghai once held a dominant position in China in terms of both the number of factories and the amount of capital compared with other cities in China. After the establishment of the People’s Republic of China, the country's light and heavy industries gradually shifted from the southeastern coastal areas to the inland regions. During the early stages of industrial development, Shanghai established a solid foundation for international trade, and has been gradually transitioning from a focus on secondary industries to tertiary industries from 1978 (Ma, 2006). Currently, Shanghai has become one of the cities with the largest GDP primarily dominated by the finance, service, and high-tech industries, which ranked first in 2023 National Statistical Annual Report (National Bureau of Statistics, 2023).

China's political situation experienced several significant transformations from 1840 to 1949, successively going through wars and revolutions before the establishment of the People's Republic of China. Afterwards, China’s economy and productivity did not fully recover from the consecutive years of turbulence. Due to multiple political campaigns, local and national recording activities of many kinds of statistics were missing. After the Reforms and opening up in 1978, Chinese society began to develop steadily, and the political system gradually improved, by which time the state's statistical records became progressively comprehensive and complete. Therefore, the record of industrial data was not very coherent and comprehensive, and there were several years blanketed during the period of 1840-1978. However, it is still able to form an overview of the industrial development between different cities based on accessible data and mathematical expectations.

The establishment of factories that were supported by the national capital greatly boosted the local economy in many cities from 1840 – to 1911. During that period, the new factories in Shanghai took up one-third of the nation’s total number, making this city the most prosperous industrial port city in China. (Figure 6. 2)

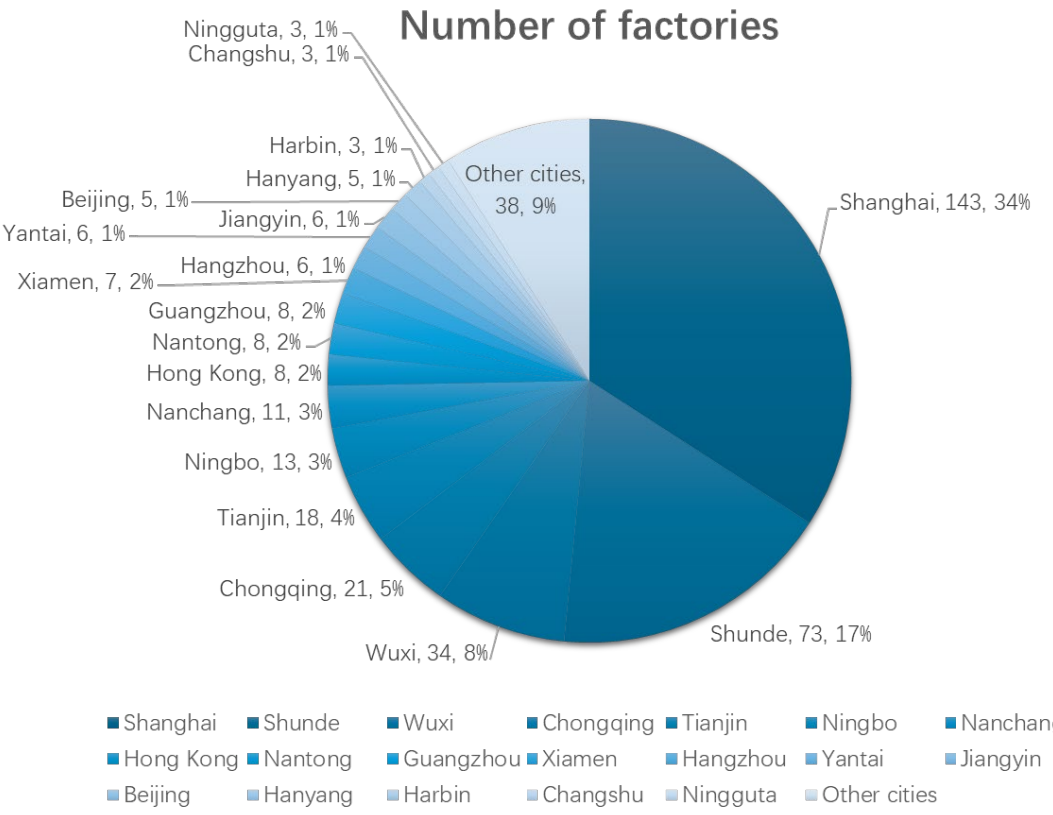
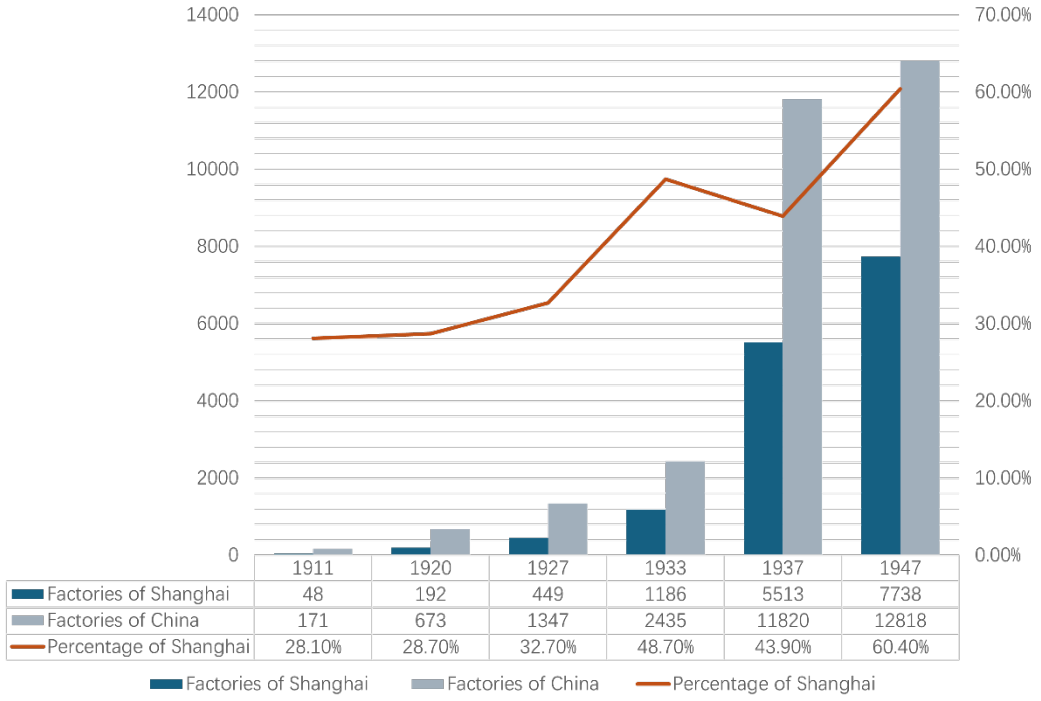


Figure 6. 2 Number of Factories Established by national capital from 1840 - 1911 Revolution (By author) Data derived from (Chen, 1961, Chen and Yao, 1957, Quan, 1958)

The outbreak of the 1911 Revolution marked the official end of the feudal era under the late Qing Dynasty. During the years of wars, as many factories shut down or got destroyed, the data of in use factories collected by 1911 shows a great drop in number. During the Republic of China period (1912-1949), despite a series of challenges such as civil wars, Japanese invasion, and political instability, this era was still a time of rapid development for modern Chinese industry, especially in Shanghai (Liu, 1936). The national and local governments implemented various methods to promote the industrial development of Shanghai, which, as a consequence, significantly advanced the early process of industrialization in China. Before the Second Sino-Japanese War (1937), Shanghai made considerable investment in the construction of civil and industrial infrastructures such as roads, ports, and power facilities; supported and protected the establishment and operation of local and national factories; encouraged industrial and technical education; and developed the capital market to promote international trade (Liu, 1936). During the Second Sino-Japanese War, Shanghai's industrial development was slowed by economic and resource constraints. However, due to Shanghai's strategic location and solid economic and industrial foundation, the Japanese government took control of Shanghai's factory resources for heavy industry and military

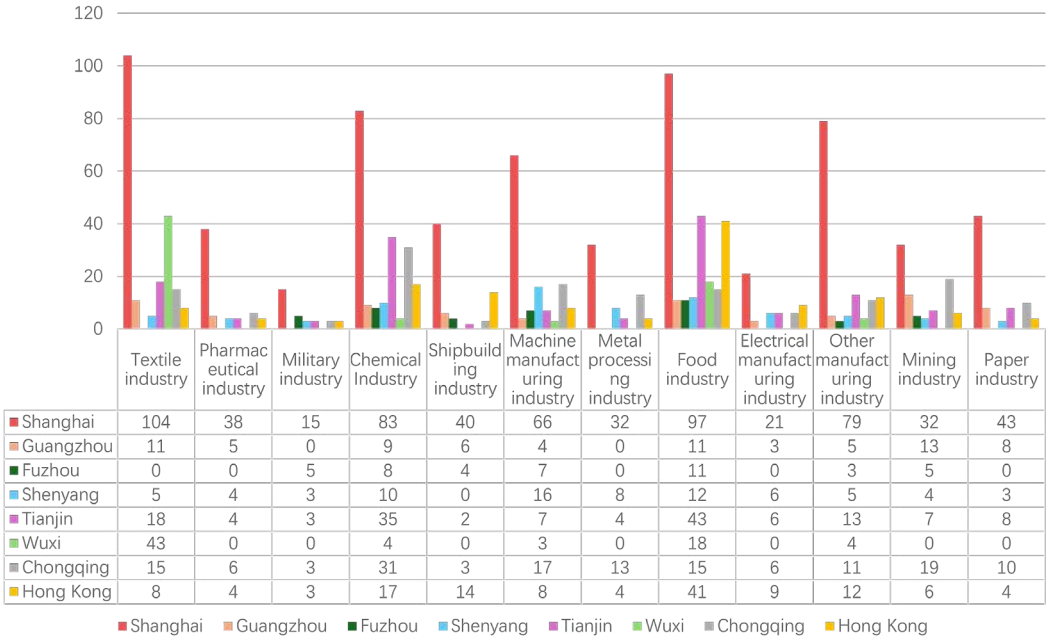
supplies, such as weapons, ammunition, clothing, food, medicine, etc. (Li, 2015). By the end of 1949, Shanghai's factories accounted for over 60% of the total number of factories nationwide. (Figure 6. 3)



	1911	1920	1927	1933	1937	1947
Factories of Shanghai	48	192	449	1186	5513	7738
Factories of China	171	673	1347	2435	11820	12818
Percentage of Shanghai	28.10%	28.70%	32.70%	48.70%	43.90%	60.40%

Figure 6. 3 Number of Factories in Operation from 1911 to 1947 in Shanghai and China (Draw by author) Date derived from (Quan, 1958, Du, 2014, Chen and Yao, 1957)

Shanghai is not only the city with the most significant gross industrial output value and the largest number of factories, but also the city with the richest industrial categories in China at that time, whose number of factories in each industrial category is far ahead compared with other cities. According to incomplete statistics on the total output value of factories in 1933, Shanghai possessed more than 30 types of factories, including both light and heavy industries. The total output value of the paper products manufacturing industry and artificial oil industry in the country is almost entirely dependent on Shanghai. Small manufacturing industries such as rubber, glass and castings account for more than 80% of the total output value in China. The textile and shipbuilding industries account for more than 70% of the country's total output value. Based on the accessible records at that time, the total industrial output value of Shanghai accounted for about 51% of the country, which made this city the veritable industrial pillar of the country. (Figure 6. 4) (Quan, 1958)



	Textile industry	Pharmaceutical industry	Military industry	Chemical Industry	Shipbuilding industry	Machine manufacturing industry	Metal processing industry	Food industry	Electrical manufacturing industry	Other manufacturing industry	Mining industry	Paper industry
Shanghai	104	38	15	83	40	66	32	97	21	79	32	43
Guangzhou	11	5	0	9	6	4	0	11	3	5	13	8
Fuzhou	0	0	5	8	4	7	0	11	0	3	5	0
Shenyang	5	4	3	10	0	16	8	12	6	5	4	3
Tianjin	18	4	3	35	2	7	4	43	6	13	7	8
Wuxi	43	0	0	4	0	3	0	18	0	4	0	0
Chongqing	15	6	3	31	3	17	13	15	6	11	19	10
Hong Kong	8	4	3	17	14	8	4	41	9	12	6	4

Figure 6. 4 Types and quantities of urban industries in China from 1840 – 1949 (incomplete statistics) (Draw by author) Data retrieved from (Chen and Yao, 1957, Chen, 1961, Fan, 1991, Liu et al., 2021, Zhu, 1989)

After the founding of the People's Republic of China, industrial activities in Shanghai were rapidly rebuilt, quickly resuming its production and business order. Subsequently, the Chinese government planned to focus on heavy industry as a priority for national economic development, leading to significant growth in Shanghai's steel and manufacturing industry, which accounted for nearly a quarter of China's industrial output. From 1958 to 1961, China entered the Great Leap Forward period, during which it aimed to rapidly increase industrial output and strengthen the national economy through the mass mobilization of social labour forces and resources. Although this phase accelerated the pace of Chinese industrialization to some degree, the neglect of product quality and the extreme imbalance in the development of light and heavy industries led to a great economic recession. The advantages of Shanghai's abundant industrial resources were not effectively utilized, and many types of manufacturing had to stop production because of insufficient labour and resources, resulting in industrial structural instability and a continuous decline in industrial output. (Meisner, 1992)

Following the Reforms and Opening up in 1978, the Chinese government re-planned and repositioned the industrial structure of Shanghai. As China's earliest international trade port and the first city to develop the financial industry (Liu et al., 2021), Shanghai gradually transitioned from focusing on heavy industry to prioritizing the tertiary sector, including the financial industry, service industry and high-tech industry, operating as a window for China's economic reforms in the global market. Despite the industrial

restructuring, Shanghai still maintains a high industrial GDP in China. From then on, Shanghai shifted from being China's industrial centre to becoming its economic centre, playing a crucial role not only in advancing China's industrial modernization but also in promoting economic modernization (Figure 6. 5) (CENGAGE, 2024). The restructuring of the Shanghai industry greatly influenced the transformation of the urban environment, leaving a great number of large-scale industrial buildings and sites within the central area of the city (the area within the outer ring road). With the rapid economic development and labour immigration in Shanghai, the issue of reusing industrial sites for growing urban requirements has become urgent. This focus promotes the practice and research on the industrial heritage in Shanghai.

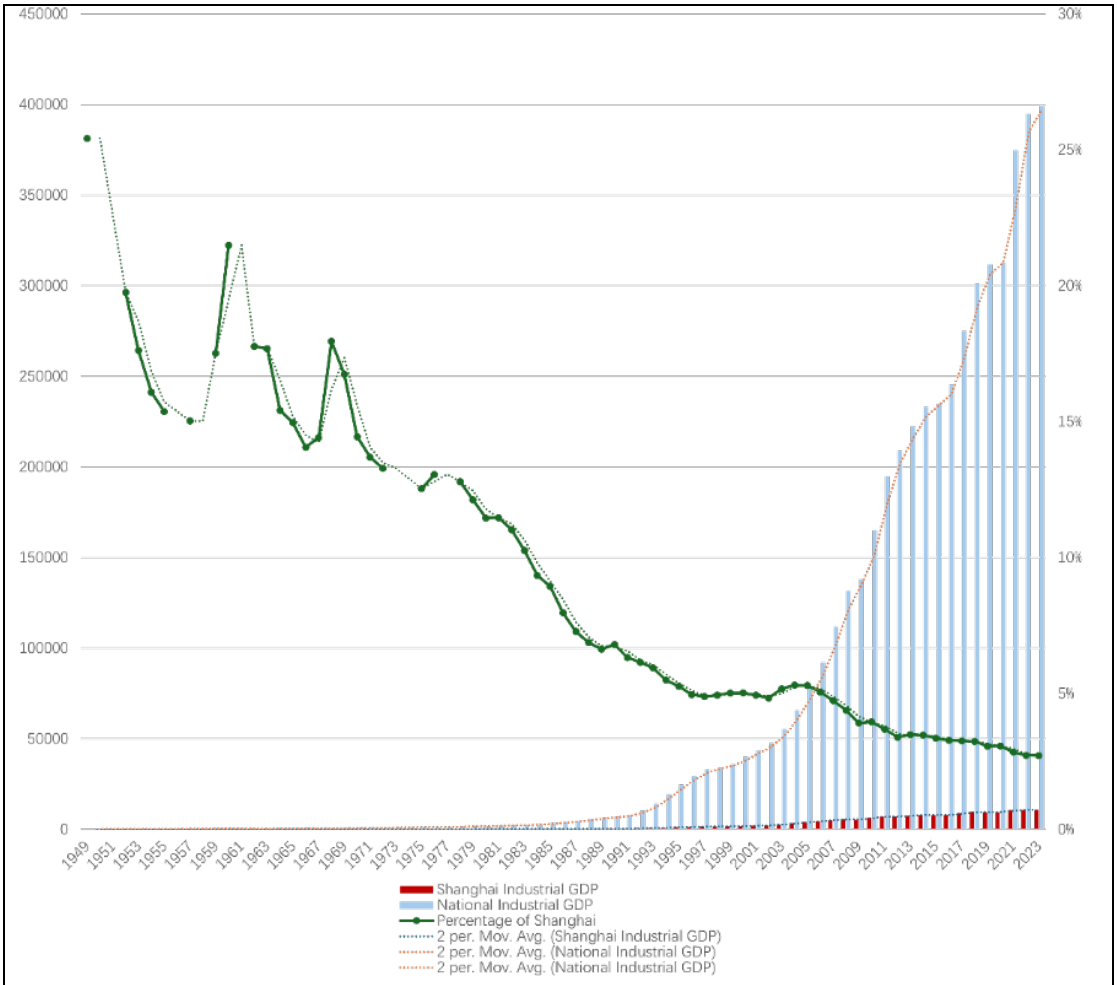


Figure 6. 5 The development of Shanghai and China industrial GDP from 1949 (with math expectation in missing years) (Draw by author) Data retrieved from (Li, 2015, Ma, 2006, Fang, 2018, Li and Shen, 2021, National Bureau of Statistics, 2024, Urban Data Query Platform, 2024, Du, 2014, Chen and Yao, 1957, Chen, 1961)

6.1.3 Industrial Development and Urban Development

Looking into industrial history, Shanghai is the city that witnessed the whole process of Chinese industrialization during modern and contemporary history. As the important port city on the east coast of China, Shanghai was pushed to join the chain of international trade, which, as an advantage, opened the gate for the incoming of various categories of industry.

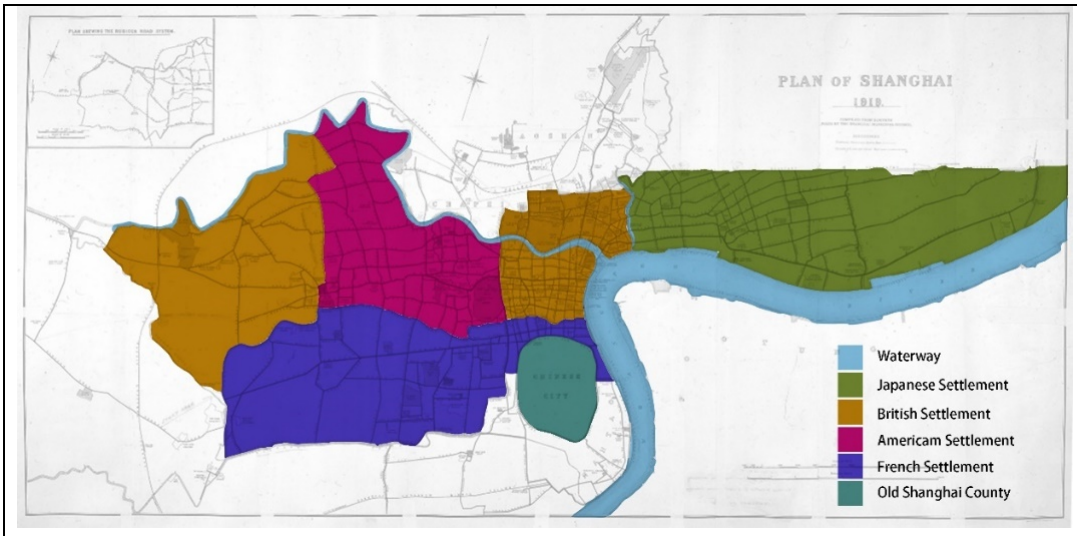


Figure 6. 6 Foreign Settlements Plan of Shanghai in 1919 (Adapted by author from https://www.virtualshanghai.net/Asset/Preview/vcMap_ID-28_No-1.jpeg Last access 17/11/2024)

Since the opening of Shanghai as a treaty port city, countries such as the United Kingdom, France, the United States, etc., successively established concessions along the Huangpu River and Suzhou Creek to facilitate international commerce. Within these concessions and the adjacent areas, foreign capital took advantage of the labour resources and convenience of water transportation, invested in factory construction, and engaged in industrial, living, and trade activities (Wu, 2011). The formation and expansion of these concessions are closely linked to the industrial development process, shaping the unique spatial feature of Shanghai's urban development. As foreign enterprises and Chinese entrepreneurs thrived, industrial zones began to emerge and extended to the northern part of the International Settlement and the east banks of the Huangpu River (Sun et al., 2024).

From 1843, the scale of the British Concession was planned around the southwest bank of the Huangpu River and Suzhou Creek junction. Later, in 1848, the American and French Concessions were established and adhered to the north and south sides of the

British Concession. The British and American settlements then integrated into the International Settlement in 1863, which expanded northward and westward, integrating advanced infrastructure such as tram lines, gas supply, and public utilities that were absent in Chinese-controlled areas (Sun et al., 2024). (Figure 6.6)

In 1926, the Shanghai municipal government issued an early version of the industrial layout plan, which designated three industrial districts in the west, east, and south, primarily dominated by foreign capital (Denison, 2006). At the same time, some national industries began to spontaneously cluster in Hongkou District which is on the north side of the International Settlement. Early factories in the central area of Shanghai city were mainly established based on spontaneous site selection without a unified plan, leading to a dispersed layout. After the outbreak of war in 1937, many factories were destroyed or forced to relocate within the concessions, forming a hybrid texture of industrial and residential spaces (Huang, 2008). (Figure 6. 7)

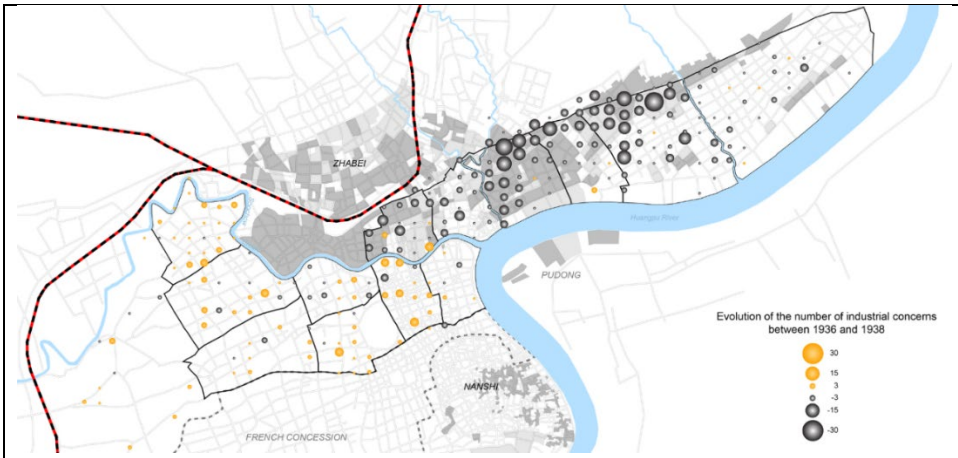


Figure 6. 7 Industrial workforces from 1936-1938 (https://www.virtualshanghai.net/Asset/Preview/vcMap_ID-667_No-1.jpeg Last access 17/11/2024)

After the establishment of the People's Republic of China, Shanghai soon began to revitalize production activities. The distribution of factories inherited the previous layout, physically forming two industrial belts. The first one was the light industry and textile industry belt, extending to the west along Suzhou Creek. This industrial area was small-scaled factory spaces with diverse industrial building types and high factory density (Liu, 1936). The second belt extended along the Huangpu River to both the north and south sides, primarily consisting of high water-consuming industries such as power factories, water supply plants, shipyards, and chemical factories (Wu, 2011). (Figure 6. 8)



Figure 6. 8 Docklands in the central area along Huangpu River in 1939 (https://www.virtualshanghai.net/Asset/Preview/vcMap_ID-46_No-1.jpeg Last access 17/11/2024)

Starting in 1953, to improve the urban environment and living conditions of the city centre, Shanghai planned to gradually relocate heavy-polluted and high-risk industries from the city centre to the suburbs. New industrial zones were planned around the existing urban area, each with its own leading industry for the convenience of resource distribution and management. The original docklands along the east bank of Huangpu River have been regenerated into the commercial and economic belt of Pudong District. By 1957, there were already ten industrial zones. In 1958, the Shanghai government proposed to upgrade its industrial structure, gradually moving towards more advanced industries. At the same time, rapid urbanization and high-speed industrialization have raised great issues concerning living quality and land development in the city centre. This catalysed the planning and construction of satellite cities focused on industry and technology, which aim to develop high-tech industries and relieve population pressure in the existing city area according to Shanghai Municipal Peoples Government in 1990. (Figure 6. 9)(Table 6. 1)



Figure 6. 9 Industrial distribution in 1992 (https://m.planning.org.cn/zx_news/8095.htm Last access 17/11/2024)

Industrial Zone	Year	Industry
Wujiaochang 五角场	1952	Electromechanical Industry
Beixinjing 北新泾	1953	Fine Chemicals Industry
Qingningsi 庆宁寺	1953	Shipbuilding Industry
Taopu 桃浦	1954	Chemical Pharmaceutical Industry
Pengpu 彭浦	1957	Electromechanical Industry
Wusong 吴淞	1958	Metallurgical Chemical Industry
Caohejing 漕河泾	1984	Instrumentation and Telecommunications Industry
Changqiao 长桥	1985	Coal Chemical Industry
Zhoujiadu 周家渡	1993	Steel Industry
Gaoqiao 高桥	2002	Petrochemical Industry

Table 6. 1 Industrial zones established in Shanghai from 1952 (By author)

By the time of the economic reforms and opening up in 1978, Shanghai had already formed a relatively comprehensive and efficient industrial layout and had completed the initial adjustments to its industrial structure (Chen, 2021). By early 21st Century, there were ten industrial zones and seven industrial satellite cities in Shanghai. Spatially, the industrial layout presented three layers: scattered small independent factories within the city centre defined by the Inner Ring Elevated Road; clustered industrial zones between the Inner and Outer Rings, featuring larger industrial spaces and accompanying

industrial communities; and industrial satellite cities beyond the Outer Ring. (Figure 6. 10)(Table 6. 2) (Jia, 2015, Chen, 2021)

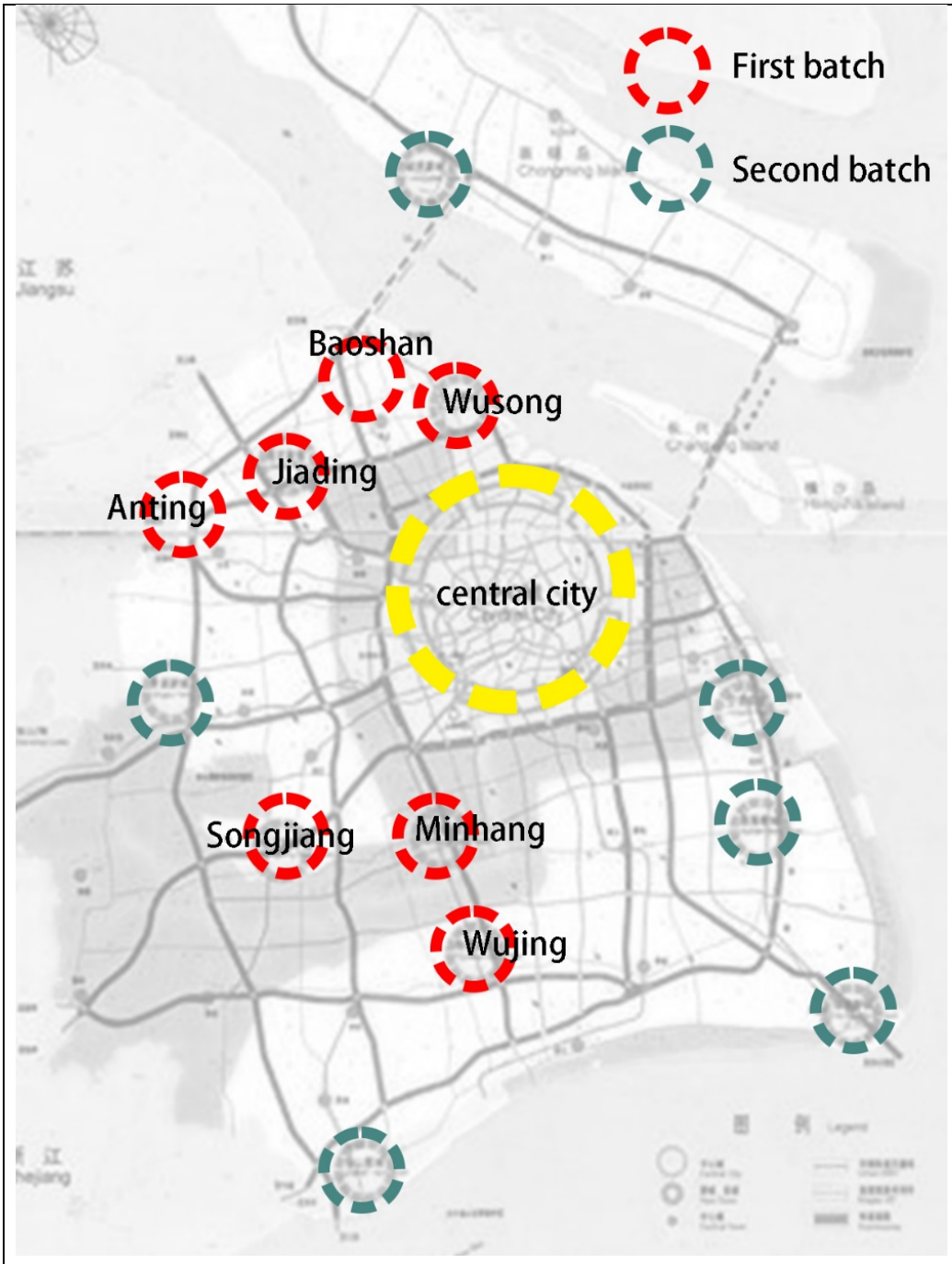


Figure 6. 10 Industrial satellite cities (Adapted by author from online map https://m.planning.org.cn/zx_news/8095.htm Last access 17/11/2024)

Industrial Satellite City	Year	Industry
Minhang 闵行	1958	Manufacturing base for power generation equipment and electromechanical industry
Wujing 吴泾	1958	Chemical industry
Wusong 吴淞	1958	Steel and Metallurgical Chemical Industry
Anting 安亭	1959	Electromechanical industry with a focus on automobile manufacturing
Songjiang 松江	1992	Instrumentation and light textile industry
Jiading 嘉定	1994	Research and other non-harmful precision industries
Baoshan 宝山	2004	Petrochemical industry

Table 6. 2 Industrial Satelite Cities established in Shanghai from 1958 (By author)

With the orientation of Shanghai's urban development adjusted, the city has gradually transformed into a political and financial centre, with factories ceasing operations and relocating outward. The subsequent decades led to a significant spatial and functional transformation as industrial areas started to be integrated into the broader urban redevelopment plans. The historical industrial sites, which once supported the city's economic development, began to be abandoned or rebuilt until they were seen as important architectural remains in recent years (Huang, 2008). This recognition promotes the conservation and regeneration of these areas, converting former industrial spaces into cultural, commercial, and public spaces while maintaining their unique historical character to display the industrial progress of this city.

6.1.4 Industrial Heritage Designation

As the research on industrial heritage in China is relatively behind, the theory of industrial heritage and urban regeneration is mostly practice-based. In the first-tier cities in China, the redevelopment of many industrial quarters started many years before they were designated as industrial heritage.

In 1958, Shanghai initiated an investigation aimed at identifying and safeguarding architectural structures of significance. This research project primarily targeted buildings with unique design styles and significant historical relevance, including specific industrial structures within concession areas (Chen, 2015). In 1999, Tongji University commenced an investigation into Shanghai's industrial architecture, marking the first official research and assessment work to study industrial remains in China. Subsequently, in 2002, Shanghai Municipal People's Government proposed conservation regulations, highlighting the necessity of effectively preserving representative factories, warehouses, workshops, and similar structures. As urban development progressed in recent years, conservation efforts and the revitalization of

industrial architecture proceeded concurrently, informing and inspiring each other in both practice and study. In 2005, the Shanghai government founded the Shanghai Industrial Tourism Promotion Centre, which greatly catalysed the systematic revitalization of many old industrial sites as well as many in-use factories, facilitating the conservation and sustainable regeneration of local industrial remains (Wang and Fu, 2019). In 2020, the National Development and Reform Commission released a pragmatic plan, influenced by a recent revitalization project in the industrial quarter of Yangpu District, aimed at promoting the protection and utilization of industrial heritage in traditional industrial cities. Consequently, Shanghai is now recognized as a pioneer in both research and practical applications concerning the conservation and reuse of industrial heritage. Through years of architectural heritage investigation and protection, Shanghai has listed more than 290 representative industrial remains based on the reports published by the government and institutions. As national certification of industrial heritage is comprehensively carried out, cities have begun to standardize and regulate the certification processes for industrial remains. Considering the various historical and industrial cultural contexts, some cities are establishing evaluation systems with local characteristics beyond the national perspective, and are undertaking their own surveys and protection measures. The heritage transformation of industrial remains into recognized industrial heritage is a continuous process. During the evaluation, industrial remains that are more representative, historically significant, vulnerable, or distinctive are often prioritized (Mo et al., 2022). This study only focuses on industrial heritages that have been certified as the prior several batches, which are officially designated by the Chinese and Shanghai governments.

The selection of samples is based on ‘National Industrial Heritage List’, ‘China Industrial Heritage Protection List’ and ‘Shanghai Industrial Heritage List’. These three lists have been certified by national and provincial professional authorities which are currently the most authoritative and reference-worthy lists in the field of China's industrial heritage research.

‘National Industrial Heritage List (国家工业遗产名单)’ is designated and announced by the Ministry of Industry and Information Technology of the People's Republic of China (MIIT of PRC) (中华人民共和国工业和信息化部), following the ‘Interim Measures for National Industrial Heritage Management (国家工业遗产管理暂行办法)’ published in 2018. The designation of the industrial heritage in the list requires a process that involves a voluntary application by the owners of the industrial heritage, recommendation by the relevant provincial Industrial and Information Technology Departments or central enterprises, expert review, on-site investigation, and online public announcement. This list plays an important role in promoting the identification and protection of China's industrial heritage. Following the first batch of this list announced in 2017, there have already been five batches including 197 industrial heritages all over China up to now.

‘China Industrial Heritage Protection List (国家工业遗产保护名录)’ is sponsored by the Publicity Department of the China Association for Science and Technology (中国科协调宣部), with the joint organization of the China Association for Science and Technology Innovation Strategy Research Institute (中国科协创新战略研究院) and the Urban Planning Society of China (中国城市规划学会) for designation and announcement. This list comprises industrial heritages with significant representativeness and outstanding value. Comparatively, the ‘National Industrial Heritage List’ focuses more on the historical and technological contribution of the industrial heritage to the industrial history of the country. While this list involves the perspective of urban planning, taking more complex social values of industrial heritage during the urban transformation process into account. Following the first batch announced in 2018, there have already been three batches including 300 industrial heritages in total up to now.

‘Shanghai Industrial Heritage List (上海工业遗产名单)’ is a local industrial heritage list that was designated and announced by Shanghai Municipal Commission of Economy and Informatization (上海市经济和信息化委员会). This list, as an extension of the national lists, focuses on industrial heritages with local characteristics and uniqueness, contextualized within Shanghai's distinctive historical and cultural background. There have been two batches including 26 industrial heritages that announced in 2023 and 2024. Up to now, there were 58 officially designated industrial heritages in Shanghai.

According to the study of the industrial heritage lists in China, Shanghai has a leading advantage over other cities of similar stature in terms of the quantity, diversity, and historical span of its industrial heritage.

6.1.5 The Reason of Taking Shanghai as Case Study

Due to the vast geographical span of China, as well as the diversity in urban environments, historical contexts, cultures, and economic developments across different regions, this study has chosen to focus on analysing a single city as a case study. Narrowing down the scale to one city offers several advantages: it allows for effective control of variables, making the causal relationships between data more direct and clearer; it ensures that the strategies and methods that relate to the research are more targeted; and it allows for a deeper exploration of the subject within the constraints of limited research time and resources.

Of all the listed industrial heritages in China, Shanghai's industrial heritage has the longest time span, the largest number of designated heritages, and the broadest category of industrial types (Figure 6. 11, Figure 6. 12, Figure 6. 13). According to the introduction of Shanghai, it can be seen from the historical progress, industrial significance, urban development, industrial heritage regeneration conservation that Shanghai is a representative city as a case study. In summary, the reasons for selecting

Shanghai as the city for the case study can be understood from the following perspectives:

History: The history of Shanghai as the commercial and industrial centre of China dates back to the early 20th century and even before, making it one of China's earliest cities to undergo industrialisation. As the pioneer of Chinese industrialisation, Shanghai established a diverse range of industries and a large number of factories, leaving much industrial heritage for the city. The history embedded in Shanghai's industrial sites reflects the evolution of China's industrialisation, colonial impacts, and the transition through different historical periods.

Industrial Culture: Shanghai's industrial culture is the outcome of Eastern and Western influences as a treaty port. This industrial culture is not simply about the factories and machinery but also about the lifestyle, worker communities, and the socio-economic conditions that formed around these industrial sites. This multidimensional industrial culture shows the influence of industrialisation on society and the built environment in historical industrial cities in China.

Urban Development and Regeneration: Shanghai's approach to urban development and regeneration inspires the practice and research on relevant topics in China. Shanghai was the first city to transform industrial sites into vibrant cultural, commercial, and residential spaces. These projects aimed to explore innovative ways to preserve industrial heritage while contributing to urban development and economic revitalisation. These regeneration efforts provide inspiring experiences in urban development, adaptive reuse of industrial spaces and conservation of urban industrial heritage.

Protection Awareness: Shanghai has shown a growing awareness of the protection and utilisation of its industrial heritage. The city encourages the practice and research on its industrial heritage sites, emphasising the progressive attitude towards industrial heritage conservation, adaptive reuse, and urban development. This awareness is important for promoting public appreciation for industrial culture and industrial relics, which are expected to be living parts of the city's cultural and social context.

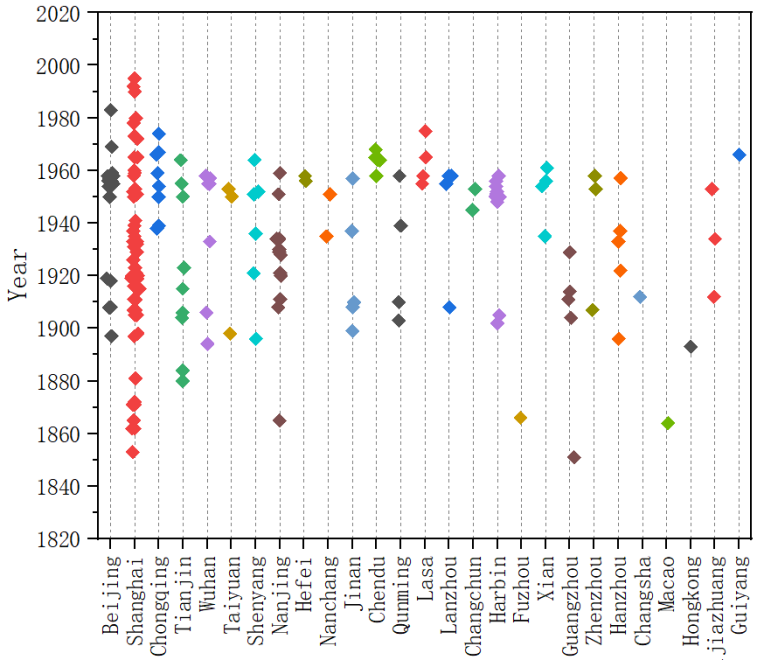


Figure 6. 11 Time span of industrial heritages in China. Different city uses different colour dots to mark the establish time of heritages (Draw by author)

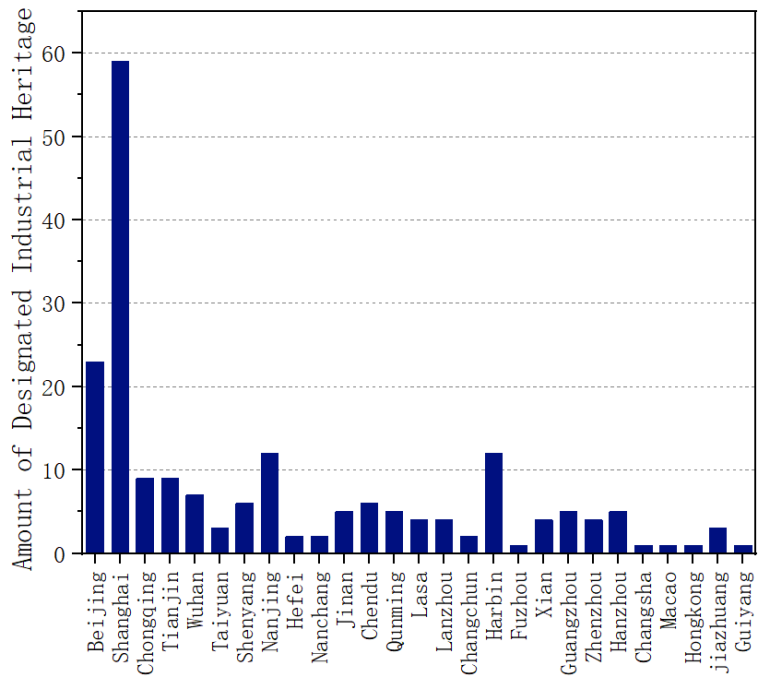


Figure 6. 12 Designated industrial heritages of municipality and capital cities in China (Draw by author)

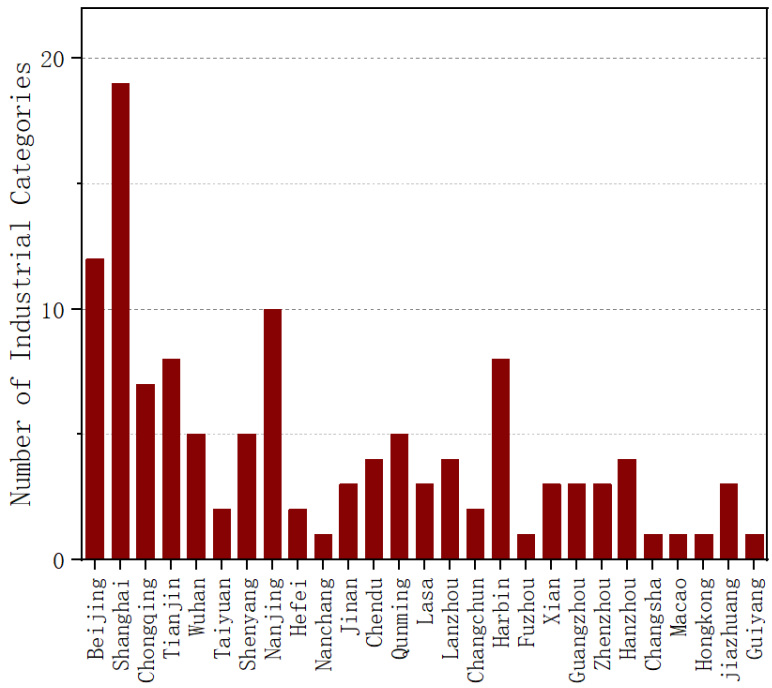


Figure 6. 13 Industrial categories of municipality and capital cities in China (Draw by author)

Shanghai's deep industrial culture, high awareness of heritage protection, rich urban development experience, and sufficient industrial heritage types make it an ideal case city for studying contextually sensitive urban industrial heritage quarter regeneration.

6.2 Sample Urban Industrial Heritage Quarters

6.2.1 Industrial Heritage in Shanghai

According to the designated industrial heritage list, Shanghai has 58 industrial heritages. Among all industrial heritages, there are 4 machines and products, 7 industrial facilities, 13 industrial architectures, 31 industrial quarters and 3 industrial zones. The machines and products are preserved by current company and most of the heritages now are located within the outer ring of Shanghai (Figure 6. 14) (Table 6. 5).

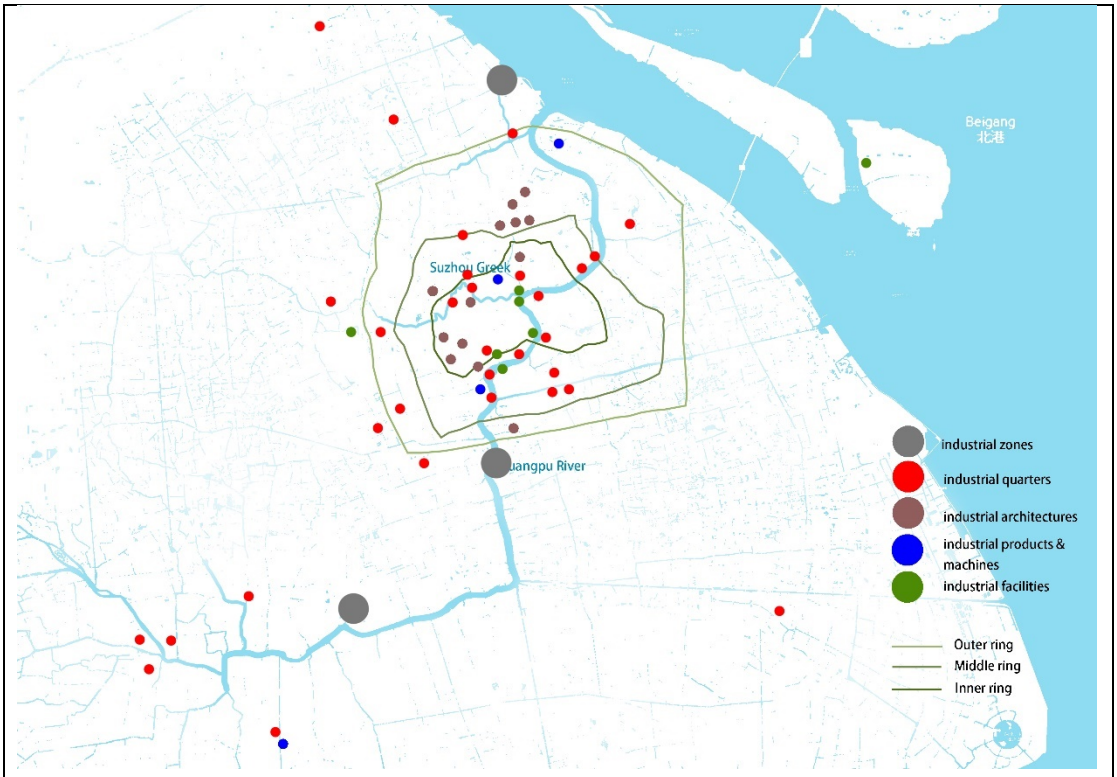


Figure 6. 14 Distribution of Shanghai industrial heritages (adapted by author from Google Map)

From the perspective of regeneration status, among all the heritages, half have been reused and the functions are mainly creative industry and recreational function. The proportion of in-use heritage is also high, as the Shanghai industry is also important and advanced in the history of new China.

Heritage No.1, No.4, No.24 and No.42 are partly preserved and partly reused, each will be counted twice in Table 6.3. Heritage No.8, No.17, No.21 and No.26 are partly functioning and partly reused, each also be counted twice in this table. (Table 6. 3, Table 6. 5)

Current status	Reused function	No.	Percent
Reused (function transformed)	Creative industry park	30	51.7%
	Museum and gallery		
	Theatre		
	Event venue		
	Sports centre		
	Office		
	Shopping centre		
	Park		

	Green belt		
In use (function continuation)		21	36.2%
Awaiting renovation	Office	4	6.9%
	Recreation and creative industry park		
	Shopping centre		
Preserved on site or in museums		11	18.9%

Table 6. 3 Preservation and utilisation status of Shanghai industrial heritages (By author)

Looking into industrial types, the major industry is the manufacturing industry, with a large proportion of transportation equipment manufacturing and some light industries such as textile, tobacco and food processing. (Table 6. 4, Table 6. 5)

Category	**Sub-category**	**No.**	**Percent**
Section C: Manufacturing	Manufacture of food products	3	65.6%
	Manufacture of beverages	3	
	Manufacture of tobacco products	4	
	Manufacture of textiles	5	
	Printing and reproduction of recorded media	3	
	Manufacture of chemicals and chemical products	3	
	Manufacture of rubber and plastics products	1	
	Manufacture of other non-metallic mineral products	1	
	Manufacture of basic metals	2	
	Manufacture of machinery and equipment n.e.c.	1	
	Manufacture of electrical equipment	2	
	Manufacture of other transport equipment	9	
	Other manufacturing	1	
Section D: Electricity, gas, steam and air conditioning supply	Electric power generation, transmission and distribution	2	5.2%
	Manufacture of gas; distribution of gaseous fuels through mains	1	
Section E: Water supply; sewerage, waste management and remediation activities	Water collection, treatment and supply	1	3.4%
	Sewerage	1	
Section F: Construction	Civil engineering	4	6.9%
Section H:	Water transport	4	10.3%

Transportation and storage	Air transport	1	
	Warehousing and support activities for transportation	1	
Section J: Information and communication	Telecommunications	4	6.9%
Section L: Real estate activities	Real estate activities on a fee or contract basis	1	1.7%

Table 6. 4 Industrial heritage categories of Shanghai industrial heritages (By author)

Shanghai's industrial heritage embodies a diverse range of types by industries—consisting of heavy industries, light industries, and related infrastructure in as many as 23 subtypes—covering 68% of the total industrial classifications in China and the longest period of 142 years in modern Chinese history. Among the three key spatial types of architecture, quarter, and zone, the industrial quarter acts as the dominant type in terms of 32 sites, more than half of the total. And of geographical distribution, industrial quarters are widely distributed across the city, providing spatial opportunities for urban regeneration. (Table 6. 5)

List	No.	Heritage	Year	Industry	Regeneration Status	Heritage Contents	Current Function
P2	1	董家渡船坞 Dongjiadu Shipyard	1853	造船厂 Manufacture of other transport equipment	Preserved Reused	Structure	船坞滨江绿地 Ferry Waterfront
P2/G5/S1	2	上海船厂-浦东 Shanghai Shipyard - Pudong	1862	造船厂 Manufacture of other transport equipment	Reused	Architecture Structure	老船厂 1862 Shipyard 1862
P2	3	上海船厂-杨浦 Shanghai Shipyard - Yangpu	1862	造船厂 Manufacture of other transport equipment	Awaiting renovation	Architecture Structure Facility	抖音滨江中心（在建） TikTok Binjiang Center (under construction)
P1	4	江南机器制造总局（含求新机器造船厂） Jiangnan Machinery Manufacturing Bureau (including Qiuxin Machinery Shipyard)	1865	造船厂 Manufacture of other transport equipment	Preserved Reused	Architecture Shipyard	上海潜艇博物馆 远望一号测量船 滨江滑板极限公园 中国船舶馆 上海中船文化传媒有限责任公司 Shanghai Submarine Museum Yuanwang-1 survey ship Binjiang Skateboarding Extreme Park China Shipbuilding Museum Shanghai CSSC Culture Media Co., Ltd
P2	5	大北电报公司-延安东路 Da Bei Telegraph Company - Yan'an East Road	1871	通信 Telecommunications	Reused	Architecture	上海电信博物馆 Shanghai Telecommunications Museum
P2/G4/S1	6	大北电报公司-中山东一路 Da Bei Telegraph Company - Zhongshan East Road	1871	通信 Telecommunications	Reused	Architecture	银行 艺术馆 Bank Art gallery
P2	7	轮船招商局 China Merchants Steamship Company	1872	航运 Water transport	Reused	Architecture	招商轮船办公 海事教育基地 企业文化展馆 China Merchants Shipping Office Maritime Education Base Corporate Culture Exhibition Hall
P1	8	杨树浦水厂 Yangshupu Waterworks	1881	自来水厂 Water collection, treatment and supply	In use Reused	Architecture Structure Facility	上海自来水科技馆 Shanghai Waterworks Science and Technology Museum
P2	9	商务印书馆 The Commercial Press	1897	印刷厂 Printing and reproduction of recorded media	Reused	Architecture	1925 Bookstore
P1	10	阜丰面粉厂 Fufeng Flour Mill	1898	食品加工 Manufacture of food products	Reused	Architecture	M50 创意园 M50 Creative Park

P2	11	开浚黄浦工程管理局（上海浚浦局）-逸仙路 Kaijun Huangpu Engineering Management Bureau (Shanghai Junpu Bureau) - Yixian Road	1905	航运 Water transport	Reused	Architecture	Retail and office building
P2	12	开浚黄浦工程管理局（上海浚浦局）-共青路 Kaijun Huangpu Engineering Management Bureau (Shanghai Junpu Bureau) - Gongqing Road	1905	航运 Water transport	Preserved	Architecture	
P1	13	外白渡桥 Garden Bridge of Shanghai	1907	桥梁 Civil engineering	In use	Bridge	
P2	14	外滩信号台 Bund Signal Station	1907	信号台 Telecommunications	In use	Architecture Facility	
S1	15	上海铁路南浦站 Shanghai Railway Nanpu Station	1907	火车站 Manufacture of other transport equipment	Reused	Architecture Structure Facility	Station 1907
P2	16	上海啤酒公司 Shanghai Beer Company	1911	酒厂 Manufacture of beverages	Reused	Architecture	苏州河梦清园环保主题公园管理处 Theme Park Management Office
P2	17	工部局电气处（杨树浦电厂） Electrical Department of the Ministry of Works (Yangshupu Power Plant)	1911	发电厂 Electric power generation, transmission and distribution	Reused In Use	Architecture Structure Facility	杨树浦电厂遗迹公园 Yangshupu Power Plant Heritage Park
S2	18	上海闸北发电厂 Shanghai Zhabei Power Plant	1911	发电厂 Electric power generation, transmission and distribution	In use	Architecture Structure Facility	
S1	19	'华丰'上海小片模 Huafeng Shanghai printing factory	1915	铸 Manufacture of basic metals	Preserved	Mould	
P2	20	南洋兄弟烟草公司-东大名路 Nanyang Brothers Tobacco Company - Dongdaming Road	1916	烟草 Manufacture of tobacco products	Reused	Architecture	Office building
P2	21	南洋兄弟烟草公司-胶州路 Nanyang Brothers Tobacco Company - Jiaozhou Road	1916	烟草 Manufacture of tobacco products	In use Reused	Architecture	南洋电机厂 Nanyang Electric Machinery Factory
S1	22	大中华纱厂和华丰纱厂 Greater China Cotton Mill and Huafeng Cotton Mill	1919	纺织厂 Manufacture of textiles	Reused	Architecture Structure Facility	半岛 1919 文化创意产业园 Peninsula 1919 Cultural and Creative Industrial Park
S1	23	上海第三十五棉纺织有限公司 Shanghai 35th Cotton Textile Co., Ltd	1919	纺织厂 Manufacture of textiles	In use	Architecture Structure Facility	

P2	24	英美烟公司-苏州路 British American Tobacco Company - Suzhou Road	1919	烟草 Manufacture of tobacco products	Preserved Reused	Architecture	各省市自治区和中央各部驻沪办事处经济合作协会 Economic Cooperation Association of Central Government Offices in Shanghai
P2	25	英美烟公司-平凉路 British American Tobacco Company - Pingliang Road	1919	烟草 Manufacture of tobacco products	Reused	Architecture	Office building
P2/G3/S1	26	上海造币厂（国营 614 厂） Shanghai Mint (State owned 614 Factory)	1920	铸 Manufacture of basic metals	In use reused	Architecture	上海造币博物馆 Shanghai Mint Museum
S1	27	上海麻袋厂 Shanghai Sack Factory	1920	纺织厂 Manufacture of textiles	Reused	Architecture	Jingyuan Fashion Industry Park/The x tower
S2	28	上海水泥厂 Shanghai Cement Factory	1920	水泥厂 Manufacture of other non-metallic mineral products	Awaiting renovation	Architecture, Structure, Facility	Shanghai Dream Center (under construction)
S2	29	上海第十七棉纺织总厂旧址 Former Site of Shanghai 17th Cotton Textile Factory	1921	纺织厂 Manufacture of textiles	Reused	Architecture, Structure, Facility	上海国际时尚中心 Shanghai International Fashion Center
P1	30	东区污水处理厂 East District Sewage Treatment Plant	1923	污水处理 Sewerage	In use	Architecture, Structure, Facility	
P1	31	福新第三面粉厂 Fuxin Third Flour Mill	1926	食品加工 Manufacture of food products	Awaiting renovation	Architecture	
S1	32	烟印公司米勒全张单色胶印机 Miller Full Color Offset Printing Machine from Tobacco Printing Company	1929	印刷厂 Printing and reproduction of recorded media	Preserved	Machine	
S1	33	上海北票煤码头 Shanghai Beipiao Coal Wharf	1929	码头 Civil engineering	Reused	Architecture, Structure, Facility	徐汇滨江绿带 Xuhui West Bund Waterfront
P3/S1	34	上海英雄金笔厂 Shanghai Hero Golden Pen Factory	1931	钢笔厂 Other manufacturing	Reused	Architectures	中以上海创新园 China Israel Shanghai Innovation Park
P2	35	英商上海煤气股份有限公司杨树浦工场 Yangshupu Factory of British Shanghai Gas Co., Ltd	1932	煤气 Manufacture of gas; distribution of gaseous fuels through mains	Awaiting renovation	Architecture, Structure, Facility	
P2	36	工部局宰牲场 Slaughterhouse of the Ministry of Works	1933	屠宰场 Manufacture of food products	Reused	Architecture	1933 老场坊 1933 Old Millfun

P2	37	中国酒精厂 Chinese alcohol factory	1933	化工厂 Manufacture of chemicals and chemical products	Preserved	Architecture	
P2	38	天利氮气制品厂 Tianli Nitrogen Products Factory	1935	化工厂 Manufacture of chemicals and chemical products	In use	Architecture	
S1	39	信和纱厂 Xinhe Textile Factory	1937	纺织厂 Manufacture of textiles	Reused	Architecture	M50 创意园 M50 Creative Park
S2	40	上海东明酿造有限公司 Shanghai Dongming Brewing Co., Ltd	1939	酒厂 Manufacture of beverages	In use	Architecture, Structure, Facility	
S2	41	上海印钞厂 Shanghai Engraving and Printing Factory	1941	印钞厂 Printing and reproduction of recorded media	In use	Architecture, Structure, Facility	
P3/S1	42	上海飞机制造厂（5703 厂） Shanghai Aircraft Manufacturing Factory (5703 Factory)	1950	飞机制造 Manufacture of other transport equipment	Reused Preserved	Architecture, Structure, Facility	西岸艺术中心 West Bund Artistic Center
S2	43	新中国第一台电站汽轮机 The first steam turbine in power plant	1951	制造厂 Manufacture of electrical equipment	Preserved	Machine	
P3	44	上海曹杨新村 Shanghai Caoyang New Village	1951	工人社区	In use	Architecture	
P3	45	上海沪东中华造船厂（437 厂、424 厂） Shanghai Hudong Zhonghua Shipyard (437 Factory, 424 Factory)	1952	造船厂 Manufacture of other transport equipment	In use	Architecture, Structure, Facility	
S1	46	南门粮库 Nanmen Grain Depot	1953	粮仓 Warehousing and support activities for transportation	Reused	Architecture, Structure, Facility	云间粮仓文化创意产业园 Cloud Grain Silo Cultural and Creative Industrial Park
S2	47	四团酒厂 Si Tuan Distillery	1958	酒厂 Manufacture of beverages	In use	Architecture, Structure, Facility	
S2	48	上海冶金矿山机械厂旧址 Former Site of Shanghai Metallurgical Mining Machinery Factory	1959	冶金机械 Manufacture of machinery and equipment n.e.c.	Reused	Architecture, Structure, Facility	静安新业坊 Jing'an New Business Park
S2	49	红旗楼建筑群 Hongqi Building Complex	1960	航天 Air transportation	In use	Architecture	
P3	50	上海打浦路过江隧道（651 工程）东段	1965	交通设施 Civil engineering	In use	Facility	

		Haidapu River Tunnel (651 Project) East					
P3	51	上海打浦路过江隧道（651 工程）西段 Haidapu River Tunnel (651 Project) West	1965	交通设施 Civil engineering	In use	Facility	
S1	52	虹桥卫星通信试验地面站 Hongqiao Satellite Communication Test Ground Station	1972	通信 Telecommunications	In use	Structure Facility	
S1	53	庐山号浮船坞 Lushan Floating Shipyard	1973	造船厂 Manufacture of other transport equipment	In use	Structure Facility	
S1	54	'远望 1'号航天测量船 Yuanwang-1 space survey ship	1978	天气测量 Weather report	Preserved	Facility	
G4/S1	55	运十飞机 Y-10 aircraft	1980	飞机制造 Manufacture of other transport equipment	Preserved	Product	
S2	56	白猫洗涤剂厂库房 White Cat Detergent Factory Warehouse	1990	化工厂 Manufacture of chemicals and chemical products	Reused	Architecture	白猫企业主体展馆 White Cat Enterprise Main Exhibition Hall
S1	57	上海大明橡胶制品厂 Shanghai Daming Rubber Products Factory	1992	制造厂 Manufacture of rubber and plastics products	In use	Architecture, Structure, Facility	
S1	58	上海远东冰箱厂 Shanghai Far East Refrigerator Factory	1995	制造厂 Manufacture of electrical equipment	Reused	Architecture	崇明联华西门里 Chongming Lianhua Supermarket

Table 6. 5 List of industrial heritage in Shanghai (Green colour highlighted are the selected samples) (By author)

1 column: the list to which the heritage belongs (P-Protection list, G-National list, S-Shanghai list)
2 column: number of heritages
3 column: Established date
4 column: Industry
5 column: Preservation and regeneration status
6 column: Heritage contents
7 column: Current function and occupancy

6.2.2 Urban Industrial Heritage Samples

According to the definition of an urban industrial heritage quarter, the samples must meet the following research requirements. Firstly, the samples should already be regenerated into new functions. So, the heritage sites where their original industries are still functioning or sites that are awaiting renovation will not be selected as samples. Secondly, the spatial character of the heritage quarters can be classified into the three spatial types (clustered industrial heritage quarters, decentralized industrial heritage quarters, and industrial heritage complexes) defined in Chapter 2. Therefore, independent and small-scale industrial buildings, facilities and structures, and other heritage items will not be considered. Thirdly, from the relationship between the urban context, the industrial heritage quarters should be used as multi-functional quarters integrating with the surrounding context. Some of the industrial quarters have been reused by other companies and are not accessible to the public, so they will not be regarded as urban quarters.

From the designated list of industrial heritages in Table 6.5, 15 heritage sites are qualified samples in this study, which are marked in green colour. After regeneration, heritage No.10 and No.39 are integrated into M50 Creative Park. Finally, this study has 14 sample sites, including 15 listed industrial heritages.

编号 No.	上海工业遗产区 Shanghai Industrial Heritage Quarters	改造项目 Regeneration Project
1	董家渡船坞董家渡船坞 Dongjiadu Shipyard	船坞滨江绿地 Ferry Waterfront
2	上海船厂-浦东 Shanghai Shipyard - Pudong	船厂 1862 Shipyard 1862
3	江南机器制造总局（含求新机器造船厂） Jiangnan Machine Manufacturing Bureau (Qiuxin Machine Shipyard)	浦西滨江世博园 Puxi Riverside Expo Park Area
4	阜丰面粉厂 Fufeng Flour Mill 信和纱厂 Xinhe Spinning Mill	M50 创意产业园 M50 Creative Park
5	上海铁路南浦站 Shanghai Nanpu Railway Station	启点 1907 Station 1907
6	工部局电气处（杨树浦电厂）Shanghai Municipal Council Electricity Department, Yangshupu Power Plant	杨树浦电厂遗迹公园 Shanghai Yangshupu Power Plant Heritage Park
7	大中华纱厂和华丰纱厂 Great China Spinning Mill and Huafeng Spinning Mill	半岛 1919 文化创意产业园 Peninsula 1919 Cultural and Creative Industrial Park
8	上海麻袋厂 Shanghai Burlap Factory	景源时尚产业园 Jingyuan Fashion Industry Park 创享塔 The X Tower
9	上海第十七棉纺织总厂旧址 Shanghai No. 17 Cotton Textile Factory	上海国际时尚中心 Shanghai International Fashion Centre
10	上海北票煤码头 Shanghai Beipiao Coal Wharf	徐汇滨江西岸 Xuhui West Bund Waterfront

11	工部局宰牲场 Shanghai Municipal Council Slaughterhouse	1933 老场坊 1933 Old Millfun
12	上海飞机制造厂（5703 厂） Shanghai Aircraft Manufacturing Plant, Factory 5703	西岸艺术中心 West Bund Artistic Centre 上海油罐艺术中心 Shanghai Oil Tank Art Centre
13	南门粮库 Nanmen Grain Depot	松江云间粮仓文化产业园 Cloud Grain Silo Cultural and Creative Industrial Park
14	上海冶金矿山机械厂旧址 Shanghai Metallurgical Mining Machinery Plant	静安新业坊 Jing'an New Business Park

Table 6. 6 Selected samples (By author)

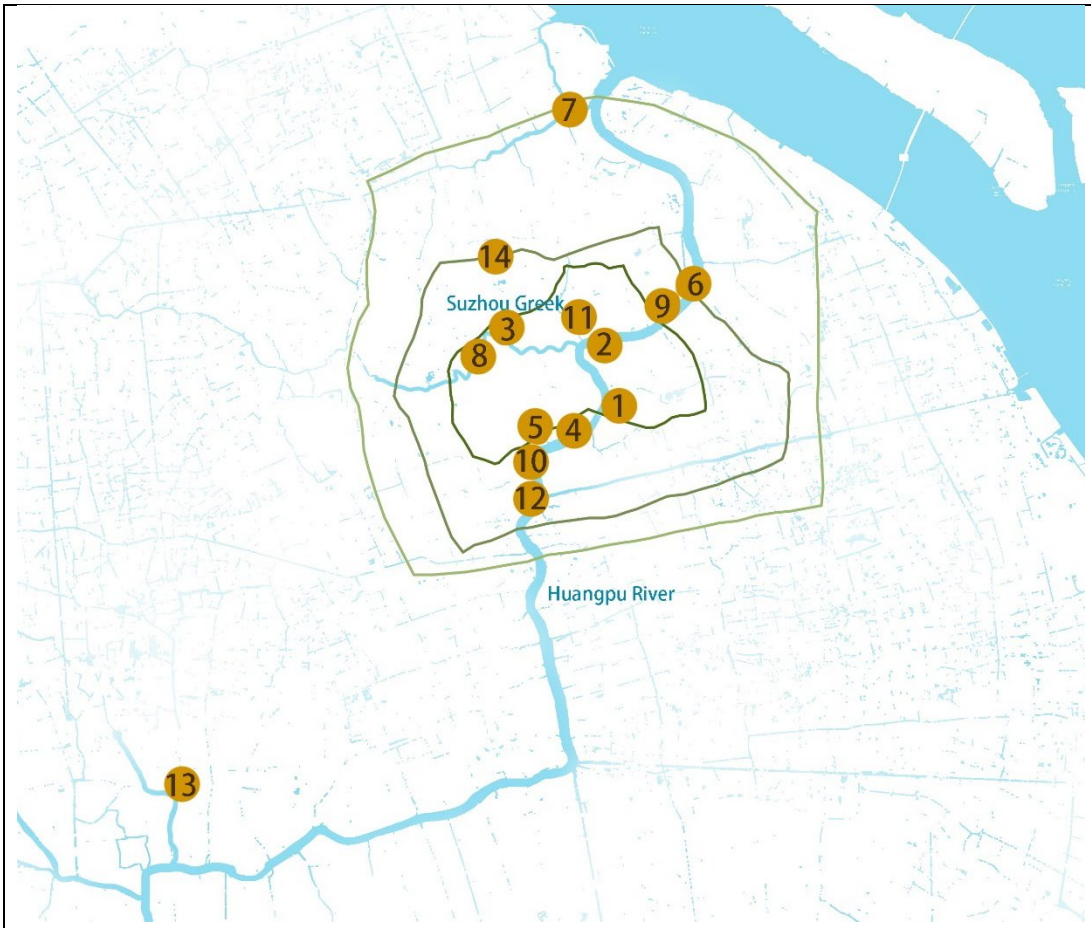


Figure 6. 15 Location of the samples (Draw by author)

Among the selected samples, 13 sites are located within the outer ring area of Shanghai, while Nanmen Granary (which is now Yunjian Granary Creation Park) is located in Songjiang District. These samples are highly diverse in terms of historical periods, geographical locations, types of industries, scale, spatial layouts, types of buildings, and existing functions. They represent a wide array of industrial heritages and transformation styles from different eras under the current conditions. (Table 6. 6) (Figure 6. 16)

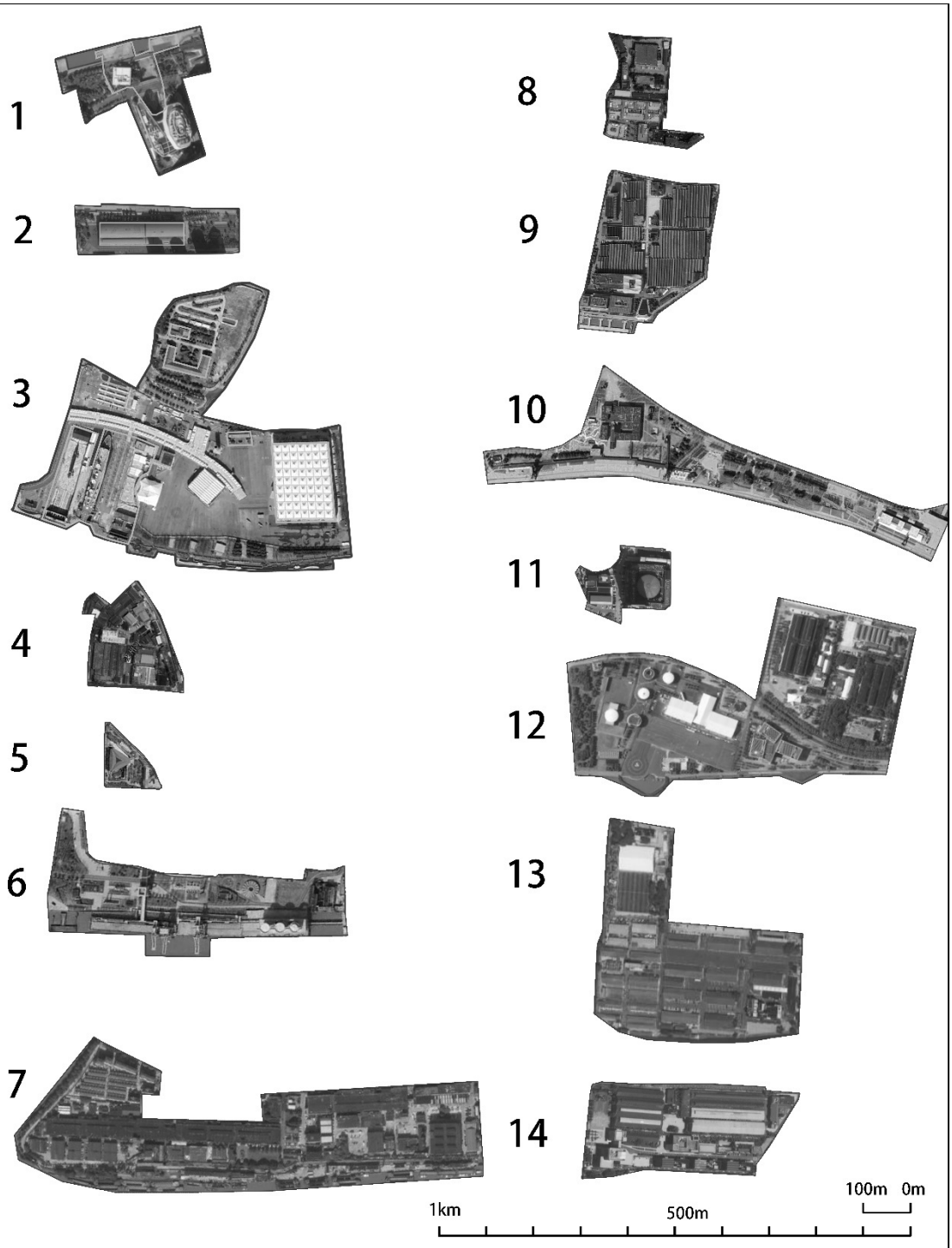


Figure 6. 16 Scale comparison of the selected samples (Draw by author)

Table 6.7 summarises the key characteristics of the 14 samples.

The majority of these 14 samples are industrial heritage sites dating from the late Qing Dynasty (1840-1912) and the Republican period (1912-1949). The regeneration of

industrial heritage sites occurred primarily in two phases. The first phase was before the 2010 Shanghai World Expo, which served as a catalyst for many urban regeneration projects. The second phase began after 2015, when cities across China gradually started recognizing and protecting industrial heritage, leading to an increase in conservation and reuse projects.

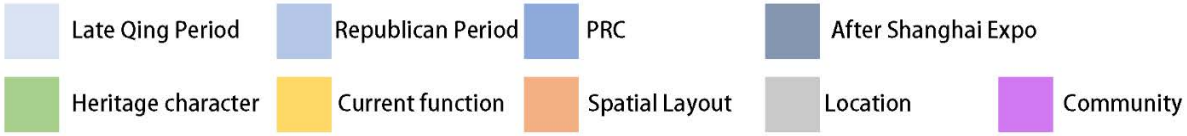
The 14 samples are rich in heritage content. Most cases include more than two types of tangible heritage. However, the Dongjiadu Shipyard, which underwent demolition before regeneration, retained only the dock landscape. Jingyuan and 1933 Millfun are urban quarters only composed of industrial buildings.

In terms of current functions, most of these 14 samples have been developed for commercial and cultural uses, with fewer sites converted into residential areas. The residential function of Peninsula 1919 continues the former employee housing area of the factory. The spatial distribution mainly consists of clustered industrial heritage quarters.

As Shanghai's industrial and urban development was based on ports and waterways, most industrial heritage sites have a waterfront characteristic and are located in central city areas. Only Station 1907 was regenerated from a railway heritage site, the old Nanpu Station, to assist in the transportation of the Beipiao Coal Dock. As the industrial structure transformed and urbanization progressed, most industrial communities gradually disappeared after factories ceased operations, with Peninsula 1919 being the only site that preserved its industrial community.

No.	Established date	Close date	Regeneration date	Heritage				Current Function							Spatial layout			Location			Industrial community
				Landscape	Architecture	structure	Machine	Residential	Retail	Hospitality	Office	Leisure and recreation	Culture	Green	Clustered	Decentralized	Complex	Waterside	Railway	Central area	
1	1853	2005	2015																		
2	1862	2005	2017																		
3	1865	2008	2008																		
4	1898	1990	2009																		
5	1907	2009	2019																		
6	1911	2010	2018																		
7	1919	2006	2007																		
8	1920		2016																		
9	1921	2007	2009																		
10	1929	2009	2009																		
11	1933	2002	2006																		
12	1950	2014	2019																		
13	1953	1998	2017																		
14	1959	2009	2016																		

Table 6. 7 Basic information and key characteristics of samples (By author)



6.2.3 Brief Introduction of Samples

The following information provides a brief overview of 14 samples. The introduction mainly covers the historical significance and functions, development process, important dates of shutdown and redevelopment, and the current functions after regeneration of each industrial heritage. This information serves as a foundation for subsequent data collection and extraction steps.

Sample 1: The Dongjiadu Shipyard – Ferry Waterfront

The Dongjiadu Shipyard, the first modern shipyard in Shanghai's history, was established in 1853 and operated until the mid-1990s. The Dongjiadu Shipyard Exhibition Hall project utilizes the main structure of the Maritime Building as a landscape-style extension facing the Huangpu River, serving as a symbol of Chinese maritime. This shipyard was closed in 2005, and all the buildings were demolished in 2010. Luckily the original dock landscape was kept. In 2015, the regeneration project was launched with the development of the east bank. The site was developed into the headquarter of China Cosco Shipping Corporation Limited. While preserving the dry dock's original historical features, the project has created a connected green space as part of the city's green belt. (Figure 6. 17, Figure 6. 18)



Figure 6. 17 Dongjiadu Shipyard in 1853 (https://news.sjtu.edu.cn/mtjj/20190413/100217.html Last access 17/11/2024)



Figure 6. 18 Ferry Waterfront (http://www.360doc.com/content/19/1205/20/9570732_877688291.shtml Last access 17/11/2024)

Sample 2: The Shanghai Shipyard Pudong - Shipyard 1862

The Shanghai Shipyard-Pudong, originally the British-owned Union Shipyard and the China Merchants Bureau Machine Shipyard, was established in 1862 with an initial dock shoreline of 413 meters. By the end of 1995, the shipyard occupied an area of 589,000 square meters and employed over 8,500 workers. The dock shoreline extended over 1,500 meters, enabling the construction of ships up to 60,000 tons. The shipyard was moved and closed in 2005 and was developed into a commercial complex, including a theatre, retail and restaurants. (Figure 6. 19, Figure 6. 20)

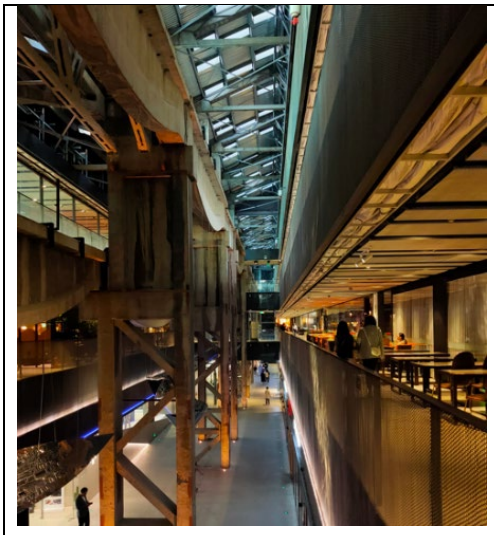


Figure 6. 19 View inside the building (Photo by author)



Figure 6. 20 Design of the building (http://wap.eworldship.com/index.php/eworldship/news/article?id=115727 Last access 17/11/2024)

Sample 3: The Jiangnan Machinery Manufacturing Bureau - Puxi Riverside Expo Park Area

The Jiangnan Machinery Manufacturing Bureau, also known as the Shanghai Machinery Bureau, was established in 1865. It was the largest modern military enterprise formed during the Self-Strengthening Movement of the Qing Dynasty. The early factory buildings of the Jiangnan Machinery Manufacturing Bureau were among the first modern factories of the time. It served as the predecessor to the Jiangnan Shipyard.

	
Figure 6. 21 Submarine Museum (https://jtw.sh.gov.cn/tpxw/20230424/010cc9dd5d7f4425bdf15e63b5071c20.html Last access 17/11/2024)	Figure 6. 22 CSSC Pavilio (https://www.kjcxpp.com/HTML/wap/qkgl/1468.shtml Last access 17/11/2024)

The factory area was closed in 2008 and was planned for Expo 2010. The area has preserved three docks; one has been designed as the Submarine Museum, one is parking the Yuanwang-1 Survey Ship for display, and another is reused as the Skateboarding Centre. The original manufacturing shed was preserved and reused as the ship museum CSSC Pavilion. (Figure 6. 21, Figure 6. 22)

Sample 4: The Xinhe Yarn Factory / The Fufeng Flour Mill – M50 Creative Park

The Xinhe Yarn Factory, established in 1937, housed 20 looms and employed over 1,000 workers. The site retains more than 50 industrial buildings from various historical periods ranging from the 1930s to the 1990s, encompassing a total area of 41,000 square meters. The M50 Fufeng Flour Mill, established in 1898, was the first mechanized flour mill founded in the Chinese national capital. (Figure 6. 23, Figure 6. 24)

By the 1930s, it possessed 90 steel milling machines, with a daily flour production capacity of 26,000 bags, accounting for approximately 17.5% of the national mechanized flour production capacity. In 1956, it became the largest flour mill in the country. The main remnants include the factory buildings, office buildings, and workers' residential areas. This makes it one of the most complete preserved collections of national textile industrial architecture along the Suzhou River. All the factories were closed in 1990, and the quarter was developed into a Creative Industry Park in 2009.



Figure 6. 23 Old image of Xinhe Factory (https://www.thepaper.cn/newsDetail_forward_9683234 Last access 17/11/2024)

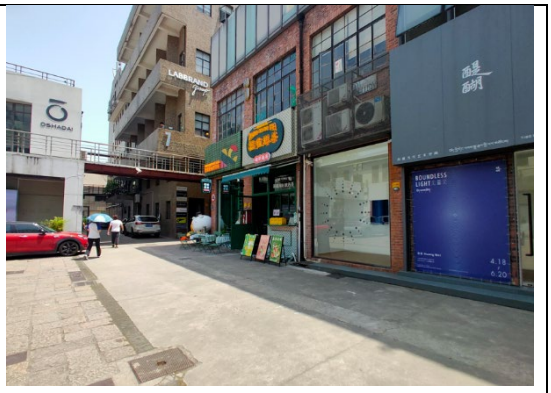


Figure 6. 24 Current space inside M50 (Photo by author)

Sample 5: The Nanpu Railway Station – Station 1907

The Nanpu Railway Station in Shanghai, originally constructed in 1907, was primarily responsible for the loading and unloading of goods on the Huangpu River. It was the only station in the Shanghai railway area to have its own dedicated dock. The station shut down in 2019. It has been transformed into the Station 1907 Creative Park in 2019. The renovation has preserved the railway tracks, blue bricks, station wall lamps, wooden canopies, platforms, and warehouses. The station building itself has been converted into an art gallery. (Figure 6. 25, Figure 6. 26)



Figure 6. 25 Old image of Nanpu Station (https://news.sina.cn/sa/2010-05-22/detail-ikmxzfmk0034247.d.html Last access 17/11/2024)



Figure 6. 26 Current square of Station 1907 (https://j.eastday.com/p/1701621306035463 Last access 17/11/2024)

Sample 6: Yangshupu Power Plant - Power Plant Heritage Park

Yangshupu Power Plant, established in 1911 as Shanghai Municipal Council Electricity Department, was one of the first large-scale thermal power plants built in modern China. By 1924, the plant's annual electricity generation capacity reached 121,000 kilowatts, making it the largest power plant in the Far East at the time. The primary remnants include an office building, the engine room, the water intake, the pump room, the old unit circulating pump house, and two chimneys. The plant closed in 2010 and started the regeneration process in 2018. It is now been transformed into the Yangshupu Power Plant Heritage Park. (Figure 6. 27, Figure 6. 28)

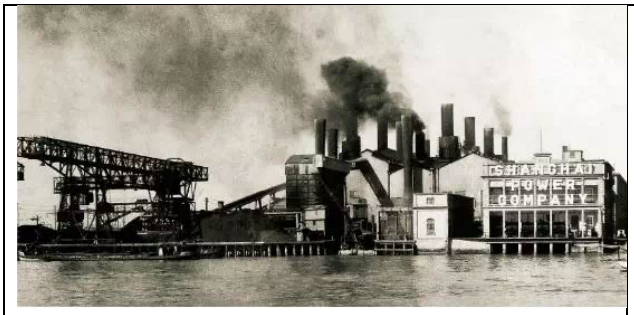


Figure 6. 27 Old image of the power plant (https://www.thepaper.cn/newsDetail_forward_4386897 Last access 17/11/2024)



Figure 6. 28 Heritage Park green path (photo by author)

Sample 7: The Shanghai No. 8 Cotton Textile Factory - Peninsula 1919 Cultural and Creative Industrial Park

The Shanghai No. 8 Cotton Textile Factory, also known as National Cotton Factory No. 8, originated from the establishment of the Greater China Yarn Factory in 1919 and the Huafeng Yarn Factory in 1920. By 1988, the factory's total output value reached 177.12 million yuan, with an export value of 59.12 million yuan, and it employed 9,945 workers. (Figure 6. 29, Figure 6. 30)

In 2007, a year after it closed, the site was transformed into the ‘Peninsula 1919’ creative industry park, where 68 historic buildings were preserved and restored.

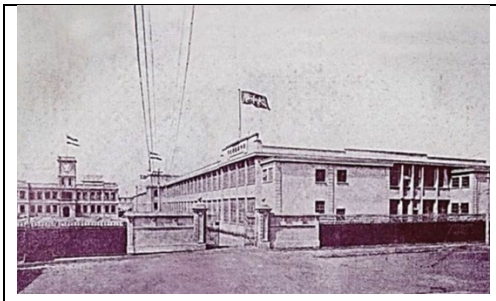


Figure 6. 29 Old image of the factory (https://www.quzefang.cn/2020/NieJiaPu.htm Last access 17/11/2024)



Figure 6. 30 Bird view of Peninsula 1919 (https://www.shbsq.gov.cn/shbs/bsdt/20231007/372977.html Last access 17/11/2024)

Sample 8: The Shanghai Sack Factory and Clothing Factory – Jingyuan Jingyuan Fashion Industry Park and The X Tower Innovative Park

The Shanghai Sack Factory, originally established in 1920 as a Japanese-owned sack factory, is located along the banks of the Suzhou River. The existing historical structures include a two-story gabled warehouse and a four-story tower.



Figure 6. 31 Current condition of Jingyuan

(https://www.quanhuaoffice.com/office/1863.html Last access 17/11/2024)

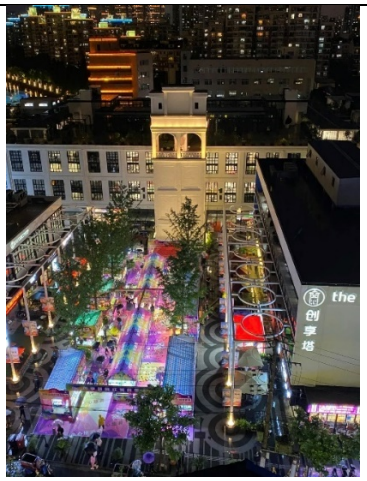


Figure 6. 32 Bird view of the X Tower

(https://m.thepaper.cn/newsDetail_forward_13632877 Last access 17/11/2024)

The warehouse is constructed with brick and timber, while the tower features a steel-reinforced concrete structure. The warehouse area was redeveloped in 2009, and the tower area was regenerated in 2016. (Figure 6. 31, Figure 6. 32)

Sample 9: The 17th Cotton Textile Factory - Shanghai International Fashion Centre

The 17th Cotton Textile Factory was originally established in 1921, beginning as the Shanghai Workshop set up by Osaka Toyo Textile Co., Ltd. from Japan. Many of the retained buildings feature the standard sawtooth-shaped roofs typical of textile industry factories, as well as office buildings. The factory shut down in 2007. In 2009, it started to regenerate and was finished and opened to the public in 2011. These structures have been transformed into the Shanghai International Fashion Centre. The fashion show venue was updated by lowering the ground floor and utilizing higher new sawtooth roof trusses to increase the ceiling height. (Figure 6. 33, Figure 6. 34)

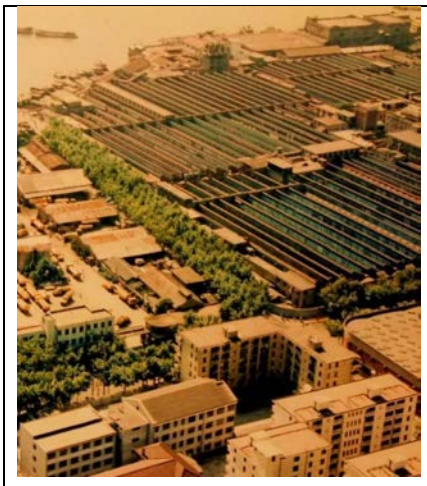


Figure 6. 33 Historical bird view of the factory district (http://sh.people.com.cn/n2/2023/0128/c134768-40280082.html Last access 17/11/2024)



Figure 6. 34 Market street within the developed centre (Photo by author)

Sample 10: The Beipiao Coal Wharf - Xuhui West Bund Waterfront

The Beipiao Coal Wharf, established in 1929, is located on the west bank of the Huangpu River, west of the Shanghai South Railway Station. The shoreline is approximately 515 meters long.

It served as a specialized dock for coal unloading at the Shanghai Port, handling coal transportation from various locations in northern China as well as coal transshipment tasks for regions like Jiangsu, Zhejiang, and Fujian. It supported over 60% of Shanghai's industrial and civilian coal supply. By 2008, the annual throughput of goods was about 14 million tons. The site closed and planned for regeneration in 2009, and has now been transformed into an open public green space, including an art gallery. (Figure 6. 35, Figure 6. 36)



Figure 6. 35 Coal Wharf in 2006 (http://www.99ys.com/home/1970/01/01/08/214734.html Last access 17/11/2024)



Figure 6. 36 Regenerated area in 2015 (https://kknews.cc/zh-sg/culture/rl8y59o.html Last access 17/11/2024)

Sample 11: The Shanghai Municipal Slaughterhouse - 1933 Old Millfun

The Shanghai Municipal Slaughterhouse, established in 1933 and designed by the British architect Andrew Balfour, spans an approximate area of 29,500 square meters. The building was taken over by the Great Wall Biochemical Pharmaceutical Factory in 1958. It was decommissioned in 2002 and has since been transformed into the 1933 Old Millfun, now a hub for fashion and creative design. The venue serves as a stage for theatrical and musical performances as well as brand events. (Figure 6. 37, Figure 6. 38)



Figure 6. 37 Façade of the building (photo by author)



Figure 6. 38 Interior of the building (photo by author)

Sample 12: The Shanghai Aircraft Manufacturing Factory - West Bund Artistic Centre, Shanghai Oil Tank Art Centre

The Shanghai Aircraft Manufacturing Factory, established in 1950, was initially tasked with overhauling aircraft and manufacturing ground equipment and parts. In 1969, it became a final assembly plant for large jet airliners. The workforce grew from 374 employees in 1951 to 3,799 by 2009. Today, the site preserves the factory building as the West Bund Artistic Centre and the old aviation oil restorage tanks are reused as the Tank Shanghai Art Centre. (Figure 6. 39, Figure 6. 40)



Figure 6. 39 West Bund Artistic Centre (http://www.deshaus.com/Cn/Index/projectDetail/id/11.html Last access 17/11/2024)



Figure 6. 40 The Tank Shanghai Art Centre landscape (photo by author)

Sample 13: The Nanmen Granary - Cloud Grain Silo Cultural and Creative Industrial Park

The Nanmen Granary, originally constructed in 1953 as a grain storage facility and factory, spans approximately 136 acres with over 60 buildings covering nearly 40,000 square meters. It was responsible for grain procurement, transportation, storage, and processing. The site was abandoned in 1998 and gradually occupied by small private businesses. The facility was transformed into the Yunjian Granary Cultural and Creative Industry Park in 2017. (Figure 6. 41, Figure 6. 42)



Figure 6. 41 Historical image of the granary area (https://m.thepaper.cn/newsDetail_forward_23505366 Last access 17/11/2024)

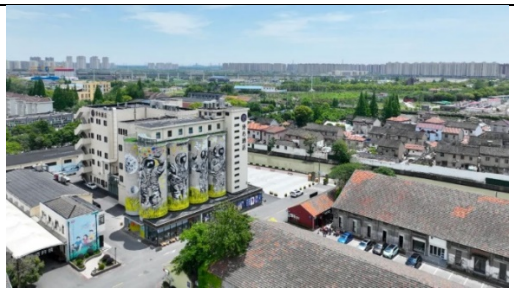


Figure 6. 42 Bird view of the silos after regeneration (https://m.jfdaily.com/sgh/detail?id=1256362 Last access 17/11/2024)

Sample 14: The Shanghai Metallurgical and Mining Machinery Factory - Jing'an New Business Park

The Shanghai Metallurgical and Mining Machinery Factory was established in 1959 and specialized in manufacturing metallurgical, mining, environmental, and general mechanical equipment. The facility covered an area of approximately 150,000 square meters, and was closed in 2009. It was transformed into the Jing'an Xinyefang International Cultural and Creative Industry Base in 2016, which focuses on promoting the film and television creative industries centred around content production. (Figure 6. 43, Figure 6. 44)

	
Figure 6. 43 Square od EVA in the quarter (https://k.sina.cn/article_3916177069_pe96c1ead02700hy4t.html Last access 17/11/2024)	Figure 6. 44 Bird view of the quarter after regeneration (https://web.shobserver.com/sgh/detail?id=1314327 Last access 17/11/2024)

6.2.3 Conclusion

This chapter discusses the selection of the case city and sample quarters.

Shanghai, with the longest industrial history in China, the most diverse range of industries, the largest number of factories, and the highest concentration of preserved industrial heritage, stands out as the most representative and comprehensive case city for this study.

The selection of Shanghai's industrial heritage samples was based on the requirement to meet the characteristics of an urban industrial heritage quarter, and only those that have undergone regeneration were included. The final 14 samples span a long period of history and contain a wide range of features, each with its own unique aspects within the broader context of Shanghai.

The data collection in Chapter 7 will be based on these 14 samples to explore the relationship between urban context and heritage value.

Chapter 7. Data Collection and Data Analysis

This chapter talks about the process of data collection and analysis through the regression model, and analyse the results generated from the modelling. The first section introduces process of data collection. The second section of this chapter will display the outcomes of data processing produced by the regression model. The results will be displayed in the diagram, revealing the impact trend of the indicators on values. By the end of the analysis, this study also uses a practical example to show how the result can be used to support decision-making.

7.1 Data Collection

Data collection refers to two processes in this study, which are value score collection and indicator collection.

7.1.1 Value Score Data

The value variation scores of all the samples are collected through questionnaires.

As introduced in Chapter 4.3.1, each qualified expert participant will score the value variation of all 14 samples. The questionnaire finally received 196 valid scoring table sheets.

Each score shown in the following Table 7.1 is the average score of 196 scores (the same value of the same sample).

		Historical	Scientific and historical	Socio-cultural	Aesthetical	Economic	Natural
1	Ferry Waterfront	27.3	8.2	31.2	27.8	15.2	42.4
2	Shipyard 1862	69.1	32.3	67.1	40.9	72.9	17.8
3	Puxi Expo Area	54.9	62.7	45.8	49.3	26.3	12.9
4	M50 Creative Park	63.4	12.6	82.8	29.1	63.1	3.1
5	Station 1907	57.1	5.1	55.7	67.5	67.2	8.4
6	Power Plant Park	75.7	66.4	63.3	81.5	25.7	84.3
7	Peninsula 1919	49.8	21.2	33.1	36.4	40.5	10.2
8	Jingyuan Fashion Industry	6.2	3.7	27.2	15.1	51.1	-2.9
9	International Fashion Center	37.8	27.1	24.4	25.8	76.4	37.1
10	Xuhui Waterfront	19.2	22.3	31.2	73.2	18.3	33.8
11	1933 Old Millfun	26.3	3.3	38.7	46.2	13.7	-1.1
12	West Bund Artistic Center	14.3	10.6	21.2	27.4	24.1	3.1
13	Cloud Grain Silo	52.7	23.4	41.1	61.9	57.2	21.4
14	Jing'an New Business Park	44.1	19.1	43.4	34.3	39.2	18.8

Table 7. 1 Value variation scores of each sample. Green coloured scores are the highest number of each value, blue coloured scores are the lowest number of each value (By author)

According to the score, the Yangshupu Power Plant Heritage Park is evaluated as the most significantly improved sample after regeneration. The site has preserved most of the intangible heritage and displays the heritage along the waterfront green belt.

The M50 Creative Park serves as a cluster of creative businesses. The small businesses on the site have formed an active community, which is considered a significant improvement in social and cultural perspectives.

As there are no production facilities and machines visible in the 1933 Old Millfun, the scientific and technological value is rarely improved.

The regeneration performance of Jingyuan Fashion Park is regarded as dissatisfactory, especially in terms of natural value. However, it is considered to have a decent increase in economic condition after regeneration.

The Shanghai International Fashion Centre enjoyed the most significant boost of economic value, and it is now the famous fashion outlet and urban landmark of Yangpu District.

7.1.2 Indicator Data

All indicators of the 14 samples will be counted, calculated, or retrieved from resources following the indicator quantification methods introduced in Chapter 5.2. The full data list is shown in Table 7.2 at the end of this section. To illustrate how each kind of data was collected, this part will give examples of the calculation process.

Due to the limitations of sample size and data availability, there is no sample that has full valid data for all indicators. Therefore, for each indicator, we will select the sample with the largest data and diagrams for illustration. If more than one sample has the same data, the example will select the sample of first order from the list. Detailed information, data resources, and diagrams of all the samples will be included in the Appendices-Samples Indicator Diagrams and Resources.

In1. Area proportion of elevation change

$$\text{In } 1 = \frac{\text{Area of elevation change}}{\text{Total area of the site}}\%$$

The Ferry Waterfront extended the area of the original dock as a sinking plaza connecting with the office building. The total area of The Ferry Waterfront is 22403m^2. The elevation change area is 8065 m^2. (Figure 7. 1)

$$\text{In } 1 \text{ of Sample } 1 = \frac{8065}{22403} = 0.36$$

In2. Average elevation change degree

$$\text{In } 2 = \frac{\text{Total elevation change}}{\text{Area of elevation change}}$$

For the Ferry Waterfront, the integral of the total elevation change is 25162.8m. (Figure 7. 2)

$$\text{In } 2 \text{ of Sample } 1 = \frac{25162.8}{8065} = 3.12$$

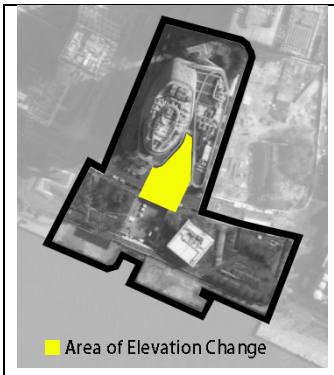


Figure 7. 1 Elevation change area of Ferry Waterfront In1 (adapted from google map by author)

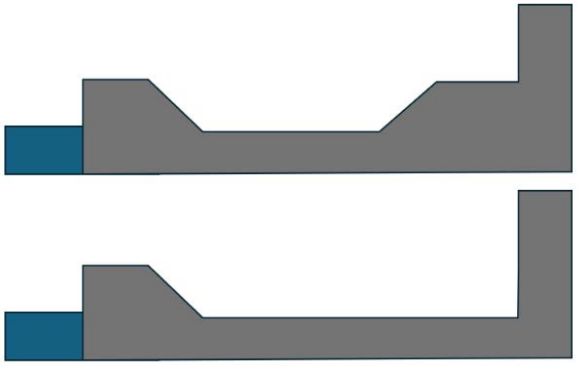


Figure 7. 2 Elevation changes section of Ferry waterfront In2 (adapted from google map by author)

In3. Variation of green plot ratio

$$\text{In } 3 = \frac{\text{Post area of greenery} - \text{Pre area of greenery}}{\text{Total area of the site}}\%$$

According to the historical map, the Shanghai Yangshupu Power Plant Heritage Park had no green area. After regeneration, this quarter added a large area of greenery between buildings and along the riverside. The current green space area is 11944m^2. The total project area of the current site is 35445m^2. (Figure 7. 3, Figure 7. 4)

$$\text{In 3 of Sample 6} = \frac{11944 - 0}{35445} = 0.33697$$



Figure 7. 3 Shanghai Yangshupu Power Plant Heritage Park Area (adapted from google map by author)

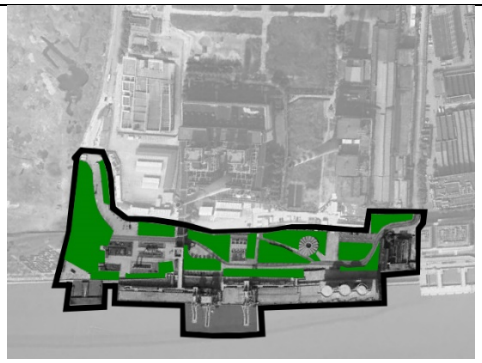


Figure 7. 4 Green space of Shanghai Yangshupu Heritage Park (adapted from google map by author)

In4. Variation in the diversity of greenery

$$\text{In } 4 = \text{Number (post types of greenery)} - \text{Number (pre types of greenery)}$$

After regeneration, the Shanghai Yangshupu Power Plant Heritage Park became part of the green belt on the west bank with a wide diversity of green space types, including a green path, small gardens, riparian green belts, green walls, and plant boxes. (Figure 7. 5, Figure 7. 6)

$$\text{In 4 of Sample } 6 = 5 - 0 = 5$$



Figure 7. 5 Power Plant Heritage Park Garden (Photo by author)

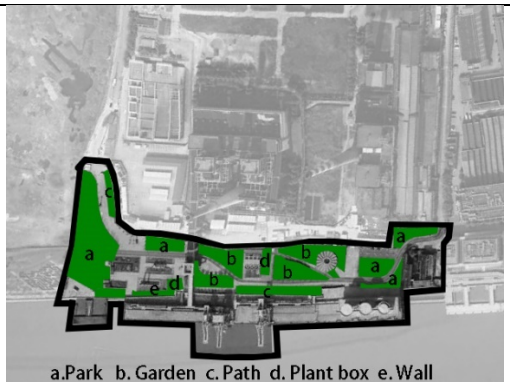


Figure 7. 6 Green types in Power Plant Heritage Park In4 (Post) (adapted from google map by author)

In5. Variation in the rate of open spaces area

$$\text{In } 5 = \frac{\text{Post area of open space} - \text{Pre area of open space}}{\text{Total area of the site}}\%$$

The Shanghai Yangshupu Power Plant Heritage Park did not have public space before regeneration. Now, it is facilitated with sufficient open spaces, with an area of 18056m^2. (Figure 7. 7)

$$\text{In 5 of Sample 6} = \frac{18056 - 0}{35445}\% = 0.509$$

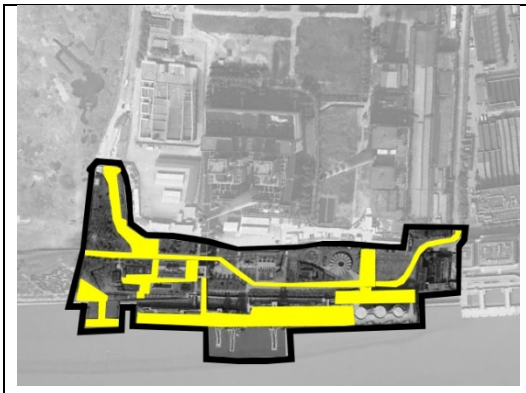


Figure 7. 7 Open space in Power Plant Heritage Park In5 (Post) (adapted from google map by author)

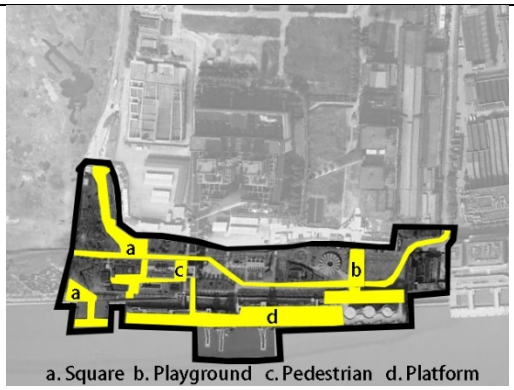


Figure 7. 8 Open space types in Power Plant Heritage Park (adapted from google map by author)

In6. Variation in the diversity of open spaces

$$\text{In } 6 = \text{Number (post types of open space)} - \text{Number (pre types of open space)}$$

The Shanghai Yangshupu Power Plant currently has small squares, inclusive playgrounds, pedestrian zones around the buildings, and waterfront platforms. (Figure 7. 8)

$$\text{In 6 of Sample 6} = 4 - 0 = 4$$

In7. Variation in the rate of waterbody area

$$\text{In } 7 = \frac{\text{Post area of waterbody} - \text{Pre area of waterbody}}{\text{Total area of the site}}\%$$

According to the data collection, no sample has enclosed waterbody areas.

In8. Variation in the rate of water active frontage

$$\text{In } 8 = \frac{\text{Post length of water active frontage} - \text{Pre length of water active frontage}}{\text{Total site perimeter}}\%$$

The waterfront of the Shanghai Yangshupu Power Plant was ship docks that were inaccessible to public users.

After regeneration, the site is actively interactive with the riverside through waterfront platforms, where people can walk and sit to enjoy the view of the east bank. The total perimeter of the site boundary is 1180m, with around 52.4% of the riverside being active frontage. (Figure 7. 9, Figure 7. 10)

$$\text{In } 8 \text{ of Sample } 6 = \frac{618 - 0}{1180} = 0.523729$$

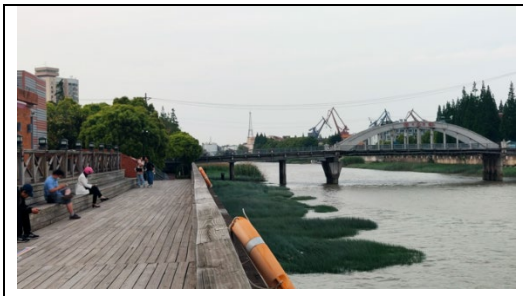


Figure 7. 9 Active waterfront of Shanghai Yangshupu Power Plant (Photo by author)

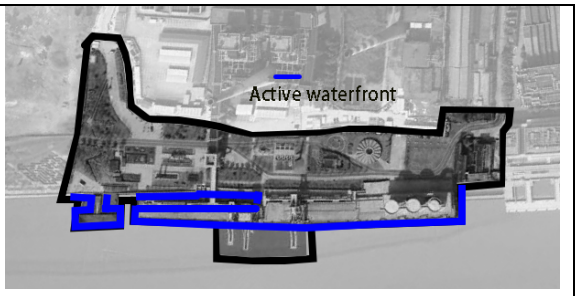


Figure 7. 10 Water active frontage of Shanghai Yangshupu Power Plant (adapted from google map by author)

In9. Variation of facilities that reduces climate influence on living environment

$$\text{In } 9 = \text{Number (post climate mitigating facilities)} - \text{Number (pre climate mitigating facilities)}$$

The Puxi Expo Park has added a walking path with sided shading. It also builds a big scaled shed on one side of the Skating Park. (Figure 7. 11)

$$\text{In } 9 \text{ of Sample } 3 = 10 - 0 = 10$$

In10. Variation of facilities that utilize climate resources

$$\text{In } 10 = \text{Number (post climate resource facilities)} - \text{Number (pre climate resource facilities)}$$

Solar street lamps were constructed on the site along the walking path and waterside to reduce energy utilization. (Figure 7. 12)

$$\text{In } 10 \text{ of Sample } 3 = 9 - 0 = 9$$

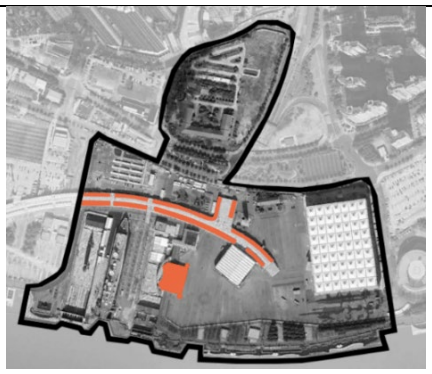


Figure 7. 11 Sun shading facilities of Puxi Expo Area (adapted from google map by author)

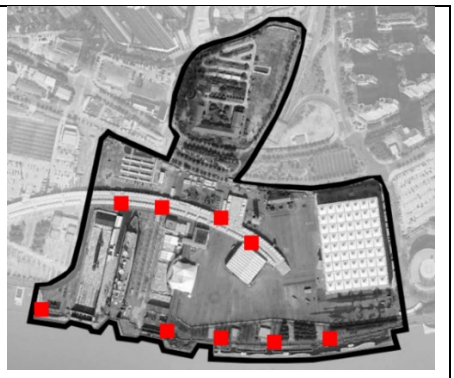


Figure 7. 12 Solar lamps of Puxi Expo Area (adapted from google map by author)

In11. Improvement of the environmental quality

$$\text{In } 11 = \text{Average reduction rate (air water soil noise)}\%$$

The Power Plant Heritage Park has been mentioned to improve the environmental quality, with 13.5% pollution reduced one year after regeneration. Reference see Appendix Samples Indicator Diagrams and Resources Sample 6 In11.

$$\text{In } 11 \text{ of Sample } 6 = 13.5\%$$

In12. Recycling rate of construction and demolition waste (CDW)

$$\text{In } 12 = \text{Recycle rate of CDW } \%$$

The 1933 Millfun has been mentioned that it recycled 8.56% of its construction waste. Reference see Appendix Samples Indicator Diagrams and Resources Sample 11 In 12.

$$\text{In 12 of Sample 11} = 0.0856\%$$

In13. Waste management input

$$\text{In 13} = \frac{\text{Number of waste collection facilities}}{\text{Total area of the site}}$$

For Station 1907, the waste bins and battery recycling points are marked on the map. (Figure 7. 13)

$$\text{In 13 of Sample 5} = \frac{4}{9197} = 0.000435$$

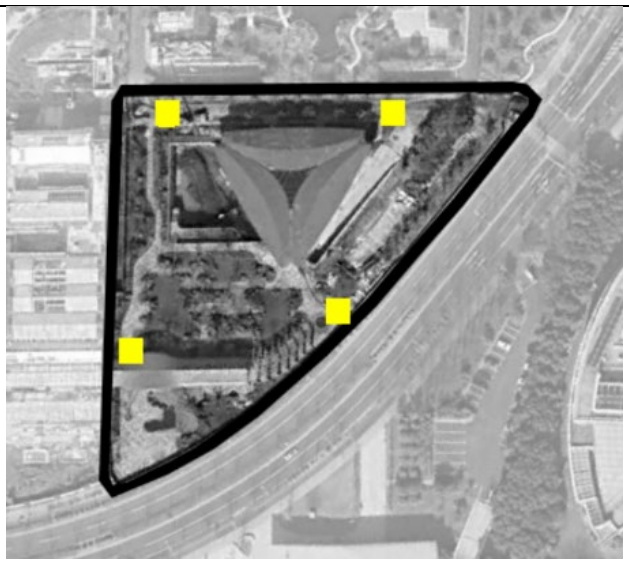


Figure 7. 13 Distribution of waste bins and battery recycling point in Station 1907 (adapted from google map by author)

In14. Variation in the rate of biological diversity

$$\text{In 14} = \text{Increase rate of biodiversity \%}$$

No records are available for any samples of this indicator.

In15. Variation of the industrial heritage quarter boundary openness

$$\text{In 15} = \frac{\text{Post length of openness} - \text{Pre length of openness}}{\text{Total perimeter of the site}}\%$$

The Shipyard 1862 was an enclosed shipyard factory, which had hard-fencing boundaries with only entrances available for staff to access. After regeneration, the hard boundaries were demolished. The design then returned the riverside space to the public with a garden area, waterfront pathway, and outdoor dining area. (Figure 7. 14, Figure 7. 15)

$$\text{In 15 of Sample 2} = \frac{556 + 0.5 * 331 - 0}{892} = 0.809$$

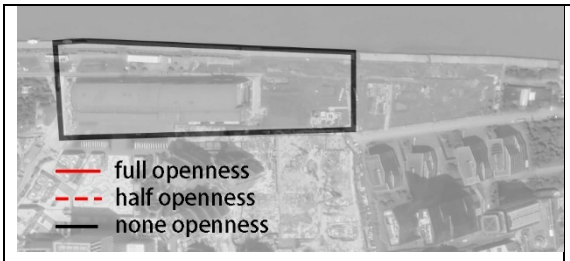


Figure 7. 14 Shipyard 1862 openness before regeneration (adapted from google map by author)



Figure 7. 15 Shipyard 1862 openness after regeneration (adapted from google map by author)

In16. Variation of the density difference between the site and surrounding context

$$\text{In 16} = \text{Post density difference} - \text{Pre density difference}$$

$$\text{Density} = \frac{\text{Total architectural gross floor area}}{\text{Total area of the site}}\%$$

$$\text{Density difference} = \text{Density of the site} - \text{Density of surrounding area}$$



Figure 7. 16 Original density of M50 Creative Park (adapted from google map by author)



Figure 7. 17 Current density of M50 Creative Park (adapted from google map by author)

The construction of the surrounding urban quarter progressed gradually with the launch of the M50 Creative Park. It was nearly empty in the north space, but it has now been developed into high-rise office buildings and commercial apartments. (Figure 7. 16, Figure 7. 17)

$$\text{In 16 of Sample 4} = \left(\frac{26895}{30500} - \frac{62518}{128000}\right) - \left(\frac{13175}{30500} - \frac{58698}{128000}\right) = 0.42$$

In17. Variation of the textural difference between the site and surrounding context

$$\text{In 17} = \text{Post f difference} - \text{Pre f difference}$$

$$\text{f} = \text{fractal dimension} = \frac{2\ln(\text{Total perimeter of the site})}{\ln(\text{Total ground floor area of adjoining architectures})}\%$$

$$\text{f difference} = \text{f of the site} - \text{f of surrounding area}$$

The fractal dimension around the site's boundaries varies with the construction conditions. For example, the texture near the Shanghai Yangshupu Power Plant Heritage Park remain unchanged, but the buildings are integrated into small one within the site, resulting in greater differences around that part. (Figure 7. 18, Figure 7. 19)

$$\text{In 17 of Sample 6} = \left(\frac{2\ln(1180)}{611} - \frac{2\ln(1180)}{26519}\right) - \left(\frac{2\ln(1180)}{27582} - \frac{2\ln(1180)}{28016}\right) = 0.02261$$



Figure 7. 18 Original fractal condition of Shanghai Yangshupu Power Plant Heritage Park (adapted from google map by author)

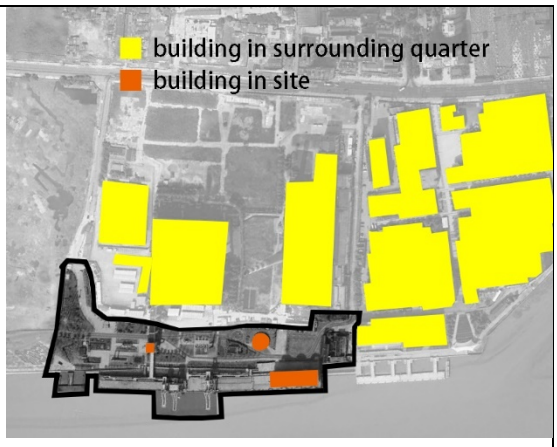


Figure 7. 19 Current fractal condition of Shanghai Yangshupu Power Plant Heritage Park (adapted from google map by author)

In18. Variation in functional diversity of the industrial heritage urban quarter

$$D = 1 - \sum_{i=1}^{S} p_i^2$$

p_i is the proportion of the site occupied by function i

$$\text{In18} = \text{Post D} - \text{Pre D}$$

As the original M50 industry closed many years ago, it had no functions before regeneration. After regeneration, it was developed as a creative industry park with diverse functions, including many small studios, offices, retail stores, and galleries. (Figure 7. 20)

$$\text{In18 of Sample 4} = 1 - \left(\left(\frac{11}{40}\right)^2 + \left(\frac{10}{40}\right)^2 + \left(\frac{10}{40}\right)^2 + \left(\frac{3}{40}\right)^2 + \left(\frac{6}{40}\right)^2\right) = 0.758$$



Figure 7. 20 Functional distribution within M50 Creative Park (adapted from google map by author)

In19. Variation of the functional distribution of the industrial heritage urban quarter

$$\mathrm{In19} = \frac{\mathrm{S}^2(\mathrm{Post}) - \mathrm{S}^2(\mathrm{Pre})}{\mathrm{Distance}(\mathrm{Average\ center} - \mathrm{Geometric\ center})}$$

$$\mathrm{S}^2 = spatial\ dispersion = \frac{\sum Distance(function\ point\ n - average\ centre)^2}{Number\ of\ function\ points - 1}$$

$$Average\ centre = (Average\ of\ horizontal\ coordinates, Average\ of\ vertical\ coordinates)$$

The functional distribution relates greatly to the site's configuration, which is sparser and more distant in linear sites such as Xuhui Riverside. (Figure 7. 21)

$$\mathrm{In19\ of\ Sample\ 10} = \frac{1846400/(16-1)}{73} = 1686$$

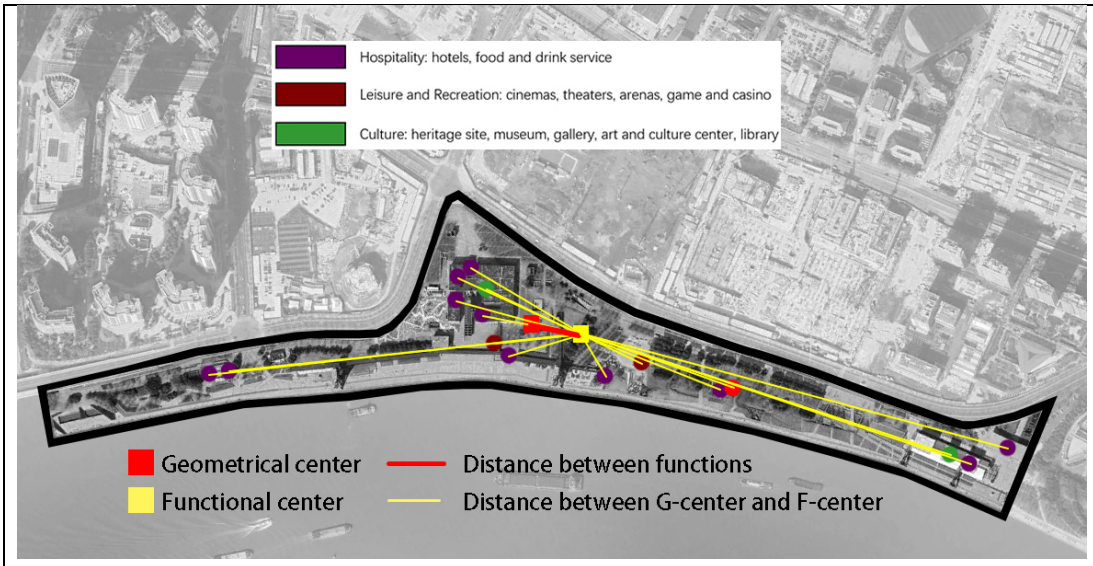


Figure 7. 21 Functional distribution within Xuhui Riverside (adapted from google map by author)

In20. Financial input rate of the urban circulatory system

$$\text{In20} = \frac{\text{Budget spent on the circulatory system}}{\text{Total area of the site}}$$

Shanghai Yangshupu Power Plant Heritage Park has been mentioned for putting 207million RMB into urban circulatory system. Reference see Appendix Samples Indicator Diagrams and Resources Sample 6 In 20.

$$\text{In20 of Sample 6} = \frac{20700}{35445} = 0.584$$

In21. Variation in the public transport connectivity

$$\text{In21} = \text{Number of increased public transportation}$$

The Puxi Expo has added three bus stops along the main road of the site. This data can be accessed based on maps, with pointed stops. (Figure 7. 22)

$$\text{In21 of Sample 3} = 3$$

In22. The number essential life service amenities within the site

$$\text{In22} = \text{Number of increased essential life service amenities}$$

The site has reserved a large area to use as the terminal for bus and ferry transfers near the main entrance. (Figure 7. 23)

$$\text{In22 of Sample 3} = 1$$



Figure 7. 22 Puxi Expo Area stations (Baidu map)



Figure 7. 23 Puxi Expo Area bus terminal (Baidu map)

In23. Heritage landscape.

$$\text{In23} = \frac{\text{Conserved area of heritage landscape}}{\text{Total heritage landscape}}\%$$

Shanghai Yangshupu Power Plant Heritage Park has a coal drop yard and dock, which have been kept and reused as playgrounds, pedestrian zones and waterfronts. (Figure 7. 24)

$$\text{In23 of Sample 6} = \frac{15698}{35445} = 0.443$$

In24. Heritage architecture

$$\text{In24} = \frac{\text{Conserved floor area of heritage architecture}}{\text{Total floor area of the heritage architecture}}\%$$

Traditional architecture in the Puxi Expo Area was preserved but not reused. Although they still remain closed to the public, front squares and introduction boards visually highlight the architecture, reminding people of its history. (Figure 7. 25)

$$\text{In24 of Sample 3} = 100\%$$

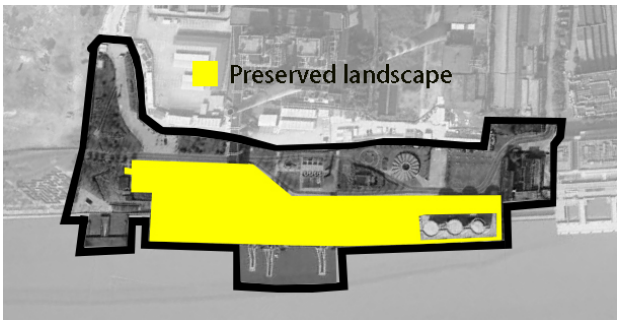


Figure 7. 24 Heritage landscape preserved at Yangshupu Power Plant Park (adapted from google map by author)

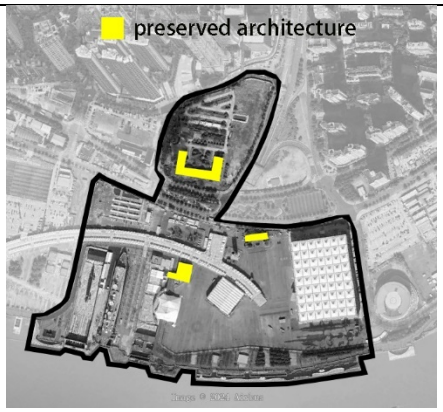


Figure 7. 25 Heritage architecture preserved at Puxi Expo Park (adapted from google map by author)

In25. Heritage structure

$$\text{In25} = \frac{\text{Conserved amount of physical structure}}{\text{Total amount of physical structure}}\%$$

The original silo in Cloud Grain Silo Cultural and Creative Industrial Park has been preserved as the exhibition centre's outer structure. (Figure 7. 26)

$$\text{In25 of Sample 13} = 100\%$$

In26. Heritage machinery

$$\text{In26} = \text{Number of conserved machines and items}$$

Shanghai Yangshupu Power Plant Heritage Park has preserved 3 riverside giant cranes and 11 machines. (Figure 7. 27)

$$\text{In26 of Sample 6} = 14$$

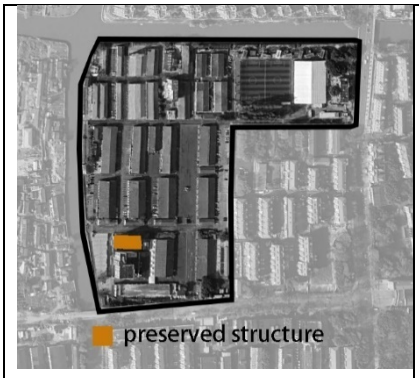


Figure 7. 26 Heritage structure preserved at Cloud Grain (adapted from google map by author)

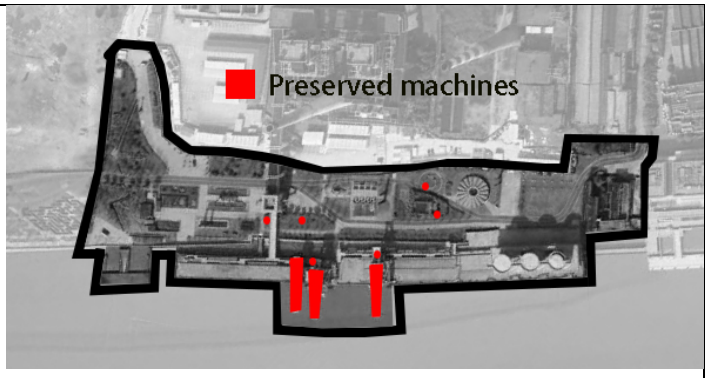


Figure 7. 27 Conserved machines at Power Plant Park (adapted from google map by author)

In27. Cultural and traditional events frequency

$$\text{In27} = \frac{\text{Total events held until research date}}{\text{Total years after regeneration until research date}}$$

According to the sample introduction, M50 has been regenerated for 15 years. It has been mentioned to have 2 memorial events after regeneration. Reference see Appendix Samples Indicator Diagrams and Resources Sample 4 In 27.

$$\text{In27 of Sample 4} = \frac{2}{15} = 0.133$$

In28. Educational and training programme events frequency

$$\text{In28} = \frac{\text{Total events held until research date}}{\text{Total years after regeneration until research date}}$$

M50 Creative Park has been mentioned to have 6 training workshops after regeneration. Reference see Appendix Samples Indicator Diagrams and Resources Sample 4 In 28.

$$\text{In28 of Sample 4} = \frac{6}{15} = 0.4$$

In29. Museum of industrial heritage

In 29 = Number of industrial museums

Puxi Riverside Expo Park has 1 maritime museum.

$$\text{In29 of Sample } 3 = 1$$

In30. Enhancing the interconnection with the local heritage system

In 30 = 1 (with interconnection) / 0 (without interconnection)

The Ferry Waterfront has been mentioned to be part of the Yangpu industrial heritage group, and under the same funding of Yangpu regeneration program. Reference see Appendix Samples Indicator Diagrams and Resources Sample 6 In 30.

$$\text{In30 of Sample } 6 = 1$$

In31. Regulation contents that relate to the conservation and regeneration of industrial heritage sites.

In31 = Number of relevant regulatory contents

Puxi Riverside Expo Park Area has been mentioned to be related to 3 conservation and regeneration regulations. Reference see Appendix Samples Indicator Diagrams and Resources Sample 3 In 31.

$$\text{In31 of Sample } 3 = 3$$

In32. Public participation during regeneration process

In32 = Total number of participants

Puxi Riverside Expo Park has been mentioned as having 36 experts participating in the planning during the regeneration process. No samples have consulted residential participants during regeneration. Reference see Appendix Samples Indicator Diagrams and Resources Sample 3 In 32.

$$\text{In32 of Sample } 3 = 36$$

In33. Variation in the real estate market

$$\text{In33} = \frac{\text{Post average property price} - \text{Pre average property price}}{\text{Pre average property price}}\%$$

The property price of the surrounding area of Puxi Riverside Expo Park has increased by 2.73 times. Reference see Appendix Samples Indicator Diagrams and Resources Sample 3 In 33.

$$\text{In33 of Sample 3} = \frac{12.7 - 3.4}{3.4} = 2.73$$

In34. Average tourism revenues of the heritage quarter

$$\text{In34} = \frac{\text{Tourism revenues per year}}{\text{Total area of the site}}$$

Shipyard 1862 has been mentioned to have 68.4million RMB per year in tourism revenues. Reference see Appendix Samples Indicator Diagrams and Resources Sample 2 In 34.

$$\text{In34 of Sample 2} = \frac{6840}{39000} = 0.175$$

In35. Budget for the regeneration process

$$\text{In35} = \frac{\text{Total budget of the project}}{\text{Total area of the site}}$$

Shanghai Yangshupu Power Plant Heritage Park has been mentioned to have a total of 2906.49million RMB in the budget for the regeneration. Reference see Appendix Samples Indicator Diagrams and Resources Sample 6 In 35.

$$\text{In35 of Sample 6} = \frac{290649}{35445} = 8.2$$

In36. Jobs provided during regeneration process

$$\text{In36} = \frac{\text{Number of jobs provided during regeneration progress}}{\text{Total area of the site}}$$

No records are available for any samples of this indicator.

In37. Job opportunities provided by the site utilization after regeneration

$$\text{In37} = \frac{\text{Number of job opportunities provided after regeneration}}{\text{Total area of the site}}$$

Ferry Waterfront has been mentioned to provide 2100 new jobs. Reference see Appendix Samples Indicator Diagrams and Resources Sample 1 In 37.

$$\text{In37 of Sample 1} = \frac{2100}{22403} = 0.0937$$

10 Xuhui Waterfront	9 International Fashion	8 Jingyuan	7 Peninsula 1919	6 Power Plant Park	5 Station 1907	4 M50	3 Puxi Expo	2 1862	1 Ferry	
0	0	0	0	0	0	0	0	0	0.36	In1
0	0	0	0	0	0	0	0	0	3.12	In2
0.319968	0.010359	0.026295	0.011429	0.336973	-0.09631	0.096492	0.020418	0.269487	0.300853	In3
4	0	1	0	5	2	1	2	4	3	In4
0.202119	0.106496	0.021633	0.005043	0.509409	0.046754	0.01918	0.342501	0.192282	0.259697	In5
3	3	1	1	4	1	1	3	2	3	In6
0	0	0	0	0	0	0	0	0	0	In7
0.450658	0.215	0.045093	0	0.523729	0	0.218459	0.276923	0.387892	0.305806	In8
1	3	1	0	1	1	0	10	2	3	In9
0	0	0	0	2	0	0	9	2	4	In10
/	/	/	/	0.135	/	/	/	/	/	In11
/	/	/	/	/	/	/	/	/	/	In12
8.51E-05	8.33E-05	0.000107	2.08E-05	8.46E-05	0.000435	0.000131	5.81E-05	0.000128	0.000357	In13
/	/	/	/	/	/	/	/	/	/	In14
0.572471	0.1926	0.115998	0.060587	0.292294	0.620554	-0.09007	0.590736	0.809417	0.772903	In15
-0.24001	0.029021	0.06269	0.234119	-0.18383	-0.12542	-0.1345	-0.03825	0.0088	-0.306	In16
-0.00035	0.000114	0.000604	-0.0006	0.01952	0.000468	0.00129	0.00058	0.00015	0.00187	In17
0.49	0.63	0.43	0.56	0.5	0.75	0.758	0.54	0.67	0.5	In18
1686	344	42	483	16.25	98	154	490	51.2	144	In19
/	0.417786	/	0.021905	0.584003	0.215505	0.163934	0.102617	0.092308	/	In20
2	1	0	1	0	0	0	3	0	0	In21
0	0	0	0	0	0	0	1	0	0	In22
0.01498	0	0	0	0.442883	0.076982	0	0.17975	0.212359	0.121859	In23
0	1	1	1	0.2	1	1	1	0.85	0	In24
0.83	0	0	0	0.5	0.63	0	0.85	0	0.13	In25
4	0	0	2	14	1	0	0	1	0	In26
0	0	0	0	0	0	0.13	0	0	0	In27
0	0	0	0	0	0	0.4	0	0	0	In28
0	0	0	1	1	1	0	1	0	0	In29
1	1	0	0	1	0	0	1	1	1	In30
0	0	0	0	1	0	0	3	0	0	In31
/	/	/	/	/	/	/	36	/	/	In32
1.2	1.26	1.58	1.27	1.26	1.5	1.64	2.73	1.62	0.93	In33
0.012992	0.126358	/	/	0.008125	/	0.059016	0.029031	0.175385	/	In34
/	0.55	/	0.14	8.2	0.89	0.2	2.23	/	/	In35
/	/	/	/	/	/	/	/	/	/	In36
0.00116	0.045221	0.071043	0.010183	0.001411	0.054366	0.045902	0.000715	0.033333	0.093737	In37

Table 7. 2 Indicator data. The yellow colour highlights the largest one of the indicator, whose sample is the example to illustrate collection method. (By author)

11	12	13	14
1933 Old Millfun	West Bund Artistic Center	Cloud Grain Silo	Jing'an New Business
0	0.23	0	0
0	1.28	0	0
0	0.053507	-0.02696	0.033472
0	2	0	2
0	0.023733	0.044604	0.025672
0	2	1	1
0	0	0	0
0	0.152889	0	0
0	0	0	0
0	0	0	0
/	/	/	/
0.0856	/	/	/
0.000364	3.87E-05	4.92E-05	4.38E-05
/	/	/	/
0.216433	0.315661	0.027174	0.303052
0.094724	-0.081	0.039641	-0.07983
-0.00041	6.71E-05	-0.00028	0.00022
0.68	0.64	0.41	0.71
39	163	929	348
0.291333	/	/	/
0	1	1	1
0	0	0	0
0	0.079401	0	0
1	0	1	1
0	0.71	1	0.25
0	0	0	0
0	0	0	0.125
0	0	0	0
0	0	1	0
0	1	0	0
0	0	0	0
3	/	18	/
1.5	1.58	1.16	1.38
/	/	0.03134	0.021905
0.51	/	/	3.4
/	/	/	/
0.012382	0.00258	0.006152	0.005111

7.2 Data Analysis

Following the process of data collection, there will be two sets of data available for analysis. As introduced in Chapter 4.4, the analysis will use the regression model to analyse the relationship between values and indicators.

7.2.1 Independent Relationship Analysis

For each heritage value, all the indicators with more than one available data can generate their own impact trends on the change of its score. The outcome of data analysis can be shown as a series of impact trend diagrams representing the influence of indicators on value variation. Therefore, the maximum number of impact trend diagrams of one value will be 38. For six values, the total maximum number of impact trend diagrams will be 228.

Due to the large number and the complexity of results, visualizing 38 indicators in a single value diagram will be too complex and difficult to read. So, this section will choose a smaller group of indicators for each value as an example to demonstrate the data analysis results and the feasibility of comparative analysis.

Theoretically, the relationship between each indicator and each value can be analysed independently. Additionally, depending on the research objectives, researchers can select multiple indicators as a group for comparative analysis. The selection criteria are not fixed and may include indicators with the clearest correlations, the most comprehensive data, all with positive impacts, or those related to a specific contextual factor.

This part will use the correlation coefficient as the selection criteria. According to Chapter 4.4, the correlation coefficient describes the intensity of the linear relationship between two variables. Indicators with only one available data point cannot generate correlation coefficients and will be excluded.

Table 7.3 below is the correlation coefficient between values and indicators, where a positive number indicates a positive correlation, a negative number indicates a negative correlation, and the absolute number means the strength of the correlation.

To clearly and effectively illustrate the impact and interrelationships, the six indicators with the highest correlation to each value metric will be selected for detailed analysis. (Table 7.3)

Table 7. 3 Correlation coefficient table: relation between Value and Indicators. Highlighted indicators are the higher coefficient ones that are selected for analysis (By author)

	V1	V2	V3	V4	V5	V6
ln1	-0.3961	-0.27983	-0.36675	-0.33388	-0.4382	0.11131
ln2	-0.34795	-0.26792	-0.32247	-0.31089	-0.42597	0.16889
ln3	0.10635	0.34534	0.18433	0.26985	-0.34981	0.67343
ln4	0.24883	0.45438	0.30354	0.47428	-0.2729	0.61436
ln5	0.40005	0.81695	0.22743	0.51251	-0.31995	0.80862
ln6	0.16	0.68502	-0.06031	0.30377	-0.22149	0.79801
ln7	--	--	--	--	--	--
ln8	0.25758	0.60784	0.2658	0.36045	-0.20005	0.69893
ln9	0.14105	0.58155	-0.02357	0.00658	-0.1124	0.0924
ln10	0.23804	0.62402	0.10566	0.07827	-0.30488	0.18247
ln11	--	--	--	--	--	--
ln12	--	--	--	--	--	--
ln13	-0.06229	-0.46474	0.13066	0.10643	-0.07998	-0.10542
ln14	--	--	--	--	--	--
ln15	0.04358	0.16159	0.00521	0.22842	-0.18725	0.22399
ln16	-0.00999	-0.09007	-0.19157	-0.30198	0.31297	-0.49386
ln17	0.45039	0.61309	0.34839	0.49588	-0.2057	0.79909
ln18	0.27316	-0.26361	0.44188	-0.1701	0.31509	-0.34891
ln19	-0.19202	0.09201	-0.28012	0.4091	-0.19214	0.10692
ln20	0.05914	0.29705	-0.06166	0.48364	-0.15822	0.7952
ln21	-0.09687	0.45629	-0.32606	0.16177	-0.26668	-0.03182
ln22	0.16657	0.58534	0.04428	0.07246	-0.20902	-0.09454
ln23	0.54239	0.74328	0.3966	0.48312	-0.1823	0.69941
ln24	0.29941	-0.08021	0.26145	-0.22627	0.60744	-0.50987
ln25	0.27725	0.20842	0.20588	0.3739	-0.07331	-0.07469
ln26	0.40759	0.61181	0.27627	0.66443	-0.24795	0.80438
ln27	0.21922	-0.14305	0.472	-0.26237	0.17325	-0.17876
ln28	0.27379	-0.13986	0.6324	-0.21331	0.27006	-0.2194
ln29	0.5557	0.50505	0.19589	0.58641	0.04374	0.22243
ln30	6.21E-17	0.52669	-0.15965	0.13615	-0.24676	0.55953
ln31	0.30687	0.7722	0.14484	0.24652	-0.27071	0.1646
ln32	0.87066	0.99054	0.98198	0.12453	0.21958	0.58699
ln33	0.17117	0.41607	0.22807	-0.06846	0.000628	-0.38648
ln34	0.19447	-0.20961	0.12711	-0.57053	0.82649	-0.25547
ln35	0.59926	0.71519	0.25103	0.69717	-0.41605	0.86839
ln36	--	--	--	--	--	--
ln37	-0.21019	-0.48797	-0.009	-0.48423	0.29286	-0.09098

It is important to note that the correlation coefficient does not indicate the strength of an indicator's impact. A high correlation coefficient only signifies a strong relationship, meaning that changes in A are likely to lead to changes in B. However, the extent of B's change is not measured by the correlation coefficient. Therefore, the coefficient is used solely to select indicators suitable for analysis.

After selecting 6 top correlation coefficiency indicators for each value, the analysis will focus on each indicator's impact trend and compare the impact trends of different indicators for a value. The outcome of the regression model will show as diagrams, which is a visualised display and is easy for analysis.

First, independently analyse the trend of each indicator's impact on value.

The impact of some indicators on value follows a linear trend, such as V1-In17, V1-In29, V2-In31, V3-In23, V3-In27, V3-In28, V4-In17, V5-In34, V6-In3, V6-In17. The slope of the line represents the speed at which the increase of the indicator influences the increase of the value. Some indicators show a negative influence on the value, such as V3-In1, V4-In34, V5-In1, V5-In3. This means that if the aim is to increase the value, regeneration needs to mitigate the change of these indicators.

Analysing indicators with linear trends is a relatively simple and straightforward process. However, some indicators show a non-linear trend in their impact on value. For the indicators that the impact trend follows an exponential change, the regeneration is expected to increase these indicators to get a great improvement in values, such as V1-In26, V1-In35, V2-In5, V2-In6, V4-In5, V4-In35, V6-In35.

There are some curves that their impact goes up after a plateau period or after a slightly downward period, such as V3-In18, V6-In6, and V6-In20. This means a substantial amount of effort is required to increase such indicators before an obvious improvement in value can be seen.

The influence of some indicators increases first but then reaches a marginal diminishing effect period or even decreases after a certain point, such as V1-In32, V4-In26, and V5-In24. The influence of increasing these indicators is not ‘more is better’; the input in these indicators should be limited within an optimal range.

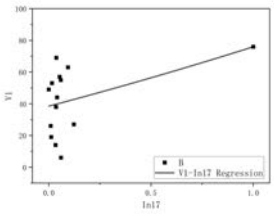
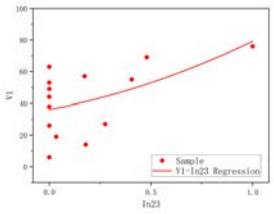
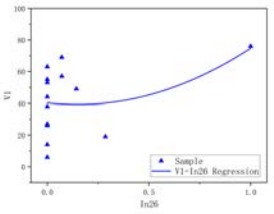
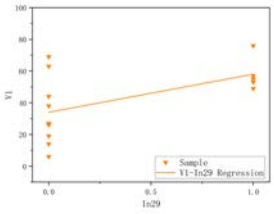
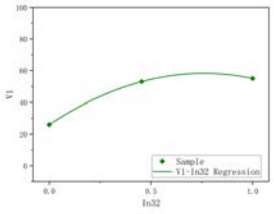
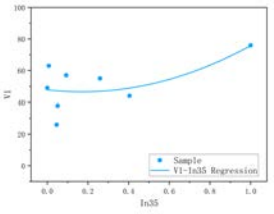
		
In17 Textural difference	In23 Conserved landscape	In26 Conserved machines
		
In29 Industrial museums	In32 Public participation	In35 Budget for regeneration

Table 7. 4 Impact Trends of Indicators on V1-Historical Value (By author)

All of the selected indicators have a positive effect on historical value. Conservation of tangible heritage, such as conserving industrial landscape and protecting production facilities, as well as increasing the regeneration budget, will have a remarkable promotion on this value. However, the increase in public participation should be limited to avoid wasting efforts. (Table 7.4)

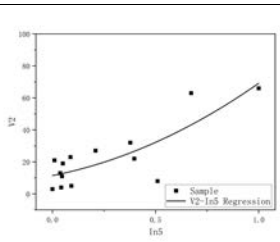
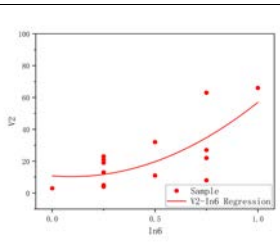
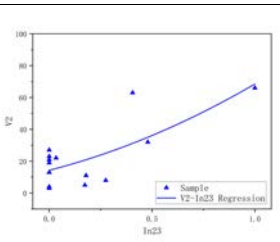
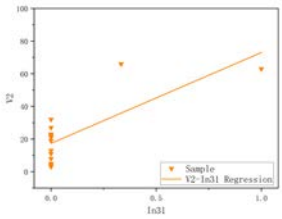
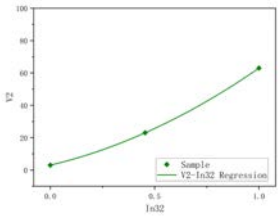
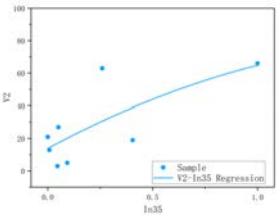
		
In5 Open spaces area	In6 Diversity of open spaces	In23 Conserved landscape
		
In31 Regulation contents	In32 Public participation	In35 Budget for regeneration

Table 7. 5 Impact Trends of Indicators on V2-Scientific and Technological Value (By author)

The selected indicators also have positive impacts; the most influential indicators are the area and diversity of open spaces. The speed of value increase slows down at the end of the trend, which means the efficiency of the regeneration budget will reach a plateau. In practice, the final input of the budget should be balanced according to its efficiency. (Table 7.5)

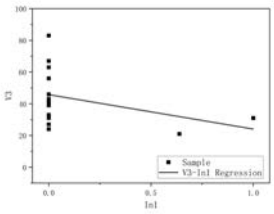
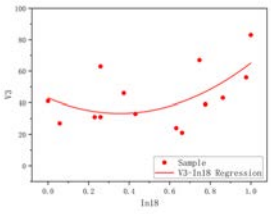
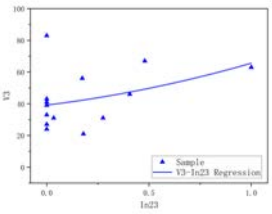
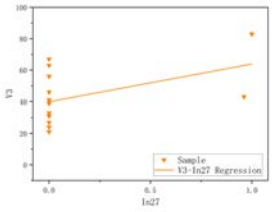
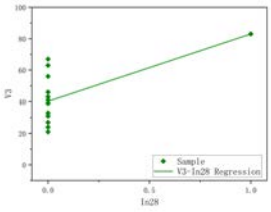
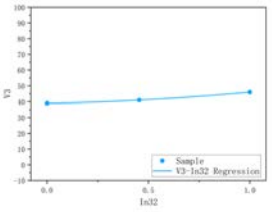
		
In1 Elevation change area	In18 Functional diversity	In23 Conserved landscape
		
In27 Cultural events	In28 Educational events	In32 Public participation

Table 7. 6 Impact Trends of Indicators on V3-Socio-cultural Value (By author)

For socio-cultural value, the elevation change area has a negative impact, which indicates the regeneration should avoid a great change in landform to increase this value. The impact of educational events will lead to a great increase in this value. For functional regeneration, the diversity of the function should reach a certain degree (approximately over the mid-value of current sample data) to promote social and cultural value. (Table 7.6)

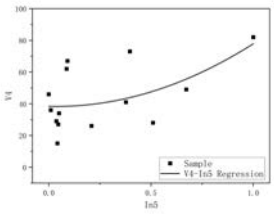
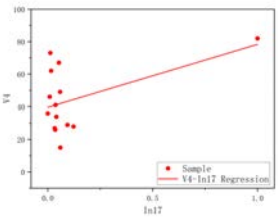
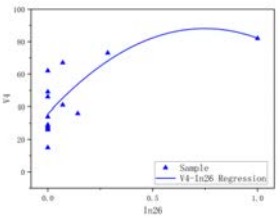
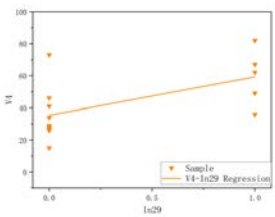
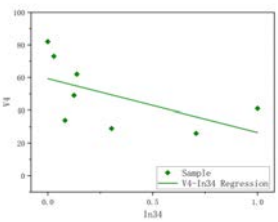
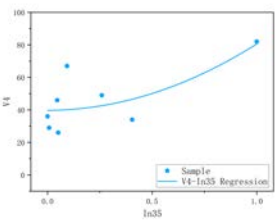
		
In5 Open spaces area	In17 Textural difference	In26 Conserved machines
		
In29 Industrial museums	In34 Urban tourism revenues	In35 Budget for regeneration

Table 7. 7 Impact Trends of Indicators on V4-Aesthetic Value (By author)

The aesthetic value can be greatly increased with the area of open space, textural difference and regeneration budget. The number of conserved machines works efficiently in increasing this value before a specific degree (approximately the value at 75% of current sample data). More conserved machines will then have a negative effect after this degree. The tourism revenue, indicating the degree of commercialization, has a negative effect on this value. (Table 7.7)

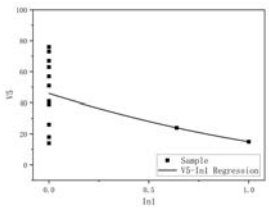
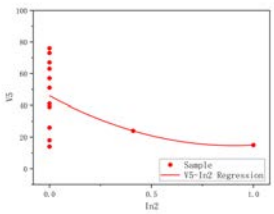
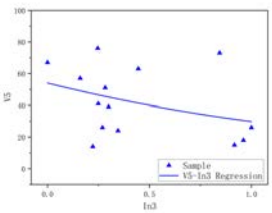
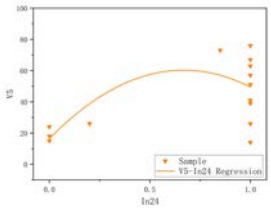
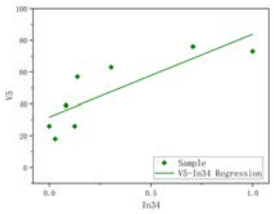
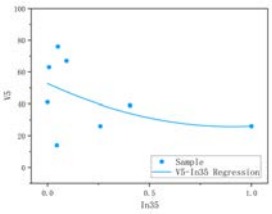
		
In1 Elevation change area	In2 Avg elevation change	In3 Green plot ratio
		
In24 Conserved architecture	In34 Urban tourism revenues	In35 Budget for regeneration

Table 7. 8 Impact Trends of Indicators on V5-Economic Value (By author)

For economic value, indicators relating to the increase of input or the increase of less profit functions will lead to the decrease of economic value. The percentage of conserved heritage architecture in the regeneration process should be balanced from the profit-driven perspective, considering the conservation input and the reuse potential. (Table 7.8)

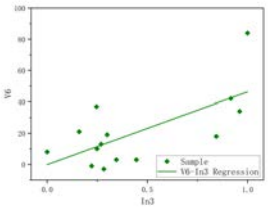
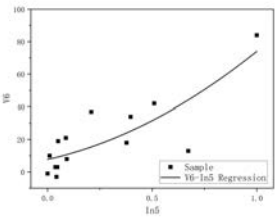
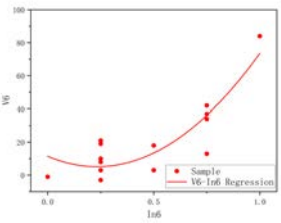
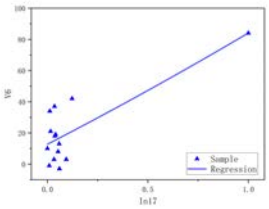
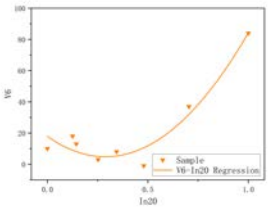
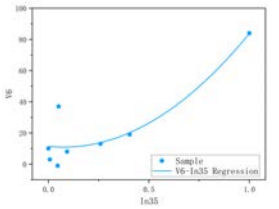
		
In3 Green plot ratio	In5 Open spaces area	In6 Diversity of open spaces
		
In17 Textural difference	In20 Financial input in urban circulatory system	In35 Budget for regeneration

Table 7. 9 Impact Trends of Indicators on V6-Natural Value (By author)

The natural value from selected impact trends requires sufficient input to achieve a great increase, especially in public spaces and urban infrastructure. (Table 7.9)

It is also possible to analyse the impact of an indicator on different values simultaneously. For example, in In35-V1-V2-V4-V5-V6, an increase in In35 (budget) will have a positive impact on the historic, scientific and technological, socio-cultural,

aesthetic, and natural values of industrial heritage. The slope of the curve shows that the impact on different values varies. Meanwhile, the increase in In35 will lead to a decrease in economic value if the ROI is considered (Return on Investment). Therefore, the regeneration project should carefully balance the input in the indicators based on the actual prospect.

7.2.2 Comparative Analysis

After obtaining data from samples (indicator) and applying statistical models for classification, regression, or other tasks, the data should undergo preprocessing for analysis purposes (García et al., 2016). For this part, to give an example of how the indicators of each value can be synthesized in one diagram for comparison, the preprocessing is to unify the indicator data. The most common preprocessing method is normalization. The role of normalization is to eliminate the influence of dimensionality, or to give equal status to the various features of the sample (Huang et al., 2023). The advantages of normalization are as follows (Patro and Sahu, 2015).

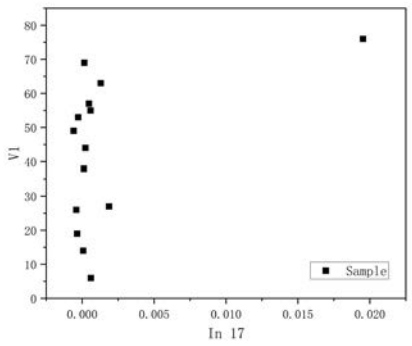


Figure 7. 28 In17 in original dimension (Generated by author)

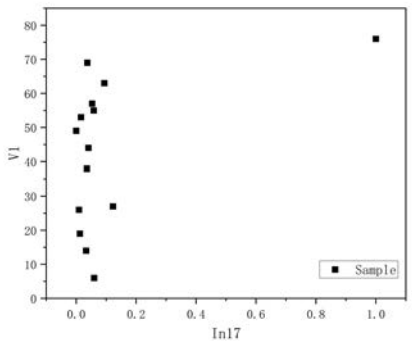


Figure 7. 29 In17 Normalized [0,1] (Generated by author)

Improving model accuracy: Normalization can eliminate the dimensional influence between different features, making the importance of each feature more equal in the model, thereby improving the prediction accuracy of the model.

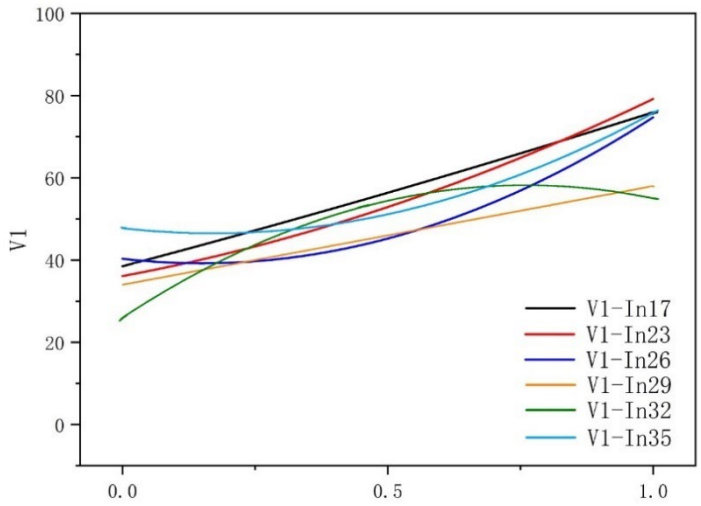
Improving model generalization ability: Normalization can reduce the sensitivity of the model to input data, enhance the model's generalization ability to unknown data, and avoid overfitting.

Stable learning process: In some algorithms, such as gradient descent, normalization can prevent certain features from oscillating during the learning process due to large values, thereby improving algorithm stability.

Facilitating data visualization: Normalized data is easier to visualize in a coordinate system, making it easier to observe and analyse data distribution characteristics.

As shown in Figure 7.28 and Figure 7.29, normalization makes no change to the distribution of In17-V1 but will facilitate comparison with other indicators with different dimensions in one diagram (meaning they can use the same X-axis).

In addition to independently analysing the impact of each indicator, analysing indicators that affect the same value together can also reveal important information. In the integrated diagram, the comparison focuses on the slope of the curves, which represents the value variation speed of the influence.



In17 Textural difference
In23 Conserved landscape
In26 Conserved machines
In29 Industrial museums
In32 Public participation
In35 Budget for regeneration

Figure 7. 30 Integrated impact trend for historical value (By author)

For historical value, In32 has the largest slope before approximately 0.6 x-coordinate, which means that In32 has the most intense effectiveness. After this range, the slope of In23 will be the one with a stronger impact. This data indicates that if a certain number of resources can increase the degree indicators from 0 to 60%, the resource should be prior to input in In32. If more resources can increase the indicators by over 60% degree, then it should choose to increase the In23 for better effectiveness. (Figure 7.30)

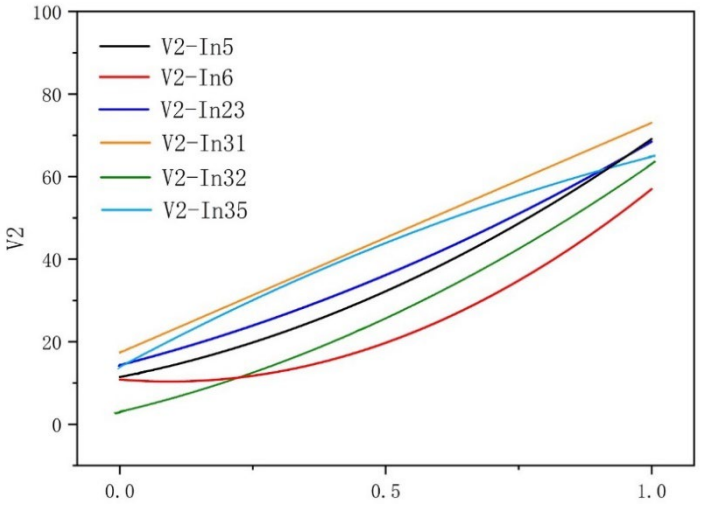


Figure 7. 31 Integrated impact trend for scientific and technological value (By author)

In5 Open spaces area
In6 Diversity of open spaces
In23 Conserved landscape
In31 Regulation contents
In32 Public participation
In35 Budget for regeneration

For scientific and technological value, In31 is the most influential indicator. However, as regulation contents are difficult to change during a project, the secondary indicator should consider emphasising In35 before approximately 0.6 x-coordinate when the impact intense is gradually decreasing. After this point, the effectiveness of In5 and In23 rises similarly for increasing the value (In5 is slightly better than In23 later) and can be considered according to which one is more feasible during the process. (Figure 7.31)

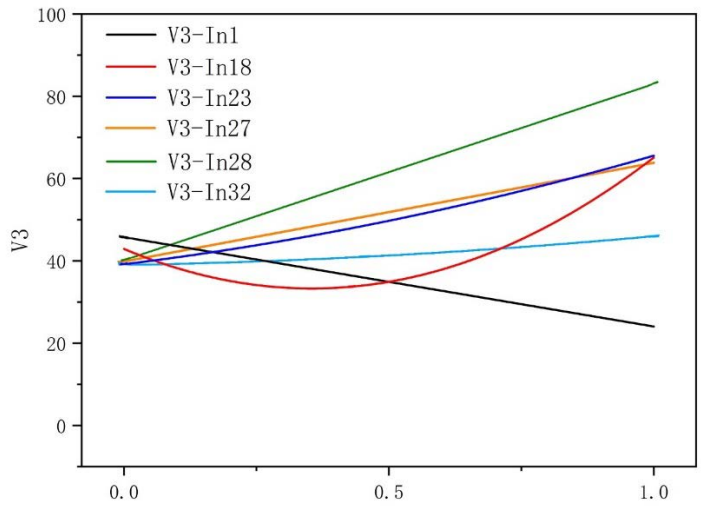


Figure 7. 32 Integrated impact trend for socio-cultural value (By author)

In1 Elevation change area
In18 Functional diversity
In23 Conserved landscape
In27 Cultural events
In28 Educational events
In32 Public participation

For social value, the In28 has the leading influence compared with other indicators before the 0.4 x-coordinate. After this point, In18 rises sharply with the increasing slop. Therefore, more resources after 0.4 should first consider to improve In18. It is also important to minimize the change of In1 during the regeneration process. (Figure 7.32)

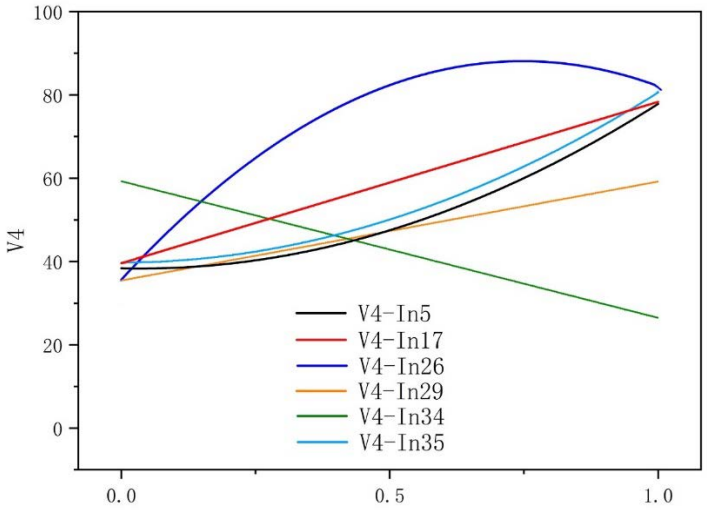


Figure 7. 33 Integrated impact trend for aesthetic value (By author)

In5 Open space area
In17 Textural difference
In26 Conserved machines
In29 Industrial museums
In34 Urban tourism revenues
In35 Budget for regeneration

To improve the aesthetic value, the resources should consider leaning towards In26 before it reaches the peak at approximately 0.6 x-coordinate. However, the effort should be limited to this peak point, or it will reduce the degree of value and be a waste of resources. After 0.6, the In35 showed a great intensity of impact, so resources should be turned to support the increase in In35. (Figure 7.33)

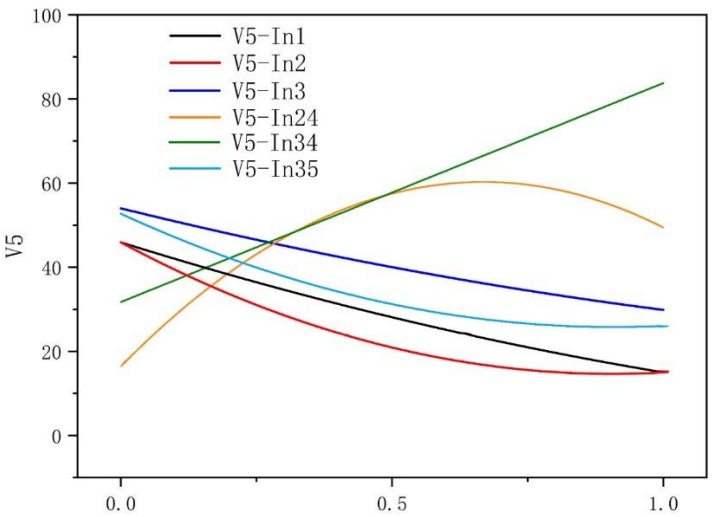


Figure 7. 34 Integrated impact trend for economic value (By author)

V5 Economic Value
In1 Elevation change Area
In2 Avg elevation change
In3 Green plot ratio
In24 Conserved architecture
In34 Urban tourism revenues
In35 Budget for regeneration

In the initial stage of V5-In24-In34, In34 has a greater impact on V5 than In24. The same amount of change in In34 will cause V5 to increase more rapidly, so resources should be considered to lean towards In34 during this stage as it is more efficient. However, after reaching a certain degree of 0.6 x-coordinate, the same number of resources invested in In24 will result in better performance compared with In34. Therefore, more effort should be put into In24 from that point. (Figure 7.34)

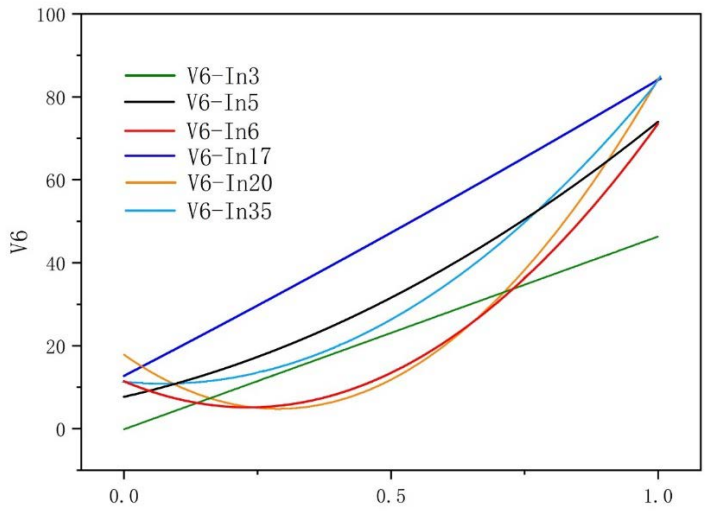


Figure 7. 35 Integrated impact trend for natural value (By author)

V6 Natural Value
In3 Green plot ratio
In5 Open spaces area
In6 Diversity of open spaces
In17 Textural difference
In20 Financial input in urban circulatory system
In35 Budget for regeneration

For the natural value, the influence of In17 works steadily to increase the value at the first stage. After approximately 0.4 x-coordinate, the influence of In20 rises sharply, which means if more regeneration resources are available, it should consider prior input in In20 for more effective performance. (Figure 7.35)

Developers need to select appropriate indicators to deal with and dynamically adjust resource allocation based on different goals (which value requires to be changed) and real-time conditions of the heritage site.

In practice, if the resource of the construction can be quantified and uniformed for all the indicators, the x-coordinates will change accordingly with the scale of the resource unit. This part will use 'money' as the resource to illustrate the actual utilization of this analysis. Taking V6-In3 (Green plot ratio) and V6-In5 (Open space area) as examples, this analysis chooses these two indicators whose construction cost is accessible from the open resources.

Suppose the construction area of an urban industrial heritage quarter regeneration project is Am^2, and the current aim of the project is to increase the natural value of this quarter only by either increasing greenery or open area.

According to data resources, the construction budget for a total area of $3963m^2$ community pocket parks is 2883 thousand yuan (KRMB); and the construction of a $900m^2$ outdoor community activity square within a residential area is 525 thousand yuan (KRMB). (Pudong Government, 2024, KOMPAN, 2024)

$$construction\ cost\ (In3) = \frac{2883}{3963} = 0.727\ {}^{KRMB}/_{m^2}$$

$$construction\ cost\ (In5) = \frac{525}{900} = 0.583\ {}^{KRMB}/_{m^2}$$

Therefore, to unify the x-coordinate with construction cost, if the In3 or In5 is increased from 0% to 100%, will the regression curves be adjusted as shown in Figure 7.36.

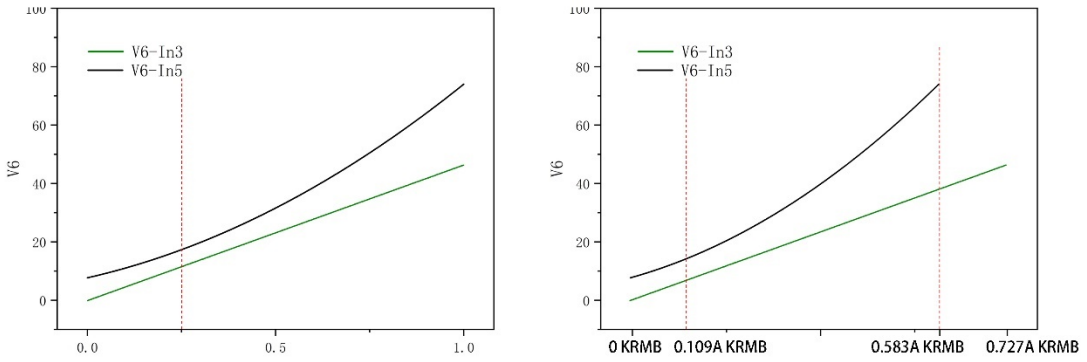


Figure 7. 36 Example of implementation of V6-In3 and V6-In5 from the perspective of construction cost (By author)

The actual trend of the In5 has slightly compressed. Therefore, on the curve, the slope rising point will move closer to 0 point. In the first stage, the increasing speed of In3 is slightly higher than In5, which means if the budget is limited to 0.109A thousand yuan, the regeneration should consider increasing the area of the community pocket park. If more budget can be input, increasing the area of activity squares will be more effective in achieving the aim of value promotion.

7.3 Conclusion

The result generated from the data analysis shows that the impact trend and the relationship between different indicators are overall clear and reasonable. The details of the analysis are an illustrative introduction with representative relationships to the analysis.

In the analysis, the author proposes the potential reason for the phenomenon. This process only illustrates the interpretability of the result. However, whether the result can be interpreted by any individual will not influence its actuality. Quantitative analysis is significant in exploring non-superficial relationships.

By analysing the relationship, the impact trend is useful in support an effective and efficient decision-making process, balancing the targets and available resource in different stages. Therefore, the contextually sensitive regeneration should emphasise the significance of reflecting indicators dynamically for relative optimal solutions according to the actual targets of the project.

Chapter 8. Conclusion

This chapter will give a thorough conclusion about this study, with retrospect to the achievements and experiences from the research, reflecting on the limitations of the current study and prospecting the inspirations and potential for future research.

The first part of this chapter will revisit the research questions and objectives, as well as an overview of the achievements and experiences of the analysis. The second part will illustrate the benefits of this research, inspire the conservation and evaluation of urban industrial heritage quarters, and promote the application of mixed-method research in urban studies. The third section will focus on the limitations of this study, reflecting on the factors that will influence the research findings through the process of research design, data collection and analysis. The fourth section will focus on the future of this topic, illustrating the inspirations that will benefit relevant studies based on this research and identifying the potential of future practice.

8.1 Conclusion

The trigger point of this research is the relationship between the regeneration of urban context factors and the change of values of industrial heritage quarters. As such, the research addresses the following key research question: How does the context of the urban environment impact the value of industrial heritage sites during the regeneration process? In order to respond to this research question, this research employed mixed-method research named as Contextual Sensitivity Analysis (CSA) to evaluate the relationship between the variation of context indicators and the variation of industrial heritage values, and analyse the industrial heritage quarter samples in Shanghai to reveal the impact trend with the specific context.

In this thesis, the research is expected to fulfil the objectives established at the beginning and be carried out in a logical way to realise the answer to the research question.

1) To understand the meaning and significance of industrial heritage, and clarify the values of urban industrial heritage quarters.

   In terms of this objective, Chapter 2 has gone through a comprehensive literature study of the definition and connotation of industrial heritage. Industrial heritage refers to the tangible and intangible relics left from the subsequent production and industrialisation process after the Industrial Revolution, which possess significant

historical and cultural values. This study mainly focuses on the scope of industrial heritage quarters within the urban context. With a combination of urban environment and heritage characteristics, the future of urban industrial heritage quarters is an interesting and challenging topic. Therefore, besides the significance of a general heritage, urban industrial heritage quarters also have a practical significance, which can be seen as a chain reaction to the process of urban transformation, including social and economic aspects. Based on the study of the current evaluation system of cultural heritage and industrial heritage in the background of conservation, regeneration and urbanisation, this thesis summarised and refined the value evaluation system to create a systematic guideline for understanding the significance and potential of industrial heritage.

2) To conduct an integrated literature study on the basic theories of contextual sensitivity in urban design and planning, defining what is contextual sensitivity and how to study it for urban regeneration study.

   Looking into the characteristics and values of urban industrial heritage quarters, the importance of context has appeared to have a great influence on such kinds of urban environments. Through the development of contextual thinking in architecture and urban design, contextual sensitivity is a progressive and self-improving theory. Chapter 3 has gone through a literature study of how the contextual idea has prevailed in the field of architecture design and urban studies as a way of respecting and reflecting the urban environment.

   Based on a comprehensive understanding of context, this theoretical concept has developed to address the importance of contextual factors, and the practice of urban thoroughfare and surrounding communities adopt the Context-sensitive Solution (CSS) as an approach to highlight context influence and public engagement. The study of context is also a quantitative method in other disciplines, using mathematical models for statistical analysis. The theory and application of contextually sensitive approaches provide great inspiration for the study of urban regeneration, which then catalysed the development and design of the thesis methodology framework.

   This thesis has proposed the concept of contextual sensitivity in urban regeneration as an attribute describing the degree of adequate and appropriate respect and response to contextual issues. This attribute inspires both the practice and research process of achieving a contextually sensitive urban regeneration project.

3) To study the detailed context factors for urban industrial heritage quarters from a regeneration perspective, establishing targeted indicators for assessment.

   In the methodology study of the research, Chapter 4 has designed a contextual sensitivity analysis (CSA) grounded on the concept of contextually sensitive urban regeneration as an analysis process to study the value variation of urban industrial

heritage quarters. This framework aims to reveal the impact trend of indicators on values. This mixed-method research requires a comprehensive study on the quantification of the assessment indicators.

In Chapter 5, this thesis has processed intensive research on the contextual factors of urban industrial heritage quarters, understanding how different dimensions of context change during the regeneration process and what strategies are closely related to the change. For this analysis, each factor has been broken down into several representative indicators, creating a 37 indicators' assessment system, that can be quantified for data analysis. As the complexity and abstraction of an urban environment, the indicators are selected and simplified to present the most targeted information.

4) To carry out a thorough case city and sample quarters selection, collecting data for the indicators.

   According to Chapter 4, 14 samples are selected from the case city of Shanghai, covering a wide range of different types, scales and characteristics. Data from the samples includes value variation scores collected from questionnaires, and statistics of indicators collected from calculations or resources.

5) To process the data and carry out the contextual sensitivity analysis. Analysing the relationship between context indicators and value variation of urban industrial heritage quarters.

   Chapter 7 first introduces how the data was collected in different samples. The data of samples will be analysed through Polynomial Regression model to generate the impact trend and the illustration diagrams. The final outcome presents a highly numeric relationship, indicating the change of contextual factors during regeneration has a certain degree of influence on the variation of industrial heritage value.

6) To compare the impact trend between different context indicators on different values. This comparison helps to balance the cooperation between different context indicators and identify effective ways to improve a specific value.

   According to the general outcomes generated, the individual diagrams will be integrated into different combinations. The difference in contribution of different indications, or an indicator to different values. This comparison between impact trends inspires the selection of higher effective indicators according to different inputs, supporting the balance of optimal regeneration action in the decision-making process.

During the process of urban regeneration, a contextually sensitive regeneration usually requires the cooperation of addressing the complex context issues. This research

provides a comprehensive study of the regeneration of industrial heritage quarters in urban context from the perspective of contextual sensitivity. From the research outcome, the Contextual Sensitivity Analysis (CSA) is effective in revealing the relationship between two urban variables which inspires further and deeper quantitative urban studies. Besides, according to the practical example in Chapter 7, this thesis also explored how the impact trend for a value can assist in regeneration action.

Overall, this thesis is a minor attempt to quantify the relationship between complex urban context and subjective heritage value. Despite many limitations throughout the process, the results show a certain degree of feasibility in this direction. From a positive perspective, as the topic of urban big data has been getting more and more popular recently, a mixed-method study is expected to be more solidly supported if participating in interdisciplinary cooperation.

8.2 Advantages of the study

The Uniqueness of Urban Industrial Heritage Regeneration

Urban industrial heritage regeneration is different from other types of industrial heritage regeneration because of its unique connection to the city. Industrial sites located in urban areas are often closely linked to the social, cultural, and economic history of the city, and their regeneration can have a significant impact on the urban fabric and the community.

The industrial heritage of cities can be seen in the physical structures and infrastructure that remain from past industries, such as factories, warehouses, and transport systems. These buildings and sites are often located in central and densely populated areas, and their regeneration can contribute to the revitalization of the urban core.

The social and economic impact of industrial heritage in cities is also significant. Industrial sites have historically provided employment opportunities and contributed to the growth of urban centres. The regeneration of urban industrial heritage can create new economic opportunities, such as the development of new businesses and industries in repurposed industrial spaces, as well as new cultural and social amenities.

However, the regeneration of urban industrial heritage is also more challenging than other types of industrial heritage regeneration, due to the complexity of urban contexts. Cities have diverse populations, complex social and cultural histories, and intricate political and economic systems that need to be taken into account in any regeneration project. The regeneration of urban industrial heritage requires a contextually sensitive

approach that responds sensitively to the unique history, culture, and social fabric of the city, and involves the active engagement of local communities and stakeholders.

In summary, urban industrial heritage regeneration is unique due to its close connection to the city and its complex contextual factors. The regeneration of urban industrial heritage sites requires a nuanced approach that is sympathetic to the historical, cultural, social, and economic factors that are specific to the urban context.

Benefits of Integrating Quantitative Analysis in Urban Heritage Study

A quantitative analysis is unique and necessary when analysing urban industrial heritage regeneration because it provides a measurable and systematic approach to understanding the impact of regeneration efforts on the site, the community, and the surrounding environment. While qualitative analysis can provide valuable insights into the experiences, perceptions, and emotions of local stakeholders, a quantitative analysis enables developers and researchers to develop clear and objective measures of success and to track progress over time.

One of the key advantages of quantitative analysis is that it enables the actions to identify and measure specific outcomes and impacts of regeneration efforts. For example, quantitative measures can be used to assess the economic benefits of the regeneration project, such as job creation or increased property values, as well as the social benefits, such as improved public spaces or increased access to cultural amenities. These measures can be compared to established benchmarks or targets to evaluate the effectiveness of the regeneration project.

Quantitative analysis can also help to identify areas of improvement and to guide future decision-making. By collecting and analysing data on the impact of the regeneration project, project planners can identify areas of success and areas where further improvements are needed. This can help to inform future planning and decision-making whilst also ensuring that the regeneration project continues to meet the needs of the community over the long term.

While qualitative analysis can give valuable perspective into the perspectives and experiences of local stakeholders, it can be more subjective and difficult to measure. Quantitative analysis, on the other hand, provides a more objective and measurable approach to understanding the impact of regeneration efforts and can help to ensure that the project has ongoing potential as a precedent for both future practices and research.

Therefore, qualitative and quantitative analysis have their strengths and limitations. A mixed-method analysis is effective and necessary when analysing urban industrial

heritage regeneration because it takes advantage of both the subjective and objective views to form a holistic research system to understand the impact of regeneration efforts and the context factors of the site, as well as guide future research and practice.

Advantages of contextual sensitivity analysis

A contextual sensitivity analysis is a practical and data-based approach when analysing urban industrial heritage regeneration, focusing on the complex and diverse contextual factors that are specific to urban areas. Urban industrial heritage sites are often located in areas that have undergone significant social, economic, and cultural changes over time, and these changes need to be taken into account in any regeneration project.

This analytical framework necessitates a comprehensive understanding of the historical, social, cultural, economic, and political elements that have influenced the urban context of the industrial heritage site. In contrast to other forms of analysis, a contextually sensitive analysis is crucial for urban industrial heritage regeneration as it allows planners, developers, and additional stakeholders to comprehend the intricate interplay between the site, its context, and the community. This examination aids in pinpointing the particular needs and priorities of the local community and in formulating strategies customized to the distinct attributes of the site and its surrounding environment. Details of the advantages listed below show the value and potential for applying CSA in such a kind of urban study.

Recognition of local context: A contextually sensitive analysis recognizes the unique social, cultural, and economic context of the site, including its history, identity, and cultural heritage. The study of a site, especially those with cultural heritages, contributes to forming a comprehensive and dynamic view to balance the conservation works and urban development requirements. It also enables the development of regeneration strategies that are tailored to the specific needs and aspirations of local communities and stakeholders.

Inclusivity: By engaging with experts or public participants in the regeneration project, a contextually sensitive analysis can ensure that different voices and perspectives are heard and multiple urban issues are reflected and incorporated into the regeneration process. This can help to promote a sense of ownership and pride in the regenerated site and foster a more inclusive and adaptable regeneration plan.

Flexibility: A contextually sensitive analysis recognizes that urban industrial heritage sites are complex and multifaceted and require flexible and adaptive approaches to regeneration. This enables a project plan to respond to changing social, economic, and environmental conditions and adjust regeneration strategies accordingly.

Overall, a contextually sensitive analysis is unique and necessary when analysing urban industrial heritage regeneration because it illustrates the comprehensive aspects and the interconnection of urban contexts and enables researchers and urban planners to develop strategies that are feasible and suitable for the specific characteristics of a heritage site and the surrounding community.

8.3 Limitations of the Study

The thesis provides a comprehensive analysis of the evaluation indicators of urban industrial heritage regeneration, the results of which can reveal and explain the relationship between contextually sensitive urban regeneration and value enhancement of urban industrial heritage quarters to a certain degree. However, there are limitations due to the time and resources that influence the accuracy and comprehensiveness of the study.

The first limitation is the classification and selection of evaluation indicators. The existing evaluation indicators of each factor are selected from the most representative perspective that targeted the characteristics of urban industrial heritage quarters specifically for this study. Therefore, they might not be comprehensive and detailed enough to capture the complete and diverse dimensions. This limitation requires a more detailed study of the site context from a holistic perspective.

The second limitation is the calculation methods of indicators. The current methods are often simplified calculation methods adapted from more extensive research, which may lead to inaccurate or biased results due to a lack of scientific rigour. Future research should adopt more advanced and sophisticated methods that are appropriate for the specific context of urban industrial heritage regeneration.

The third limitation is the generalizability of the findings. The analysis in this thesis is based on samples in Shanghai only, which may limit its applicability to other countries or regions. To address this limitation, researchers can consider including more diverse samples from different countries and regions to enhance the generalizability of the findings from a global perspective.

The fourth limitation is the sample size and types. The samples used in this thesis were selected and studied based on a literature review and onsite visit. Although they have tried to cover a wide range of heritage sites of different characteristics, they might still not be diverse enough to represent different typologies of urban industrial heritage regeneration. For more comprehensive and convincing results, this research should consider including more diverse and representative samples to provide a more nuanced analysis.

The fifth limitation is the data collection process. Due to the limitations of information retrieval and data recording, much data, especially the information from the original site, was absent or not accurate enough.

The sixth limitation is the expertise of questionnaire participants. The questionnaires only focused on the experts, which was insufficient to best represent the public views. Besides, as the scores are marked on different aspects by the same group of people, it should be better to include more experts from different disciplines to mark specific items. Otherwise, the objectivity and comprehensiveness of the interviewees were not representative and convincing enough. Future improvement should consider the expertise, objectivity, and comprehensiveness of participants to provide more reliable and valid data. It is also important that the next stage of the study is able to gain public views.

8.4 Future Research

This thesis has provided an innovative perspective for studying the evaluation indicators of urban industrial heritage regeneration. However, it is essential to recognize the limitations and areas that need further exploration to enhance the accuracy, validity, and generalizability of the analysis. The following sections outline the key areas for future research, addressing the identified limitations and expanding the scope of the study.

Comprehensive Evaluation Indicators: Future research should seek to develop a more comprehensive set of evaluation indicators, taking the diverse dimensions of urban industrial heritage regeneration. This would require an in-depth analysis of context factors in general urban quarters and integration of the specific characteristics of urban industrial heritage quarters.

Advanced Calculation Methods: To ensure more accurate and reliable results, future studies should adopt advanced and sophisticated calculation methods appropriate for the specific context of urban industrial heritage regeneration.

Expanding Geographical Scope: To enhance the generalizability of the findings, future research should include more diverse samples from different countries and regions, considering variations in cultural, political, environmental, and social contexts. This expansion of the research subjects can also promote a cross-comparison between different countries and also form a global view to encourage the conservation and reuse of industrial heritage.

Diverse Sample Size and Types: In order to provide a comprehensive and detailed analysis, future research should consider including more diverse and representative

samples, representing different scenarios of urban industrial heritage regeneration with a wide variety of urban characters. This might catalyse the potential to study such heritage quarters from the perspective of typology.

Improved Data Collection: For the accuracy and completeness of the data, future research should employ advanced and reliable data collection methods, addressing the limitations of information retrieval and data recording encountered in this thesis.

Expanded Expertise and Diversity of Participants: To provide more reliable and valid data, future research should focus on the composition of the participants and improve the screening process to ensure the professionalism of the expert participants. The research method of this study can also be used to study public views towards heritage sites, targeting more user-focused contextual analysis.

By addressing these limitations and expanding the scope of the research, future work in the field of urban industrial heritage regeneration can provide more comprehensive and detailed information for contextual sensitivity analysis, improving the accuracy and scientific of the result and enhancing the understanding of the logic of relevant issues and topics. This will ultimately contribute to the development of more effective and contextually sensitive strategies for preserving and enhancing the value of urban industrial heritage sites.

Bibliography

ABDELHAMEED, W. 2019. Industrial Revolution Effect on the Architectural Design. *2019 International Conference on Fourth Industrial Revolution (ICFIR).*

ABDUL, Y., MUNKLEY, E. & YATES, A. 2019. Greening the Built Environment: The Benefits of Selecting Ecological Options. BREEAM.

ADAIR, A., BERRY, J., MCGREAL, S., DEDDIS, B. & HIRST, S. 2000. The financing of urban regeneration. *Land use policy,* 17**,** 147-156.

AITCHISON, M. 2014. *The architecture of industry : changing paradigms in industrial building and planning,* Surrey, Burlington, Vermont, Surrey, England, Burlington, Vermont: Ashgate Publishing Limited : Ashgate Publishing Company.

AKOKA, J., COMYN-WATTIAU, I. & LAOUFI, N. 2017. Research on Big Data–A systematic mapping study. *Computer Standards & Interfaces,* 54**,** 105-115.

AKOTIA, J. & OPOKU, A. 2018. Sustainable regeneration project delivery in UK: A qualitative analysis of practitioners' engagement. *Journal of facilities management,* 16**,** 87-100.

AL-HAMMADI, N. & GRCHEV, K. 2022. Aspects of contextual architecture regarding traditional/contemporary architecture, physical/cultural and place identity: a systematic literature review. *Open House International*.

ALBERTS, H. C. & HAZEN, H. D. 2010. Maintaining Authenticity and Integrity at Cultural World Heritage Sites. *Geographical review,* 100**,** 56-73.

ALICE, R. 2012. *Footprint Policy by Igloo* [Online]. Igloo Regeneration. Available: http://www.iglooregeneration.co.uk/wp-content/uploads/2016/06/Footprint-Policy-by-igloo.pdf [Accessed 10 September 2022].

ALVAREZ, L. 2021. Understanding context. *Context 167.* Institute of Historic Building Conservation.

AMADO, M. & POGGI, F. 2022. Chapter 8 - Urban Infrastructures Analysis. *In:* AMADO, M. & POGGI, F. (eds.) *Sustainable Energy Transition for Cities.* Elsevier.

AMADO, M. & RODRIGUES, E. 2019. A heritage-based method to urban regeneration in developing countries: The case study of Luanda. *Sustainability,* 11**,** 4105.

AMEEN, R. F. M., MOURSHED, M. & LI, H. 2015. A critical review of environmental assessment tools for sustainable urban design. *Environmental Impact Assessment Review,* 55**,** 110-125.

ANDRIEUX, J.-Y. 2024. *Industrial Heritage: A New Cultural Issue* [Online]. Digital Encyclopedia of European History. Available: https://ehne.fr/en/encyclopedia/themes/arts-in-europe/monument/industrial-heritage-a-new-cultural-issue [Accessed 17 November 2024].

AOKI, N. & XU, S. 2021. *Research on Value Estimation of Industrial Heritage Sites (工业遗产价值评估研究)*, China City Press (中国城市出版社).

ARCHITECTS DESIGN PARTNERSHIP 2007. *Education and contextualism,* London, London : Black Dog Pub.

AUSTIN, R. L., WOODCOCK, D. G., STEWARD, W. C. & FORRESTER, R. A. 1988. *Adaptive reuse : issues and case studies in building preservation,* New York, New York : Van Nostrand Reinhold.

BAKER, C. 2018. City & Town Classification of Constituencies & Local Authorities. House of Commons Library: UK Parliament.

BARILE, S. & SAVIANO, M. 2015. From the management of cultural heritage to the governance of the cultural heritage system. *Cultural heritage and value creation: Towards new pathways***,** 71-103.

BERGER, S. 2019. Industrial Heritage and the Ambiguities of Nostalgia for an Industrial Past in the Ruhr Valley, Germany. *Labor (Durham, N.C.),* 16**,** 37-64.
BERKENBOSCH, K., GROOTE, P. & STOFFELEN, A. 2022. Industrial heritage in tourism marketing: legitimizing post-industrial development strategies of the Ruhr Region, Germany. *Journal of heritage tourism,* 17**,** 327-341.
BERNARDO, F., LOUPA-RAMOS, I. & CARVALHEIRO, J. 2021. Are biodiversity perception and attitudes context dependent? A comparative study using a mixed-method approach. *Land Use Policy,* 109**,** 105703.
BERTA, M., BOTTERO, M. & FERRETTI, V. 2018. A mixed methods approach for the integration of urban design and economic evaluation: Industrial heritage and urban regeneration in China. *Environment and planning. B, Urban analytics and city science,* 45**,** 208-232.
BESANA, A., ESPOSITO, A., FISICHELLA, C. & VANNINI, M. C. Memory and Communities-A new day has begun for Industrial Heritage and Trails. Congress, 2021. 6.
BEŞTEPE, F. & YILDIRIM, S. Ö. 2022. Acceptance of IoT-based and sustainability-oriented smart city services: A mixed methods study. *Sustainable cities and society,* 80**,** 103794.
BEUKES, E. A., VANDERSCHUREN, M. J. W. A. & ZUIDGEEST, M. H. P. 2011. Context sensitive multimodal road planning: a case study in Cape Town, South Africa. *Journal of Transport Geography,* 19**,** 452-460.
BIAGINI, C. & ARSLAN, P. 2018. Industrial Heritage in the historical neighbourhood: BIM strategies for urban regeneration. *Disegnarecon,* 11**,** 9-1-9.15.
BIRMINGHAM CITY COUNCIL & BRITISH WATERWAYS 2002. City Centre Canal Corridor: Development Framework. Birmingham City Council.
BMBEIT 2009. Guidelines for the Conservation and Reuse of Industrial Heritage in Beijing (北京市工业遗产保护与再利用工作导则). *In:* TECHNOLOGY, T. B. M. B. O. E. A. I. (ed.).
BOLE, D. 2021. 'What is industrial culture anyway?' Theoretical framing of the concept in economic geography. *Geography compass,* 15**,** n/a.
BOTTERO, M., D'ALPAOS, C. & OPPIO, A. 2019. Ranking of Adaptive Reuse Strategies for Abandoned Industrial Heritage in Vulnerable Contexts: A Multiple Criteria Decision Aiding Approach. *Sustainability (Basel, Switzerland),* 11**,** 785.
BOYD, S. W. 2017. Editorial: heritage trails and tourism. *Journal of heritage tourism,* 12**,** 417-422.
BRITANNICA, T. E. O. E. 2023. *What Is Cultural Appropriation?* [Online]. Encyclopaedia Britannica. Available: https://www.britannica.com/story/what-is-cultural-appropriation. [Accessed 17 November 2024].
BRITISH GEOLOGICAL SURVERY. 2024. *Landforms* [Online]. British Geological Survery. Available: https://www.bgs.ac.uk/discovering-geology/geological-processes/landforms/ [Accessed 17 November 2024].
BUCHANAN, R. A. 1989. *The engineers : a history of the engineering profession in Britain, 1750-1914,* London, London : Jessica Kingsley.
BULLEN, P. A. & LOVE, P. E. D. 2011. Adaptive reuse of heritage buildings. *Structural survey,* 29**,** 411-421.
BUNICH, P. 1962. Proportion between Fixed Assets and Gross Industrial Output. *Problems in Economics,* 5**,** 46-54.
BURDEN, E. E. 2012. *Illustrated dictionary of architecture,* New York ; London, New York ; London : McGraw-Hill.
CAMBRIDGE DICTIONARY. 2024a. *Civilization* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/civilization [Accessed 17 November 2024].
CAMBRIDGE DICTIONARY. 2024b. *Context* [Online]. https://dictionary.cambridge.org/dictionary/english/context. Available: https://dictionary.cambridge.org/dictionary/english/context [Accessed 17 November 2024].

CAMBRIDGE DICTIONARY. 2024c. *Culture* [Online]. Cambridge University Press and Assessment. Available: https://dictionary.cambridge.org/dictionary/english/culture [Accessed 17 November 2024].
CAMBRIDGE DICTIONARY. 2024d. *History* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/history [Accessed 17 November 2024].
CAMBRIDGE DICTIONARY. 2024e. *Industry* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/industry [Accessed 17 November 2024].
CAMBRIDGE DICTIONARY. 2024f. *Town* [Online]. Cambridge University Press and Assessment. Available: https://dictionary.cambridge.org/dictionary/english/town [Accessed 17 November 2024].
CAMBRIDGE DICTIONARY. 2024g. *Village* [Online]. Cambridge University Press and Assessment. Available: https://dictionary.cambridge.org/dictionary/english/village [Accessed 17 November 2024].
CARMONA, M., DE MAGALHãES, C., HAMMOND, L., BLUM, R. & YANG, D. 2004. Living Places: Caring for Quality. London: The Bartlett School of Planning, UCL.
CARMONA, M., TIESDELL, S., HEATH, T. & OC, T. 2010. *Public places--urban spaces : the dimensions of urban design,* Oxford, Oxford : Architectural.
CASSAR, J. & GRIMA, R. 2013. *Approaches to Industrial Heritage: what works?*, The Farsons Foundation.
CENGAGE 2024. History Of Industries In Shanghai. *International magazines.* Encyclopedia.com.
CHAN, H. H., HU, T.-S. & FAN, P. 2019. Social sustainability of urban regeneration led by industrial land redevelopment in Taiwan. *European planning studies,* 27**,** 1245-1269.
CHANDLER, J., LANE, S. & WALSTRA, A. 2007. Quantifying landform change.
CHEN, X. 2015. Tighten the protection and useof industrial heritage for scientificdevelopment of cultural heritage 加强上海工业遗产保护利用促进文化遗产事业科学发展. *Shanghai Wenbo 上海文博论丛*. Shanghai: Museum of Shanghai 上海博物馆.
CHEN, X. 2021. *Shanghai Metropolitan Area Development Report 1: Spatial Structure 上海都市圈发展报告·第一辑——空间结构,* Shanghai, Truth & Wisdom Press (格致出版社).
CHEN, Z. 1961. *Historical data of modern Chinese industry: Series 3 (中国近代工业史资料: 第三辑),* Beijing, Joint Publishing 三联书店.
CHEN, Z. & YAO, L. 1957. *Historical data of modern Chinese industry: Series 1(中国近代工业史资料: 第一辑(1840-1895 年)),* Beijing, Joint Publishing 三联书店.
CHIESURA, A. 2004. The role of urban parks for the sustainable city. *Landscape and Urban Planning,* 68**,** 129-138.
ÇIZGEN, G. 2012. *Rethinking The Role of Context and Contextualism in Architecture and Design.* Doctoral dissertation Doctoral dissertation, Eastern Mediterranean University (EMU).
CLARK, J. 2013. Adaptive Reuse of Industrial Heritage: Opportunities & Challenges. Austrilia: Heritage Council of Victoria.
COLE, R. J. & JOSE VALDEBENITO, M. 2013. The importation of building environmental certification systems: international usages of BREEAM and LEED. *Building research & information,* 41**,** 662-676.
COLLAZO, A. A. 2022. Urban Morphology and Industrial Heritage Perspectives *WIT Transactions on Ecology and the Environment,* 260**,** 427-436.
COMER, D. & GREENE, J. S. 2015. The development and application of a land use diversity index for Oklahoma City, OK. *Applied Geography,* 60**,** 46-57.
COPIC, S., ĐORĐEVIĆ, J., LUKIC, T., STOJANOVIĆ, V., ĐUKIČIN, S., BESERMENJI, S., STAMENKOVIĆ, I. & TUMARIC, A. 2014. Transformation of industrial heritage: An example of tourism industry development in the Ruhr area (Germany). *Geographica Pannonica,* 18**,** 43-50.

COŞKUN, B. S. Constructive conservation: A British approach for conservation. Reuso 2105-III Congreso Internacional sobre Documentación, Conservación y Reutilización del Patrimonio Arquitectónico, 2015. 22-24.

COUCH, C. 2017. *City of change and challenge: Urban planning and regeneration in Liverpool*, Routledge.

COUCH, C., SYKES, O. & BöRSTINGHAUS, W. 2011. Thirty years of urban regeneration in Britain, Germany and France: The importance of context and path dependency. *Progress in Planning - PROG PLANN,* 75**,** 1-52.

CRESWELL, J. W. 2023. *Research design : qualitative, quantitative, and mixed methods approaches* Thousand Oaks, California : SAGE Publications, Inc.

CRISTOBAL-FRANSI, E., DARIES, N., MARTIN-FUENTES, E. & MONTEGUT-SALLA, Y. 2020. Industrial Heritage 2.0: Internet Presence and Development of the Electronic Commerce of Industrial Tourism. *Sustainability (Basel, Switzerland),* 12.

CROMPTON, J. L. 2005. The impact of parks on property values: empirical evidence from the past two decades in the United States. *Managing leisure,* 10**,** 203-218.

DAISA, J. 2006. ITE Committee Report Summary - Context sensitive solutions in designing major urban thoroughfares for walkable communities: An ITE proposed recommended practice. *Ite Journal-Institute Of Transportation Engineers,* 76**,** 32.

DAVIES, P. 2008. What Makes Industrial Sites Heritage Significant and How Can they be Managed to Retain Their Heritage Value in an Operating System? The Heritage of Hydro Tasmania-a Case Study. 6**,** 21-26.

DE BELLEFON, M.-P., COMBES, P.-P., DURANTON, G., GOBILLON, L. & GORIN, C. 2021. Delineating urban areas using building density. *Journal of Urban Economics,* 125**,** 103226.

DE LA TORRE, M. 2002. Assessing the Values of Cultural Heritage: Research Report. Los Angeles: CA: Getty Conservation Institute.

DENG, C., LU, C., TONG, B. & ZHANG, J. 2011. Research on the development of an industrial heritage conservation list - the case of Nanjing (工业遗产保护名录制定研究——以南京为例). *Transformation and Reconstruction - 2011 China Urban Planning Conference (转型与重构——2011 中国城市规划年会论文集).* Nanjing.

DENISON, E. 2006. *Building Shanghai : The Story of China's Gateway*, Newark : John Wiley & Sons, Incorporated.

DEPARTMENT FOR CULTURE MEDIA & SPORT 2013. Scheduled Monuments & nationally important but non-scheduled monuments. *In:* DEPARTMENT FOR CULTURE, M. S. (ed.). Historic England.

DERVOZ, I. 2013. *Industrial heritage in Europe* [Online]. Committee on Culture, Science, Education and Media. Available: http://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=19512&lang=EN [Accessed 17 November 2024].

DOMENECH, T. & BORRION, A. 2022. Embedding circular economy principles into urban regeneration and waste management: Framework and metrics. *Sustainability,* 14**,** 1293.

DON CATCHMENT RIVER TRUST. 2020. *Salmon of Steel Trial* [Online]. Festival of the Mind. Available: https://festivaloftheмind.sheffield.ac.uk/wp-content/uploads/sites/2/2020/09/FINAL-MAP-Salmon-of-Steel-Trail-2020.pdf [Accessed 10 September 2022].

DOTS. 2018. *Understanding CSD and CSS* [Online]. U.S.Department of Transportation. Available: https://www.fhwa.dot.gov/planning/css/what_is_css/ [Accessed 5 May 2020].

DOTS. 2020. *Context Sensitive Solutions (CSS)* [Online]. Department of Transportation. Available: https://www.dot.ny.gov/divisions/engineering/design/dqab/css [Accessed 5 May 2020].

DOUET, J. & INTERNATIONAL COMMITTEE FOR THE CONSERVATION OF THE INDUSTRIAL HERITAGE 2012. *Industrial heritage re-tooled : the TICCIH guide to industrial heritage conservation* Lancaster United Kingdom : Carnegie Publishing Limited.

DOUGLAS, O., RUSSELL, P. & SCOTT, M. 2019. Positive perceptions of green and open space as predictors of neighbourhood quality of life: implications for urban planning across the city region. *Journal of environmental planning and management,* 62**,** 626-646.

DU, M., PENG, A. & PINFIELD, S. Applying Qual-Quan Mixed Methods Design in Smart City Research. 2017 2017 Kidmore End. Kidmore End: Academic Conferences International Limited, 95-103.

DU, X. 2014. *National capitalism and the old Chinese government 民族资本主义与旧中国政府,* Shanghai, Shanghai People's Press 上海人民出版社.

EDELBLUTTE, S. 2011. What remains after deindustrialization? From dereliction and denial to industrial heritage. *Bulletin de l'Association de géographes français,* 88**,** 150-163.

ENGLISH-HERITAGE. 2008. Conservation Principles, Policies and Guidance: For the Sustainable Management of the Historic Environment. *Guidance* [Online]. Available: https://historicengland.org.uk/images-books/publications/conservation-principles-sustainable-management-historic-environment/ [Accessed 7 June 2022].

EOM, J. S. & AN, D. W. 2018. Regeneration of Industrial Facilities into Cultural Facilities in Seoul: Studying Location Value. *Sustainability* [Online], 10.

EWING, R. 2020. *Basic Quantitative Research Methods for Urban Planners*, Oxford : Taylor & Francis Group.

FALSER, M. & YANG, M. 2001. Industrial Heritage Analysis: World Heritage List and Tentative List. *Global Strategy Studies* [Online]. Available: https://whc.unesco.org/archive/ind-study01.pdf [Accessed 26 July 2020].

FAN, X. 1991. *History of industrial development in modern China 中国近代工业发展史: 1840-1927*, Shanxi Renmin Publishing Company 陕西人民出版社.

FANG, S. 2018. A Re-estimation of the Industrial Gross Output Value of Shanghai, 1908 -1948. *In:* GAO, C. (ed.). Reseaches in Chinese Economic History.

FANG, X. 2011. Ethical reflections on the design of urban space boundaries (城市空间边界设计的伦理思考). *"City Details", Issue 7, 2011 ("城市细节"2011 年第 7 期专题)* [Online]. Available: http://www.izhsh.com.cn/doc/183/3_1241.html [Accessed 24 Feburary 2023].

FEILDEN, B. M. & JOKILEHTO, J. 1998. Management guidelines for world cultural heritage sites. ICCROM.

FERRER, A. L. C., THOMé, A. M. T. & SCAVARDA, A. J. 2018. Sustainable urban infrastructure: A review. *Resources, Conservation and Recycling,* 128**,** 360-372.

FINIO, N. 2021. Measurement and Definition of Gentrification in Urban Studies and Planning. *Journal of Planning Literature,* 37**,** 249-264.

FOX, E. J. 2008. Chapter 5: Contextualistic Perspectives *Handbook of research on educational communications and technology.* Mahwah: NJ: Lawrence Erlbaum Associates.

FRAGNER, B., VALCHáŘOVá, V., ZIKMUND, J., BERAN, L., SKŘIVAN, T. & VORLíK, P. 2015. Industrial topography/ the architecture of conversion Czech Republic 2005–2015. Industrial Heritage and the Participation of Academic Community.

FRAMPTON, K. 2020. *Modern architecture : a critical history*, London : Thames & Hudson.

FRANTáL, B., KUNC, J., NOVáKOVá, E., KLUSáČEK, P., MARTINáT, S. & OSMAN, R. 2013. Location matters! Exploring brownfields regeneration in a spatial context (A case study of the South Moravian Region, Czech Republic). *Moravian geographical reports,* 21**,** 5-19.

FRISCH, M. 1998. De-, re-, and post-industrialization: industrial heritage as contested memorial terrain.(Point Park Revisited: Legacies and New Perspectives on Applied Folklore). *Journal of Folklore Research,* 35**,** 241.

GAN, T., CHEN, J., YAO, M., CENCI, J., ZHANG, J. & HE, Y. 2024. Frontier Revitalisation of Industrial Heritage with Urban–Rural Fringe in China. *Buildings,* 14**,** 1256.

GARCIA ASUERO, A., SAYAGO, A. & GONZáLEZ, G. 2006. The Correlation Coefficient: An Overview. *Critical Reviews in Analytical Chemistry - CRIT REV ANAL CHEM,* 36**,** 41-59.

GARCíA, S., RAMíREZ-GALLEGO, S., LUENGO, J., BENíTEZ, J. M. & HERRERA, F. 2016. Big data preprocessing: methods and prospects. *Big data analytics,* 1**,** 1-22.

GARDINER, C. 1998. Developing Indicators to Assess the Potential for Urban Regeneration: Improvements Using the 1991 Census of Population Samples of Anonymised Records. *Urban studies (Edinburgh, Scotland),* 35**,** 1519-1540.

GEERTZ, C. 2016. The interpretation of cultures: selected essays. Basic Books.

GEHL, J. 2010. *Cities for people*, London Washington, DC : Island Press.

GEREMEW, Y. M., HUANG, W.-J. & HUNG, K. 2023. Fuzzy-Set Qualitative Comparative Analysis as a Mixed-Method and Analysis Technique: A Comprehensive Systematic Review. *Journal of Travel Research,* 63**,** 3-26.

GIAMARELOS, S. 2022. *Resisting postmodern architecture : critical regionalism before globalisation*, London : UCL Press.

GIBBONS, S., OVERMAN, H. & SARVIMäKI, M. 2021. The local economic impacts of regeneration projects: Evidence from UK's single regeneration budget. *Journal of Urban Economics,* 122**,** 103315.

GILL, S. E., HANDLEY, J. F., ENNOS, A. R. & PAULEIT, S. 2007. Adapting Cities for Climate Change: The Role of the Green Infrastructure. *Built environment (London. 1978),* 33**,** 115-133.

GILLHAM, B. 2000. *Case Study Research Methods*, London : Bloomsbury Publishing Plc.

GILLHAM, B. 2008. *Developing a questionnaire*, A&C Black.

GIVONI, B. 1998. *Climate considerations in building and urban design,* New York Chichester, New York Chichester : Van Nostrand Reinhold.

GODOY-SHIMIZU, D., STEADMAN, P. & EVANS, S. 2021. Density and morphology: from the building scale to the city scale. *Buildings and Cities*.

GOLD, J. R. 2007. *The practice of modernism : modern architects and urban transformation, 1954-1972* London New York, London New York : Routledge.

GOMEZ, L. F., SARMIENTO, R., ORDOñEZ, M. F., PARDO, C. F., DE Sá, T. H., MALLARINO, C. H., MIRANDA, J. J., MOSQUERA, J., PARRA, D. C., REIS, R. & QUISTBERG, D. A. 2015. Urban environment interventions linked to the promotion of physical activity: A mixed methods study applied to the urban context of Latin America. *Social science & medicine (1982),* 131**,** 18-30.

GOODWIN, C. & DURANTI, A. 1992. *Rethinking context: Language as an interactive phenomenon (No. 11)*, Cambridge University Press.

GöRMAR, F., HARFST, J., SIMIC, D. & WUST, A. 2019. *The transformative power of Industrial Culture - From concepts to actions*.

GRAFE, F.-J. & MIEG, H. A. 2019. Connecting financialization and urbanization: the changing financial ecology of urban infrastructure in the UK. *Regional Studies, Regional Science,* 6**,** 496-511.

GRAHAM, H., MASON, R. & NEWMAN, A. 2009. Historic Environment, Sense of Place, and Social Capital. Newcastle: International Centre for Cultural and Heritage Studies.

GRAHN, P. & STIGSDOTTER, U. K. 2010. The relation between perceived sensory dimensions of urban green space and stress restoration. *Landscape and urban planning,* 94**,** 264-275.

GREAT BRITAIN MINISTRY OF HOUSING, COMMUNITIES AND LOCAL GOVERNMENT GREAT BRITAIN MINISTRY OF HOUSING & GOVERNMENT, C. A. L. 2018. *National planning policy framework* Norwich, Norwich : TSO, distributor.

GREY, C. & O'TOOLE, M. 2020. The Placing of Identity and the Identification of Place: "Place-Identity" in Community Lifeboating. *Journal of management inquiry,* 29**,** 206-219.

GRIFFIN, T. 1979. The Stock of Fixed Assets in the United Kingdom: How to Make Best Use of the Statistics. *In:* PATTERSON, K. D. & SCHOTT, K. (eds.) *The Measurement of Capital: Theory and Practice.* London: Palgrave Macmillan UK.

GUO, P., LI, Q., GUO, H. & LI, H. 2021. Quantifying the core driving force for the sustainable redevelopment of industrial heritage: Implications for urban renewal. *Environmental Science and Pollution Research,* 28**,** 48097-48111.
HALCOMB, E. J. & HICKMAN, L. 2015. Mixed methods research.
HALL, P. 2014. *Cities of tomorrow : an intellectual history of urban planning and design since 1880,* Chichester, Chichester : Wiley-Blackwell.
HAMADA, S., TANAKA, T. & OHTA, T. 2013. Impacts of land use and topography on the cooling effect of green areas on surrounding urban areas. *Urban forestry & urban greening,* 12**,** 426-434.
HAMEDANI, A. Z. & HUBER, F. 2012. A comparative study of DGNB, LEED and BREEAM certificate systems in urban sustainability. *The sustainable city VII: Urban regeneration and sustainability,* 1121**,** 121-132.
HARFST, J., WUST, A. & NADLER, R. 2018. Conceptualizing industrial culture. *GeoScape,* 12**,** 1-9.
HARRISON, R. 2010. What is heritage. *Understanding the politics of heritage***,** 5-42.
HARRISON, R. 2012. Heritage: critical approaches.
HARUN, N. Z., MANSOR, M. & SAID, I. 2013. The Experience of Diversity in Open Spaces of Two Historical Towns in Malaysia. *Procedia - Social and Behavioral Sciences,* 85**,** 582-591.
HEATH, T. 2016. Sustainable Urban Architecture: the life and death of sustainability - long live contextual senstitivism (Keynote paper). *The 3rd International Conference on Engineering Technology and Industrial Application.* Surakarta, Indonesia.
HEFFERNAN, E., HEFFERNAN, T. & PAN, W. 2014. The relationship between the quality of active frontages and public perceptions of public spaces. *Urban design international (London, England),* 19**,** 92-102.
HIGGINS, C. & KANAROGLOU, P. 2018. Rapid transit, transit-oriented development, and the contextual sensitivity of land value uplift in Toronto. *Urban Studies,* 55**,** 2197-2225.
HISTORIC-ENGLAND 2017a. Post-Modern Architecture: Introductions to Heritage Assets.
HISTORIC-ENGLAND 2017b. The Setting of Heritage Assets - Historic Environment Good Practice Advice in Planning Note 3 (Second Edition). 2 ed. Historic England.
HISTORIC-ENGLAND. 2019. *Understanding Industrial and Infrastructure Heritage* [Online]. Historic-England. Available: https://historicengland.org.uk/research/current/discover-and-understand/industry-and-infrastructure/ [Accessed 17 November 2024].
HISTORIC-ENGLAND. 2023a. *People's Attachment to Historic Places and the Benefits* [Online]. Available: https://historicengland.org.uk/research/heritage-counts/heritage-and-society/attachment-historic-places/ [Accessed 17 November 2024].
HISTORIC-ENGLAND. 2023b. *The Role of Heritage in Bringing People Together* [Online]. Available: https://historicengland.org.uk/research/heritage-counts/heritage-and-society/social-cohesion/ [Accessed 17 November 2024].
HISTORIC ENVIRONMENT DIVISION. 2021. *Conservation Principles - Guidance for the sustainable management of the historic environment in Northern Ireland* [Online]. Department for Communities: Department for Communities. Available: https://www.communities-ni.gov.uk/consultations/consultation-proposed-conservation-principles-guidance-sustainable-management-historic-environment [Accessed].
HKU. 2020. *Architecture of the Urban Industrial Complex* [Online]. Available: https://www.arch.hku.hk/research_project/architecture-of-the-urban-industrial-complex/ [Accessed 17 November 2024].
HOAGLAND, A. K. 2000. A History of American Architecture: Buildings in Their Cultural and Technological Context Mark Gelernter. *Journal of the Society of Architectural Historians,* 59**,** 413-414.
HOCHMAN, O. & HOCHMAN, E. 1980. Regeneration, Public Goods, and Economic Growth. *Econometrica,* 48**,** 1233-1250.

HøJRIIS, J., HERRMANN, I. T., NIELSEN, P. S. & BULKELEY, P. A comparative study of contextual urban design approaches in the UK and DK. *In:* L. BJERREGAARD JENSEN, M. K. T., ed. The 3rd International Workshop on Design in Civil and Environmental Engineering, 2014. DCEE.

HOLMGREN, J. 2020. The effect of public transport quality on car ownership – A source of wider benefits? *Research in Transportation Economics,* 83**,** 100957.

HOLTON, R. J. 1992. *Economy and society,* London, London : Routledge.

HUANG, L., QIN, J., ZHOU, Y., ZHU, F., LIU, L. & SHAO, L. 2023. Normalization techniques in training dnns: Methodology, analysis and application. *IEEE transactions on pattern analysis and machine intelligence,* 45**,** 10173-10196.

HUANG, Q. 2008. *Conservation and Reuse of Modern Industrial Buildings in Shanghai (上海近代工业建筑保护和再利用).* Ph.D, Tongji University.

HUANG, W., XIONG, G., ZHONG, L., LI, K., LI, H., SKITMORE, M. & TALEBIAN, N. 2022. Research into Satisfaction with Industrial Heritage Renewal Based on the SEM-IPA Model: A Case Study of the Dongguan Jianyuzhou Park. *Land (Basel),* 11**,** 403.

HUDSON, K. 1963. Industrial archaeology : an introduction.

HUDSON, K., UNIVERSITY OF BRISTOL. DEPARTMENT OF EXTRA-MURAL, S. & BATH UNIVERSITY OF, T. 1967. The industrial past and the industrial present

HUUB, P. & PASCAL, B. 2015. Evaluating urban regeneration: An assessment of the effectiveness of physical regeneration initiatives on run-down industrial sites in the Netherlands. *Urban studies (Edinburgh, Scotland),* 52**,** 2151-2169.

ICOMOS. International charter for the conservation and restoration of monuments and sites (The Venice Charter 1964). IInd international congress of architects and technicians of historic monuments, 1964. ICOMOS Venice.

ICOMOS SLOVENIA 2017. Protection and Reuse of Industrial Heritage: Dilemmas, Problems, Examples. *In:* IFKO, S. & STOKIN, M. (eds.).

IFKO, S. 2016. Comprehensive Management of Industrial Heritage Sites as A Basis for Sustainable Regeneration. *Procedia Engineering,* 161**,** 2040-2045.

IñIGUEZ, A. 2024. *The New Life of Industrial Architecture in Cities: 20 Renovations and Conversions of Old Factories and Warehouses* [Online]. ArchDaily: ArchDaily. Available: https://www.archdaily.com/1013254/the-new-life-of-industrial-architecture-in-cities-20-renovations-and-conversions-of-old-factories-and-warehouses [Accessed 17 November 2024].

INTERNATIONAL RESCUE COMMITTEE 2017. Urban context analysis toolkit. Guidance note for humanitarian practitioners. IIED, London.

IQBAL, N., AKBAR, S. H. & VAN CLEEMPOEL, K. 2022. Identification of Industrial Heritage and a Theoretical Framework for an Industrial Heritage Inventory System in Pakistan. *Sustainability (Basel, Switzerland),* 14**,** 5797.

IRYNA, M. & IRINA, B. Ecological transformation of industrial regions: Recreation system by the example of the Emscher Landscape Park. 2023 2023 Melville. Melville: American Institute of Physics.

ITE 2006. Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities. *ITE Report.* https://www.epa.gov/sites/production/files/2015-11/documents/rp036.pdf: Institute of Transportation Engineers.

ITE 2010. Designing Walkable Urban Thoroughfares: A Context Sensitive Approach. *ITE Report.* https://www.ite.org/pub/?id=E1CFF43C-2354-D714-51D9-D82B39D4DBAD: Institute of Transportation Engineers.

ITZEN, P., MüLLER, C. & ARBEITSKREIS DEUTSCHE, E.-F. 2013. *The invention of industrial pasts : heritage, political culture and economic debates in Great Britain and Germany, 1850-2010* Augsburg, Augsburg : Wissner.

IVERSEN, G. R. 1987. Analysis of variance.

JANG, H. & MENNIS, J. 2021. The role of local communities and well-being in unesco world heritage site conservation: An analysis of the operational guidelines, 1994–2019. *Sustainability (Basel, Switzerland),* 13**,** 7144.

JAYNE, M. & BELL, D. 2017. *City of quarters: Urban villages in the contemporary city*, Routledge.

JEVREMOVIC, L., VASIĆ, M. & AU 2012. *Aesthetics of Industrial Architecture in the Context of Industrial Buildings Conversion*

JI, H. & XU, S. 2012. A Preliminary Study on the Identification and Classification of the Scientific and Technological Value of Industrial Heritage - Tianjin's Modern Industrial Heritage as an Example（工业遗产科技价值认定与分类初探——以天津近代工业遗产为例）. *New Architecture (新建筑)***,** 28-33.

JIA, Y. 2015. 1949-1978: Adjustment of industrial layout and evolution of urban form in Shanghai 1949—1978： 上海工业布局调整与城市形态演变. *Shanghai Party history and Party building 上海党史与党建,* 1**,** 27-30.

JOHANSSON, S. E., KONLAAN, B. B. & BYGREN, L. O. 2001. Sustaining habits of attending cultural events and maintenance of health: a longitudinal study. *Health Promotion International,* 16**,** 229-234.

JOINT ICOMOS & TICCIH. 2011. *The Dublin Principles* [Online]. Available: https://ticcih.org/wp-content/uploads/2013/10/GA2011_ICOMOS_TICCIH_joint_principles_EN_FR_final_20120110.pdf [Accessed 21 August 2022].

JOKILEHTO, J. 2005. Definition of cultural heritage: References to documents in history. *ICCROM Working Group 'Heritage and Society,* 4.

JONES, C. & WATKINS, C. 1996. Urban regeneration and sustainable markets. *Urban Studies,* 33**,** 1129-1140.

KAFY, A. A. 2018. Importance of Surface Water Bodies for Sustainable Cities: A Case Study of Rajshahi City Corporation.

KAIYU, W. 2009. A Brief History of Context. *International journal of computer science issues,* 6**,** 33.

KAPLAN, H., PRAHALAD, V. & KENDAL, D. 2022. Native for whom: A mixed-methods literature review and synthesis to conceptualise biotic nativeness for social research in the urban context. *People and nature (Hoboken, N.J.),* 4**,** 15-31.

KATAPALLY, T. R., RAINHAM, D. & MUHAJARINE, N. 2016. The influence of weather variation, urban design and built environment on objectively measured sedentary behaviour in children. *AIMS Public Health,* 3**,** 663.

KAYA, E. N. Transforming industrial urban waterfronts : industrial heritage and tourism. 2017.

KELLER, W. & SHIUE, C. H. 2021. The Economic Consequences of the Opium War. *NBER Working Paper Series*.

KERR, J. S. The Burra Charter of Australia ICOMOS. Protecting the past for the future. Proceedings of the UNESCO regional conference on historic places. Sydney, 22-28 May 1983, 1983. 220-227.

KIFT, D. 2011. Heritage and history: Germany's industrial museums and the (re-) presentation of labour. *International journal of heritage studies : IJHS,* 17**,** 380-389.

KIM, S. & KWON, H.-A. 2020. Sustainable regeneration through the cultural conversion of urban heritage. *Sustainability (Basel, Switzerland),* 12**,** 2932.

KIRKWOOD, N. 2001. *Manufactured sites : rethinking the post-industrial landscape,* London, London : Taylor & Francis.

KIROVOVA, L. & SIGMUNDOVá, A. 2014. *Implementing an Ecosystem Approach to the Adaptive Reuse of Industrial Sites*.

KOMPAN. 2024. *The Cost of A Playground* [Online]. Available: https://www.kompan.com/zh/cn/planning/playground-budgeting-cost-breakdown [Accessed 17 November 2024].

KOWARIK, I. 2005. Wild Urban Woodlands: Towards a Conceptual Framework.

KREISLOVA, K., KNOTKOVA, D. & GEIPLOVA, H. 2013. 15 - Atmospheric corrosion of historical industrial structures. Elsevier Ltd.
KRYDER-REID, E. & MAY, S. 2024. *Toxic heritage : legacies, futures, and environmental justice* Milton Park, Oxon : Routledge.
KUTUT, V. 2017. Specific Characteristics Of real Estate Development In Cultural Heritage Areas. *Procedia engineering,* 208**,** 69-75.
LA ROSA, D., PRIVITERA, R., BARBAROSSA, L. & LA GRECA, P. 2017. Assessing spatial benefits of urban regeneration programs in a highly vulnerable urban context: A case study in Catania, Italy. *Landscape and Urban Planning,* 157**,** 180-192.
LABADI, S. & LOGAN, W. 2015. Approaches to urban heritage, development and sustainability. *Urban heritage, development and sustainability.* Routledge.
LAGRO, J. A. 2013. *Site analysis : informing context-sensitive and sustainable site planning and design* Hoboken, N.J., Hoboken, N.J. : Wiley.
LAMPARD, E. E. 2024. City: Industrialization and the Modern World. *Encyclopedia Britannica.*
LANDMAN, K. 2014. Learning through Real-life Experience: Using Case Studies for Urban Planning and Design Education.
LANDORF, C. 2009. A Framework for Sustainable Heritage Management: A Study of UK Industrial Heritage Sites. *International journal of heritage studies : IJHS,* 15**,** 494-510.
LAPRISE, M., LUFKIN, S. & REY, E. 2015. An indicator system for the assessment of sustainability integrated into the project dynamics of regeneration of disused urban areas. *Building and Environment,* 86**,** 29-38.
LARKHAM, P. J. & ADAMS, D. 2023. Revisioning and Rebuilding Britain's War-Damaged Cities. *Urban planning,* 8**,** 169-181.
LEE, M. J. & LEE, D.-E. 2014. Questioning Beliefs Surrounding Urban Sustainability: The Need for a Contextual Urban Model. *Journal of Asian Architecture and Building Engineering,* 13**,** 163-170.
LEED. 2021. *Aligning Sustainability Plans with LEED for Cities and Communities* [Online]. https://www.usgbc.org/. Available: https://www.usgbc.org/resources/aligning-sustainability-plans-leed-cities-and-communities [Accessed 17 November 2022].
LEEDY, D. & ADAMS, L. 1984. A Guide to Urban Wildlife Management.
LEHTINEN, S. 2022. Urban Aesthetics and Technology. *In:* VALLOR, S. (ed.) *The Oxford Handbook of Philosophy of Technology.* Oxford University Press.
LI, G. & WU, S. 2011. Analysis of the Elements of the Urban Context. *Advanced Materials Research,* 243-249**,** 6620-6623.
LI, H., TIAN, W., ZHANG, Y. & CHEN, X. 2016. *The basis for evaluating the recycling of old industrial buildings (旧工业建筑再生利用评价基础)*, China Construction Industry Press (中国建筑工业出版社).
LI, H., ZHENG, S. & ZHANG, Y. 2012. A study on the value evaluation and conservation and utilization gradient of Chongqing's industrial heritage (重庆工业遗产的价值评价与保护利用梯度研究). *Architectural Journal (建筑学报)***,** 24-29.
LI, S. 2018. *Between human and urban : the opportunities of industrial heritage in Shanghai.*
LI, S. & HEATH, T. 2020. Achieving Contextual Sensitivity: an organic approach of British urban industrial heritage regeneration. *In:* (ED.), R. L. (ed.) *AMPS Proceedings 19.2. The City and Complexity: Life, Design and Commerce in the Built Environment.* Online.
LI, S. & QU, F. 2022. Preserving Authenticity in Urban Regeneration: A Framework for the New Definition from the Perspective of Multi-Subject Stakeholders—A Case Study of Nantou in Shenzhen, China. *International Journal of Environmental Research and Public Health* [Online], 19.
LI, S. & WANG, Q. 2019. Conservation of "Living" Industrial Heritage in UK from the Perspective of Existence and Continuity (存续视角下英国 "活态" 工业遗产保护). *City & House (城市住宅).*

LI, W. 2015. *The Japanese Army's economic plot to occupy Shanghai (日军侵占上海的经济图谋)* [Online]. 2015 Shanghai Local Chronicle Forum. Available: http://dangshi.people.com.cn/n/2015/0809/c85037-27432640.html [Accessed 17 November 2024].
LI, X. & SHEN, J. 2021. A Century of Industrialization under the Leadership of the Communist Party of China: Progress, Experience, and Prospects. *Contemporary Finance & Economics,* 12**,** 3-14.
LI, Z. 2005. *Digital terrain modeling : principles and methodology,* Boca Raton, Boca Raton : CRC Press.
LIAUW, F. 2019. Reference for contextual design. *IOP Conference Series: Materials Science and Engineering,* 508**,** 12031.
LICATA, L. & MERCY, A. 2015. Collective Memory, Social Psychology of. *In:* WRIGHT, J. D. (ed.) *International Encyclopedia of the Social & Behavioral Sciences (Second Edition).* Oxford: Elsevier.
LICCIARDI, G. 2012. *Economics of Uniqueness : Investing in Historic City Cores and Cultural Heritage Assets for Sustainable Development*, Herndon : World Bank Publications.
LINDNER, C., ROSA, B., BAKER, T., BRASH, J., BIRGE-LIBERMAN, P., CORNER, J., LARSON, S., LOUGHRAN, K., MILLINGTON, N. & PATRICK, D. 2017. *Deconstructing the High Line: Postindustrial Urbanism and the Rise of the Elevated Park,* United States, United States: Rutgers University Press.
LIU, B. & LI, K. 2008. A Preliminary Study on the Evaluation of Beijing's Industrial Heritage (北京工业遗产评价办法初探). *Architectural Journal (建筑学报)***,** 10-13.
LIU, C., WU, J., BAI, X. & ZHANG, G. 2012. Research on the value evaluation system of industrial heritage - An example of industrial heritage protection in Tianjin (工业遗产价值评价体系研究——以天津市工业遗产保护为例). *Diversity and Inclusion - Proceedings of the 2012 China Urban Planning Conference (多元与包容——2012 中国城市规划年会论文集).*
LIU, D. 1936. *The Growth and Industrialization of Shanghai (上海工业化研究)*, China Institute of Pacific Relations.
LIU, F., ZHAO, Q. & YANG, Y. 2018. An approach to assess the value of industrial heritage based on Dempster–Shafer theory. *Journal of Cultural Heritage,* 32**,** 210-220.
LIU, J., HE, J. & XU, S. 2021. *Spatial-temporal evolution of modern urban industry in China from 1840 to 1949 中国近代城市工业时空演变分析.*
LOURES, L. 2008. Industrial Heritage: the past in the future of the city. *WSEAS Transactions on Environment and Development,* 4**,** 687-687.
MA, D. 2006. Shanghai-based industrialization in the early 20th century: a quantitative and institutional analysis.
MADANIPOUR, A. 2010. *Whose Public Space?: International Case Studies in Urban Design and Development,* London, London: Routledge.
MALWITZ, N. 1996. History of Humanity: Scientific and Cultural Development, vol. 3, From the Seventh Century BC to the Seventh Century AD. *Library Journal,* 121**,** 56.
MANN, R. 2003. *UK guide to industrial heritage sites and museums on the trail of the industrial revolution,* S.l.], S.l. : Gateway Books.
MARSELLE, M. R., LINDLEY, S. J., COOK, P. A. & BONN, A. 2021. Biodiversity and Health in the Urban Environment. *Current Environmental Health Reports,* 8**,** 146-156.
MARTIN, D. 2015. AnnaStorm2014: Post-industrial Landscape Scars. New York: Palgrave Macmillan. *International journal of urban and regional research,* 39**,** 1289-1290.
MARTIN, P. 2022. *Regression Models for Categorical and Count Data,* London, London: SAGE Publications, Limited.
MCCLATCHEY, C. 2011. Why do towns want to become cities? *BBC News Magazine*.
MEISNER, M. J. 1992. *Mao's China and After: A History of The People's Republic （毛泽东的中国及后毛泽东的中国: 人民共和国史）*, Sichuan People's Publishing House 四川人民出版社.

MELA, A. 2014. Urban public space between fragmentation, control and conflict. *City, Territory and Architecture,* 1**,** 15.

MERRIAM-WEBSTER. 2024a. *Culture* [Online]. Available: https://www.merriam-webster.com/dictionary/culture [Accessed 17 November 2024].

MERRIAM-WEBSTER. 2024b. *History* [Online]. Available: https://www.merriam-webster.com/dictionary/history [Accessed 17 November 2024].

MESA-MINGORANCE, J. L. & ARIZA-LóPEZ, F. J. 2020. Accuracy Assessment of Digital Elevation Models (DEMs): A Critical Review of Practices of the Past Three Decades. *Remote Sensing* [Online], 12.

MIIT 2023. The National Industrial Heritage Management Approach (国家工业遗产管理办法). *In:* TECHNOLOGY, M. O. I. A. I. (ed.).

MINISTRY OF HOUSING AND URBAN-RURAL DEVELOPMENT OF THE PEOPLE'S REPUBLIC OF CHINA 1999. Standard for Basic Terminology of Urban Planning 城市规划基本术语标准. *In:* CHINA, M. O. H. A. U.-R. D. O. T. P. S. R. O. (ed.). Ministry of Housing and Urban-Rural Development of the People's Republic of China.

MO, C., WANG, L. & RAO, F. 2022. Typology, Preservation, and Regeneration of The Post-1949 Industrial Heritage in China: A Case Study of Shanghai. *Land,* 11**,** 1527.

MOHAMED, M. M., LIU, P. & NIE, G. 2022. Causality between Technological Innovation and Economic Growth: Evidence from the Economies of Developing Countries. *Sustainability* [Online], 14.

MOMCHEDJIKOVA, B. 2013. *Captured by the City : Perspectives in Urban Culture Studies*, Newcastle-upon-Tyne : Cambridge Scholars Publishing.

MUMFORD, L. 1961. The city in history : its origins, its transformations, and its prospects.

MUSSINELLI, E., TARTAGLIA, A., FANZINI, D., RIVA, R., CERATI, D. & CASTALDO, G. 2020. New paradigms for the urban regeneration project between green economy and resilience. *Regeneration of the Built Environment from a Circular Economy Perspective***,** 59-67.

NATIONAL BUREAU OF STATISTICS. 2021. *Industry 工业* [Online]. Jiangsu. Available: https://jszd.stats.gov.cn/TrueCMS//gjtjjjsdczd/zbjs/content/d1d70de7-ba66-4f00-9b0e-9f0e656a09bb.html#:~:text=%E7%BB%9F%E8%AE%A1%E6%8C%87%E6%A0%87%E8%A7%A3%E9%87%8A%2D%E5%B7%A5%E4%B8%9A&text=%E5%B7%A5%E4%B8%9A%E6%8C%87%E4%BB%8E%E4%BA%8B%E8%87%AA%E7%84%B6%E8%B5%84%E6%BA%90,%E5%8A%A0%E5%B7%A5%E7%9A%84%E7%89%A9%E8%B4%A8%E7%94%9F%E4%BA%A7%E9%83%A8%E9%97%A8%E3%80%82 [Accessed 17 November 2024].

NATIONAL BUREAU OF STATISTICS 2023. China Statistical Yearbook 2023. *In:* FU, L. & YE, L. (eds.). Beijing: China Statistics Press.

NATIONAL BUREAU OF STATISTICS. 2024. *National Data* [Online]. Available: https://www.stats.gov.cn/search/s?qt=GDP [Accessed 17 November 2024].

NEUMAN, T. R., FORBES, D., UNITED STATES. FEDERAL HIGHWAY, A., NATIONAL COOPERATIVE HIGHWAY RESEARCH, P. & AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION, O. 2002. *A guide to best practices for achieving context sensitive solutions,* Washington, D.C., Washington, D.C. : Transportation Research Board, National Research Council.

OEVERMANN, H. & MIEG, H. A. 2015. *Industrial heritage sites in transformation: clash of discourses,* New York, New York: Routledge, Taylor & Francis Group.

OGLETHORPE, M. 2005. Industrial Heritage and National Identity - Sharing Data, the Importance of Context and Strategic Priorities. *Industrial archaeology review,* 27**,** 27-31.

OGLETHORPE, M. 2014. The Rolt Memorial Lecture 2013: The Public Benefit of Industrial Heritage - Taking a Positive View *Industrial Archaeology Review,* 36**,** 85-96.

OKOLI, C. & PAWLOWSKI, S. D. 2004. The Delphi method as a research tool: an example, design considerations and applications. *Information & Management,* 42**,** 15-29.

OLIVEIRA, E. 2014. Reframing the 'creative city' through tailored and context-sensitive policies. *City,* 18**,** 598-602.
OLSSON, K. 2008. Citizen input in urban heritage management and planning: A quantitative approach to citizen participation. *The Town Planning Review***,** 371-394.
ONG, B. L. 2003. Green plot ratio: an ecological measure for architecture and urban planning. *Landscape and urban planning,* 63**,** 197-211.
ONION, R. 2008. Reclaiming the Machine:: An Introductory Look at Steampunk in Everyday Practice. *Neo-Victorian Studies,* 1**,** 138-163.
OSTERTAGOVA, E. 2012. Modelling Using Polynomial Regression. *Procedia Engineering,* 48**,** 500–506.
OUYANG, W., MORAKINYO, T. E., REN, C. & NG, E. 2020. The cooling efficiency of variable greenery coverage ratios in different urban densities: A study in a subtropical climate. *Building and Environment,* 174**,** 106772.
OXFORD ENGLISH DICTIONARY. 2021. *heritage* [Online]. Oxford English Dictionary. Available: https://www.oed.com/view/Entry/86230?rskey=i2KdmY&result=1#eid [Accessed 17 November 2024].
OXFORD ENGLISH DICTIONARY. 2023. *village, n., sense 1.a* [Online]. Oxford University Press. [Accessed 17 November 2024].
OXFORD ENGLISH DICTIONARY. 2024a. *city, n., sense 2.b* [Online]. Oxford University Press. [Accessed 17 November 2024].
OXFORD ENGLISH DICTIONARY. 2024b. *Culture* [Online]. Available: https://www.oed.com/search/dictionary/?scope=Entries&q=culture [Accessed 17 November 2024].
OXFORD ENGLISH DICTIONARY. 2024c. *town, n., sense I.4.a* [Online]. Oxford University Press. [Accessed 17 November 2024].
OXFORD ENGLISH DICTIONARY. 2024d. *Value* [Online]. Available: https://www.oed.com/dictionary/value_n?tab=factsheet#15828043 [Accessed 17 November 2024].
PAHL, B. Strategies for a sustainable management of our industrial-cultural heritage - Response to Ticcih Congress, Lille, 6-11 September 2015. 2016 2015. 434-440.
PALMER, M. & SISSONS, M. 2012. Industrial archaeology : a handbook.
PATRO, S. & SAHU, K. K. 2015. Normalization: A preprocessing stage. *arXiv preprint arXiv:1503.06462*.
PAULAUSKAS, L., PAULAUSKAS, A., BLAŽAUSKAS, T., DAMAŠEVIČIUS, R. & MASKELIŪNAS, R. 2023. Reconstruction of Industrial and Historical Heritage for Cultural Enrichment Using Virtual and Augmented Reality. *Technologies (Basel),* 11**,** 36.
PEISER, R. 2015. Real Estate Development. *In:* WRIGHT, J. D. (ed.) *International Encyclopedia of the Social & Behavioral Sciences (Second Edition).* Oxford: Elsevier.
PEPPER, S. C. 1942. *World hypotheses, a study in evidence,* Berkeley and Los Angeles,, University of California press.
PETERS, K., ELANDS, B. & BUIJS, A. 2010. Social interactions in urban parks: Stimulating social cohesion? *Urban forestry & urban greening,* 9**,** 93-100.
PIGMAN, J. G., HARTMAN, D. L., HOPWOOD, T., AGENT, K. R., O'CONNELL, L., STAMATIADIS, N. & TYNDALL, P. 2005. Context sensitive design : thinking beyond the pavement : documentation of workshop development and training.
PLEVOETS, B. & VAN CLEEMPOEL, K. 2019. *Adaptive Reuse of the Built Heritage : Concepts and Cases of an Emerging Discipline,* Milton, UNITED KINGDOM, Taylor & Francis Group.
PLOEGMAKERS, H. & BECKERS, P. 2015. Evaluating urban regeneration: An assessment of the effectiveness of physical regeneration initiatives on run-down industrial sites in the Netherlands. *Urban Studies,* 52**,** 2151-2169.

POTTERIES MUSEUM AND ART GALLERY 2021. Beyond Preservation: re-evaluating Intangible Cultural Heritage in the UK Ceramic Industry. Stoke-on-trent.
POULIOS, I. 2014. *The past in the present : a living heritage approach, Meteora, Greece*, London, England : Ubiquity Press.
PRIFTI, A. & ZENELAJ, E. 2013. Challenges Towards Sustainable Tourism for Regional Development of Vlore Region. *European Journal of Sustainable Development,* 2**,** 285-285.
PROJECT FOR PUBLIC SPACES 2000. *How to Turn a Place Around: A Handbook for Creating Successful Public Spaces*, Project for Public Spaces.
PUDONG GOVERNMENT. 2024. *2024 Pocket Park construction project* [Online]. Available: https://www.pudong.gov.cn/zwgk/14475.gkml_ywl_gysy/2024/66/324503.html [Accessed 17 November 2024].
QI, Y. & DING, J. 2008. Research on the Evaluation System of Industrial Heritage - An Example of Modern Industrial Heritage in Wuhan City (工业遗产评价体系研究——以武汉市现代工业遗产为例). *Urban and Rural Planning in the Perspective of Ecological Civilization - Proceedings of the 2008 China Urban Planning Conference (生态文明视角下的城乡规划——2008 中国城市规划年会论文集).*
QUAN, H. 1958. The Role of Shanghai in the Industrialization of Modern China (上海在近代中國工業化中的地位). *Bulletin of IHP of Institute of History and Philology, Academia Sinica (中央研究院歷史語言研究所集刊),* 29**,** 461-497.
RACHEL LOMBARDI, D., PORTER, L., BARBER, A. & ROGERS, C. D. F. 2011. Conceptualising Sustainability in UK Urban Regeneration: a Discursive Formation. *Urban studies (Edinburgh, Scotland),* 48**,** 273-296.
RAUNER, F. 1997. Industrial culture and its implication for a development concept for a "culture of manufacturing". *International journal of advanced manufacturing technology,* 13**,** 464-473.
RAUTENBERG, M. 2012. Industrial heritage, regeneration of cities and public policies in the 1990s: elements of a French/British comparison. *International journal of heritage studies : IJHS,* 18**,** 513-525.
REBECCHI, A., BUFFOLI, M., DETTORI, M., APPOLLONI, L., AZARA, A., CASTIGLIA, P., D'ALESSANDRO, D. & CAPOLONGO, S. 2019. Walkable Environments and Healthy Urban Moves: Urban Context Features Assessment Framework Experienced in Milan. *Sustainability* [Online], 11.
REICHER, C. 2022. Urban Development Under Conditions of Deindustrialization. Approaches from the Ruhr Region in Germany. Cham: Cham: Springer International Publishing.
RESCH, B., PUETZ, I., BLUEMKE, M., KYRIAKOU, K. & MIKSCH, J. 2020. An Interdisciplinary Mixed-Methods Approach to Analyzing Urban Spaces: The Case of Urban Walkability and Bikeability. *International journal of environmental research and public health,* 17**,** 6994.
RHODES, M. A., II, PRICE, W. R. & WALKER, A. 2021. *Geographies of post-industrial place, memory, and heritage,* Milton Park, Abingdon, Oxon, New York, NY, NY: Routledge.
RIAZI, M. & EMAMI, A. 2018. Residential satisfaction in affordable housing: A mixed method study. *Cities,* 82**,** 1-9.
RICCI, L., MARIANO, C. & PERRONE, F. 2024. Cultural Heritage Recognition through Protection of Historical Value and Urban Regeneration: CSOA Forte Prenestino. *Land (Basel),* 13**,** 453.
RICHARDS, G. 2013. *Cultural Tourism Research Methods*, Wallingford : CAB International.
RIFAIOĞLU, M. N. 2022. Interpreting living urban-industrial heritage: The Jewellery Quarter, Birmingham. *Journal of design for resilience in architecture and planning : (Online),* 3**,** 308-324.
RIX, M. 1967. *Industrial archaeology,* London, London : Historical Association.
ROBERTS, P. W. The Evolution, Definition and Purpose of Urban Regeneration. 2008.
RODINA, O. A. 2018. Industrial heritage of metallurgists from Nizhniy Tagil. *Chernye Metally***,** 70-77.

RODRíGUEZ-NúñEZ, E., CERVERA-TAULET, A. & PERIáñEZ-CAñADILLAS, I. 2024. Assessing social value derived from social innovation capacity: a review on the European urban context. *European planning studies,* 32**,** 904-923.

ROGERS, A. & STEPHEN, V. 2020. *The urban context: ethnicity, social networks and situational analysis* [Online]. Routledge. [Accessed].

ROJAS-SOLA, J. I. 2020. Applied sciences to the study of technical historical heritage and/or industrial heritage. *Applied sciences,* 10**,** 3648.

SALINGAROS, N. & PAGLIARDINI, P. 2016. *Geometry and life of urban space*.

SANDFORD, M. 2022. What makes a city? Available: https://commonslibrary.parliament.uk/what-makes-a-city/ [Accessed 17 November 2024].

SANG, K. & LIN, G. 2023. A Landscape Design Strategy for the Regeneration of Brownfield: The Case of Shougang Industrial Park in China. *Resilient and Responsible Smart Cities: The Path to Future Resiliency.* Springer.

SANOFF, H. 2000. *Community participation methods in design and planning / Henry Sanoff,* New York Chichester, New York Chichester : Wiley.

SCHILDERS, P., PROVOOST, M., ANNABLE, B., VANSTIPHOUT, W. & INSTITUTE, I. N. T. 2010. *The Organic City: Method Or Metaphor?: The Meaning of 'organic' in Architecture and Urban Planning*, International New Town Institute (INTI).

SCHüTZE, H., MANNING, C. D. & RAGHAVAN, P. 2008. *Introduction to information retrieval*, Cambridge University Press Cambridge.

SCHWARTZ, E. E. 2008. *Beyond LEED for neighborhood development: a contextual analysis of urban design and sustainability.* Master Masters Paper, University of North Carolina at Chapel.

SHACH-PINSLY, D., FISHER-GEWIRTZMAN, D. & BURT, M. 2011. Visual Exposure and Visual Openness: An Integrated Approach and Comparative Evaluation. *Journal of Urban Design,* 16**,** 233-256.

SHACKEL, P. A. 2004. Labor's Heritage: Remembering the American Industrial Landscape. *Historical archaeology,* 38**,** 44-58.

SHAHBAZI, S. 2016. Contextualism: a strategy for achieving sustainable architecture. *European Online Journal of Natural and Social Sciences,* 5**,** 306-314.

SHANGI, Z. A. D., HASAN, M. T. & AHMAD, M. I. 2020. Rethinking Urban Waterfront as a Potential Public Open Space: Interpretative Framework of Surma Waterfront. *Architecture Research,* 10**,** 69-74.

SHENG, G., LIAO, L., XIONG, L., ZHU, B.-W. & CHEUNG, S. M. 2022. Revitalization and Development Strategies of Fostering Urban Cultural Heritage Villages: A Quantitative Analysis Integrating Expert and Local Resident Opinions. *Systems,* 10**,** 202.

SIA. 2018. *About Society for Industrial Archaeology* [Online]. Society for Industrial Archaeology. Available: http://www.sia-web.org/about/ [Accessed 17 November 2024].

SILVA, R. A. R. D. 2011. Industrial and cultural landscape: memories from a heritage of contemporaneousness. *Labor & Engenho*.

SMARDON, R. C. 1988. Perception and aesthetics of the urban environment: Review of the role of vegetation. *Landscape and Urban Planning,* 15**,** 85-106.

SMITH, A. 2012. *Events and urban regeneration: The strategic use of events to revitalise cities*, Routledge.

SMITH, B. A. 1978. Measuring the value of urban amenities. *Journal of Urban Economics,* 5**,** 370-387.

SMITH, L. 2006a. Uses of Heritage. *Uses of Heritage***,** 1-351.

SMITH, M. K. 2006b. *Tourism, culture and regeneration,* Wallingford, UK, Wallingford, UK: CAB International.

SOBRINO, J. & SANZ, M. 2019. Seville charter of industrial heritage 2018. The challenges of the 21st century. *Centro de Estudios Andaluces*.

SPENCER-OATEY, H. 2021. *What is Culture? A Compilation of Quotations for the Intercultural Field. GlobalPeople Core Concept Compilation*.

STAMATIADIS, N. & HARTMAN, D. 2011. Context-sensitive solutions versus practical solutions: What are the differences? *Transportation Research Record,* 2262**,** 173-180.

STAMATIADIS, N., KIRK, A., HARTMAN, D. & PIGMAN, J. 2012. A Process for Measuring Context Sensitive Solutions Benefits. *Green Streets and Highways 2010***,** 46-56.

STAMATIADIS, N., UNITED STATES. FEDERAL HIGHWAY, A., NATIONAL RESEARCH COUNCIL . TRANSPORTATION RESEARCH, B., NATIONAL COOPERATIVE HIGHWAY RESEARCH, P. & AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION, O. 2009. *Quantifying the benefits of Context Sensitive Solutions,* Washington, D.C., Washington, D.C. : Transportation Research Board.

STAMPS, A. A. 1994. A Study in Scale and Character: Contextual Effects on Environmental Preferences. *Journal of environmental management,* 42**,** 223-245.

STIBRAL, K. & FAKTOROVá, V. 2021. The origins of the aesthetic appreciation and artistic depiction of the industrial landscape. *Journal of heritage tourism,* 16**,** 151-163.

STRATTON, M. 1990. Industrial Monuments: A Protection Programme. *Industrial Archaeology Review,* 13**,** 35-49.

STRICKER, G. 2020. *Industrial Decay: Environmental Value of Industrial Heritage Sites.* Columbia University.

SUN, M. & CHEN, C. 2023. Renovation of industrial heritage sites and sustainable urban regeneration in post-industrial Shanghai. *Journal of Urban Affairs,* 45**,** 729-752.

SUN, S., AOKI, N. & XU, S. 2024. Planning and construction of the British concessions and settlements in modern East Asia (1845–1876): Shanghai, Yokohama, and Tianjin. *Planning Perspectives***,** 1-36.

SUN, Y. J. 2014. Much in Little - Analysis and Summary of the Literature of Urban Heritage & Industrial Heritage Research on the "Architectural Journal" from 2001 to 2012. *Applied Mechanics and Materials,* 584-586**,** 222-225.

SUSTAINABLE SEATTLE, M. Y. 1994. *The Sustainable Seattle 1993 indicators of sustainable community : a report to citizens on long-term trends in our community,* Seattle, Wash., Sustainable Seattle.

SWENSEN, G. 2023. Resilience Thinking in Museums: Industrial Heritage, Urban Regeneration and Civic Engagement. *Museum and society,* 21**,** 36-56.

SWENSEN, G. & GRANBERG, M. 2024. The Impact of Images on the Adaptive Reuse of Post-Industrial Sites. *The Historic Environment: Policy & Practice,* 15**,** 101-129.

SWENSEN, G. & STENBRO, R. 2013. Urban planning and industrial heritage – a Norwegian case study. *Journal of Cultural Heritage Management and Sustainable Development,* 3**,** 175-190.

SYAFII, N. I., ICHINOSE, M., WONG, N. H., KUMAKURA, E., JUSUF, S. K. & CHIGUSA, K. 2016. Experimental Study on the Influence of Urban Water Body on Thermal Environment at Outdoor Scale Model. *Procedia Engineering,* 169**,** 191-198.

SYKES, A. O. 1993. An introduction to regression analysis.

SýKORA, M., HOLICKý, M. & MARKOVá, J. Advanced assessment of industrial heritage buildings for sustainable cities' development. 2010 2010. 1-8.

TALLON, A. 2010. *Urban regeneration in the UK,* London, London : Routledge.

TARA, A. 2015. Visual Openness in Urban Environments: Measuring Visual Openness and Visibility to Natural Landscapes in a Changing Urban Landscape in Gold Coast, Australia. *International Journal of the Constructed Environment,* 6.

TARSITANO, E., ROSA, A. G., POSCA, C., PETRUZZI, G., MUNDO, M. & COLAO, M. 2021. A sustainable urban regeneration project to protect biodiversity. *Urban Ecosystems,* 24**,** 827-844.

TERRELL, S. R. 2012. Mixed-methods research methodologies. *Qualitative report,* 17**,** 254-280.

THE ASSOCIATION FOR INDUSTRIAL ARCHAEOLOGY. 2024. *Affiliated Societies* [Online]. Available: https://industrial-archaeology.org/links/affiliated-societies/ [Accessed 17 November 2024].
THROSBY, D. 2000. *Economics and Culture*, Cambridge : Cambridge University Press.
THROSBY, D., ZEDNIK, A. & ARAñA, J. E. 2021. Public preferences for heritage conservation strategies: a choice modelling approach. *Journal of cultural economics,* 45**,** 333-358.
TIAN, Y. 2013. Research on the overall conservation and sustainable use of Wuhan's industrial heritage (武汉工业遗产整体保护与可持续利用研究). *Chinese Landscape Architecture (中国园林),* 29**,** 90-95.
TICCIH, P. The Nizhny Tagil Charter for the industrial heritage. TICCIH XII International Congress, 2003. 169-175.
TICCIH, P. 2012. Taipei Declaration for Asian Industrial Heritage. *The Fifteenth TICCIH General Assembly*.
TILLEY, S., NEALE, C., PATUANO, A. & CINDERBY, S. 2017. Older People's Experiences of Mobility and Mood in an Urban Environment: A Mixed Methods Approach Using Electroencephalography (EEG) and Interviews. *International journal of environmental research and public health,* 14**,** 151.
TUROFF, M. 1970. The design of a policy Delphi. *Technological forecasting & social change,* 2**,** 149-171.
TWEEDALE, G. 1992. Steel Metropolis: A View of Sheffield Industry at Kelham Island Industrial Museum. JSTOR.
TYLOR, E. B. 1874. *Primitive culture : researches into the development of mythology, philosophy, religion, language, art and custom,* Massachusetts, Massachusetts: Estes & Lauriat, 1874.
TZOULAS, K., KORPELA, K., VENN, S., YLI-PELKONEN, V., KAŹMIERCZAK, A., NIEMELA, J. & JAMES, P. 2007. Promoting ecosystem and human health in urban areas using Green Infrastructure: A literature review. *Landscape and urban planning,* 81**,** 167-178.
UNESCO 1999. *Operational Guidelines for the Implementation of the World Heritage Convention*, World Heritage Centre.
UNESCO 2002. Universal Declaration on Cultural Diversity. France.
UNITED NATIONS EDUCATIONAL SCIENTIFIC CULTURAL ORGANIZATION 2003. Convention for the safeguarding of the intangible cultural heritage. Unesco Paris.
URBAN DATA QUERY PLATFORM. 2024. *Chinese Cities GDP data over the years* [Online]. Gotohui: Jv hui Data. Available: https://gdp.gotohui.com/ [Accessed 17 November 2024].
VAN NOORDWIJK, M., POULSEN, J. G. & ERICKSEN, P. J. 2004. Quantifying off-site effects of land use change: filters, flows and fallacies. *Agriculture, Ecosystems & Environment,* 104**,** 19-34.
VECCO, M. 2010. A definition of cultural heritage: From the tangible to the intangible. *Journal of cultural heritage,* 11**,** 321-324.
VICTORIA GOVERNMENT. 2016. *Urban Design Guidelines for Victoria: Glossary and resources* [Online]. https://www.urban-design-guidelines.planning.vic.gov.au/home. Available: https://www.urban-design-guidelines.planning.vic.gov.au/__data/assets/pdf_file/0008/440990/UDGV-07-Glossary-and-Resources.PDF [Accessed 17 November 2024].
WANG, H. & FU, Y. 2019. A Comparative Study of Industrial Tourism of Cities in China. *Chinese Studies,* 08**,** 13-26.
WANG, X. & ZHOU, R. 2015. A Literature Review of Industrial Culture 工业文化研究综述. *Journal of Harbin Institute of Technology (Social Sciences Edition) 哈尔滨工业大学学报（社会科学版）*, 1**,** 88-93.
WANG, Y., YAMAGUCHI, K. & WONG, Y. D. 2020. The multivalent nexus of redevelopment and heritage conservation: A mixed-methods study of the site-level public consultation of urban development in Macao. *Land Use Policy,* 99**,** 105006.
WANG, Z. 2018. Xi'an Declaration of the First Shanghai Cooperation Organization People's Forum. *Collection (收藏),* 2.

WCMC BIODIVERSITY SERIES 1999. A global review of protected area budgets and staff.
WEEKS, J. 2010. Defining Urban Areas.
WEISBERG, S. 2005. *Applied linear regression*, John Wiley & Sons.
WILLEKENS, M. & LIEVENS, J. 2016. Who participates and how much? Explaining non-attendance and the frequency of attending arts and heritage activities. *Poetics,* 56**,** 50-63.
WILLIAMS, M. Culture, Civilization, and Theorie. 2015.
WOLF, K. L. 2006. Assessing public response to freeway roadsides: urban forestry and context-Sensitive solutions. *Transportation research record,* 1984**,** 102-111.
WOODCRAFT, S. 2015. Understanding and measuring social sustainability.
WOOLLEY, H., ROSE, S., CARMONA, M. & FREEDMAN, J. 2004. The Value of Public Space: How high quality parks and public spaces create economic, social and environmental value. London: CABE Space Design Council.
WU, Q. 2011. *A Study on the Relationship between Port and City in Modern Shanghai (1843-1937) 近代上海港城关系研究（1843-1937）*. Ph.D PhD Thesis, Fudan University.
XIE, F. 2006. Developing industrial heritage tourism: A case study of the proposed jeep museum in Toledo, Ohio. *Tourism management (1982),* 27**,** 1321-1330.
XIE, F. 2015a. *A life cycle model of industrial heritage development,* OXFORD, OXFORD: Elsevier Ltd.
XIE, P. F. 2015b. *Industrial heritage tourism,* Bristol, Bristol : Channel View Publications.
XU, D. 2013. An Exploration of Modern Industrial Heritage Value Evaluation Methods - Chongqing as an Example (近现代工业遗产价值评价方法探析——以重庆为例). *China Mingcheng Journal 中国名城***,** 66-70.
YAN, P., SUN, X. & CHEN, W. 2021. Industrial Heritage: An Outline for the Future 工业遗产：一个面向未来的论纲. *Oriental Study 东方学刊,* 9**,** 83-99.
YAN, Y. 2023. Shanghai: The model of "people's city" (上海：“人民城市”的样板). *Communist (共产党人）*, 21.
YANG, J., WU, H. & JIN, T. 2017. A study of the spatial morphology and scale texture of new district planning in China (中国新区规划的空间形态与尺度肌理研究). *International Urban Planning (国际城市规划),* 32.
YANG, X. 2017. Industrial heritage tourism development and city image reconstruction in Chinese traditional industrial cities: a web content analysis. *Journal of Heritage Tourism,* 12**,** 267-280.
YE, Y., ZHUANG, Y., ZHANG, L. & NES, A. 2016. Designing Urban Spatial Vitality from Morphological Perspective – A Study Based on Quantified Urban Morphology and Activities' Testing. *Urban Planning International,* 1(31)**,** 26-33.
YORKSHIRE. 2014. *Town vs. City in the UK: Understanding the Differences* [Online]. Welcome to Yorkshire. Available: https://www.yorkshire.com/history/town-vs-city-in-the-uk-understanding-the-differences/ [Accessed 17 November 2024].
YU, K. 2006. Recommendations for the conservation of China's industrial heritage (关于中国工业遗产保护的建议). *Landscape Design (景观设计)***,** 70-71.
ZADEH, H. B., NADOLNY, A., ATTARIAN, K., NAJAR, B. S. A. & SAFAEI, S. S. H. 2020. Promoting sustainable development of cultural assets by improving users' perception through space configuration (case study: The industrial heritage site). *Sustainability (Basel, Switzerland),* 12**,** 5109.
ZEYNEP, G. N. 2014. The Golden Horn: Heritage Industry vs. Industrial Heritage. *Uludağ University Journal of The Faculty of Engineering,* 19**,** 97-108.
ZHANG, Q., LEE, J., JIANG, B. & KIM, G. 2022. Revitalization of the Waterfront Park Based on Industrial Heritage Using Post-Occupancy Evaluation—A Case Study of Shanghai (China). *International journal of environmental research and public health,* 19**,** 9107.
ZHAO, P., MD ALI, Z. & AHMAD, Y. 2023. Developing indicators for sustainable urban regeneration in historic urban areas: Delphi method and Analytic Hierarchy Process (AHP). *Sustainable cities and society,* 99**,** 104990.

ZHAO, Y. 2009. Institutional Archetype of City (城市的制度原型). *City Planning 城市规划,* 33**,** 9-18.
ZHONG, Y. & CAO, Y. 2013. Analysis of the Urban Renewal Benefits of the Three Old Transformation Areas - A Case Study of Guangzhou's North Coast Cultural Wharf Area (三旧改造区域的城市更新效益分析——以广州北岸文化码头区域为例). *Urban Insight (城市观察),* No.23**,** 133-141.
ZHOU, S. & ZHANG, S. 2015. Contextualism and sustainability: A community renewal in old city of Beijing. *Sustainability (Basel, Switzerland),* 7**,** 747-766.
ZHU, C. 1989. *Industrial history ofModern China 中国近代工业史*, Chongqing Publishing House 重庆出版社.
ZHU, Q.-Y. & ZHU, Y. 2012. Ecological Transforming in Industrial Heritage Site: Quarry Park Proposal for Sustainable Development. *Applied mechanics and materials,* 178-181**,** 934-942.
ZHUANG, L. & ZHANG, J. 2002. *History of urban development and construction in China 中国城市发展与建设史,* Nanjing, Southeast University Press.
ZUKIN, S. 1995. *The cultures of cities,* Cambridge, Mass. Oxford, Cambridge, Mass. Oxford : Blackwell.

Appendices

Ethics Application form

Reviewer Decision

Participants Information Sheet

Background Information Value

Background Information Samples

Participants Consent Form

Pre-survey Questionnaire

Value Variation Scoring Questionnaire

Samples Indicator Diagrams and Resources

2021-2022

Faculty of Engineering
Process for approval of research study involving human participants

Introduction

This document describes the process to be followed when planning and obtaining approval for studies involving human participants within the Faculty of Engineering. This process is based on one previously run within the School/Dept. M3. The process is administered by the Faculty Research Ethics Committee, and managed by the Chair of the Ethics Committee and the Faculty Research Ethics Officer. All queries regarding the process should be initially sent to ez-eng-ethics@nottingham.ac.uk

What is Ethics Approval?

When conducting any study or observation or collecting data about individuals, it is essential that full consideration is given to ethical issues and that steps are taken to ensure participant well-being throughout the study.

Participants involved in research studies have a right to:
- Know the goals of the study and who is funding the work
- Make an informed decision about whether or not they wish to participate
- Leave the study at any time if they do not wish to continue
- Know what will happen to them during the study and how long it will take
- Know if they may experience any discomfort
- Know what will happen to the findings
- Privacy of personal information
- Be treated courteously

The University of Nottingham and Faculty of Engineering have an ethics procedure that requires all staff and students to submit an application for ethical approval before conducting any research study involving human participants. Members of the Ethics Committee read through study proposals to check that the researcher has demonstrated that they have given full consideration to ethical issues and that they have provided participants with appropriate and sufficient information.

Who needs Ethics Approval?

ANY member of staff or registered student of the University of Nottingham involved in conducting any study or observation or collecting data about individuals **MUST** adhere to the University Code of Research Conduct and Research Ethics. Those affiliated with the Faculty of Engineering **MUST ALSO** comply with the Faculty ethical approval process before commencing their study.

Ethics application procedure

The attached document outlines the ethics approval process within the Faculty of Engineering. For all applications required to undergo formal review, applications must be submitted to the **Ethics Administrator**, ez-eng-ethics@nottingham.ac.uk The application will then be reviewed by the ethics committee. We aim to return a decision to applicants within two weeks but the procedure may be delayed if the ethics committee require further information. It is the applicant's responsibility to make sure that applications are submitted in good time.

THE STUDY MAY **NOT** START UNTIL ETHICAL APPROVAL HAS BEEN AWARDED

Information you should give to ALL participants

The following list describes the information that should be given to all participants. Normally this should be given in a participant information sheet at the beginning of the study, and participants should be required to confirm that they have understood the nature of the study, and that they are happy to participate.
The following information should be included:

- Details of who will be conducting the study.
- Details about who is sponsoring the study and what the terms of the sponsorship are (i.e. who will 'own' the data and how the data will be used).
- Details about the nature, purpose and duration of the study. (Participants whose first language is NOT English may need further explanation of what is involved as their understanding of some of the terminology may be limited).
- What kinds of procedures will be used and what participant will be asked to do.
- Details about any hazards, inconveniences and risks associated with the study.
- What procedures will be followed if a participant is injured. (only needed if risk of injury has been identified)
- What benefits (payments, expenses etc) are attached to the study.
- What they need to do in order to receive the payments described above.
- What procedures will be employed to maintain confidentiality and anonymity (e.g. removing personal details from data/reports, keeping data in locked files)
- What will happen to the data (how it will be used, how it will be stored, in what form it will be disseminated and if it is likely to be used for further analysis).
- How you will use photographs or video records (data analysis, illustration purposes, displayed to sponsors/ non-public academic audiences, printed in public domain documents etc).
- Details about who to contact if questions or problems arise.
- ALL participants must be told that any involvement in the study is voluntary and they are free to withdraw at any time. You should also explain any consequences for the participant of withdrawing from the study and indicate what will be done with the participant's data if they withdraw.

2021-2022

Faculty of Engineering
Application for approval of research study involving human participants

ALL applicants must provide the following information

The applicant must be the person who will conduct the investigations; each application must be made by one applicant:

- usually the student in the case of taught or research courses,
- usually the researcher (the member of university research or academic staff) who will conduct the study in the case of funded research projects,
- usually the principal investigator in the case of applications for ethics approval in advance of submission of a research proposal

If the applicant is an Undergraduate or Postgraduate taught or research student please complete the information below. The application must be approved by a Supervisor.

Name of student:	Simiao Li	Student No:	20109965
Course of study:	PhD architecture design (social science)	Email address:	SIMIAO.LI@nottingham.ac.uk
Supervisor:	Prof. Tim Heath	PGR ■	PGT ☐
		MSc ☐	UG ☐

If the applicant is a member of university research or academic staff, please complete the information below: For research staff, the application must be approved by the Principal Investigator

Name:		Principal Investigator (Budget Holder)	
Email address:		PI Signature: ……	

Title of investigation: ……Contextual sensitive study of urban industrial heritage regeneration……

Planned date for study to begin ……25/03/2024…..…… Duration of Study ……10……

Please state whether this application is:

☐ New ☐ Revised ■ A renewal ☐ For a continuation study

Selection of review process

Please indicate whether the application is required to go forward to the ethics committee for formal review, or, in the case of projects completed by ***taught undergraduate and postgraduate students only***, whether the application can be approved by the supervisor under the expedited review process*.

■ Formal review, application will be submitted to ethics committee

☐ Expedited review, application is approved by supervisor*
* This option can only be selected if the Supervisor is a member of the Faculty Ethics committee

Approval by supervisor: expedited review

I approve the application as supervisor of this project, under the expedited review procedure.

Name of supervisor…… Signature…… Date…….

Office use only

Date form received: **Date decision returned to applicant:**

Passed to reviewers: 1. Name…… Date……..

(formal review only) 2. Name…… Date……..

2021-2022

Ethical Issues Checklist

The purpose of this Checklist is to facilitate the review process and to identify any ethical issues that may concern the Committee. It is meant to be an aid to both the researcher and the Committee. Listed below are areas which require some justification and attention on your part in specifying your study protocol. Please answer each question honestly, giving full details where required. Answering "YES" to any of the questions will not necessarily lead to a negative response to your application but it will draw issues to your attention and give the reviewers the opportunity to ensure appropriate steps are being taken. In expedited review, supervisors should ensure that for any questions where the answer "YES" has been given, appropriate measures have been taken to maintain ethical compliance.

Applicant's full name ……Simiao Li……

You must complete ALL of this section before submitting your application

1 Who is the population to be studied?

* This research will go through regenerated industrial heritage sites in Shanghai, China.
* There will be paper questionnaires for the participants to evaluate the industrial heritage sites. The paperwork will be delivered by contact people in Shanghai that have been selected.
* The population to be studied are practitioners and professionals who work in fields related to industrial heritage and urban regeneration in Shanghai, including researchers, designers and planners, developers, consultants, government and organization employees, etc. And will be anyone who gets the paper questionnaire and is willing to take part in the study.

……

2 Please give details of how the participants will be identified, approached and recruited. (Include any relationship between the investigator and participants e.g. instructor-student).

* In this study, the participants, as mentioned above, are researchers, designers and planners, developers, consultants, and government and organization employees who are working in Shanghai.
* Before the study, I have 12 selected contact people from the categories, some are previous teachers and colleagues, and others are professionals and practitioners recommended by them. I have contacted all of them, and they are all willing to help me deliver the paper questionnaire.
* Each of my contact people will receive an electric version of the questionnaire. They will print 30 copies and will deliver the questionnaire to around 30 of their colleagues, while the actual amount will vary across different contact persons depending on the difficulties in practice.
* After they have collected all the responses from the participants, they will scan the questionnaires and send them back to me.

……

3 Will the population studied include any vulnerable members of the public? **YES** ☐ **NO** ■
Note: for the purpose of ethics approval this includes participants who are under 18, people who are disabled or in poor health, and also those who are non-English speakers and may not be able to understand the consent forms. (If YES, please give further details)

* Although this study is based in China, I have confirmed that all the participants can read and understand English. And I will also provide Chinese version with all the questionnaire for their reference.

……

4 Will it be possible to associate specific information in your records with specific participants on the basis of name, position or other identifying information contained in your records? **YES** ☐ **NO** ■

5 What steps have you taken to ensure confidentiality of personal information and anonymity of data both during the study and in the release of its findings?

* This research will be following the Data Protection Act 1998 (UK) and GDPR.
* The consent form does not collect name, contact information, gender, age, etc., but acts as a pre-requisite to participation in the survey.
* In the study, the questionnaire is designed to be delivered to professionals and practitioners who have enough experience and a thorough understanding of the topic and can provide rational scores to evaluate

the cases. Therefore, I will have to record their affiliations, familiar fields, and years of work. In order to protect privacy, the familiarity fields will be shown as multiple-choice questions, and years of work will be shown as a general range from which to select. The questionnaire will not record any exact information (such as name, contact details, gender, age, etc.) except the name of the affiliation.
* The contact people's information will not be shown specifically.
* I will not ask for any personal information from the participants' contact people.
* Participants will be asked to read and tick the paper consent form to confirm their participation and to give the researcher's permission to use the data collected in the study. They have the right to quit or withdraw the questionnaire at any time.
* The final result of the questionnaire will be the average data of the scores in the final thesis; all questionnaire information will not be shown in the thesis and appendix. The original file of the questionnaire will be accessed by the supervisor and examiners through private links for assessment purposes only.

.....

6 Describe what data will be stored, where, for what period of time, the measures that will be put in place to ensure security of the data, who will have access to the data, and the method and timing of disposal of the data.

Paper records should be stored in a locked filing cabinet. Digital data should be stored only on a password-protected computer and/or on a secure server. In accordance with the Data Protection Act, the data needs to be kept securely for seven years following publication kept securely for seven years following publication of results. After this time, electronic files will be deleted and any hard copies will be destroyed.

At the end of a student project, students are responsible for ensuring that all data from the study is passed on to their academic supervisor/s. The supervisors/s will then have responsibility for the storage of that data.

During the research, all data will be stored in a password protected filed and stored in a locked filing cabinet and scanned to be stored digitally on a password protected external hard drive. The researcher and supervisor will be the only person with access to the raw data.

In accordance with the Data Protection Act and the rule of the University of Nottingham, the data will be kept securely for seven years following publication of results. After this time, electronic files will be deleted, and any hard copies will be destroyed.

7 Will persons participating in the study be subjected to physical or psychological discomfort, pain or aversive stimuli which is more than expected from everyday life? (If YES, please give further details) **YES** ☐ **NO** ■

.....

8 Will participants engage in strenuous or unaccustomed physical activity? (If YES, please give further details) **YES** ☐ **NO** ■

.....

9 Will the investigation use procedures designed to induce participants to act contrary to their wishes? (If YES, please give further details) **YES** ☐ **NO** ■

.....

10 Will the investigation use procedures designed to induce embarrassment, humiliation, lowered self esteem, guilt, conflict, anger, discouragement or other emotional reactions? (If YES, please give further details) **YES** ☐ **NO** ■

.....

11 Will participants be induced to disclose information of an intimate or otherwise sensitive nature? (If YES, please give further details) **YES** ☐ **NO** ■

.....

12	Will participants be deceived or actively misled in any manner? (If YES, please give further details)	**YES** ☐	**NO** ■
	.....		
13	Will information be withheld from participants that they might reasonably expect to receive? (If YES, please give further details)	**YES** ☐	**NO** ■
	.....		
14	Will the research involve potentially sensitive topics? (If YES, please give further details)	**YES** ☐	**NO** ■
	.....		
15	Will data be collected which requires potentially invasive procedures (eg attaching electrodes to the skin) and/or other health-related information to be identified (eg heart rate). If yes please give details	**YES** ☐	**NO** ■
	.....		

If you require space for additional information, please add it here and identify the question to which it refers:

Checklist of information to include with your application:
Please tick the boxes below to confirm that you have included the following information with your submission. Failure to include the required information may result in your ethics application and approval for start of your research to be delayed.

- ■ A brief description of the study design:
  - number and type of participants
  - number and duration of activities participants will be involved in
  - equipment and procedures to be applied
  - information about how participants will be recruited
  - whether participants will be paid (state how this will be done)
  - plans to ensure participant confidentiality and anonymity
  - plans for storage and handling of data
  - information about what will happen to the data after the study
  - information about how any data and images may be used
  - state whether it will be possible to identify any individuals.

- ■ Copies of any information sheets to be given to participants (include recruitment information (e.g. adverts, posters, letters, etc)

- ■ A copy of the participant consent form

- ■ Copies of data collection sheets, questionnaires, etc

I confirm that all of the above is included in the application:

As the applicant I confirm that I have read and understand the Ethical requirements for my study and have read and complied with the University of Nottingham Code of Research Conduct and Research Ethics.

Signature of applicant .....Simiao Li..... ..... Date 08/03/2024

As supervisor, I confirm that I have checked the details of this application.

Signature of supervisor  Date 18 March 2024

NB The signature of the supervisor on this part of the application DOES NOT indicate supervisor approval for expedited review. If supervisor approval is granted then the front page of the application MUST be signed for approval to be confirmed.

Ethics Committee Reviewer Decision

This form must be completed by each reviewer. Each application will be reviewed by two members of the ethics committee. Reviews may be completed electronically and sent to the Faculty ethics administrator from a University of Nottingham email address, or may be completed in paper form and delivered to the Faculty of Engineering Research Office.

Applicant full name Simiao Li

Reviewed by: B18

Name

Signature (paper based only) ……..……

Date 03/05/2024

- ☑ Approval awarded - no changes required
- ☐ Approval awarded - subject to required changes (see comments below)
- ☐ Approval pending - further information & resubmission required (see comments)
- ☐ Approval declined – reasons given below

Comments:

n/a

Please note:

1. The approval only covers the participants and trials specified on the form and further approval must be requested for any repetition or extension to the investigation.
2. The approval covers the ethical requirements for the techniques and procedures described in the protocol but does not replace a safety or risk assessment.
3. Approval is not intended to convey any judgement on the quality of the research, experimental design or techniques.
4. Normally, all queries raised by reviewers should be addressed. In the case of conflicting or incomplete views, the ethics committee chair will review the comments and relay these to the applicant via email. All email correspondence related to the application must be copied to the Faculty research ethics administrator.

Any problems which arise during the course of the investigation must be reported to the Faculty Research Ethics Committee

Ethics Committee Reviewer Decision

This form must be completed by each reviewer. Each application will be reviewed by two members of the ethics committee. Reviews may be completed electronically and sent to the Faculty ethics administrator from a University of Nottingham email address, or may be completed in paper form and delivered to the Faculty of Engineering Research Office.

Applicant full name Simiao Li

Reviewed by:

Name S03

Signature (paper based only) ……

Date 17/05/2022

- [x] Approval awarded - no changes required
- [ ] Approval awarded - subject to required changes (see comments below)
- [ ] Approval pending - further information & resubmission required (see comments)
- [ ] Approval declined – reasons given below

Comments:

Please note:

1. The approval only covers the participants and trials specified on the form and further approval must be requested for any repetition or extension to the investigation.
2. The approval covers the ethical requirements for the techniques and procedures described in the protocol but does not replace a safety or risk assessment.
3. Approval is not intended to convey any judgement on the quality of the research, experimental design or techniques.
4. Normally, all queries raised by reviewers should be addressed. In the case of conflicting or incomplete views, the ethics committee chair will review the comments and relay these to the applicant via email. All email correspondence related to the application must be copied to the Faculty research ethics administrator.

Any problems which arise during the course of the investigation must be reported to the Faculty Research Ethics Committee

University of Nottingham
UK | CHINA | MALAYSIA

资料表 Information Sheet

研究课题 Title of Study: 城市工业遗产再生的文脉敏感性评价 Contextual sensitivity evaluation of urban industrial heritage regeneration
研究者姓名 Name of Researcher(s): 李偲淼 SIMIAO LI
导师姓名 Name of Supervisor: 蒂姆·希斯教授 Prof. Tim Heath

我们诚邀您参与我们的研究项目。在您决定是否参与之前，我们希望您能通过这份资料表了解研究目的，研究对象，以及参与其中将对您意味着什么。请您仔细阅读本资料表提供的信息，并欢迎随时联系我或我的导师，我们会及时回答您的任何问题。如果您愿意，可以与他人讨论这项研究的内容和问卷问题。

We cordially invite you to participate in our research project. Before you decide whether to take part, we want you to understand the content of the research, its objectives, subjects, and what participation would mean for you, through this information sheet. Please carefully read the information provided in this document, and feel free to contact me or my supervisor at any time; we will promptly answer any questions you may have. If you wish, you may discuss the content of this research and the questionnaire questions with others.

本次调查问卷分两轮进行，第一轮为预调查问卷，主要用于选择适合进行第二轮的参与者。第一轮预调查环节，除了本资料表之外，您还将收到一份《参与者同意书》（如果您同意参与研究将需要您在同意书上签字）和《城市工业遗产区更新过程中的工业遗产价值评估预调查问卷》。预调查问卷预计占用您 3-5 分钟的时间，您有 3 天的时间填写并返回调查问卷，您也将在返还调查问卷的 3 天内收到礼品券。

This survey will be conducted in two rounds. The first round is a pre-survey questionnaire, primarily used to select participants suitable for the second round. In the first round of pre-survey, in addition to this information sheet, you will also receive a Participant Consent Form (you will need to sign this form if you agree to participate in the study), and a Industrial Heritage Value Evaluation during Urban Industrial Heritage Quarter Regeneration Pre-Survey Questionnaire. The pre-survey questionnaire will takes 3-5 minutes. Please return your answers in 3 days, and you will receive your gift voucher within 3 days of returning the completed questionnaire.

通过预调查问卷的分析结果，如果您是我们期待的参与者，您将受邀参加第二轮的问卷。第二轮是工业遗产项目的评分环节，您将收到一份《背景资料》（为您解析工业遗产的价值和介绍您所要评价的工业遗产信息），和一个《城市工业遗产区改造过程中价值变化打分表》（您将在这份问卷对所列出的工业遗产及价值的变化量进行评分）。第二轮的参与者将有 7 天的时间完成调查问卷，您也将在收到返还调查问卷的 7 天内收到您的礼品券。

Based on the analysis of the pre-survey questionnaire results, if you are identified as an ideal participant, you will be invited to participate in the second round of the questionnaire. The second round is the value evaluation of listed industrial heritage projects. You will receive a Background Information document (to explain the value of industrial heritage and introduce the industrial heritage you will be evaluating), and Value Variation Scoring Table for Urban Industrial Heritage Quarter Regeneration (where you will score the value variation of listed industrial heritage projects). You will have 7 days to complete the survey questionnaire, and you will receive your gift voucher within 7 days of returning the completed questionnaire.

研究目的 What is the purpose of the study?

这项调查是我关于城市工业遗产地区再生的博士学位研究的一部分。研究旨在深入理解在这些遗产地区再生过程中，工业遗产地点如何敏感地响应其所处的城市环境，并探究这种响应方式如何影响工业遗产价值的演变。This survey is a part of my PhD study about urban industrial heritage quarter regeneration. the purpose of this study is to understand, during the regeneration, how sensitively the industrial heritage sites responding to the urban context influences the variation of industrial heritage value.

研究对象 What are the objects of the study?

这项研究将聚焦于上海再生的工业遗产区块。在问卷调查过程中，研究将以这些地点作为评估对象，收集这些地点在再生前后价值变化的数据。This study will focus on the regenerated industrial heritage quarters in Shanghai. During the questionnaire, the study will take those sites as evaluation objects, collecting the data of the value variation of these sites before and after regeneration.

邀请您参与研究的原因 Why have you been invited?

您被邀请参与本次调查是因为您目前正在上海工作生活，并且您从事的工作内容与工业遗产，城市更新，建筑设计，城市设计，地产评估等领域密切相关。我们认为您的工作经验和生活经历能够为改造前后工业遗产区的价值变化提供有针对性且较为客观的评分。You are invited to participate in this survey because you are currently living and working in Shanghai, and your job is closely related to industrial heritage, urban renewal, architectural design, urban design, real estate appraisal, and similar fields. We believe that your work experience and life experiences can provide targeted and relatively objective assessments of the value changes in industrial heritage areas before and after their regeneration.

您是不是必须参加本次研究 Do you have to take part?

参与与否完全由您决定。如果您决定参与，您将获得这份信息表以供保留，并需要签署一份同意书并完成问卷调查。即便您决定参与，您仍然可以随时提出任何问题或在不提供任何理由的情况下退出。这不会影响您的法律权利。不论如何，我们都将感激您的参与。It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep，be asked to sign a consent form and complete the questionnaire. Even if you decide to take part, you are still free to ask any questions or withdraw at any time without giving a reason. This would not affect your legal rights. We will appreciate your participation all the same.

如果您参与本次研究您将会 What will happen to me if I take part?

1. 您将需要阅读并勾选同意书的内容，以允许研究人员使用在研究中收集的数据。本研究不收集任何详细的个人信息或人口统计数据。参与者不需要提供姓名、电子邮件、电话号码或其他联系方式。You will need to read and tick the contents of a consent form to permit the researcher to use the data collected in the study. No detail personal information or demographic data is being collected in this study. Participants will not be asked to provide name, email, phone number or other contact details.
2. 如果您参与第二轮的调研，您需要阅读提供的信息，以了解研究内容和需要评估的工业遗产区块。然后，您需要填写一个评分表，以评估所有地点的价值变化。因为了解这些工业遗产和评估可能会需要时间查阅资料和思考，本次问卷将会给您一周的时间完成。问卷的主题集中在工业遗产地点价值的不同方面。我们期望您根据自己的工作经验和对地点的印象诚实地回答问题。If you participate in the second round of the questionnaire, you will need to read the information provided to understand the study and the selected sites. Then you will need to fill out a scoring table for you to evaluate the value variation of all the sites. Because understanding these industrial heritages and assessing them may require time to review materials and think, this questionnaire will give you one week to complete. The question topics focus on the different vectors of the value of an industrial heritage site. You are expected to answer the questions honestly based on your working experience and impression of the site.

费用 Expenses and payments

参与本次研究不需要支付任何费用。每位参加本次研究并完成问卷调查的参与者将会收到瑞幸咖啡购物券作为感谢。（第一轮 ¥15，第二轮 ¥50）Participation in this study does not require any fees. Each participant who takes part in this study and completes the questionnaire will receive a Luckin Coffee voucher as a token of appreciation. (First round 15RMB, Second Round 50RMB)

参加本次研究的风险 What are the possible disadvantages and risks of taking part?

在本研究中将不会有任何可能的不利影响或风险。There will be no possible disadvantages or risks during the study.

参加本次研究的益处 What are the possible benefits of taking part?

通过全面参与本研究，您将获得津贴。此外，我们无法保证这项研究将直接帮助到您，但我们从这项研究中获得的信息可能有助于理解影响工业遗产再生项目成功的因素。本研究旨在为未来的再生提供可能的设计策略。鉴于所有参与者都是来自相关领域的实践者和专业人士，如果本研究中的任何信息或想法能够激发您的工作灵感，我们将非常高兴。You will get an allowance by taking full participation in this study. Besides, we cannot promise the study will help you but the information we get from this study may help to understand the factors that influence the success of an industrial heritage regeneration project. The study is expected to provide possible design strategies for future regeneration. As all participants here are expected to be practitioners and professionals from relevant fields, we will be very glad to see if any information or ideas in this study inspire your work.

如果对本次研究有问题 What if there is a problem?

如果您对本研究的任何方面有疑虑，您应先行与研究人员沟通，他们将尽力回答您的问题。如果您仍然不满意并希望正式提出投诉，您可以联系诺丁汉大学研究伦理办公室工作人员。所有联系方式将在这份信息表的最后提供。If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions. If you remain unhappy and wish to complain formally, you can do this by contacting the School Research Ethics Officer. All contact details are given at the end of this information sheet.

您参加这项研究的情况会保密吗 Will your taking part in the study be kept confidential?

我们将遵循道德和法律实践，所有关于您的信息将被保密处理。We will follow ethical and legal practice and all information about you will be handled in confidence.

如果您加入研究，由诺丁汉大学负责组织研究的授权人员将会查看为研究收集的数据。为了检查研究是否正确进行，授权人员也可能查看这些数据。所有这些人员都对您作为研究参与者有保密义务，我们将尽最大努力履行这一义务。If you join the study, the data collected for the study will be looked at by authorised persons from the University of Nottingham who are organising the research. They may also be looked at by authorised people to check that the study is being carried out correctly. All will have a duty of confidentiality to you as a research participant and we will do our best to meet this duty.

问卷调查是匿名的，不会收集您的个人数据（姓名、年龄，性别，地址、电话号码等）。在研究过程中收集的有关您的回应的所有信息将被严格保密，在诺丁汉大学内部安全保存。The questionnaire is anonymous, and will not collect your personal data (name, age, gender, address, telephone number, etc). All information which is collected about your responds during the course of the research will be kept **strictly confidential**, secured within the University of Nottingham.

尽管您在面试中说的话是保密的，如果您向我们透露的任何信息让我们感觉您或其他人存在任何风险，我们可能觉得有必要向适当的人报告这一情况。Although what you say in the interview is confidential, should you disclose anything to us which we feel puts you or anyone else at any risk, we may feel it necessary to report this to the appropriate persons.

如果您不想继续参与调查 What will happen if I don't want to carry on with the study?

您的参与是自愿的，您可以随时退出，无需提供任何理由，且不会影响您的法律权利。Your participation is voluntary and you are free to withdraw at any time, without giving any reason, and without your legal rights being affected.

本次研究的研究成果 What will happen to the results of the research study?

研究结果将作为案例研究章节的一部分，纳入我的博士论文中。同时，这些结果也将在一些期刊或会议论文中发布。The results of the research study will form a part of my PhD thesis in the case study chapter. It will also be published in some journals or conference papers.

本研究的组织和资助机构是 Who is organising and funding the research?

这项研究由诺丁汉大学组织，没有接受任何资金支持。This research is being organised by the University of Nottingham with no funding.

本研究的审查机构是 Who has reviewed the study?

诺丁汉大学的所有研究都会被一个称为研究伦理委员会（REC）的团体审查。本研究已经获得了诺丁汉大学工程学院研究伦理委员会的积极伦理评价。All research in the University of Nottingham is looked at by a group of people, called a Research Ethics Committee (REC). This study has received a Favourable Ethical Opinion by the Faculty of Engineering Research Ethics Committee of the University of Nottingham.

更多信息和联系方式 Further information and contact details

研究人员 Researcher: 李偲淼 Simiao Li (SIMIAO.LI@nottingham.ac.uk)
导师 Supervisor/PI: 蒂姆 • 希斯教授 Prof. Tim Heath (tim.heath@nottingham.ac.uk)
诺丁汉大学 University of Nottingham, 工程学院 Faculty of Engineering, 研究伦理 Research Ethics Officer: Dr Ed Morris, david.morris@nottingham.ac.uk

背景资料

Background Information

这份资料旨在为您提供本次研究所需的关键背景信息。在此次研究中，您将完成一项问卷调查，对上海已改造的城市工业遗产区域的价值进行评估。您需要对这些工业遗产改造后价值的变化（无论是价值提升还是价值降低）打分。本资料将首先介绍工业遗产的价值维度，以及应从哪些具体方面进行评估。通过阅读下面表格中的介绍，您将能够对您即将评估的内容进行深入理解和思考。此外，资料还将简要介绍选定的城市工业遗产区块，并提供相关的网站链接和资料来源，便于您在填写问卷过程中，根据兴趣进行额外的信息搜索，以深化对这些工业遗产的认识。

This document aims to provide you with key background information necessary for this research. In the study, you will complete a questionnaire to assess the value of urban industrial heritage areas in Shanghai that have been regenerated. You will be asked to rate the change in value of these industrial heritages after their transformation (whether an increase or decrease in value). This material will first introduce the dimensions of industrial heritage value and the specific aspects that need to be considered for assessment. By reading the introductions in the following table, you will gain a deeper understanding and consideration of the aspects you are about to evaluate. Additionally, the document will briefly introduce the selected urban industrial heritage areas and provide relevant website links and sources of information, allowing you to further explore these industrial heritages based on your interest while completing the questionnaire.

价值分类	评估项
历史价值	时间跨度
	历史事件和人物相关
	在工业发展史上的意义
	在区域和国民经济史上的意义
	城市发展史上的意义
	建筑发展史上的意义
	真实而全面地记载和呈现历史
	稀有性和代表性
科学技术价值	科学创新与进步
	生产技能的创新和进步
	生产工艺和管理的创新和进步
	工业建筑和结构的创新和进步
	真实全面地记录科学技术
社会文化价值	对相关社区和社会的影响
	作为地点识别符号的意义
	对集体记忆的影响

	在传统和习俗中的意义
	对政策法规的影响
	教育和研究意义
美学价值	公众对工业遗迹的偏好
	架构的视觉效果
	结构和设施的视觉影响
	景观的视觉冲击
经济价值	位置和交通
	结构和空间适应性
	旅游推广潜力
	市场推广潜力
	促进就业的潜力
自然价值	当前生态系统和生物系统的意义
	环境改善的潜力

Value	**Evaluation Aspects**
Historic Value	Age and Longevity
	Relates to historical events and people
	Significance in the history of industrial development
	Significance in the history of regional and national economy
	Significance in the history of urban development
	Significance in the history of architectural development
	Records and presents of history true and comprehensive
	Rarity and Representativeness
Scientific and Technological Value	Innovation and advancement in science
	Innovation and advancement in production skills
	Innovation and advancement in production process and management
	Innovation and advancement in industrial architectures and structures
	Records of science and technology true and comprehensive
Socio-cultural Value	Influence on relevant communities and societies
	Significance as a symbol of place identification

	Influence on collective memory
	Significance in tradition and custom
	Influence on policies and regulations
	Significance for education and research
Aesthetic Value	Public preference for industrial remains
	Visual impact of architectures
	Visual impact of structures and facilities
	Visual impact of landscapes
Economic Value	Location and transportation
	Structural and spatial adaptiveness
	Potential for tourism promotion
	Potential for market promotion
	Potential for employment promotion
Natural Value	Significance of current eco-system and bio-system
	Potential for environmental improvement

a) Historical Value

Historical value of industrial heritage refers to the importance and usefulness of the record relating to industrial activities that is retained for the purpose of history. It is regarded as the linkage between past life and present. The history of heritage has an illustrative function, which relates to the visible heritage that can demonstrate the unique evidence of a historic period.

For industrial heritage, historic value aids the interpretation of the industrial past, the development of modern civilization, and the tradition of human manufacture. Both visible and invisible pieces of evidence, the physical factory sites, relevant structures and pieces of machinery, product activities, and livelihood, contribute to a memorable development history. Based on current value study, historical value of industrial heritage can be considered from the following aspects:

Age and Longevity: Age and longevity refer to whether the heritage has a long history and the period of its existence, which has the ability to show the origin and the development of industrial practices over long periods.

Relates to historical events and people: The history of industrial heritage is always highlighted by notable historical events or individuals, which usually mark the meaningful moments of the development of the industrial site.

Significance in the history of industrial development, regional and national economy, urban development, and architectural development: Industrial heritage used to play an important role in the industrial, economic, and spatial development in the history of the city and the country. For the history of industrial development, the significance of industrial heritage considers its contribution to the specific and its relevant industries, how it impels the form, transformation and development of those industries and whether it has a continuous influence on the condition of those industries now. Industrial heritage sites, as mentioned before, their original production

capacity may have an influence on the regional and national economy, contributing to the increasing of investment and local GDP. Within the urban context, the rise and fall of industrial heritage indicates the transformation of urban texture, recording how industrial sites formed, planned, extended and decreased with the development of the modern city. Moreover, the configuration and structure of industrial architectures were in continuous development to serve the spatial requirement of the production process, which may influence the design and construction of future industrial buildings and even modern architectures.

Records and presents of history is true and comprehensive: This aspect relates to the authenticity and integrity of an industrial heritage site, whose ability to truly and comprehensively present historical records and physical evidences of the site.

Rarity and Representativeness: Rarity talks about how unique the heritage is, and representativeness relates to whether it can exemplify key characteristics of its kind within a particular period or area.

1.历史价值

工业遗产的历史价值是指为了历史目的而保留的与工业活动有关的记录的重要性。它被视为连接过去与现在的纽带。遗产的历史具有说明展示功能，这与可见的遗产相关，它们能够展示特定历史时期的独特证据。

对于工业遗产来说，拥有历史价值有助于解读工业历史、现代文明的发展和人类制造的传统。无论是可见的还是不可见的历史证据，包括实体的工厂遗址、相关结构和机械设备、产品活动以及生活方式，都是历史发展的重要组成部分。工业遗产的历史价值可以从以下几个方面考虑：

时间跨度：时间跨度指的是遗产是否有悠久的历史以及考虑其存在的历史时间段，可以展示工业实践在长时间历史跨度内的起源和发展。

与历史事件和人物的关联：工业遗产的历史价值通常会因重大历史事件或人物而得到突出展现，这些事件或人物通常标志着工业发展中的重要时刻。

在工业发展史、地区和国家经济、城市发展及建筑发展中的重要性：工业遗产在城市和国家历史中，对工业、经济和空间发展曾发挥重要作用。在工业发展史上，工业遗产的意义体现在它对特定行业及相关行业的贡献上，以及它如何推动这些行业的形态转变和发展，是否对这些行业当今的状态有持续影响。工业遗产地点的原始生产能力可能对地区和国家经济产生影响，促进投资增加和地方 GDP 的提高。在城市背景下，工业遗产的兴衰标志着城市结构的变迁，记录了工业场所如何随现代城市的发展而形成、扩展和消失。此外，工业建筑的配置和结构也在不断发展，以满足生产过程中的空间需求，这可能会影响当代工业建筑甚至未来建筑的设计和施工。

历史记录和展示的真实性和完整性：这一方面涉及工业遗产地的真实性和完整性，其是否真实而全面地展示该遗址的历史记录和保留实体遗迹的能力。

稀有性和代表性：稀有性指的是遗产的独特性，而代表性则是遗产是否能够体现特定时期或地区的关键特征。

b) Scientific and Technological Value

The industrial heritage is of “technological and scientific value in the history of manufacturing, engineering and construction”. Scientific and technological value is the main value that distinguishes the key characteristics of industrial heritage from

other kinds of cultural heritage. Contemporary technology and science are accumulated outcomes which are developed based on previous works. Based on previous developments in science and technology, industrial heritage plays a significant role in presenting achievements in skills, knowledge, and experiences. For industrial heritage, conservation and expression of science and technology aspects contribute to the heritage authenticity and integrity. In addition, the preservation and utilization of industrial remains during the heritage redevelopment process, such as restoring facilities and structures, pollution control also need to be considered in a sustainable and technological way.

Innovation and advancement in science, production skills, production process and management, and architectures and structures: The development of industry and the development of basic and applied sciences were mutually promoted, such as material science, engineering, chemistry, etc. These innovations drove industrial efficiency and capacity, leading to widespread technological progress. This attribute refers to the efficiency and effectiveness of production technology and engineering skills, which showcase the ingenuity of craftsmanship, the creation of production methods, and the efficiency of engineering prowess. The business management models of industrial companies are also needed to consider the creativity and innovation, some of which can also impact the operation and management procedure of contemporary businesses. Besides, advancement also exists in the design and construction of industrial architecture and structure. Industrial heritage sites include architectural innovations that enabled new forms of industrial activity, such as large-span structures, prefabricated buildings, and integrated complexes.

Records of science and technology is true and comprehensive: Accurate and comprehensive records of the scientific and technological development and activities that relate to the production process and development of industrial sites are important to show why the industrial heritage is contributive and what achievements it led to.

2.科学和技术价值

工业遗产在制造、工程和建筑历史中具有“技术和科学价值”。科学和技术价值是区分工业遗产与其他类型文化遗产的主要价值。在科学和技术的历史发展基础上，工业遗产在展示技能、知识和经验等方面发挥了重要作用。对于工业遗产来说，科学和技术方面的保护和表达有助于展现遗产的真实性和完整性。此外，在遗产再开发过程中，工业遗留物的保存和利用（如修复设施和结构、污染控制等）也需要以可持续和技术化的方式进行。

科学、生产技能、生产过程和管理、建筑与结构的创新和进步：工业的发展与应用科学的发展是相互促进的，如材料科学、工程学、化学等。这些科技创新推动了工业效率和能力的提升，带来了广泛的技术进步。这一特征指的是工业遗产所涉及的生产技术和工程技能的效率和效果，展示了工艺的巧妙性、生产方法的创造性以及工程技术的高效性。工业公司的商业管理模式也需要考虑创造力和创新，其中一些也可能影响当代企业的运营和管理面试。此外，工业建筑和结构的设计与施工也存在进步。工业遗产地包括了建筑创新，如大跨度结构、预制建筑和综合体，这些创新使新的工业活动形式成为可能。

科学和技术记录的真实性和完整性：准确并全面记录与生产过程和工业遗址发展相关的科学和技术发展活动，对于展示工业遗产的贡献及其所取得的成就至关重要。

c) Socio-cultural Value

The social and cultural importance of industrial heritage lies in its ability to record history, memorise the stories of people's lives, and deliver a sense of belonging, which have deep attachments with the lifestyle in a local and national scale. Industrial heritages are of social and cultural value as they "testify to the ordeals and exploits of those who work in them". Assessing the socio-cultural value of industrial heritage means considering its contribution to forming place identification, connecting the lifestyle of present generations with the industrial past, and providing intangible evidence for social development. The study of heritage significance often involves complex social and cultural aspects, intertwined with various abstract concepts and theories. This complexity arises from the multifaceted nature of heritage, which encompasses historical, social, cultural, and emotional dimensions that are deeply interwoven and context-specific. Based on existing heritage assessment studies, this value will be considered according to the aspects of community, identification, collective memory, tradition and custom, policies and regulations and educational potential.

Influence on relevant communities and societies: Industrial heritage sites often play an important role in the establishment and evolution of communities. The rise of industries typically led to the formation of new living quarters, towns and cities, attracting workers and their families to settle down around the workplace. Over time, these industrial quarters can transform into communities with unique cultural identities. Industrial heritage quarters relate to the historical and cultural background of a community and generate shared working and living experience, forming a sense of belong among residents. This sense of belonging contributes to the continuous potential of industrial heritage conservation.

Significance as a symbol of place identification: Place identification refers to the process through which individuals or communities themselves differentiate a specific location from others, acquiring a sense of belonging and meaning from that place. Place identification of industrial heritage relates to the emotional connections of society or community to industrial remains and sites. Generally speaking, public understanding of place identification can be influenced by commemorative and spiritual factors which closely relate to the continuity of sociocultural activities, as well as the survival of historic fabric which provides physical evidence of the activities and events. Industrial remains have created a durable and long-lasting emotional attachment with local dwellers, and have established a sense of identity in the memory of people associated with them. The identification of industrial heritage is largely associated with people who have lived, worked, benefited or even been hurt through the process of production activities. This symbolic place with a unique place identity is essential in preventing the neglect and destruction of industrial heritage. Industrial heritage sites always have impressive characteristics that are easily identified and remembered. For most such quarters, industrial buildings and

structures are visually attractive for their massive scale and configuration. They are usually referred to as a symbol of a period of time, a snapshot place of events, or simply a place that people use for location.

Influence on collective memory: Industrial heritage sites serve as tangible links to the past. People and communities that are closely related to or involved in the history of the industrial heritage site have strong emotional links with this specific urban environment, including shared experiences and stories and also consensual values within a specific community. Some industrial heritages have deeply impacted the lifestyle of a certain group of people, leaving them with indelible memories. Industrial heritage can be seen as a complicated mixture of people and places, practices and processes. Compared with the traditional community, industrial heritage quarters are new models of workplace-centred human settlement, whose development and decay have a deep impact on the formation of the modern urban context. The contribution of regeneration is not only shown in the preservation of physical elements and storage of old memories but is also highlighted in the potential of accumulating and generating new memories among the communities. However, some of the emotional attachment to an industrial heritage is not always positive of former spirit and pride. In fact, it might relate to unpleasant memories, such as safety accidents, pollution issues, job loss, community destruction, or simply fear of the future. The negative aspects of the industrial heritage are also important in making people the reflection of past mistakes, which is the impel of technological, managing and social development.

Significance in tradition and custom: Industrial heritage sites contribute significantly to regional and national traditions and customs. They often host cultural events, festivals, community gatherings, and educational programs that celebrate industrial achievements, technology advancements or successful labour movements, reinforcing traditional practices and community bonds. Activities and lifestyles left from the industrial age may also have a profound influence on local customs, such as the use of tools, food habits, time schedules, special daily ceremonies, etc. It might also generate some long-lasting traditional skills and living habits that are influenced by production and working activities.

Influence on policies and regulations: The political significance of industrial heritage illustrates how the protection and regeneration attempts are impacted by policies, as well as how the actual practices influence the formulation and adjustment of policies. With the growing focus on industrial heritage, many countries and cities have developed conservation and regeneration guidelines, including perspectives on value assessment and list designation, architecture conservation and reuse, and urban development. The regulations and principles illustrate the significance of industrial remains and landscapes, promoting local and national actions to maintain the existence of industrial heritage. On the other hand, the development and regeneration of urban industry influence the transformation of land use patterns and labour structure. During the process of preservation and regeneration, practical experiences also raise guidelines and policies to address previous issues and guide future actions.

Significance for education and research: The original educational and academic significance lies in the capacity to gain knowledge from the industrial past through archaeological techniques. Nowadays, it can also refer to the potential of promoting public awareness of industrial history and the continuity of industrial culture through tourism, education and training. Besides, the research and educational value of industrial heritage is high in the science and technology of industrial production and management. They are the wisdom left from industrial civilization and are worthy of being inherited and passed through generations. The continuity of technology and skill relies on the opportunity for research and training. The research on industrial archaeology and technological history contributes to the comprehensiveness of heritage records. With training and education activities, knowledge and skills are more likely to maintain their activeness in the long term.

3.社会文化价值

工业遗产的社会和文化重要性在于其记录历史、保存人民生活故事并传递归属感的能力，这些能力与本地和国家层面的生活方式有着深刻的联系。工业遗产具有社会文化价值，因为它们“见证了在其中工作的人的苦难和功绩”。评估工业遗产的社会文化价值需要考虑其对形成区域认同、连接当代生活方式与工业历史以及为社会发展提供无形证据的贡献。遗产重要性的研究通常涉及复杂的社会和文化方面，与各种抽象概念和理论交织在一起。这种复杂性源于遗产的多面性，包括历史、社会、文化和情感等深度交织且具有特定情境的不同维度。基于现有的遗产评估研究，这种价值将根据社区、认同、集体记忆、传统与习俗、政策与法规以及教育潜力等方面进行考虑。

对相关社区和社会的影响：工业遗产通常在附近社区的建立和发展中扮演重要角色。工业的兴起通常导致新的居住区、城镇和城市的形成，吸引工人及其家庭在工作场所周围定居。随着时间的推移，这些工业区域可以转变为具有独特文化身份的社区。工业遗产区与社区的历史和文化背景相关，并产生共同的工作和生活经验，形成居民之间的归属感。这种归属感有助于发挥工业遗产保护的持续潜力。

作为地点认同的象征意义：地点认同是指个人或社区区分特定地点与其他地点的过程，从该地点获得归属感。工业遗产的地点认同涉及社会或社区与工业遗址和遗迹的情感联系。工业遗迹作为当地居民长期的情感依附对象，在与之相关的人们的记忆中建立了身份感。工业遗产的认同在很大程度上与那些生活、工作、受益甚至在生产活动过程中受到伤害的人相关联。这种具有独特地点身份的象征性对于防止工业遗产被忽视和破坏至关重要。工业遗产地点总是具有容易识别和记忆的显著特征。对于大多数此类区域，工业建筑和结构因其巨大的规模而具有视觉吸引力。它们通常被视为一个时代的象征、或一个事件的实体记录，或简单地作为一个地理位置的标记。

对集体记忆的影响

工业遗产地作为联系过去的实物纽带，与其历史密切相关的个人和社区往往对这些特定的城市环境怀有深厚的情感纽带，包括共同的经历、故事以及在特定社区中达成共识的价值观。某些工业遗产对特定群体的生活方式产生了深远影响，给他们留下了难以磨灭的记忆。工业遗产可以看作是人与地方、实践与过程的复杂融合。与传统社区相比，工业遗产区是以工作场所为中心的新型人类聚居模式，其发展与衰退对现代城市背景的形成有着深刻影响。改造的贡献不仅体现在对物质元素的保护和旧记忆的保存，还体现在积累和产生新记忆的潜力。然而，对工业遗产的情感依附并不总是积极的，可能还包括

与过去的骄傲和精神相关的不愉快回忆，如安全事故、污染问题、失业、社区破坏或对未来的恐惧。这些负面方面也促使人们反思过去的错误，从而推动技术、管理和社会的发展。

在传统与习俗中的重要性

工业遗产地对区域和国家的传统习俗有重要贡献。它们经常举办文化活动、节庆、社区聚会和教育项目，以庆祝工业成就、技术进步或成功的劳动运动，强化传统实践和社区纽带。从工业时代遗留下来的活动和生活方式也可能对当地习俗产生深远影响，例如工具的使用、饮食习惯、时间安排、特殊的日常仪式等。这些活动还可能产生一些受生产和工作活动影响的长期传统技能和生活习惯。

对政策和法规的影响

工业遗产的政治意义体现在其保护和再生尝试受到政策的影响，同时实际操作也影响政策的制定和调整。随着对工业遗产关注的增加，许多国家和城市制定了保护和再生的指导方针，包括价值评估、名录编制、建筑保护和再利用、以及城市发展的观点。这些法规和原则体现了工业遗产和景观的重要性，推动了地方和国家层面的行动以维护工业遗产的存在。另一方面，城市工业的发展和再生影响了土地利用模式和劳动结构的转变。在保护和再生的过程中的实际经验也提出了新的指导方针和政策，以解决过去的问题并指导未来的行动。

对教育和研究的重要性

工业遗产的教育和学术价值在于通过考古技术从工业遗产中获取知识。如今，它还包括通过旅游、教育和培训提高公众对工业历史和工业文化连续性的认识。此外，工业遗产在工业生产和管理的科学技术方面具有很高的研究和教育价值。它们是工业文明留下的智慧，值得继承和传承。技术和技能的延续依赖于研究和培训的机会。工业考古学和技术历史的研究有助于遗产记录的全面性。通过培训和教育活动，知识和技能更有可能长期保持活力。

d) Aesthetic Value

Industrial heritage also has aesthetic qualities concerning architecture, design and planning. This value tends to be specific to time and cultural context, but not always culturally exclusive as a visual impact.

The beauty of industrial architecture is appreciated as a perfect combination of function and form. And this aesthetic value comes from the purity of structure and fabric.

The aesthetic value also exists in other derivative art forms and genres such as artworks, literature, movies and films, etc. The aesthetic style of steampunk is largely derived from the visual and thematic elements of industrial and post-industrial machines, architectures and cities. This includes the co-existence of advanced technology with decaying urban landscapes, reflecting both the rational order of industrial progress and the chaotic beauty of urban decay.

The industrial architecture, structure and landscape have outstanding industrial aesthetics. Considering the style, structure, configuration, space, fabric, detailing, etc., the urban quarter with industrial relics is of unique visual attractiveness that figurate the power of technology and machinery. Even though some of the sites have been abandoned, the ruins are also valued for the beauty of dilapidation.

Public preference for industrial remains: Public preference for industrial remains reflects an appreciation for the historical and cultural significance of industrial heritage sites. These preferences can be influenced by the site's historical importance, nostalgia, and social impact. When people value industrial remains as part of their cultural identity and cherish the sites for collective memories, the preservation and regeneration activities are more easily forwarding. Such preferences highlight the importance of engaging local communities and reflecting social requirements in heritage conservation efforts.

Visual impact of architectures: The visual impact of architecture in industrial heritage sites relates to the aesthetic evaluation of the design, form, and details of the buildings. Industrial buildings, such as factories and warehouses, are often designed into unique architectural styles characterized by functional requirements and robust materials. Their preservation can enhance visual attractiveness and place identification of the heritage site, serving as a recognizable landmark within the urban context.

Visual impact of structures and facilities: The visual impact of structures and facilities at industrial heritage sites relates to the impressiveness of machinery and infrastructure that supports the production process, such as cranes, tanks, silos, pipes, etc. These structures can be visually striking and symbolize productional and technological advancement.

Visual impact of landscapes: The visual impact of landscapes in industrial heritage sites relies on the overall aesthetic of architecture and structures, together with the landform characteristics and environmental quality of the surroundings. Industrial landscapes play a crucial role in supporting the production, excavation, and shipment requirements. From the perspective of urban regeneration, landscapes can soften the visual impact of large-scale industrial buildings and structures and provide open space for people.

4.美学价值

工业遗产在建筑、设计和规划方面也具有美学价值。尽管这种价值通常与特定的时代和文化背景相关，但它作为一种视觉影响并不总是局限于某种文化。工业建筑的美被认为是功能与形式的完美结合。这种美学价值源于结构和材料的纯粹性。美学价值也存在于其他衍生艺术形式和类别中，如艺术作品、文学、电影等。蒸汽朋克的美学风格在很大程度上源于工业和后工业时代机器、建筑和城市的视觉主题元素。这种风格包括先进技术与衰败城市景观的共存，反映了工业进步的理性秩序与城市衰败的混乱美。工业建筑、结构和景观具备独特的工业美学。考虑到风格、结构、配置、空间、材料、细节等方面，拥有工业遗迹的城市区域具有独特的视觉吸引力，体现了科技和机械的力量。即使一些遗址已被废弃，这些废墟仍因其破败之美而受到重视。

对工业遗迹的公众偏好

公众对工业遗迹的偏好反映了他们对工业遗产地历史和文化意义的认可。这些偏好可能受到遗址历史重要性、怀旧情感和社会影响的影响。当人们将工业遗迹视为其文化身份的一部分，并珍惜这些遗址的集体记忆时，保护和改造活动就更容易推进。这种偏好强调了在遗产保护工作中吸引当地社区参与和反映社会需求的重要性。

建筑的视觉影响

工业遗产地的建筑视觉影响涉及对建筑设计、形式和细节的美学评价。工业建筑，如工厂和仓库，通常采用独特的建筑风格，具有功能要求和坚固材料的特点。它们的保存可以增强遗址的视觉吸引力和地方认同，成为城市环境中可识别的地标。

结构和设施的视觉影响

工业遗产地结构和设施的视觉影响与支持生产过程的机械和基础设施的震撼感有关，如起重机、罐、筒仓、管道等。这些结构不仅在视觉上引人注目，还象征着生产和技术的进步。

景观的视觉影响

工业遗产地的景观视觉影响取决于建筑和结构的整体美学，以及周围地形特征和环境质量。工业景观在支持生产、开采和运输需求方面起着重要作用。从城市再生的角度来看，景观可以柔化大型工业建筑和结构的视觉冲击，并为人们提供开放空间。

e) Economic Value

In a broad sense, the economic value of industrial heritage can be understood as the benefit generated in the process of heritage-related activities, including research, conservation, regeneration, utilization, etc. One special economic factor that industrial heritage should consider is the productivity of the original function if its original industry is still functioning. This value is more of the profit-lead allocation and utilization of heritage resources, which usually leads to financial results.

The benefit of industrial heritage is “included in the modern economic activities being combined with new economic form and highlighting nonnegligible financial value” during the process of urban transformation. As catalysts for urban development, tangible buildings and landscapes are physical resources for reuse and regeneration. Intangible heritage with outstanding cultural identification also stimulates the creative industry and tourism.

Location and transportation: The location of industrial heritage sites significantly impacts their economic value. The location near functional centres and easy access to transportation hubs promote the attractiveness of redevelopment and increase the land value for the real estate market. Industrial heritage quarters can benefit if they neighbour commercial, economic and political centres in the urban context. The convenient connection to transportation networks also enhances the tourism, investment and regeneration potential of the site.

Structural and spatial adaptiveness: A well-preserved industrial heritage quarter is a spatial resource for urban regeneration, as it provides large-scale open areas and completely structured buildings. For one thing, the relatively large-scale spaces of industrial buildings and structures provide the potential for multi-functional development. The mixed-use strategy of heritage quarters promotes economic vitality and increases land value. For another, proper reuse of the land, structures and materials can greatly diminish the construction waste and budget.

Potential for tourism promotion: As a unique urban landmark, an industrial heritage quarter is attractive to tourists who are interested in industrial history and culture. During the urban regeneration, the redevelopment of the site is expected to make it more convenient to access and more impressive to experience. Even without

considering admission fees for industrial heritage, the consumption of relevant tourism services also greatly boosts the local economy. With the idea of encouraging industrial heritage tourism prosperity, the UK and European countries have established industrial heritage trails to revitalize the heritage sites systematically. Many cities in China have also launched industrial heritage tourism programmes to encourage the active development of industrial heritage quarters.

Potential for market promotion: In the urban environment, industrial heritage sites can be regarded as a catalyst for the commercial market and real estate market as the refurbished quarters usually offer ideal places for creative industries and high-end residential blocks. During the regeneration process, the holistic improvement of the quarter might stimulate the local economy, increase land value and attract investment.

Potential for employment promotion: Regeneration of industrial heritage sites has a great influence on economic value from an employment perspective. Developed sites can provide various types of job opportunities. For the development stage, heritage projects require the participation of designers and planners, conservation specialists, construction workers, etc. The utilization stage should consider the operation, maintenance, and management of the heritage and property, as well as generate relevant job opportunities. For some living industries, the revitalization of the quarter might increase the scale of the original business and call for more workers. After the adaptive reuse of industrial buildings, many regeneration plans for office properties, inviting new companies and employment. Besides, the development of related tourism also promotes the prosperity of the hospitality industry and creative industry around the quarter.

5.经济价值

广义上讲，工业遗产的经济价值可以理解为与遗产相关活动（如研究、保护、再生、利用等）过程中产生的利益。如果原有产业仍在运行，则工业遗产需要特别考虑其原功能的生产力。这种价值更多是遗产资源的利润导向分配和利用，通常会带来财务收益。

在城市转型过程中，工业遗产的利益“包含在现代经济活动中，与新的经济形式结合，并突显了不可忽视的经济价值”。作为城市发展的催化剂，实物建筑和景观是可再利用和再生的物理资源。具有突出文化认同的无形遗产也刺激了创意产业和旅游业的发展。

地理位置和交通

工业遗产地的位置显著影响其经济价值。靠近功能中心和便捷交通枢纽的位置提升了重建吸引力，并增加了房地产市场的土地价值。如果工业遗产区毗邻城市中的商业、经济和政治中心，其受益将更加显著。便利的交通网络连接也增强了遗址的旅游、投资和再生潜力。

结构和空间适应性

保存良好的工业遗产区是城市再生的空间资源，提供了大规模的开放区域和结构完整的建筑。一方面，工业建筑结构相对大规模的空间提供了多功能开发的潜力。遗产区的混合使用策略促进了经济活力并提高了土地价值。另一方面，合理再利用土地、结构和材料可以大大减少建筑废弃物和预算。

旅游促进潜力

作为独特的城市地标，工业遗产区对工业历史和文化感兴趣的游客具有吸引力。在城市再生过程中，遗址的重新开发有望使其更加便利。即使不考虑工业遗产的门票收入，相关旅游服务的消费也能极大地促进了当地经济。在鼓励工业遗产旅游繁荣的理念下，英国和欧洲国家已建立工业遗产旅游路线，系统性地振兴遗产地。中国的许多城市也推出了工业遗产旅游项目，以鼓励工业遗产区的积极发展。

市场推广潜力

在城市环境中，工业遗产地可以作为商业市场和房地产市场的催化剂，因为翻新的区域通常为创意产业和高端住宅区提供理想的场所。在再生过程中，区域的整体改善可能刺激当地经济、增加土地价值并吸引投资。

就业促进潜力

从就业的角度来看，工业遗产地的再生对经济价值有重大影响。开发后，这些遗址可以提供各种类型的就业机会。在开发阶段，遗产项目需要设计师和规划师、保护专家、建筑工人等参与。在利用阶段，还需考虑遗产和物业的运营、维护和管理，进而产生相关的就业机会。对于某些仍在运行的行业，区域的复兴可能扩大原有业务规模并增加劳动力需求。在工业建筑的适应性再利用后，许多再生计划为办公物业提供新公司和就业机会。此外，相关旅游的发展也促进了该区域周边酒店业和创意产业的繁荣

f) Natural Value

Industry is a kind of human activity that may have great environmental impacts. Some production activities relate to the excavation, utilization and processing of raw materials, which closely interact with natural resources and their surrounding environment. For those relying on natural resources for transportation and energy, like canal heritage and dock lands, industrial heritage also brings a unique ecological system to the city with water features and greenery.

Many industrial heritage sites are regarded as toxic and polluted brownfields. Therefore, the regeneration of industrial sites is beneficial for reactivating environmental resilience and improving biodiversity. Heritage quarters that closely interact with natural resources, such as water systems and green lands, contribute to the holistic improvement of the city's living environment.

Significance of current eco-system and bio-system: The significance of the current ecosystem and biosystem in industrial heritage sites lies in their ability to support biodiversity and provide ecological functions within urban context. These sites often resulted from minimal human intervention during the post-industrial period and were gradually reoccupied by various plants and animals. These ecosystems contribute to environmental quality, micro-climate adjustment, and serve as green spaces for urban residents.

Potential for environmental improvement: Industrial heritage sites benefit the natural environment by transforming polluted or degraded areas, preserving urban green systems, and providing ecological corridors. Methods such as mitigating site pollution and constructing green infrastructure not only restore ecological balance but also contribute to the overall environmental health of urban areas.

6.自然价值

工业是一种可能对环境产生巨大影响的人类活动。一些生产活动涉及原材料的开采、利用和加工，这些过程与自然资源及其周边环境紧密相互作用。对于依赖自然资源进行运输和能源供应的遗产，如运河遗产和码头区，工业遗产也为城市带来了独特的生态系统，包括水体景观和绿化。

许多工业遗产地被视为有毒和污染的棕地。因此，工业场地的再生有助于恢复环境弹性和改善生物多样性。与自然资源如水系和绿地密切互动的遗产区，有助于整体改善城市的生活环境。

当前生态系统和生物系统的重要性

工业遗产地对当前生态系统的重要性在于它们在城市环境中支持生物多样性并提供生态功能。这些遗址在后工业时期受到人为干预较少，逐渐被各种植物和动物重新占据。这些生态系统有助于改善环境质量、调整小气候，并为城市居民提供绿色空间。

环境改善的潜力

工业遗产地通过改造污染或退化的区域、保护城市绿化系统和提供生态走廊等方式，促进自然环境的改善。通过减少场地污染和建设绿色基础设施等方法，不仅恢复了生态平衡，还对城市区域的整体环境健康做出了贡献。

序号 No.	工业遗产 Industrial heritage quarter	原功能 Original function	当前功能 Current function	简要介绍 Brief introduction
1	董家渡船坞-滨江绿地 The Dongjiadu Shipyard- Ferry Waterfront	造船厂 Shipyard	滨江绿地 Waterfront	董家渡船坞是上海历史上第一个现代化船厂，成立于 1853 年，运营至 20 世纪 90 年代中期。董家渡船坞展览馆项目利用海事大楼的主体结构，作为面向黄浦江的景观式延伸，象征着中国的海事发展。该船厂于 2005 年关闭，所有建筑物于 2010 年被拆除。幸运的是，原有的船坞景观得以保留。2015 年，随着东岸开发的推进，启动了该地块的再生项目。该地块被开发为中国远洋海运集团有限公司的总部。项目在保留干船坞原有历史特色的同时，还创建了与城市绿带相连的绿色空间。 The Dongjiadu Shipyard, the first modern shipyard in Shanghai's history, was established in 1853 and operated until the mid-1990s. The Dongjiadu Shipyard Exhibition Hall project utilizes the main structure of the Maritime Building as a landscape-style extension facing the Huangpu River, serving as a symbol of Chinese maritime. This shipyard was closed in 2005, and all the buildings were demolished in 2010. Luckily the original dock landscape was kept. In 2015, the regeneration project was launched with the development of the east bank. The site was developed into the headquarter of China Cosco Shipping Corporation Limited. While preserving the dry dock's original historical features, the project has created a connected green space as part of the city's green belt.
2	上海船厂 Shanghai Shipyard	造船厂 Shipyard	船厂 1862 文化商业综合体 Shipyard 1862 Cultural and Commercial Complex	船厂 1862 是位于中国上海的一处标志性工业遗产改造项目，原为英国船商创办的船舶修造厂，建于 1862 年。这个历史悠久的地标经过精心改造，转变成了一个融合了艺术、文化和商业功能的多功能空间。船厂 1862 保留了原有的工业建筑特色，如高大的空间和钢结构，同时引入了现代设计元素，成为展示现代设计和文化交流的平台。

				Shipyard 1862 is a landmark industrial heritage renovation project located in Shanghai, China. Originally established by British ship merchants as a shipbuilding factory in 1862, this historic landmark has been meticulously transformed into a multifunctional space that integrates art, culture, and commercial functions. Shipyard 1862 retains the original industrial architectural features, such as the large spaces and steel structures, while incorporating modern design elements, making it a platform for showcasing modern design and cultural exchange.
3.	江南机器制造总局-浦西滨江世博园 The Jiangnan Machinery Manufacturing Bureau - Puxi Riverside Expo Park Area	造船厂 Shipyard	滨江世博园 Museum Park	江南机器制造局，又称上海机器局，成立于 1865 年，是清朝洋务运动期间建立的最大的现代化军工企业。江南机器制造局的早期厂房是当时最早的现代化工厂之一，并成为江南造船厂的前身。该厂区于 2008 年关闭，并计划用于 2010 年世博会。该区域保留了三个船坞，其中一个被设计为潜艇博物馆，一个用于展示远望一号测量船，另一个则被改造为滑板中心。原有的制造厂棚被保留并重新利用为船舶博物馆——中船馆 The Jiangnan Machinery Manufacturing Bureau, also known as the Shanghai Machinery Bureau, was established in 1865. It was the largest modern military enterprise formed during the Self-Strengthening Movement of the Qing Dynasty. The early factory buildings of the Jiangnan Machinery Manufacturing Bureau were among the first modern factories of the time. It served as the predecessor to the Jiangnan Shipyard. The factory area was closed in 2008 and was planned for Expo 2010. The area has preserved three docks; one has been designed as the Submarine museum, one is parking the Yuanwang-1 Survey Ship for display, and another is reused as the Skateboarding Center. The original manufacturing shed was preserved and reused as the ship museum CSSC Pavilion
4	信和纱厂 Xinhe Yarn Factory	纺织厂 Textile Factory	M50 创意产业园 M50 Creative Industrial Park	M50 创意园位于，上海市普陀区莫干山路。M50 创意园的原身为上海春明粗纺厂，于 2000 年起开始转型为艺术创意园区。2011 年 7 月，上海春明粗纺厂更名为上海 M50 文化创意产业发展有限公司，园区占地面积约 36 亩。从 2008 年

				开始，上海纺织集团时尚事业部和 M50 创意园的管理层对于 M50 的品牌建设提出了创新理念，即，从主体到客体，从实体到载体，意在以 M50 创意园为基础，充分利用园区资源聚集的能力和汇集起来的资源，将 M50 放到一个更高的层面，作为一个以 “艺术、创意、生活” 为核心价值的品牌去打造。 M50 Creative Park is located on Moganshan Road in Putuo District, Shanghai. Originally the Shanghai Chunming Worsted Mill, it began transitioning into an art and creative park in 2000. In July 2011, Shanghai Chunming Worsted Mill was renamed Shanghai M50 Culture and Creative Industry Development Co., Ltd., with the park covering an area of about 36 acres. Starting from 2008, the Fashion Division of Shanghai Textile Group and the management team of M50 Creative Park proposed innovative concepts for M50's brand building. The strategy was to shift from subject to object and from physical entities to carriers, intending to use M50 Creative Park as a foundation. By fully leveraging the park's resource aggregation capability and the resources gathered, the goal was to elevate M50 to a higher level, creating a brand centered around "art, creativity, and life."
5	上海铁路南浦站 Shanghai Railway Nanpu Station	火车站 Train Station	博物馆，工业景观 Museum, Industrial Landscape	中国最早的铁路货运栈南浦车站变身上海生活新地标“Station 1907 启点”（简称“启点 1907”），成为徐汇滨江靓丽一景。启点 1907 不仅保留了百年的铁轨、青砖、车站壁灯、木质雨棚等，连广场前的一棵百年乌桕也完好保留。历经沧桑的百年铁轨、月台、站房、仓库经过修复得以新生。 China's earliest railway freight station, Nanpu Station, has been transformed into Shanghai's new landmark of lifestyle, "Station 1907 Qidian" (abbreviated as "Qidian 1907"), becoming a beautiful sight along the Xuhui Riverside. Qidian 1907 not only preserves the century-old railway tracks, green bricks, station wall lamps, and wooden canopies but also a century-old Chinese tallow tree in front of the plaza. The century-old railway tracks, platforms, station buildings, and warehouses, after undergoing restoration, have been given a new lease on life.

6	上海杨树浦发电厂 Shanghai Yangshupu Power Plant	发电厂 Power Plant	商业综合体，工业景观 Commercial Complex, Industrial Landscape	杨树浦电厂滨水艺术空间前身为英商投资建于 1913 年的杨树浦发电厂。这座曾经的远东第一火力发电厂虽然在上海的城市发展中扮演了重要的角色，但也因为大量燃煤而造成空气污染，危及生态环境。2015 年，伴随着整个黄浦江公共空间工程计划的启动，电厂关停开始实施生态和艺术改造，从封闭的“闲人免入”生产岸线，向文化和生态共享的生活性滨水开放空间转型，“还江于民”，修复燃煤造成的生态污染，塑造电厂的场所精神，嵌入城市律动的滨水公共空间。
7	大中华纱厂和华丰纱厂 Da Zhonghua Yarn Factory and Huafeng Yarn Factory	纺织厂 Textile Factory	半岛 1919 产业园 Peninsula 1919 Industrial Park	得名于 1919 年建造的吴淞大中华纱厂，历经百年尘世，曾经叱咤上海滩的纱厂已经变身为国际化的文化创意园。园区建筑融中式、日式和欧式于一体，其中有六幢已被列为优秀历史保护建筑，仍保留着昔日的纺织机、传送轨道和钟楼等历史元素，拥有杨明洁工业设计博物馆、蓝星搏击馆、梵卡烘焙生活馆、陶艺家等十余个风格各异的体验空间。 Named after the Wusong Dachung Hua Yarn Factory built in 1919, this centennial establishment, once a prominent figure on the Shanghai scene, has transformed into an international cultural and creative park. The park's architecture is a fusion of Chinese, Japanese, and European styles, including six buildings that have been designated as outstanding historical conservation buildings. It still retains historical elements from its past, such as textile machines, conveyor tracks, and a clock tower. The park houses over ten distinct experiential spaces, including the Yang Mingjie Industrial Design Museum, Bluestar Boxing Gym, Vanke Baking Life Pavilion, and pottery artists' studios, among others.
8	景源时尚产业园 创享塔 The Shanghai Sack Factory and	纺织厂 Manufacture of textiles	时尚产业园 Fashion Industry Park/	上海麻袋厂最初由日本人于 1920 年创立，位于苏州河畔。现存的历史建筑包括一座两层的山墙仓库和一座四层的塔楼。仓库采用砖木结构建造，而塔楼则为钢筋混凝土结构。仓库区域于 2009 年进行了重新开发，塔楼区域则在 2016 年进行了再生改造。

	Clothing Factory - Jingyuan Fashion Industry Park and The X Tower Innovative Park			The Shanghai Sack Factory, originally established in 1920 as a Japanese-owned sack factory, is located along the banks of the Suzhou River. The existing historical structures include a two-story gabled warehouse and a four-story tower. The warehouse is constructed with brick and timber, while the tower features a steel-reinforced concrete structure. The warehouse area was redeveloped in 2009, and the tower area was regenerated in 2016.
9	上海第十七棉纺织总厂 Shanghai No. 17 Cotton Textile Factory	纺织厂 Textile Factory	国际时尚中心 International Fashion Center	上海国际时尚中心原为上海第十七棉纺织总厂，坐落于杨树浦路 2866 号，前身为 1921 年日商裕丰纺织株式会社裕丰纱厂。跨越了近一个世纪的优秀历史保护建筑，记录了上海纺织乃至中国纺织业的发展和变迁。从百年老厂成功转型后的上海国际时尚中心，总建筑面积约 13 万平方米，以时尚为核心立意，集创意、文化及现代服务经济于一体，更挖掘现有城市特色和资源优势，将百年建筑的历史内涵与现代时尚的文化底蕴巧妙地融合。The Shanghai International Fashion Center, originally the Shanghai No. 17 Cotton Textile Factory, is located at 2866 Yangshupu Road. Its predecessor was the Yufeng Yarn Factory, established in 1921 by the Japanese Yufeng Textile Co., Ltd. As an outstanding historical conservation building that spans nearly a century, it documents the development and changes of the textile industry in Shanghai and across China. Following its successful transformation, the Shanghai International Fashion Center now spans approximately 130,000 square meters. With fashion as its core concept, it integrates creativity, culture, and modern service economy, further leveraging the city's unique characteristics and resource advantages. It ingeniously blends the historical essence of the century-old building with the cultural depth of modern fashion.
10	徐汇滨江西岸 The Beipiao	码头 Wharf	滨江绿地 艺术画 Bund Waterfront	北票煤码头建立于 1929 年，位于黄浦江西岸，上海南站西侧，岸线长约 515 米。它是上海港专门用于煤炭卸载的码头，负责处理来自中国北方各地的煤炭

	Coal Wharf - Xuhui West Bund Waterfront		Art gallery	运输，以及为江苏、浙江和福建等地区的煤炭中转任务。该码头曾为上海提供超过 60%的工业和民用煤炭供应。到 2008 年，货物年吞吐量约为 1400 万吨。该地于 2009 年关闭并计划进行再开发，如今已转变为一个开放的公共绿地，包括一个艺术画廊。 The Beipiao Coal Wharf, established in 1929, is located on the west bank of the Huangpu River, west of the Shanghai South Railway Station. The shoreline is approximately 515 meters long. It served as a specialized dock for coal unloading at the Shanghai Port, handling coal transportation from various locations in northern China as well as coal transshipment tasks for regions like Jiangsu, Zhejiang, and Fujian. It supported over 60% of Shanghai's industrial and civilian coal supply. By 2008, the annual throughput of goods was about 14 million tons. The site closed and planned for regeneration in 2009, and has now been transformed into an open public green space, including an art gallery.
11	上海屠宰场 Shanghai Slaughterhouse	屠宰场 Slaughterhouse	1933 老场坊文创综合体 1933 Old Millfun Cultural and Creative Complex	1933 老场坊位于上海市虹口区沙泾路 10 号，是 1933 年，由工部局出资兴建，著名英国设计师设计，中国当时的知名建筑营造商建造的上海工部局宰牲场。1933 老场坊的建筑融汇了东西方特色，整体建筑可见古罗马巴西利卡式风格，不同的季节，不同的时间，不同的角度，永远可以领略到 1933 老场坊不一样的风情。在当时，全世界这样格局规模的宰牲场也只有三座，而 1933 老场坊是目前唯一现存完好的建筑，其他的也都无从可寻了。1933 老场坊。 Located at No. 10 Shajing Road in Hongkou District, Shanghai, the 1933 Old Millfun was funded by the Ministry of Works in 1933, designed by a renowned British architect, and constructed by a famous Chinese construction firm of the time as the Shanghai Municipal Council Slaughterhouse. The architecture of 1933 Old Millfun blends Eastern and Western characteristics, with the overall structure displaying the style of an ancient Roman basilica. Depending on the season, time, and viewing

				angle, 1933 Old Millfun always presents a distinct charm. At that time, there were only three slaughterhouses of this scale and layout in the world, and 1933 Old Millfun is the only one that remains intact today, with the others no longer existing.
12	上海飞机制造厂-西岸艺术中心上海油罐艺术中心 The Shanghai Aircraft Manufacturing Factory - West Bund Artistic Center, Shanghai Oil Tank Art Center	飞机制造厂 Aircraft Manufacturing Factory	艺术中心 West Bund Artistic Center	上海飞机制造厂成立于 1950 年，最初负责飞机检修以及制造地面设备和零部件。1969 年，该厂成为大型喷气式客机的总装厂。员工人数从 1951 年的 374 人增长到 2009 年的 3,799 人。如今，该厂的厂房被保留并改造成西岸艺术中心，旧有的航空油料储罐则被重新利用为油罐艺术中心。 The Shanghai Aircraft Manufacturing Factory, established in 1950, was initially tasked with overhauling aircraft and manufacturing ground equipment and parts. In 1969, it became a final assembly plant for large jet airliners. The workforce grew from 374 employees in 1951 to 3,799 by 2009. Today, the site preserves the factory building as the West Bund Artistic Center and the old aviation oil tanks are reused as the Tank Shanghai Art Center
13	南门粮库 Nanmen Grain Silo	粮仓、码头 Grain Silo, Dock	云间粮仓文创园 Clouds Art Park	松江云间粮仓占地 136 亩，有 60 余栋仓储建筑，自上个世纪 50 年代年建立，云间粮仓文化创意园区前生是上世纪的松江粮食仓库及工厂，承载了特殊的工业历史记忆，历经了繁盛到衰落，如今，在城市更新背景下，遵循修旧如旧的更新改造，园区重新成为了城市活力新据点。 Songjiang Cloud Grain Silo covers an area of 136 mu and has more than 60 storage buildings. The pre-existence of Cloud Grain Silo Cultural and Creative Park was Songjiang grain warehouse and factories established in the 1950s, which carries a special memory of industrial history, and has experienced prosperity to decline. Now, in the context of urban renewal, following the renewal and transformation of repairing the old as the old, the park has re-emerged as a new stronghold of urban vitality.

14	上海冶金矿山机械厂 Shanghai Metallurgical and Mining Machinery Factory	机械厂 Machinery Factory	静安新业坊 Jing'an New Industry Square	静安新业坊，原址为隶属于上海电气集团的上海冶金矿山机械厂，成立于 1959 年，是国家大型二级企业，上海市骨干企业。随着产业调整与升级，工厂于 2009 年正式停厂。2016 年初，静安区政府与上海临港集团签署战略合作协议，引进“新业坊”品牌对上海冶金矿山机械厂开展城市更新和持续运营。园区以工业历史建筑的保护再利用为载体，打造集影视制作、艺术传媒、工业设计、体育竞技等文创要素的亚洲领先、世界一流的文化创意产业集聚区。 Jing'an New Industry Square, originally the site of the Shanghai Metallurgical and Mining Machinery Factory belonging to the Shanghai Electric Group, was established in 1959 as a large-scale second-tier national enterprise and a key enterprise in Shanghai. With industrial adjustment and upgrading, the factory officially ceased operations in 2009. In early 2016, the Jing'an District government signed a strategic cooperation agreement with Shanghai Lingang Group to introduce the "New Industry Square" brand for the urban renewal and sustainable operation of the Shanghai Metallurgical and Mining Machinery Factory. The park, leveraging the protection and adaptive reuse of industrial historical buildings, aims to create an Asia-leading, world-class cultural and creative industry cluster featuring elements of film and television production, art media, industrial design, and sports competition.

参与人员同意书 Participants Consent Form

研究课题 Title of Study: 城市工业遗产再生的文脉敏感性评价 Contextual sensitivity evaluation of urban industrial heritage regeneration

研究者姓名 Name of Researcher(s): 李偲淼 SIMIAO LI

导师姓名 Name of Supervisor: 蒂姆·希斯教授 Prof. Tim Heath

此表格是为了帮助您决定是否愿意参加本次研究并完成调查问卷。请您先行阅读所提供的全部相关信息和问卷问题后填写此表格。如果您决定参加问卷调查，并同意以下陈述，请每条陈述后面的方格内打勾。全部选择“是”选项代表您将做好准备参加本次研究并完成问卷内容。

This form is designed to help you decide whether you wish to participate in this study complete the survey questionnaire. Please read all the relevant information and questionnaire questions provided before filling out this form. If you decide to participate in the survey and agree with the statements below, please check the box after each statement. Choosing "Yes" for all options indicates that you are prepared to participate in this study and complete the questionnaire content.

1. 我已阅读描述本研究的信息表和问卷问题。I have read the questionnaire and the information sheet describing the study. ☐ 是 Yes ☐ 否 No

2. 我有机会思考相关信息、提出问题并且我的问题已经得到了满意的回答。I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐ 是 Yes ☐ 否 No

3. 我知道我可以随时退出研究，无需给出理由，也不会受到任何不利影响。I know that I can withdraw from the study at any time without giving a reason without prejudice. ☐ 是 Yes ☐ 否 No

4. 我知道我可以随时向研究人员询问有关研究的更多信息。I know that I can ask the researcher for further information about the study at any time. ☐ 是 Yes ☐ 否 No

5. 我理解我提供的所有信息将会保密并匿名处理，研究报告中将不可能识别出任何参与者。I know that all information I give will be confidential and anonymized, and that it will not be possible to identify any of the respondents in the study report. ☐ 是 Yes ☐ 否 No

6. 我理解研究中的数据可能会被用于最终报告/论文和其他出版物中。I understand that data from the study might be used in the final report/thesis and in other publications. ☐ 是 Yes ☐ 否 No

我同意上述内容，同意参与本次研究并完成调查问卷。I consent with the statements mentioned above and agree to participate in this study and complete the survey questionnaire.

☐ 是，我愿意参与两轮问卷 Yes, I am willing to participate in both the two rounds of the questionnaire.

☐ 是，我愿意参与第一轮问卷，第二轮问卷需要重新询问我的意愿 Yes, I am willing to participate in the first round of the questionnaire. However, my willingness to participate in the second round of the questionnaire will need to be confirmed again.

☐ 否，我不愿参与任何一轮问卷 No, I am **not** willing to participate in any of the two rounds of the questionnaire.

城市工业遗产区更新过程中的工业遗产价值评估预调查问卷

Industrial Heritage Value Evaluation during Urban Industrial Heritage Quarter Regeneration Pre-Survey Questionnaire

您好 Hello，

感谢您在百忙之中抽空参加这项有关工业遗产的问卷调查。本研究的目的是对上海已改造的14个工业遗产项目进行价值变化评分。

Thank you for taking the time to participate in this questionnaire survey on industrial heritage. The purpose of this study is to evaluate the value changes of 14 industrial heritage projects that have been renovated in Shanghai.

本轮问卷是该研究的预调查问卷，目的是了解参与者的工作经验，专长领域研究，和对工业遗产相关议题的了解程度。由于本研究下一轮的评分环节需要参与者有一定工作经验，了解或参与过相关项目，对工业遗产和城市更新议题有一定程度的了解，本轮问卷将对统计结果进行选择，如果您是我们的目标参与者，您将会收到后续问卷填写的邀请。无论您是否会参与后续研究，我们都诚挚感谢您本次的积极参与。

This round of questionnaires is a pre-survey aimed at understanding participants' work experience, areas of expertise, and knowledge of issues related to industrial heritage. As the next round of this study requires participants with relevant work experience, familiarity with or involvement in related projects, and a certain degree of understanding of industrial heritage and urban renewal issues, this pre-survey will be used to select suitable participants. If you meet our criteria, you will receive an invitation to complete the subsequent questionnaire. Regardless of whether you will participate in the subsequent research, we sincerely appreciate your active participation in this pre-survey.

您需要完成以下8个问题，完成全部问题预计需要占用您3-5分钟。您有3天的时间可以完成本问卷并返回您的答案。本次预调查的请根据自己的生活经历，专业知识和工作经验给出真实的答案。如果您不愿意参加，可以随时终止参加本次调查活动。本研究涉及到的工业遗产改造项目如下表所示。

You are required to complete the following 8 questions, which will take approximately 3-5 minutes. You will have 3 days to complete and return your answers. Please answer truthfully based on your personal experiences, professional knowledge, and work background. If you do not wish to participate, you may withdraw from the survey at any time. The industrial heritage renovation projects involved in this study are listed in the table below.

编号 No.	上海工业遗产区 Shanghai Industrial Heritage Quarters	改造后功能 Regenerated Function
1	董家渡船坞董家渡船坞 Dongjiadu Shipyard	船坞滨江绿地 Ferry Waterfront
2	上海船厂-浦东 Shanghai Shipyard - Pudong	船厂 1862 Shipyard 1862
3	江南机器制造总局（含求新机器造船厂）Jiangnan Machine Manufacturing Bureau (Qiuxin Machine Shipyard)	浦西滨江世博园 Puxi Riverside Expo Park Area
4	阜丰面粉厂 Fufeng Flour Mill	M50 创意产业园 M50 Creative Park
	信和纱厂 Xinhe Spinning Mill	
5	上海铁路南浦站 Shanghai Nanpu Railway Station	启点 1907 Station 1907
6	工部局电气处（杨树浦电厂）Shanghai Municipal Council Electricity Department, Yangshupu Power Plant	杨树浦电厂遗迹公园 Shanghai Yangshupu Power Plant Heritage Park
7	大中华纱厂和华丰纱厂 Great China Spinning Mill and Huafeng Spinning Mill	半岛 1919 文化创意产业园 Peninsula 1919 Cultural and Creative Industrial Park
8	上海麻袋厂 Shanghai Burlap Factory	景源时尚产业园 Jingyuan Fashion Industry Park 创享塔 The X Tower
9	上海第十七棉纺织总厂旧址 Shanghai No. 17 Cotton Textile Factory	上海国际时尚中心 Shanghai International Fashion Center
10	上海北票煤码头 Shanghai Beipiao Coal Wharf	徐汇滨江西岸 Xuhui West Bund Waterfront
11	工部局宰牲场 Shanghai Municipal Council Slaughterhouse	1933 老场坊 1933 Old Millfun
12	上海飞机制造厂（5703 厂） Shanghai Aircraft Manufacturing Plant, Factory 5703	西岸艺术中心 West Bund Artistic Center 上海油罐艺术中心 Shanghai Oil Tank Art Center
13	南门粮库 Nanmen Grain Depot	松江云间粮仓文化产业园 Cloud Grain Silo Cultural and Creative Industrial Park
14	上海冶金矿山机械厂旧址 Shanghai Metallurgical Mining Machinery Plant	静安新业坊 Jing'an New Business Park

1. 请提供您的从业时间 Please provide the time you worked in your profession：_____年 Years
2. 请提供您工作中主要涉及的相关领域 Please provide several primary fields that your work related：
   ☐室内设计 Interior Design ☐建筑设计 Architectural Design ☐城市设计 Urban Design
   ☐城市规划 Urban Planning ☐景观园林 Landscape Architecture
   ☐工业设计 Industrial Design ☐交通规划 Transportation Planning
   ☐土木工程 Civil Engineering ☐造价精算 Cost Estimation ☐历史研究 Historical Research
   ☐文物保护 Cultural Heritage Conservation ☐房地产 Real Estate
   ☐城市经济 Urban Economics ☐环境评估 Environmental Assessment
   ☐社会活动 Social Activities ☐其他 Others：_____
3. 您是否游览过本研究列出的 14 个上海工业遗产区块的城市更新项目中的某一个或几个 Have you ever visited one or more urban regeneration projects of the 14 Shanghai's industrial heritage quarters listed in this research:
   ☐是 Yes ☐否 No
4. 如果您选择是，请您提供您去过的所列项目的个数 If you answered 'yes,' please provide the number of listed quarters you have visited：_____
5. 您是否参与过本研究列出的 14 个上海工业遗产区块的城市更新项目中的一个或几个（参与在本问卷中指您参与包括研究，设计，规划，建设，评估，投资，开发等在内的但不限于以上几种的与该项目有关的工作）Have you ever been involved in one or more urban regeneration projects of the 14 Shanghai's industrial heritage quarters listed in this research (Be involved in this questionnaire refers to your participation in research, design, planning, construction, evaluation, investment, development, consulting, etc., including but not limited to the above types of work related to the project)：
   ☐是 Yes ☐否 No
6. 如果您选择是，请您提供您参与过的所列项目的个数 If you answered 'yes,' please provide the number of listed quarters you have been involved：_____
7. 请选择您对上海工业遗产相关领域的熟悉程度 How familiar are you with the topic of Shanghai industrial heritage：
   ☐完全不熟悉 Not Familiar at All ☐稍微熟悉 Slightly Familiar
   ☐中等熟悉 Moderately Familiar ☐非常熟悉 Very Familiar
   ☐极其熟悉 Extremely Familiar
8. 请选择您对上海城市更新相关领域的熟悉程度 How familiar are you with the topic of Shanghai urban regeneration：
   ☐完全不熟悉 Not Familiar at All ☐稍微熟悉 Slightly Familiar
   ☐中等熟悉 Moderately Familiar ☐非常熟悉 Very Familiar
   ☐极其熟悉 Extremely Familiar

感谢您完成这部分的问题，以上问题的答案不涉及详细个人信息，所有答案内容也不会以任何形式透露给其他人。Thank you for completing this part of the questionnaire. The answers to the above questions do not involve detailed personal information, and all response content will not be disclosed to others in any form.

所属单位 Affiliation：_____

调研日期 Date: _____ 编号：_____

城市工业遗产区改造过程中价值变化打分表

Value Variation Scoring Table for Urban Industrial Heritage Quarter Regeneration

您好 Hello，

经过第一轮预调查问卷筛选，您是符合我们预期的参与者，我们诚挚邀请您参与第二轮的评估环节。感谢您在百忙之中抽空参加这项有关工业遗产价值评估的问卷调查。

Following the first round of pre-survey screening, you have been identified as a suitable participant for our study. We sincerely invite you to participate in the second round of the evaluation phase. Thank you for taking the time out of your busy schedule to participate in this questionnaire on the valuation of industrial heritage.

您需要完成《城市工业遗产区改造过程中价值变化评估表》，完成全部问题预计需要占用您30-45 分钟，但考虑到您可能需要时间思考相关问题并查阅有关资料，您将有 7 天时间完成所有问题。您将在评分表中对本问卷列出的上海已经完成改造多项工业遗产区在改造过程中的价值变化进行评估。请根据自己的生活经历，专业知识和工作经验给出真实的答案和客观的分数。如果您不愿意参加本环节和评估环节，可以终止参加本次调查活动。

You are required to complete the " Value Variation Scoring Table for Urban Industrial Heritage Quarter Regeneration." It is estimated to take 30-45 minutes to answer all the questions. However, considering that you may need time to think about the questions and consult relevant materials, you will have 7 days to complete all the questions. You will evaluate the value changes during the transformation process of several renovated industrial heritage areas in Shanghai listed in the rating form. Please provide genuine answers and objective scores based on your life experiences, professional knowledge, and work experience. If you do not wish to participate in this section and the assessment phase, you may terminate your participation in this survey activity.

接下来请您通过下方的评分表对本研究列出的 14 个已改造的上海工业遗产城市区块在改造前后工业遗产价值的变化量进行评分。工业遗产主要可以通过历史价值，科学技术价值，社会文化价值，美学价值，经济价值和自然价值 6 种价值进行研究。《背景信息》文件中，详细介绍了本研究中工业遗产的价值分类，每种价值的意义，每种价值在评价时需要考虑的方面。您可以参考该文件进行评价。我们也为 14 个项目提供了简要介绍和资料来源，您可以参阅相关内容，也可以根据您的需要自行收集相关信息来帮助您更好地给出评分。

Next, please use the rating table below to evaluate the changes in the value of the 14 regenerated urban industrial heritage quarters in Shanghai, as listed in this study. The industrial heritage can be assessed through six types of value: historical value, scientific and technological value, socio-cultural value, aesthetic value, economic value, and natural value. The "Background

Information" document provides a detailed explanation of the value categories, the significance of each type of value, and the aspects to be considered during evaluation. You can refer to this document for your assessment. We have also provided a brief introduction and sources of information for the 14 projects, which you can review. Additionally, you may gather any further information you need to help you provide more accurate ratings.

您将需要评价的是在改造过程中每个区块的每个价值指标是否发生变化，每个价值指标变化量的总分为±100 分（整数分）。例如，在某工业遗产的历史价值中，历史意义指标，在改造过程中如果您基于您的经验知识评价其历史价值得到了提升，您可以根据提升的强度给出0-100 中任意整数分。如果您评价其历史价值被减弱，您可以根据被减弱的程度给出-100-0中的任意负整数分。如果您评价历史意义没有发生变化，则分数为 0。

You will need to evaluate whether each value of each project has changed during the regeneration process. The total score for the change in each value ranges from ±100 points (integer number). For example, after reviewing the relevant information on the historical value of a particular industrial heritage project, if you evaluate based on your knowledge that its historical value has been increased during the regeneration, you can assign any integer score between 0 and 100 based on the strength of the increasement. If you think the historical value has been decreased, you can assign any negative integer score between -100 and 0 based on the degree of reduction. If you evaluate the historical value has remained unchanged, the score is 0.

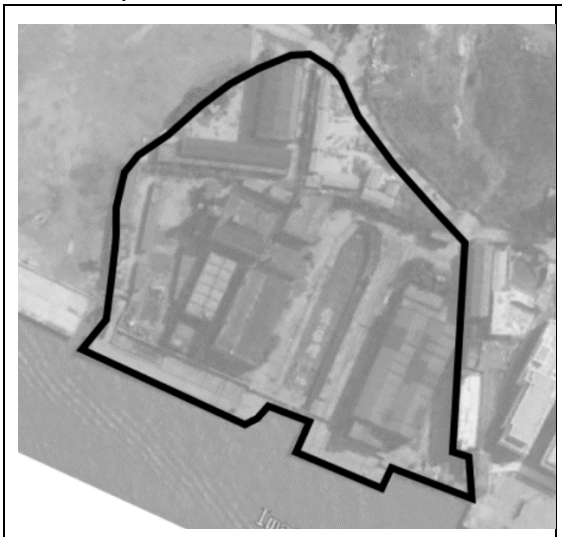
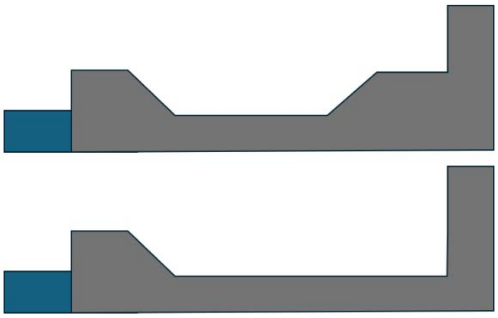
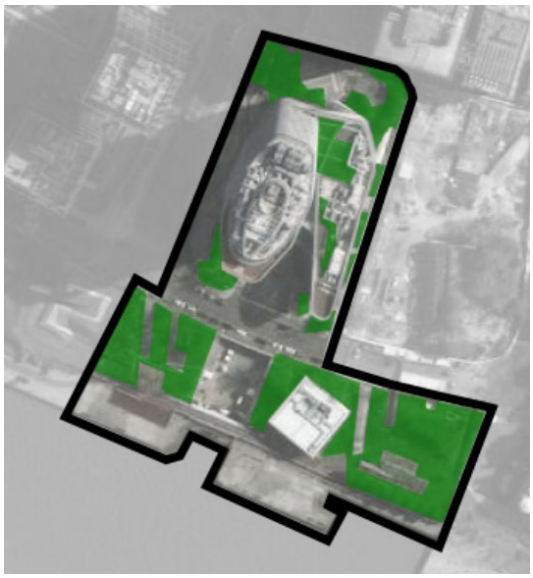
工业遗产改造过程中价值变化打分表 Value Variation Scoring Table for Urban Industrial Heritage Quarter Regeneration

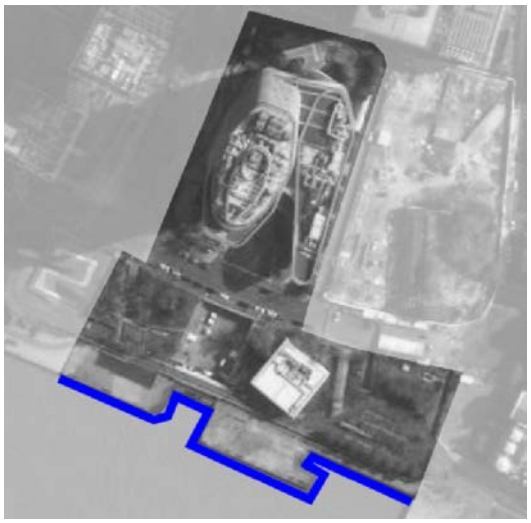
上海工业遗产区 Shanghai Industrial Heritage Quarters	改造后功能 Regenerated Function	编号 No.	工业遗产的价值分类 Value Category of Industrial Heritage					
			历史价值 Historic Value	科学技术价值 Scientific and Technological Value	社会文化价值 Socio-cultural Value	美学价值 Aesthetic Value	经济价值 Economic Value	自然价值 Natural Value
董家渡船坞董家渡船坞 Dongjiadu Shipyard	船坞滨江绿地 Ferry Waterfront	1						
上海船厂-浦东 Shanghai Shipyard - Pudong	船厂 1862 Shipyard 1862	2						
江南机器制造总局（含求新机器造船厂）Jiangnan Machine Manufacturing Bureau (Qiuxin Machine Shipyard)	浦西滨江世博园 Puxi Riverside Expo Park Area	3						
阜丰面粉厂 Fufeng Flour Mill 信和纱厂 Xinhe Spinning Mill	M50 创意产业园 M50 Creative Park	4						
上海铁路南浦站 Shanghai Nanpu Railway Station	启点 1907 Station 1907	5						
工部局电气处（杨树浦电厂）Shanghai Municipal Council Electricity Department, Yangshupu Power Plant	杨树浦电厂遗迹公园 Shanghai Yangshupu Power Plant Heritage Park	6						
大中华纱厂和华丰纱厂 Great China Spinning Mill and Huafeng Spinning Mill	半岛 1919 文化创意产业园 Peninsula 1919 Cultural and Creative Industrial Park	7						
上海麻袋厂 Shanghai Burlap Factory	景源时尚产业园 Jingyuan Fashion Industry Park 创享塔 The X Tower	8						
上海第十七棉纺织总厂旧址 Shanghai No. 17 Cotton Textile Factory	上海国际时尚中心 Shanghai International Fashion Center	9						
上海北票煤码头 Shanghai Beipiao Coal Wharf	徐汇滨江西岸 Xuhui West Bund Waterfront	10						
工部局宰牲场 Shanghai Municipal Council Slaughterhouse	1933 老场坊 1933 Old Millfun	11						
上海飞机制造厂（5703 厂） Shanghai Aircraft Manufacturing Plant, Factory 5703	西岸艺术中心 West Bund Artistic Center 上海油罐艺术中心 Shanghai Oil Tank Art Center	12						
南门粮库 Nanmen Grain Depot	松江云间粮仓文化产业园 Cloud Grain Silo Cultural and Creative Industrial Park	13						
上海冶金矿山机械厂旧址 Shanghai Metallurgical Mining Machinery Plant	静安新业坊 Jing'an New Business Park	14						

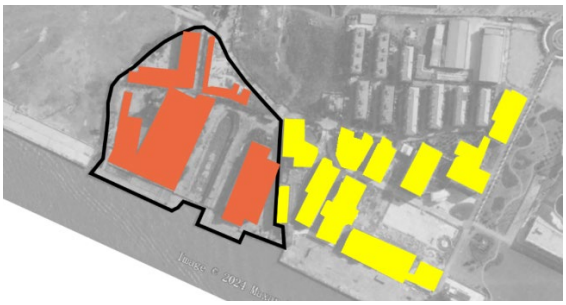
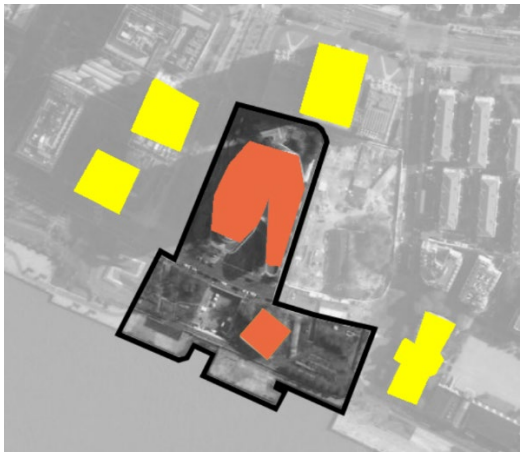
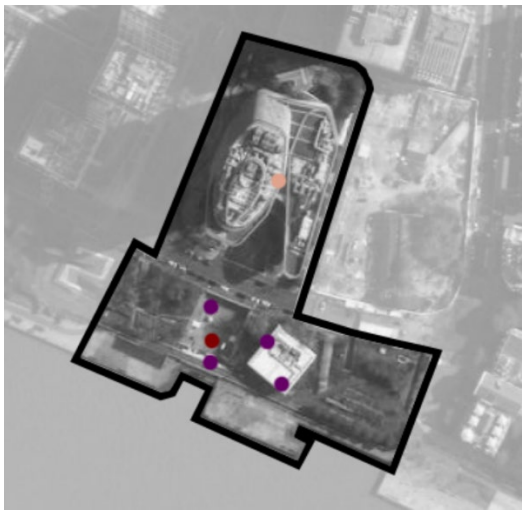
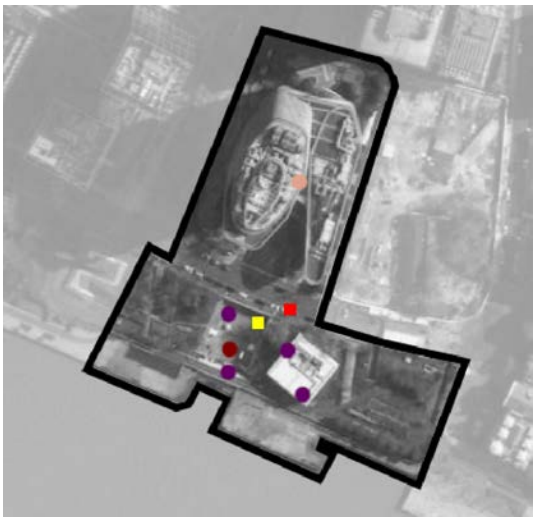
所属单位Affiliation：_____ 调研日期 Date: _____ 编号：_____

Samples Indicator Diagrams and Resources

1. Ferry Waterfront

	
In1/In2	In1/In2
	
In3/In4	In5/In6

	
In8	In9
	
In10	In13
	
In15	

	
In16post	In16pre
	
In17post	In17pre
	
In18	In19

	
In23	In25

In30

https://www.baidu.com/link?url=2j4Q1rFGR6UjTKilqZM6iQqX3-k-NMCocQ3Nt_tyMy5xc7aMVmgf7JpfUUCqDJ45NHoLXVt9Vwku5aR-2SyA4_&wd=&eqid=f56c6dca009846ac0000000666b050ea

https://baijiahao.baidu.com/s?id=1783930434988646649&wfr=spider&for=pc

https://sghexport.shobserver.com/html/baijiahao/2024/03/21/1279627.html

https://www.shyp.gov.cn/yp-zwgk/zwgk/buffersInformation/details?id=599c8850-aeb4-468b-8edf-8121a074e687

In33

https://sh.leju.com/zhuanti/2014cankao/

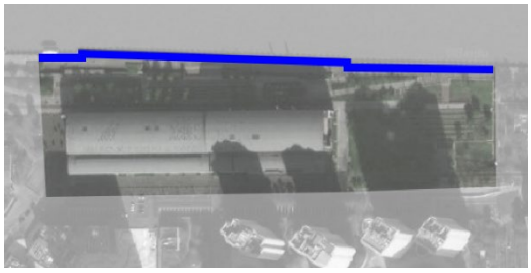
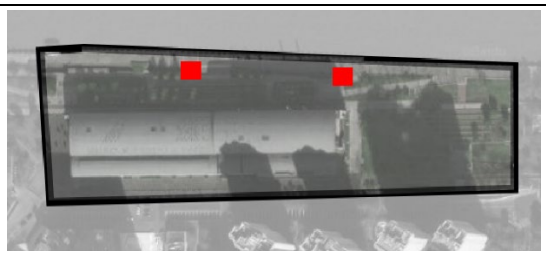
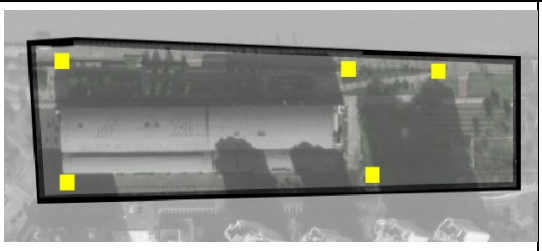
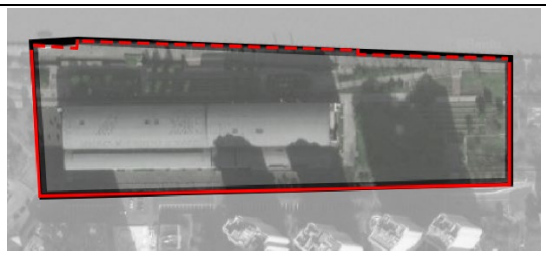
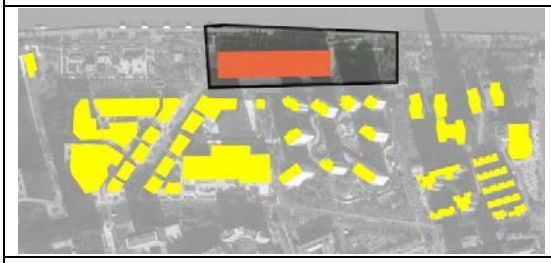
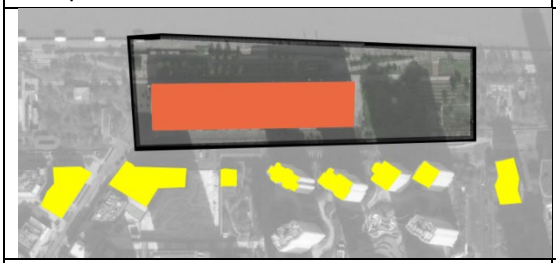
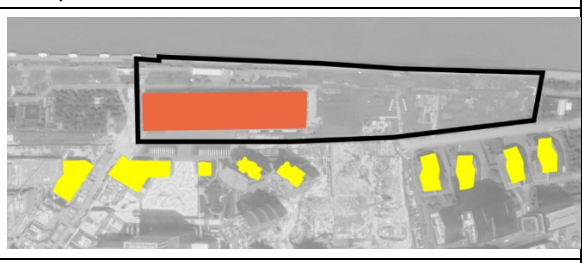
https://shanghai.anjuke.com/community/trends/866408?from=PC_Prop_FJZSNeighborhood_click&prop_id=3428815821561868

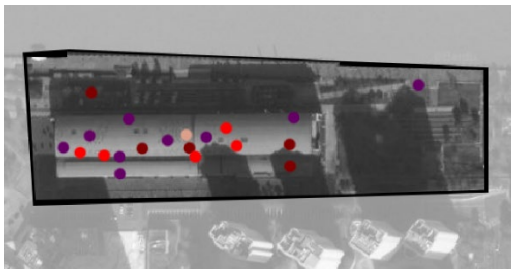
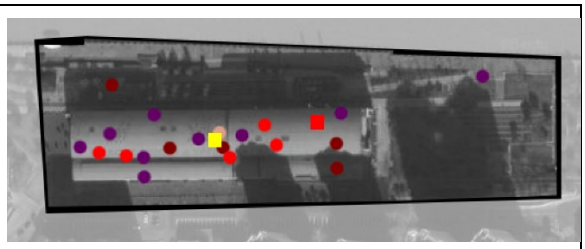
In37

https://www.sohu.com/a/295521139_235422

https://www.163.com/dy/article/DINM48VA0530KEJV.html

2. Shipyard 1862

	
pre	In3
	
In5	In8
	
In9	In10
	
In13	In15
	
In16post	In16pre
	
In17post	In17pre

	
In18	In19
	
In23	

In20

https://www.163.com/dy/article/F2QIKAVU05158K7T.html

http://www.harbourcity.sh.cn/mifa_2.asp

https://www.sohu.com/a/258197893_380622

In24

https://sghexport.shobserver.com/html/baijiahao/2023/01/28/950552.html

https://zhuanlan.zhihu.com/p/706060621

In26

https://sghexport.shobserver.com/html/baijiahao/2023/01/28/950552.html

https://sghexport.shobserver.com/html/baijiahao/2024/06/02/1339547.html

https://zhuanlan.zhihu.com/p/684408082

In30

https://baijiahao.baidu.com/s?id=1783930434988646649&wfr=spider&for=pc

https://sghexport.shobserver.com/html/baijiahao/2024/03/21/1279627.html

https://www.shyp.gov.cn/yp-zwgk/zwgk/buffersInformation/details?id=599c8850-aeb4-468b-8edf-8121a074e687

In33

https://shanghai.anjuke.com/sale/pudong-q-lujiazui/?from=esf_list

In34

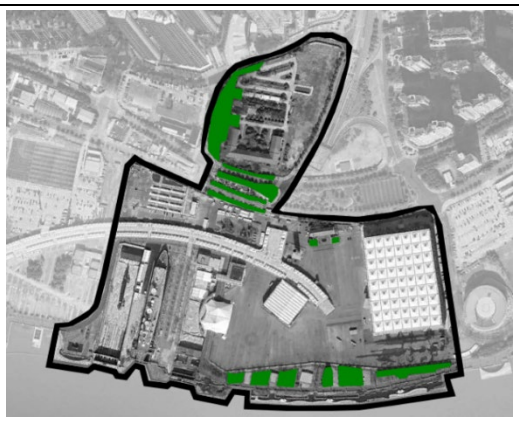
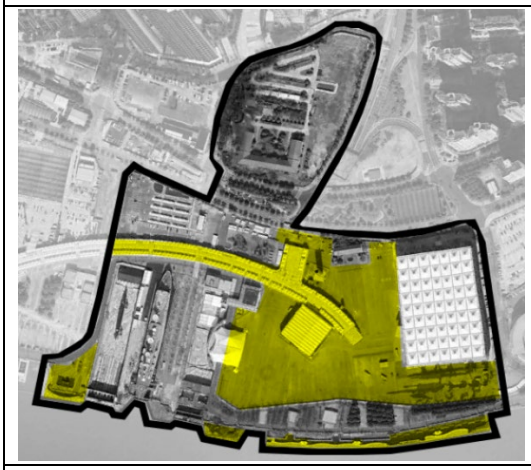
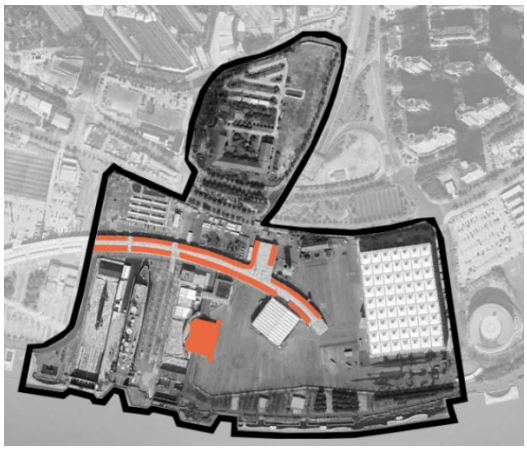
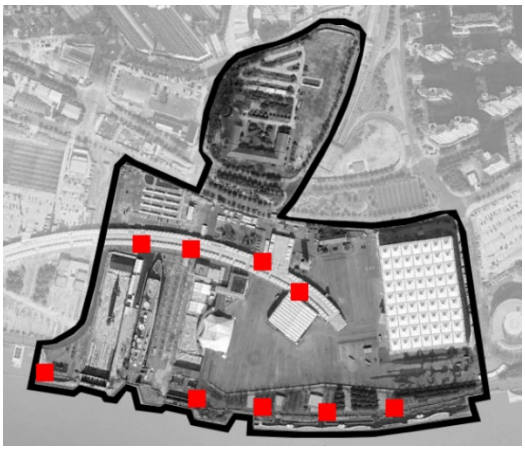
https://www.163.com/dy/article/GM7QBTL105349T9I.html

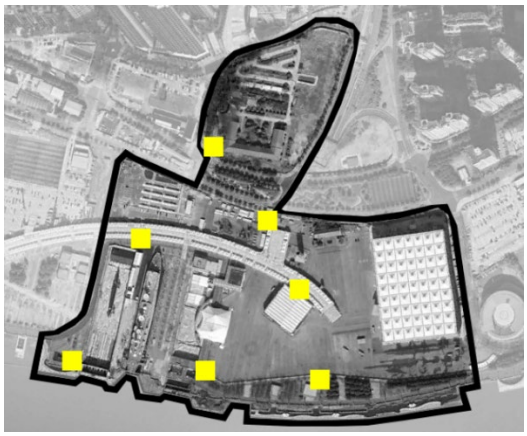
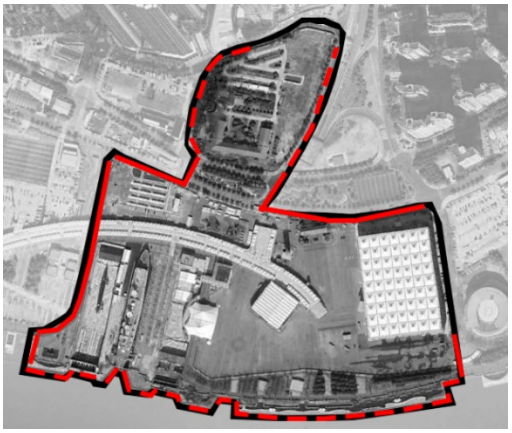
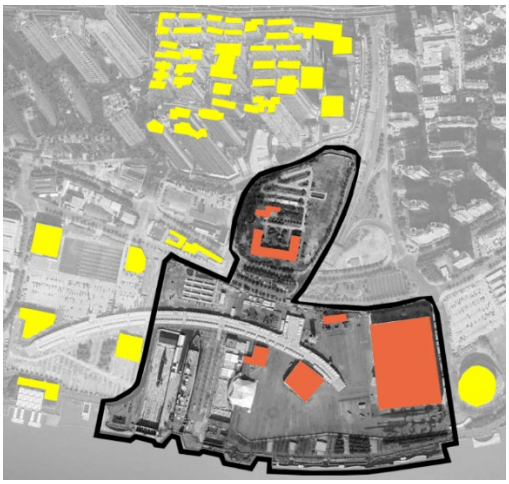
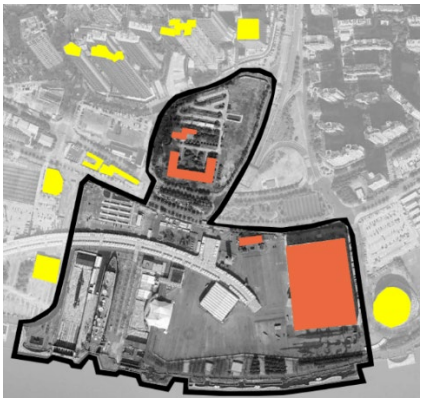
https://zhuanlan.zhihu.com/p/684408082

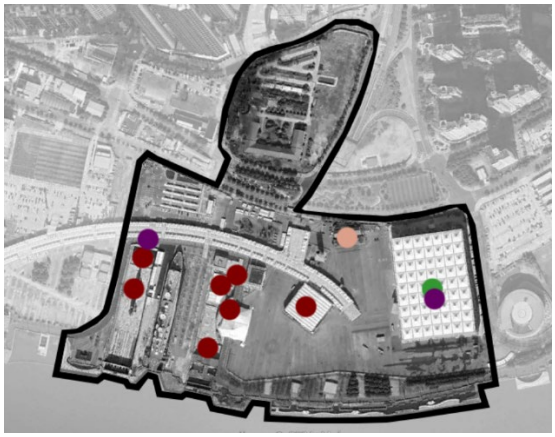
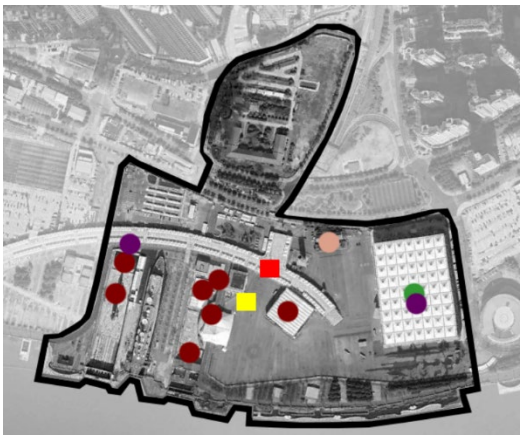
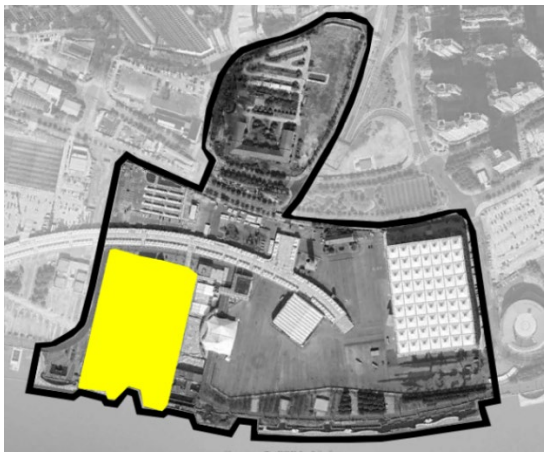
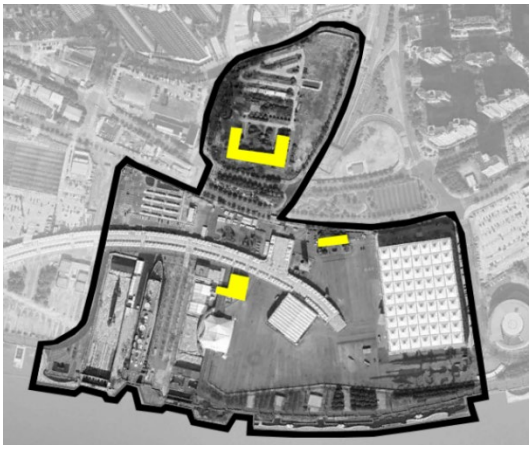
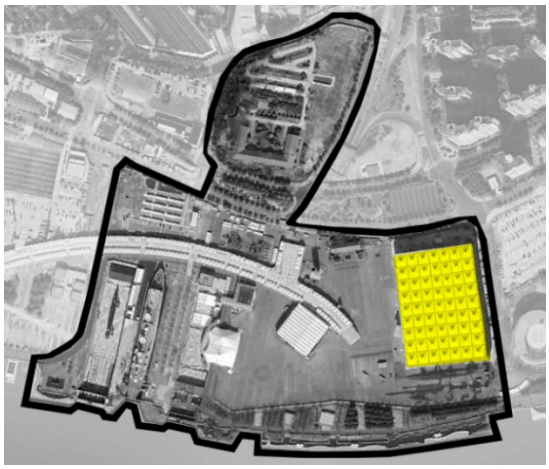
In37

https://www.163.com/dy/article/F2QIKAVU05158K7T.html

3. Puxi Riverside Expo Park Area

	
In3pre	In3post
	
In5	In8
	
In9	In10

	
In13	In15
	
In16pre	In16post
	
In17pre	In17post

	
In18	In19
	
In23	In24
	
In25	

In20

https://news.sina.com.cn/expo2010/news/roll/2010-06-23/073920528468.shtml

In30

https://www.baidu.com/link?url=2j4Q1rFGR6UjTKilqZM6iQqX3-k-NMCocQ3Nt_tyMy5xc7aMVmgf7JpfUUCqDJ45NHoLXVt9Vwku5aR-2SyA4_&wd=&eqid=f56c6dca009846ac0000000666b050ea

https://baijiahao.baidu.com/s?id=1783930434988646649&wfr=spider&for=pc
https://sghexport.shobserver.com/html/baijiahao/2024/03/21/1279627.html
https://www.shyp.gov.cn/yp-zwgk/zwgk/buffersInformation/details?id=599c8850-aeb4-468b-8edf-8121a074e687

In31
https://www.biwuke.com/lyds/zixuninfo/111.html
https://www.sohu.com/a/730413833_118328

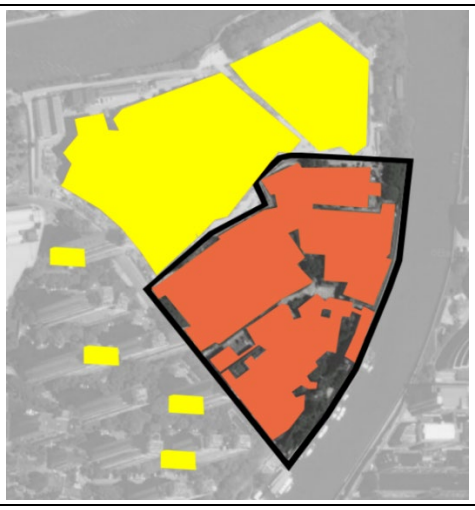
In32
https://tech.sina.com.cn/d/2006-06-23/16571005774.shtml

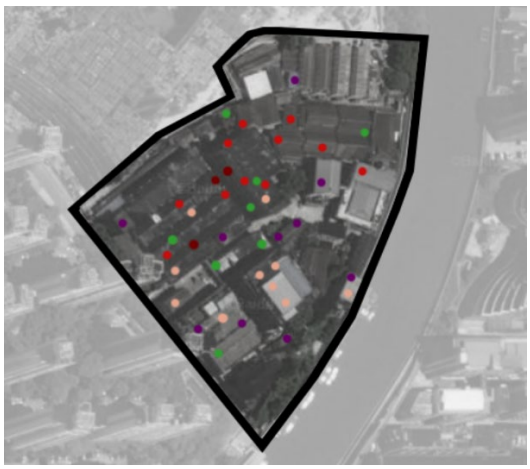
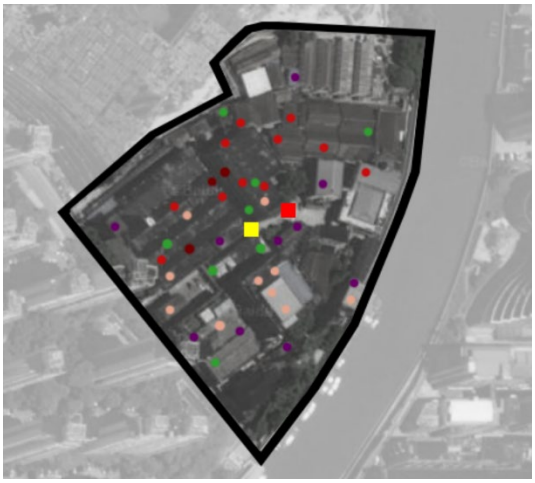
In33
https://shanghai.anjuke.com/map/sale/?from=esf_list

In34 In35
https://export.shobserver.com/baijiahao/html/292304.html
https://zhuanlan.zhihu.com/p/632310243
https://news.sohu.com/a/768646118_391452
https://www.mct.gov.cn/preview/whzx/qgwhxxlb/sh/201912/t20191224_849823.htm
In 37
https://news.sina.com.cn/expo2010/news/roll/2010-06-23/073920528468.shtml

4. M50 Creative Park

	
In3	In5
	
In8pre	In8post
	
In13	

	
In15pre	In15post
	
In16pre	In16post
	
In17pre	In17post

	
In18	In10

In20
https://www.163.com/dy/article/FK6DSIU60518TFG3.html

In25
https://baijiahao.baidu.com/s?id=1799165835932982335&wfr=spider&for=pc

In27
https://www.163.com/dy/article/EL60R7C4055040N3.html

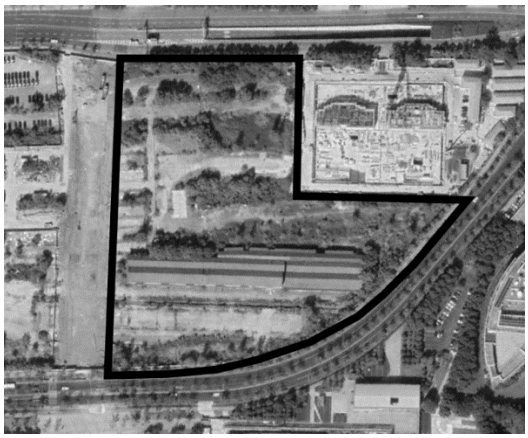
In28
https://baijiahao.baidu.com/s?id=1725814759872383479&wfr=spider&for=pc
https://k.sina.com.cn/article_2010666107_v77d8547b020014k1o.html
https://news.sohu.com/a/588341556_120006290

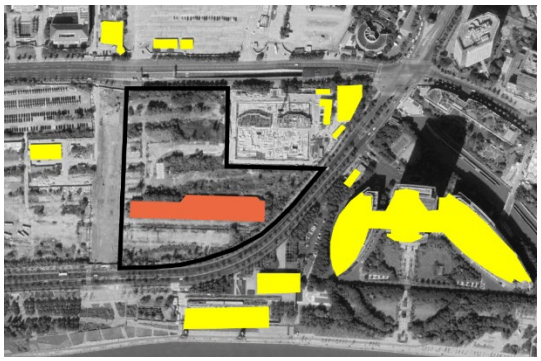
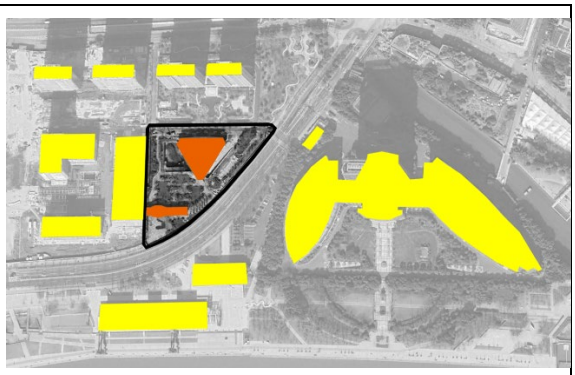
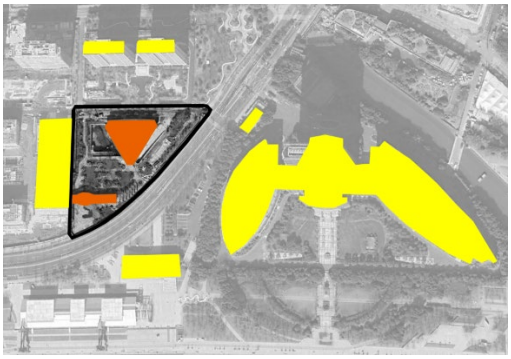
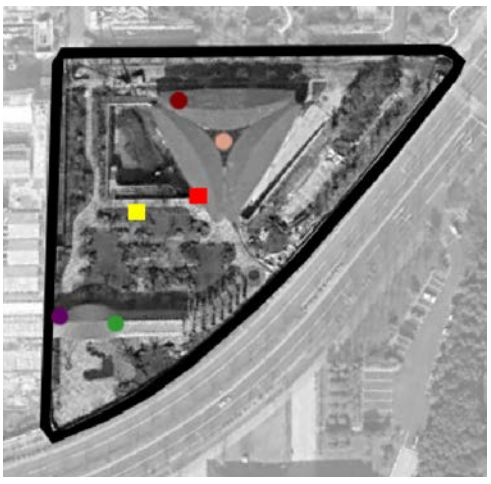
In33
https://shanghai.anjuke.com/map/sale/?from=esf_list

In34
https://www.renrendoc.com/paper/194268003.html

In37
https://sghexport.shobserver.com/html/baijiahao/2020/10/23/283824.html

5. Station 1907

	
In3pre	In3post
	
In9pre	In9post
	
In15pre	In15post

	
In16pre	In16post
	
In17pre	In17post
	
In18	In19

	
In23 In24	In25

In20
https://new.qq.com/rain/a/20231202A076Q700/

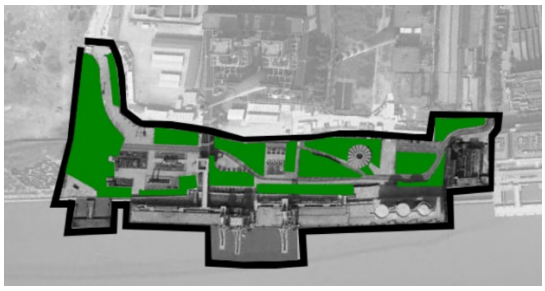
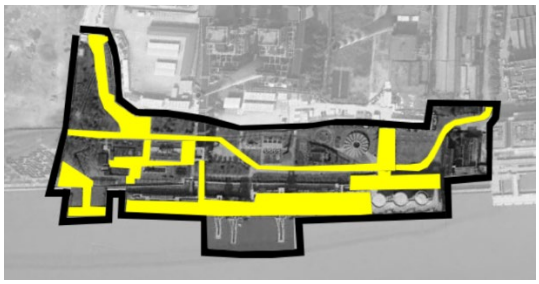
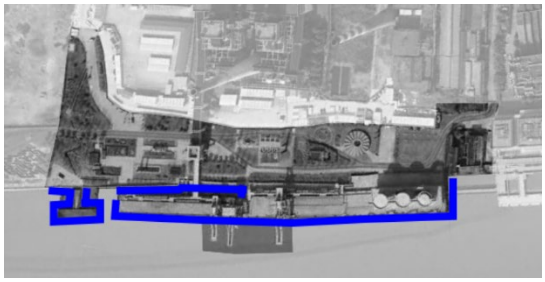
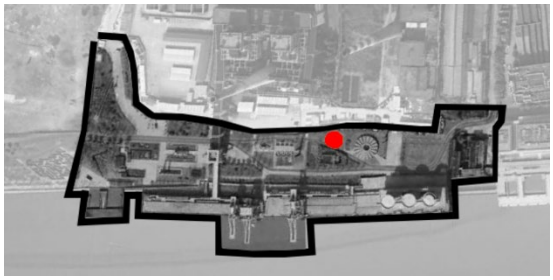
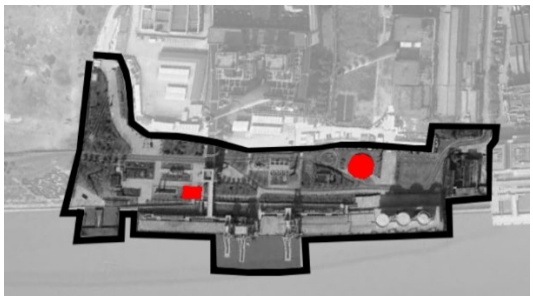
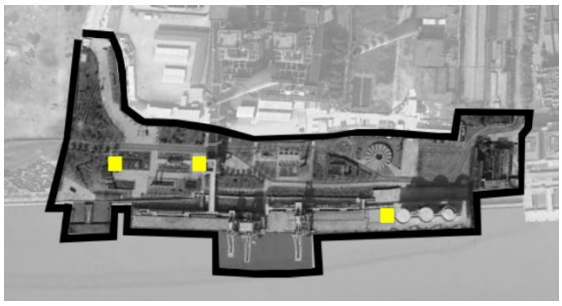
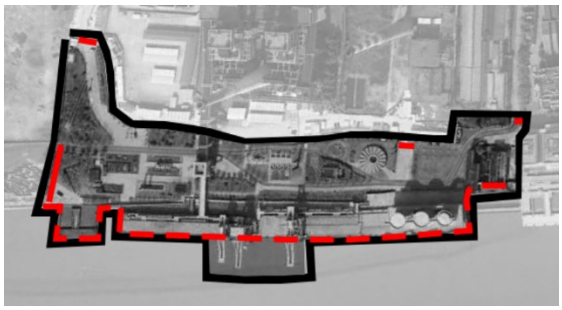
In33
https://shanghai.anjuke.com/map/sale/?from=esf_list

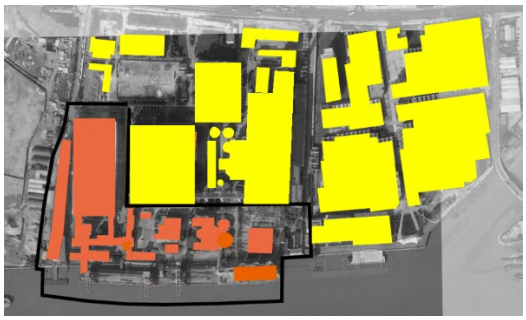
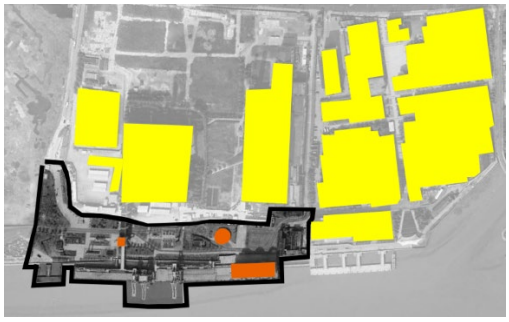
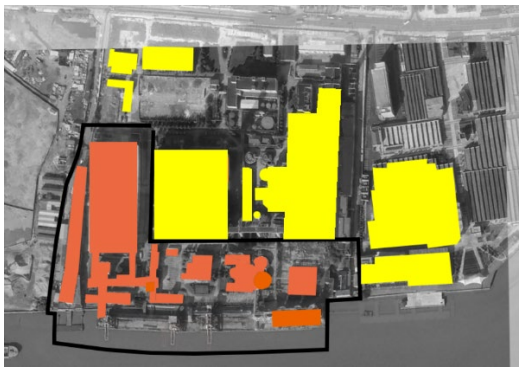
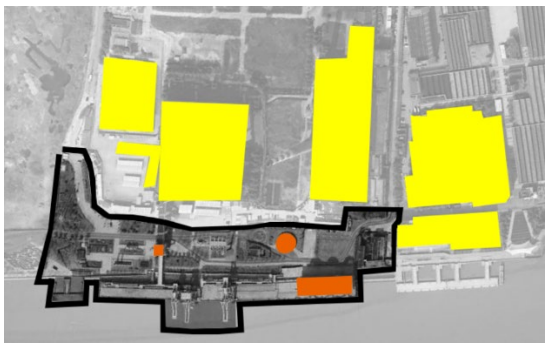
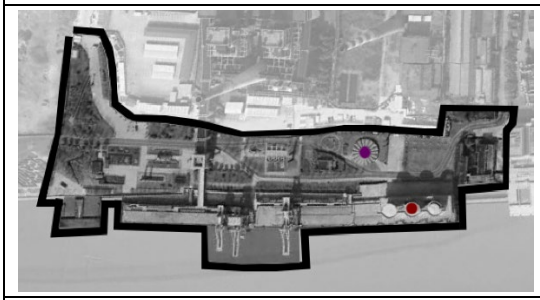
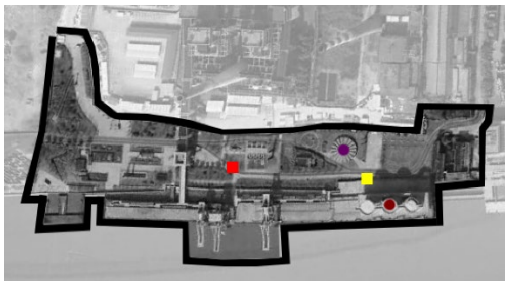
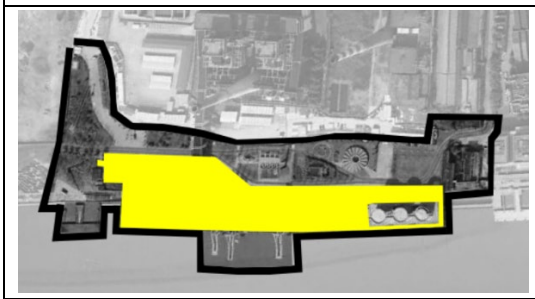
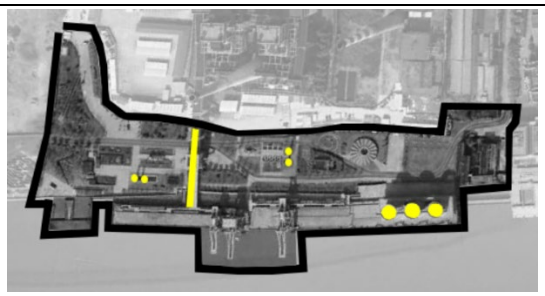
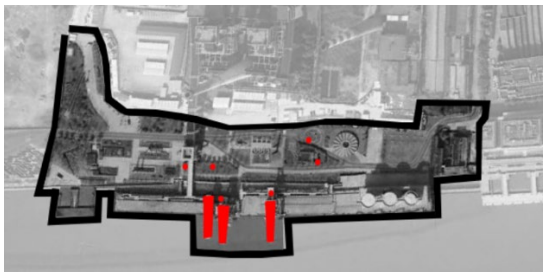
In34
https://new.qq.com/rain/a/20231202A076Q700/

In 35
https://new.qq.com/rain/a/20231202A076Q700/

In37
https://new.qq.com/rain/a/20231202A076Q700/

6. Shanghai Yangshupu Power Plant Heritage Park

	
In3	In5
	
In8	In9
	
In10	In13
	
In15pre	In15post

	
In16pre	In16post
	
In17pre	In17post
	
In18	In19
	
In23	In25
	
In26	

In10
https://www.archdaily.cn/cn/947629/shang-hai-yang-shu-pu-dian-han-yi-ji-gong-yuan-tong-ji-yuan-zuo-she-ji-gong-zuo-shi

In11
https://baijiahao.baidu.com/s?id=1778021507131567294&wfr=spider&for=pc

In24
https://www.archdaily.cn/cn/947629/shang-hai-yang-shu-pu-dian-han-yi-ji-gong-yuan-tong-ji-yuan-zuo-she-ji-gong-zuo-shi

In26
https://www.163.com/dy/article/IJP345DQ05506BEH.html
https://mp.weixin.qq.com/s?__biz=Mzg4OTU4MjE0OA==&mid=2247501098&idx=1&sn=2f91cd0df0b7f8f7f4ceaded119002af&chksm=cfeb2201f89cab174e527c01a48517996d04a54c3465acb14291975ef75a673e92a8712190a0&scene=27

In30
https://www.baidu.com/link?url=2j4Q1rFGR6UjTKilqZM6iQqX3-k-NMCocQ3Nt_tyMy5xc7aMVmgf7JpfUUCqDJ45NHoLXVt9Vwku5aR-2SyA4_&wd=&eqid=f56c6dca009846ac0000000666b050ea
https://baijiahao.baidu.com/s?id=1783930434988646649&wfr=spider&for=pc
https://sghexport.shobserver.com/html/baijiahao/2024/03/21/1279627.html
https://www.shyp.gov.cn/yp-zwgk/zwgk/buffersInformation/details?id=599c8850-aeb4-468b-8edf-8121a074e687

In31
https://www.shanghai.gov.cn/nw48222/20231026/16b3537aa357403799fefee1b7ef0d73.html

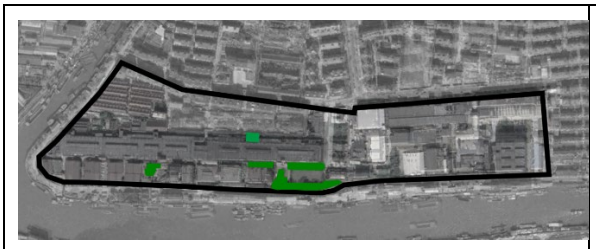
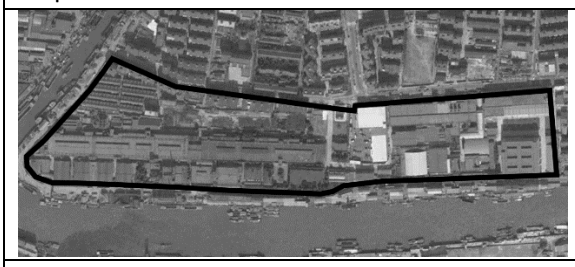
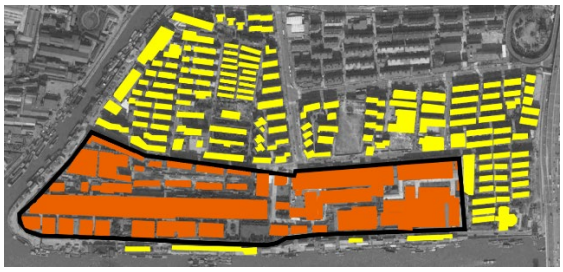
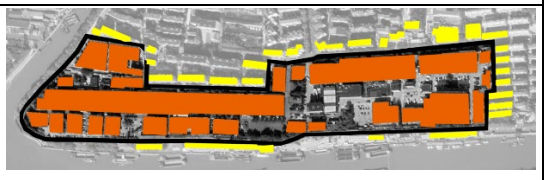
In33
https://shanghai.anjuke.com/map/sale/?from=esf_list

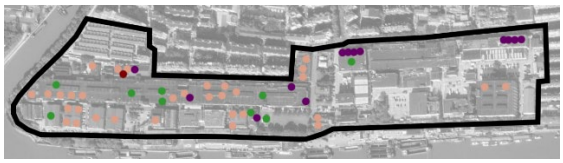
In34
https://www.zhihu.com/question/657657605/answer/3545723912

In 35
https://www.dianping.com/review/794988204?source=m_jump

In37
https://www.zhihu.com/question/657657605/answer/3545723912

7. Peninsula 1919 Cultural and Creative Industrial Park

	
In3pre	In3post
	
pre	In5post
	
In13	
	
In15pre	In5post
	
In16pre	In16post
	
In17pre	In17post

	
In8	In19

In24 25 26

https://sghexport.shobserver.com/html/baijiahao/2023/11/12/1175894.html

In29

https://sghexport.shobserver.com/html/baijiahao/2023/11/12/1175894.html

In33

https://shanghai.anjuke.com/map/sale/?from=esf_list

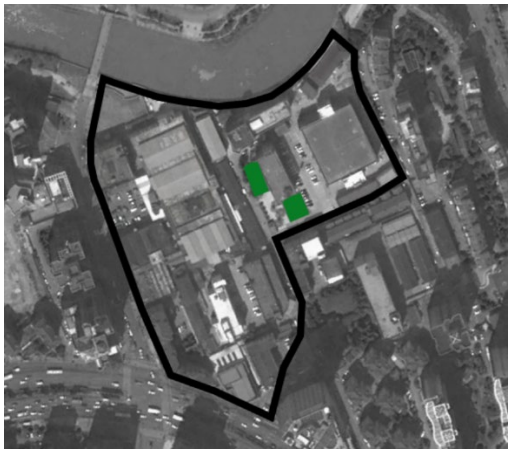
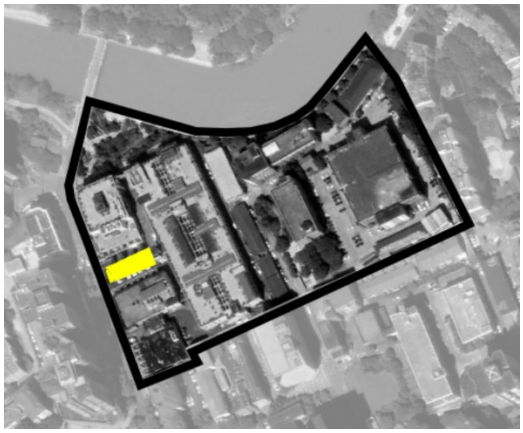
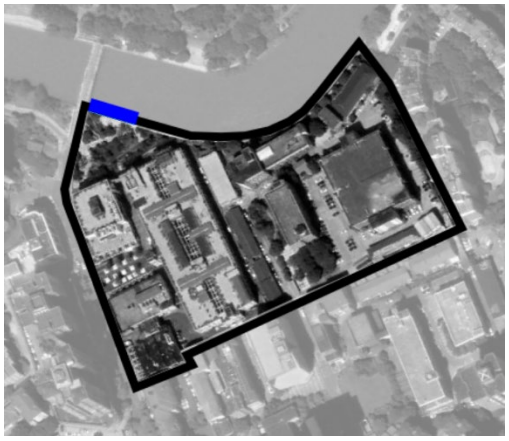
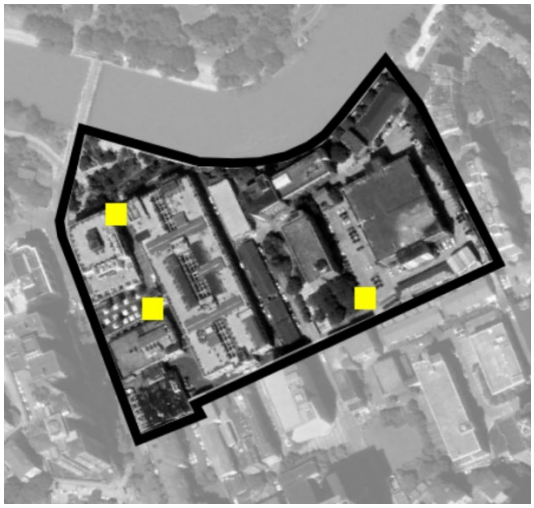
In 35

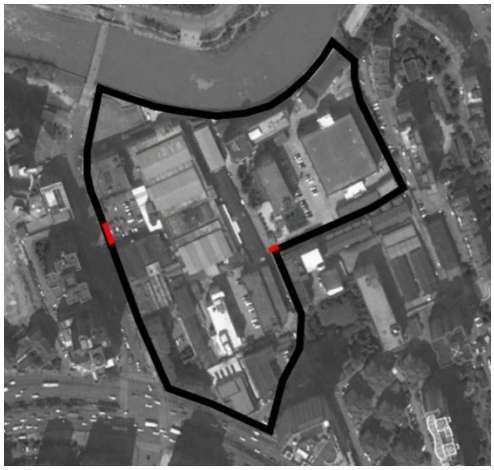
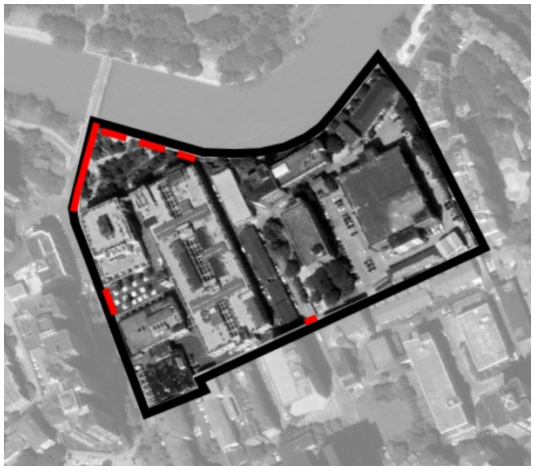
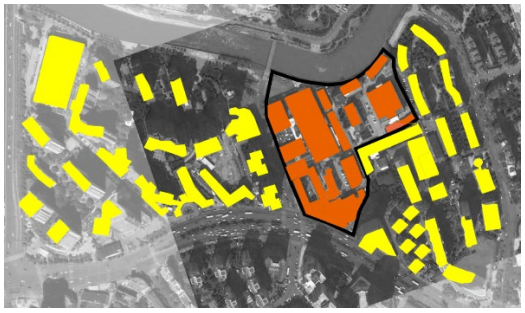
https://baike.baidu.com/item/%E5%8D%8A%E5%B2%9B1919/4196808?fr=ge_ala

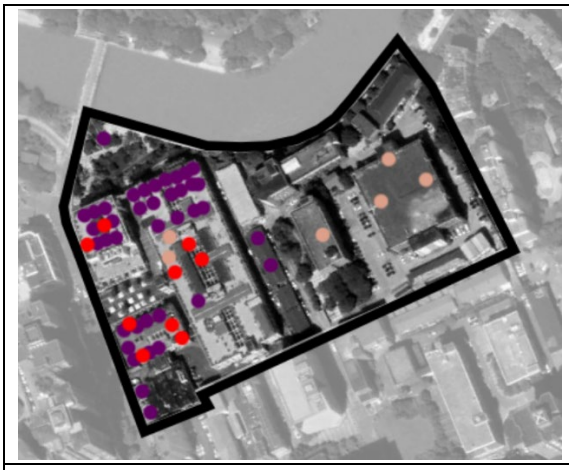
In37

https://www.shbsq.gov.cn/shbs/zttj/20211220/328291.html

8. Jingyuan Fashion Industry Park

	
In3pre	In3post
	
In5	In8
	
In13	

	
In15pre	In15post
	
In6pre	In16post
	
In17pre	In17post

	
In18	In19

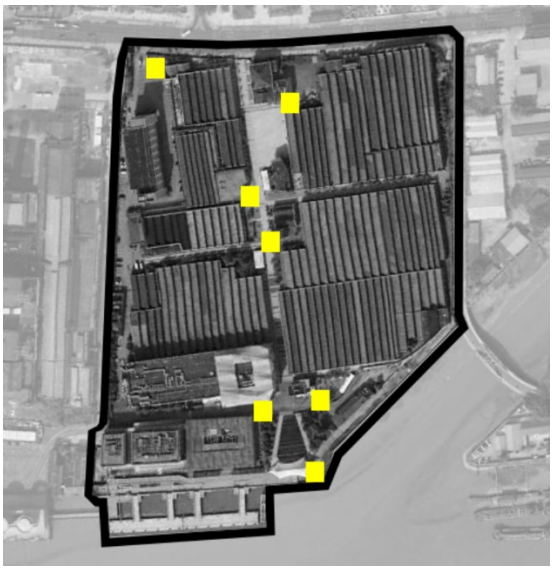
In33

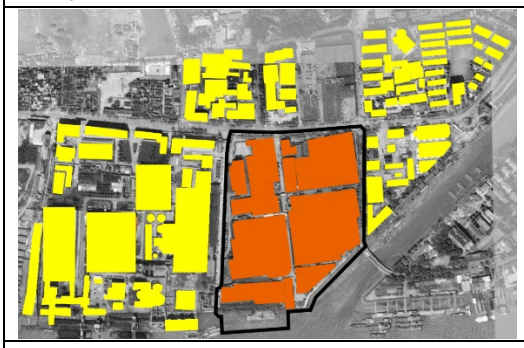
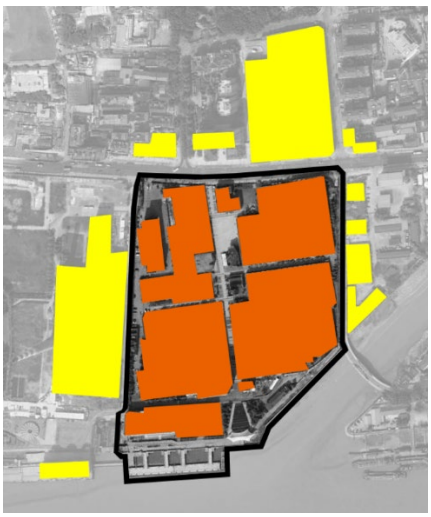
https://shanghai.anjuke.com/map/sale/?from=esf_list

In37

https://www.sohu.com/a/736530096_257321

9. Shanghai International Fashion Center

	
In3pre	In3post
	
In5	In8
	
In9	In13

	
In15pre	In5post
	
In16pre	In16post
	
In17pre	In17post

	
In8pre	In18post

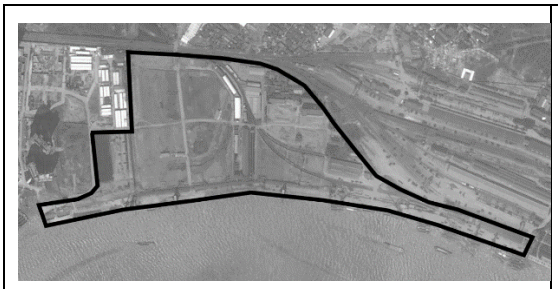
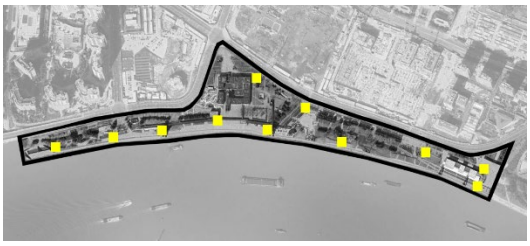
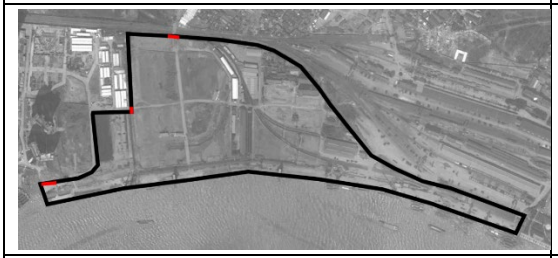
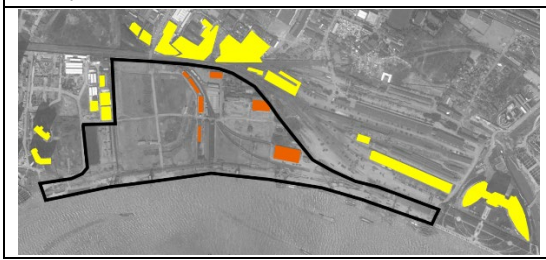
In 10
https://www.taodocs.com/p-81082258-2.html
In20 24 25 26 34 35 37
https://www.taodocs.com/p-81082258-2.html
https://mp.weixin.qq.com/s?__biz=Mzg4OTU4MjE0OA==&mid=2247501098&idx=1&sn=2f91cd0df0b7f8f7f4ceaded119002af&chksm=cfeb2201f89cab174e527c01a48517996d04a54c3465acb14291975ef75a673e92a8712190a0&scene=27

In30
https://www.baidu.com/link?url=2j4Q1rFGR6UjTKilqZM6iQqX3-k-NMCocQ3Nt_tyMy5xc7aMVmgf7JpfUUCqDJ45NHoLXVt9Vwku5aR-2SyA4_&wd=&eqid=f56c6dca009846ac0000000666b050ea
https://baijiahao.baidu.com/s?id=1783930434988646649&wfr=spider&for=pc
https://sghexport.shobserver.com/html/baijiahao/2024/03/21/1279627.html
https://www.shyp.gov.cn/yp-zwgk/zwgk/buffersInformation/details?id=599c8850-aeb4-468b-8edf-8121a074e687

In31
https://mp.weixin.qq.com/s?__biz=Mzg4OTU4MjE0OA==&mid=2247501098&idx=1&sn=2f91cd0df0b7f8f7f4ceaded119002af&chksm=cfeb2201f89cab174e527c01a48517996d04a54c3465acb14291975ef75a673e92a8712190a0&scene=27

In33
https://shanghai.anjuke.com/map/sale/?from=esf_list

10. Xuhui West Bund Waterfront

	
pre	In3
	
In5	In8
	
In9	In13
	
In5pre	In15post
	
In16pre	In16post
	

In7pre	In17post
	
In18	In19
	
In23 25	In26

In30

https://www.baidu.com/link?url=2j4Q1rFGR6UjTKilqZM6iQqX3-k-NMCocQ3Nt_tyMy5xc7aMVmgf7JpfUUCqDJ45NHoLXVt9Vwku5aR-2SyA4_&wd=&eqid=f56c6dca009846ac0000000666b050ea

https://baijiahao.baidu.com/s?id=1783930434988646649&wfr=spider&for=pc

https://sghexport.shobserver.com/html/baijiahao/2024/03/21/1279627.html

https://www.shyp.gov.cn/yp-zwgk/zwgk/buffersInformation/details?id=599c8850-aeb4-468b-8edf-8121a074e687

In33

https://shanghai.anjuke.com/map/sale/?from=esf_list

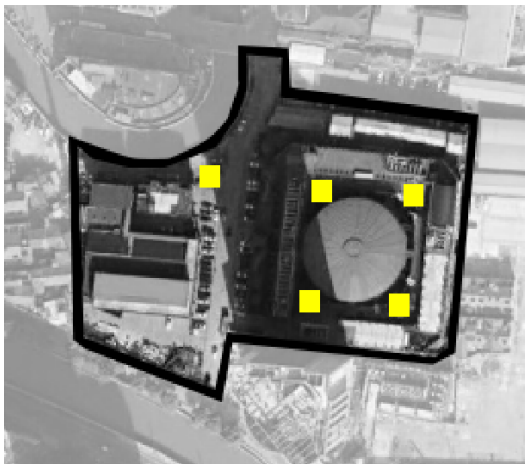
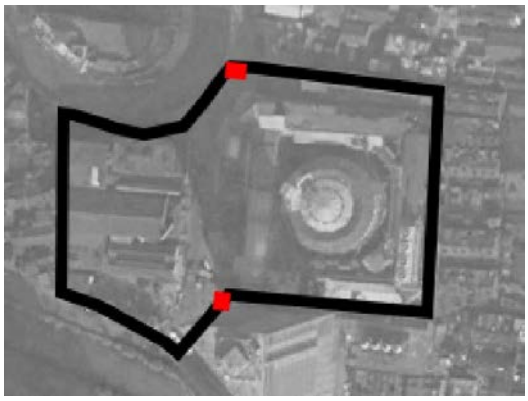
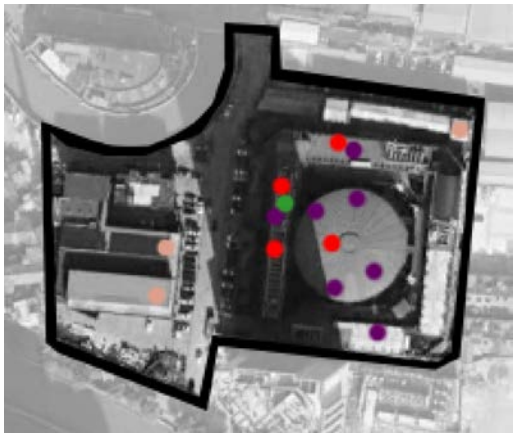
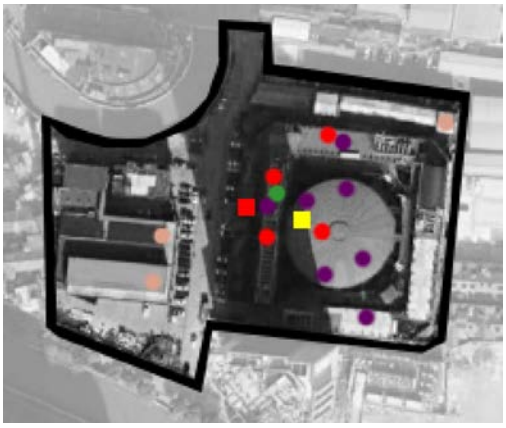
In37

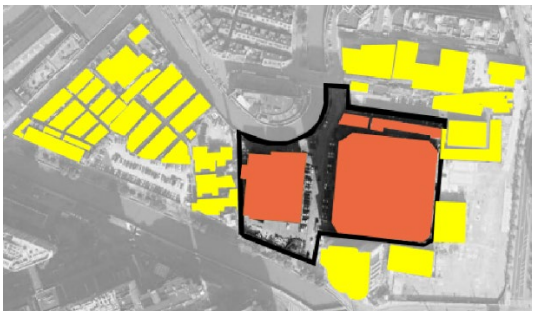
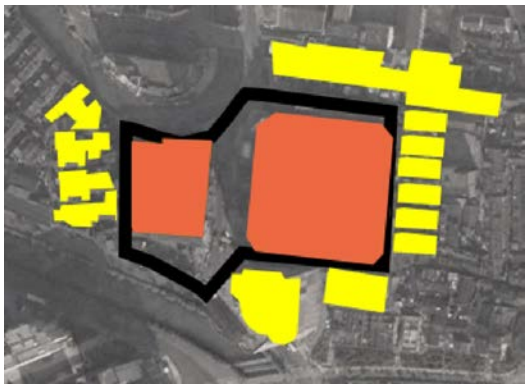
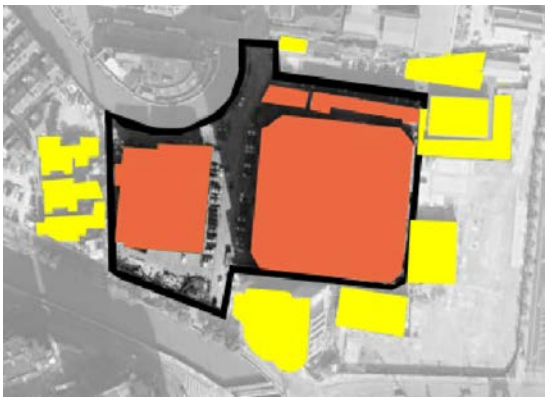
https://baike.baidu.com/item/%E8%A5%BF%E5%B2%B8%E7%BE%8E%E6%9C%AF%E9%A6%86/24238105?fr=ge_ala

http://www.thelongmuseum.org/west-bund.html

https://m.gmw.cn/2022-08/06/content_1303078546.htm

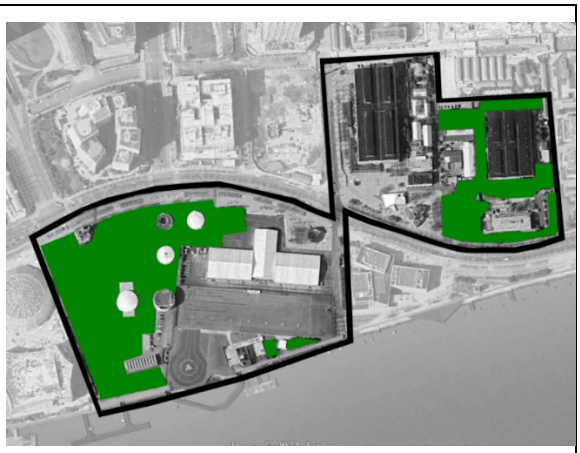
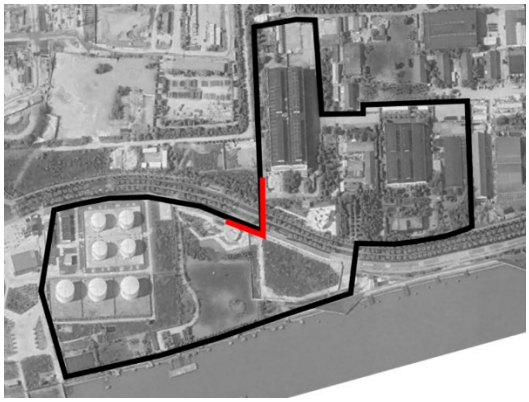
11. 1933 Old Millfun

	
In13	
	
In15pre	In15post
	
In18	In19

	
In16pre	In16post
	
In17	In17post

In12
https://www.163.com/dy/article/FE7N5LGV0534I0NW.html
In20
https://www.163.com/dy/article/FE7N5LGV0534I0NW.html
In32
https://www.163.com/dy/article/FE7N5LGV0534I0NW.html
In33
https://shanghai.anjuke.com/map/sale/?from=esf_list
In 35
https://news.sina.com.cn/s/2006-08-02/12279637491s.shtml
In37
https://max.book118.com/html/2022/1001/6001211224004243.shtm

12. West Bund Artistic Center

	
In3pre	In3post
	
In8	In13
	
In15pre	In15post



In6pre



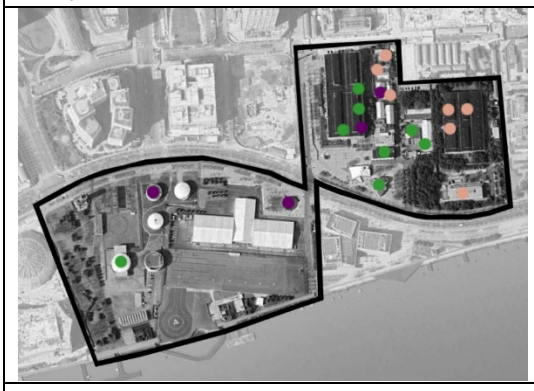
In6post



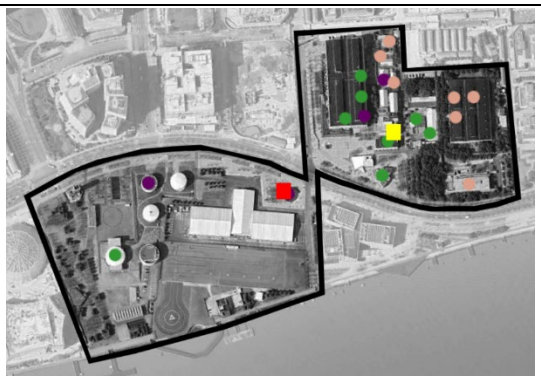
In17pre



In17post



In18



In19



In23

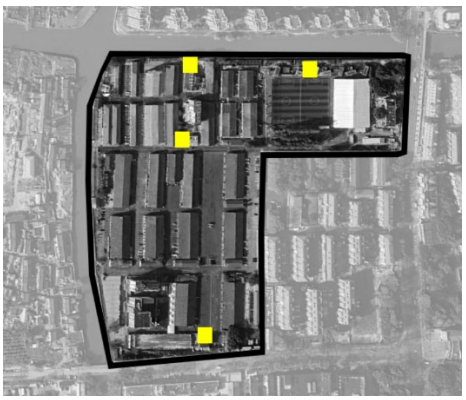
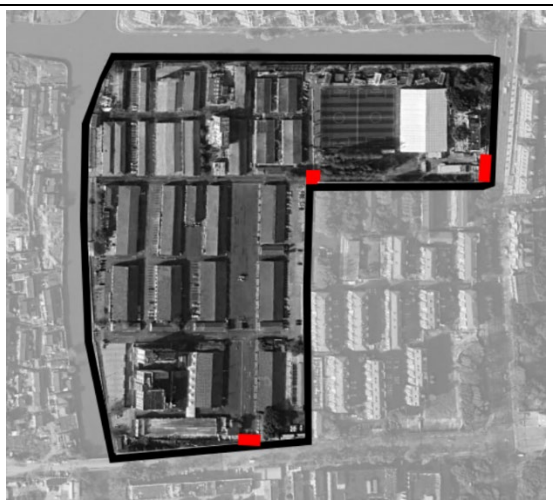


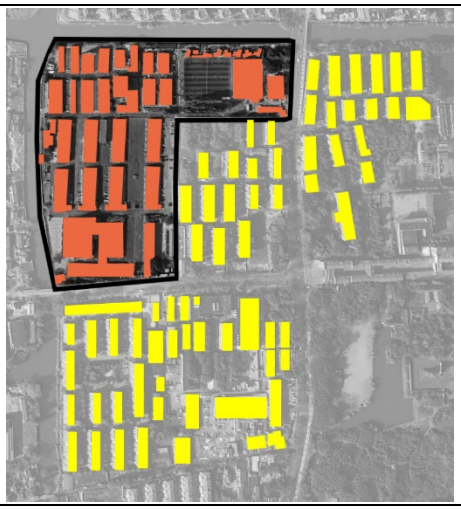
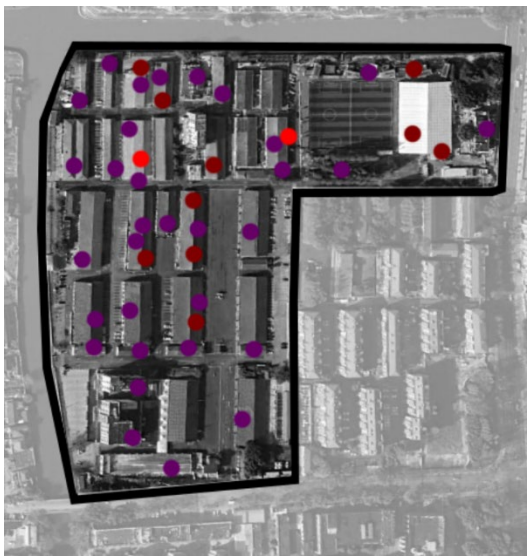
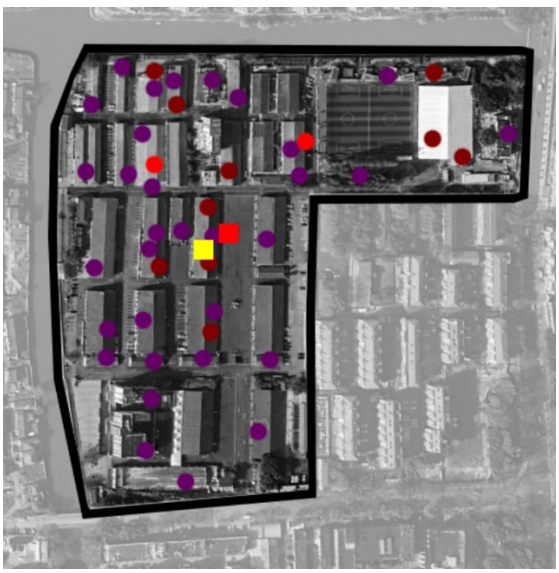
In25

In30

https://www.baidu.com/link?url=2j4Q1rFGR6UjTKilqZM6iQqX3-k-NMCocQ3Nt_tyMy5xc7aMVmgf7JpfUUCqDJ45NHoLXVt9Vwku5aR-2SyA4_&wd=&eqid=f56c6dca009846ac0000000666b050ea
https://baijiahao.baidu.com/s?id=1783930434988646649&wfr=spider&for=pc
https://sghexport.shobserver.com/html/baijiahao/2024/03/21/1279627.html
https://www.shyp.gov.cn/yp-zwgk/zwgk/buffersInformation/details?id=599c8850-aeb4-468b-8edf-8121a074e687
In33
https://shanghai.anjuke.com/map/sale/?from=esf_list
In37
http://www.westbund.com/cn/index/WEST-BUND-GROUP/Group-Profile/About-West-Bund-Group.html
https://www.zhihu.com/question/25270489
https://www.renrendoc.com/paper/162149897.html

13. Cloud Grain Silo Cultural and Creative Industrial Park

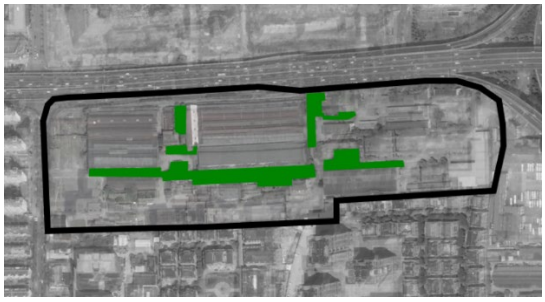
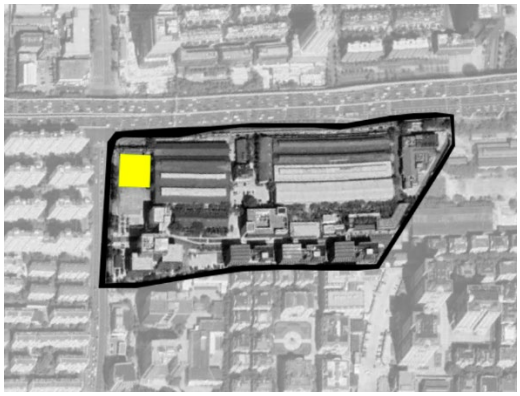
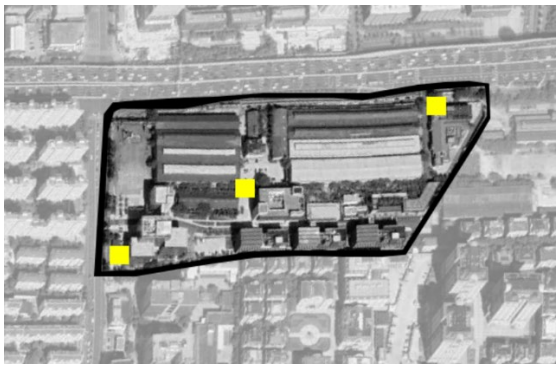
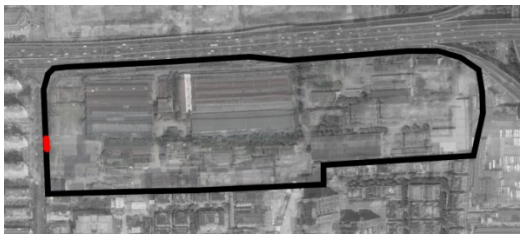
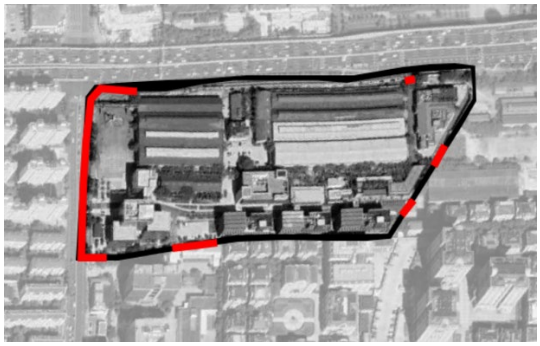
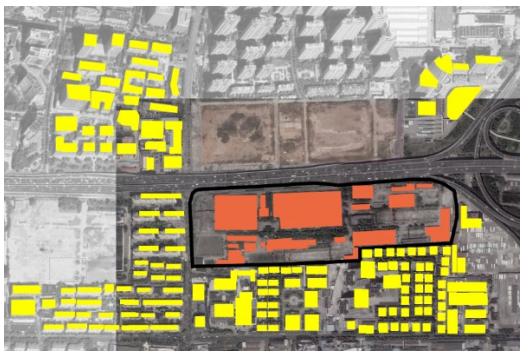
	
In3pre	In3post
	
In5	In13
	
In15pre	In15post

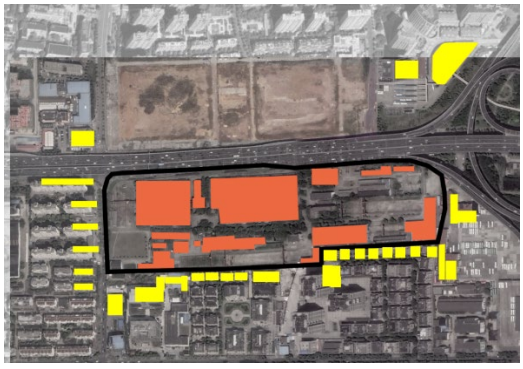
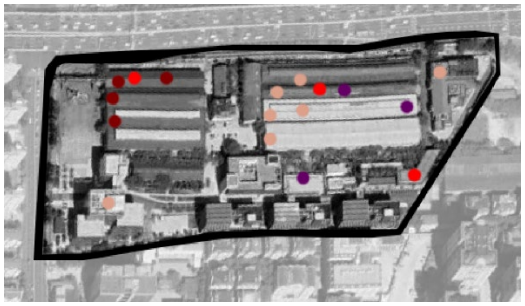
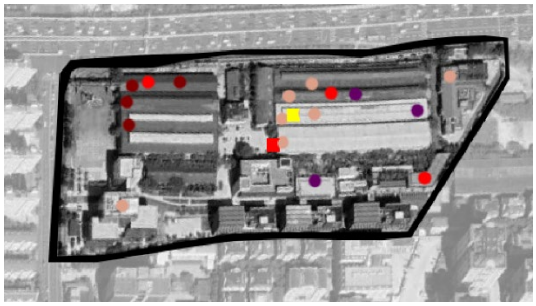
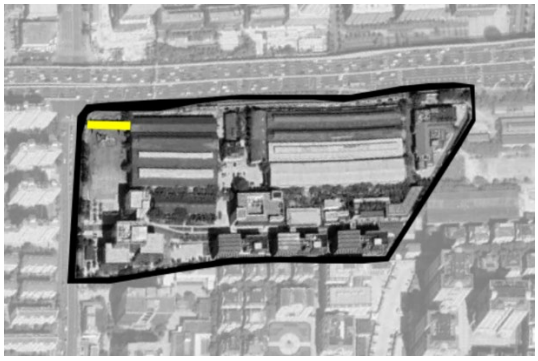
	
In16pre	In16post
	
In17pre	In17post
	
In18pre	In18post

	
In 24 25	

In29
https://sghexport.shobserver.com/html/baijiahao/2022/01/15/635331.html
In32
https://baijiahao.baidu.com/s?id=1796039332158149721&wfr=spider&for=pc
In33
https://shanghai.anjuke.com/map/sale/?from=esf_list
In34
https://www.shanghai.gov.cn/nw15343/20240109/d3b440d5ed2c4ae887d20eddc05a7af5.html

14. Jing’an New Business Park

	
In3pre	In3post
	
In5	In13
	
In15pre	In15post
	
In16pre	In16post

	
In17pre	In17post
	
In18	In19
	
In24 25	

In27

https://www.sohu.com/a/199020759_286686

In33

https://shanghai.anjuke.com/map/sale/?from=esf_list

In34

http://www.zbxyf.cn/

http://m.urlou.com/newshow.php?itemid=3953