



Research article

What makes a successful industrial heritage park?—China’s experience based on the ecosystem cultural services perspective

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Abstract: The transformation of downtown industrial spaces is prevalent in cities in China and the global South. Because of economic development and social transformation, former factories no longer carry out production activities and are abandoned. Industrial heritage parks, as integrated urban parks with new cultural and ecological paradigms, provide unique cultural ecosystem services (CES) that contribute to the sustainable development of urban renewal. Assessing their CES to identify public satisfaction is essential for urban green space planning and management and for enhancing human well-being. Thus, we tried to investigate public perceptions of CES in industrial heritage parks and explored the relationship between public satisfaction with CES and high-quality industrial heritage parks. Using importance-satisfaction analysis (ISA) to assess CES based on public perceptions, the cultural ecosystem services importance satisfaction analysis (CES-ISA) framework was established. Two successful examples of industrial heritage renewal in China, Qijiang Park, and Shougang Park were selected as case studies. The results indicated that: i) There is a positive correlation between public importance-satisfaction feedback at the cultural level and high quality industrial heritage parks; ii) the recreational, aesthetic and cultural heritage, and spiritual services provided by industrial heritage parks were the types of CES most valued by the public; iii) improving the sense of place service is key to enhancing public satisfaction and promoting the sustainability of industrial heritage parks; iiiii) the CES-ISA framework can identify differences between public perceptions of importance and satisfaction with CES. It is beneficial to obtain management priorities for cultural services in industrial heritage parks.

Keywords: China; cultural ecosystem service; industrial heritage park; importance satisfaction analysis; public perception; urban renewal

1. Introduction

Sustainable development goals (SDGs) are key concepts and central principles guiding the economic and social development of countries around the world [1]. As an essential part of SDGs, ‘sustainable cities and communities’ require the preservation of cultural heritage, improvements to environmental quality and the creation of green spaces [2]. However, the transformation of downtown industrial spaces is prevalent in cities in China and the global South such as Jaipur, Mumbai, Bangkok and even further afield in Buenos Aires and Johannesburg. Thus, how to achieve sustainable development through the renewal of industrial spaces has become a widely discussed topic.

Industrial heritage parks have attracted increasing attention from multiple countries as an important approach to urban renewal. However, there are few successful industrial heritages involved in urban renewal, especially in developing countries such as China [3–5]. Unsustainable industrial heritage parks can lead to ‘Abandonment Again’, which is detrimental to the environment and economy [3]. ‘Abandonment Again’ refers to a failed industrial heritage reuse project. When it was successfully transformed into a non-industrial production space, due to wrong design and planning, it did not produce strong vitality, but became ruins again. Indeed, sustainability is one of the most challenging values to quantify in the reuse of industrial heritage, whether in terms of economic benefits, social value, or the measurement of carbon emissions. Therefore, it is necessary to develop evaluation criteria for the success of industrial heritage parks to improve their sustainable value and contribution to urban renewal.

The concept of urban renewal was first introduced in 1958 at an urban renewal symposium in the Netherlands, where it was defined as the improvement of buildings, streets, parks, green spaces, shopping, recreation, and other tangible and intangible aspects of life in the city. Subsequently, Roberts defined urban renewal more broadly: ‘Solving urban problems with holistic concepts and actions aimed at bringing sustainable economic, physical, social and environmental enhancement to cities in a state of change’ [6]. The origins of urban renewal can be traced back to the 1950s when urban renewal movements were undertaken in Western countries to regenerate cities devastated by economic depression and two world wars. However, large-scale urban transformation has also generated a range of social problems, such as poverty, housing inequity, disease, and racial segregation [7,8]. As a result, with a further understanding of the need for urban renewal, social equity and welfare have received widespread attention, and scholars are gradually focusing on disadvantaged groups and neighbourhood restoration [9,10]. Furthermore, a new tendency to investigate urban gentrification has emerged in urban renewal [11]. In the 1990s, the public gradually accepted humanist ideas and the concept of sustainable development, and, consequently, public participation and partnership in urban renewal were widely discussed [12,13]. With the concept of sustainable development gaining popularity, people realise that urban renewal is essentially a process of dynamic optimisation of the human-land system through resource reuse and land redevelopment. The basic objective is to build sustainable cities in an integrated manner. Therefore, existing studies agree that urban renewal should be organically integrated with sustainable values [14]. However, there is a lack of research on the connections underlying the internal relevance between urban renewal and sustainable values.

The industrial heritage park is one of the main forms of conservation and reuse of industrial heritage and an essential path for urban renewal [15]. Industrial parks are an effective approach to redeploying urban resources, including space, economy and culture [16]. There is no clear definition of an 'industrial heritage park', but it is a type of heritage park based on an industrial site. Therefore, based on the research of Prentice et al., Chen, Alfrey J, and Putnam T [17,18], this research defines an industrial heritage park as 'a new type of park with historical and aesthetic values formed on the old industrial production space through the transformation and ecological management of industrial heritage'.

In fact, industrial heritage parks exist widely around the world [19,20]. Seattle Gas Works Park in the United States was the first official industrial heritage park in the world, and it was also the landmark beginning of the establishment of industrial heritage parks. Since then, industrial heritage parks have attracted much attention for their ecological and social value and have been investigated in several countries worldwide, such as the North Duisburg Scenic Park in Germany, the La Villette Park in France and the Boston Shore Cement General Factory Park in the USA. However, as China is a late developer, industrial heritage parks in China have developed relatively late, with the Shougang Park in Beijing and the Qijiang Park in Zhongshan both typical examples.

Of course, the research is not just about finding a way out of social governance in China, but about the fact that the problem is universal in countries of the global South, such as Jaipur, Mumbai, Jakarta, and even more distant ones such as Buenos Aires and Johannesburg. Considering that many of these cities face the same problems as China's industrial cities, an industrial heritage park is certainly an option that could be taken up, and this is the original purpose of the study.

A core issue needs to be explored here: How can the performance of these industrial heritage parks be tested?

One of the most widely recognised approaches to assessing industrial heritage is cultural ecosystem services (CES). There is now a wealth of research in the field of CES and it is also an important approach to the study of cultural heritage in the context of ecological transformation. According to the Millennium ecosystem assessment [21], CES refers to the nonmaterial benefits that humans derive from ecosystems through spiritual satisfaction, cognitive development, reflection, recreation and aesthetic experiences; these benefits include recreational tourism, aesthetic, spiritual, or religious experiences, improved knowledge systems, education, inspiration, social relationships, a sense of place, a sense of cultural heritage, and a sense of cultural diversity. CES play a significant role in providing for human psychological and spiritual needs and enhancing human well-being [22]. Research on CES has focused on the construction of indicators [23], spatial mapping [24], the relationship between CES [25] and human well-being, and the application of CES in planning and management [26]. There are two common approaches to evaluating the cultural performance of industrial heritage based on the CES approach: One is to monetize the cultural outcomes of the transformation of existing industrial heritage to validate its performance, and the other is to measure the equivalent proportional level of cultural performance by considering ecological indicators. For example, Zhao et al. and Huo et al. used the social value of ecological services model to investigate the CES at the regional and park scales, respectively [27,28]. However, CESs are subjective, nonconsumptive and cross-integrative in nature [29–32]. Previous assessment methods centred on monetisation have gradually been modified and supplemented to include public participation.

In developing countries, the market does not play a leading role in urban renewal and industrial heritage reuse, and the significance of public perception exceeds monetisation. This study constructs

the cultural ecosystem services importance satisfaction analysis (CES-ISA) framework to investigate the relevance of public perception to the sustainability of industrial heritage parks. More specifically, our objectives of this study are as follows: (1) To establish the CES-ISA framework and explore management priorities for CES; (2) to comprehensively analyse the importance and satisfaction of the public with cultural ecosystem services in the CES-ISA framework; (3) to explore the relevance of public perception to the sustainable industrial heritage parks; and (4) to test the usefulness of the CES-ISA framework.

1.1. Theoretical framework

Based on the literature review and the identified research gap, this study employs importance-satisfaction analysis (ISA) to assess CES based on public perceptions [31]. ISA is modified from the importance-performance analysis (IPA) applied to regulate the quality of experience at tourism locations [32,33]. ISA evaluates the perceived relevance of a place's attribute and the degree to which individuals are satisfied with each quality when visiting the location. The findings highlight the disparity between importance and satisfaction. The use of ISA is to notify the management agency whether it is achieving its desired experience outcomes while making the best use of limited resources.

1.2. Research pathway map

When it comes to the article structure, this study is divided into six parts. The first part is the introduction, which focuses on the background of the study and a review research in the field of industrial heritage parks' participation in urban renewal and cultural ecosystem services. The first part also describes the theoretical framework and research path of the research. The second part is study areas, which describes the reasons for the selection and briefly introduces the two case parks. The third part is the research design, which introduces the research methodology and data processing process. The fourth part presents the research findings in terms of importance-satisfaction analysis and the correlation between public perceptions and high quality industrial heritage parks. The fifth part shows the discussion of the study. The last part demonstrates the conclusions of the study (Figure 1).

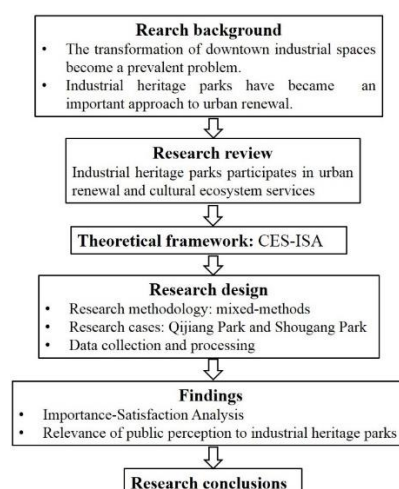


Figure 1. The research pathway map.

In conclusion, this research provides a new contribution to the theoretical study of the sustainable value of urban renewal and depicts evidence-based policy implications for sustainable urban renewal led by industrial heritage parks.

2. Study area

Two successful examples of industrial heritage renewal in China, Qijiang Park and Shougang Heritage Park, were selected as study areas (Figure 2).

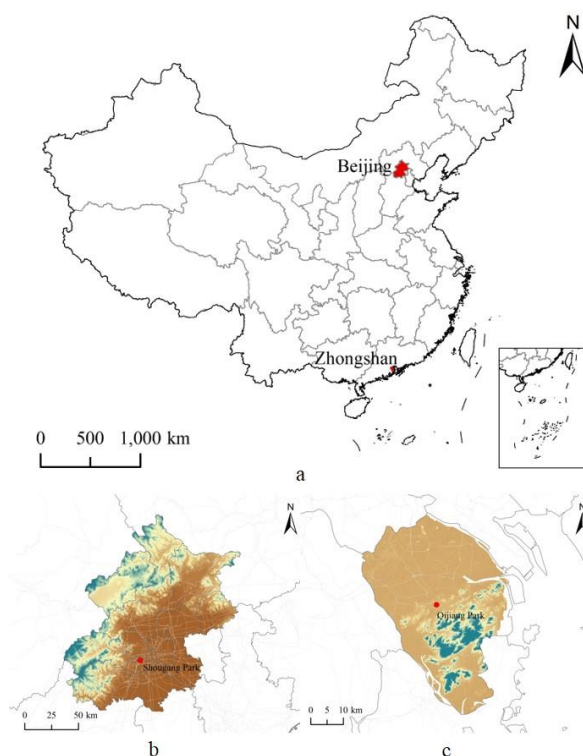


Figure 2. The geographical locations of Beijing and Zhongshan City in the Chinese map (a), the geographical location of Shougang Park in Beijing (b), and the geographical location of Qijiang Park in Zhongshan City (c).

2.1. Reasons for choosing these two parks

There are three major reasons for choosing these two parks:

First, these two parks are located in cities that are very representative of China. The reuse of industrial heritage is closely related to the overall context of the city [34,35]. This is particularly evident in China [36]. Qijiang Park is located in Zhongshan, one of the smallest cities in China, a small southern city at the forefront of China's reform and opening up. Shougang Park is located in Beijing, the northern metropolis that is the political centre of China, and one of the largest cities in northern China. These two parks represent how two different types of cities in China have approached industrial heritage parks.

Second, they are successful from the point of view of temporal evolution. In the case of cities in the global South, the life of public space is reflected by its sustainability, i.e., the stability of public space can withstand the disruption of the uninterrupted process of renewal and pattern evolution within Southern cities due to development needs [37]. The two parks are among the first industrial heritage parks to begin planning and construction in China and have a long history in the country, which reflects their time-tested and clearly successful status.

Third, both parks were subjected to controversy prior to their construction, and a decision on the proposal was taken by vote. Democratization of public space planning is a prerequisite for more objective feedback afterwards [38,39]. In China, a vote on a government decision may be subject to a certain degree of criticism or be considered an incomplete (or formalistic) form of democracy. However, comparing the decision-making process of these two parks with other industrial heritage projects, they are very rare cases in China clearly.

In conclusion, the success of the cases selected in this paper are of comparable value and should be of greater relevance to countries of the global South, including China.

2.2. *Qijiang Park*

Qijiang Park is in the heart of Zhongshan, Guangdong Province, China, with a total planning area of 11 hm², including 3.6 hm² of water surface and 3,000 m² of interior space. The original site was the Yuezhong Shipyard, which served as a symbol of Zhongshan's socialist industrial development in the early 1950s and ceased to function in the late 1990s. The park was completed in October 2001 and was awarded the American Society of Landscape Architects (ASLA) honorary design award in 2002 and the Urban Land Institute (ULI) Asia Pacific distinguished honor award and global excellence in design and development award in 2009.

Qijiang Park is a successful example of how an industrial heritage park can contribute to urban renewal. First, our research found that the price of housing prices in the same location near the park will be 13 times higher in 2023 than in 2003, while the average housing price in Zhongshan City will only increase by 6 times during these 20 years. Second, these designs enhanced the cultural atmosphere of the surrounding area. We found that in the past two decades, the number of public cultural spaces (such as small museums and bookstores) around this park has quadrupled, and the space where the park is located has changed from an industrial centre to a cultural center. Third, the design connecting the park's inner lake to the Shiqi River allows the park to blend into the urban fabric and culture.

In terms of functional zoning, Qijiang Park is divided into an industrial heritage area, a recreational area, and a natural ecological area (Figure 3).

2.3. *Shougang Park*

Shougang Park is located at Lianshi Lake, the first lake on the Yongding River in Shijingshan, Beijing, with a total construction area of 70 hm². The park was selected for inclusion in the first batch of sites for China's industrial heritage conservation list in January 2018. In addition, Shougang Park received the Royal Institution of Chartered Surveyors (RICS) award as a China Urban Renewal Champion in 2022.

Shougang Park is one of the most representative example of an industrial heritage park in China's urban renewal. It is the largest and best-preserved steel industrial site in China. The area of the factory

is approximately 200 km², and there are more than 200 industrial buildings. In addition, the park was selected as the venue for the 2022 Olympic Winter Games, becoming a ‘new landmark in the capital’s urban renewal’. Shougang Park used to be the area with the lowest housing prices in Beijing. However, when Shougang Park was completed, housing prices in Shijingshan District doubled within a year, and many newcomers to Beijing have accepted the fact that this is already an international cultural and creative area rather than an industrial area.

Shougang Park has been divided into three functional areas (Figure 3), including the industrial heritage area, the recreation area, and the natural ecological area.



Figure 3. Functional areas of Qijiang Park (a) and Shougang Park (b).

3. Study design

To aid in the understanding of complicated issues, we use a mixed-methods research design (Figure 4) that combines both qualitative and quantitative data collecting and analysis [40,41]. This a method of investigation that adheres to a realistic worldview that places a focus on autonomy and proper scalability for governance [42].

Qualitative data were obtained through interviews and questionnaires to determine public perceptions of importance and satisfaction with the CES of the industrial heritage parks. Specifically, a Likert scale was adopted to quantify the public’s perception of importance and satisfaction, and questionnaires were distributed in Qijiang Park and Shougang Park. Additionally, CES categories were obtained by reviewing domestic and international literature, which were used as the primary indicators for evaluation. By including the major concerns of the research process, the Delphi method [43] was used to screen and identify five categories of cultural services that have strong relevance to this study, and a CES indicator system was established (Table 1).

were reliable (Table 2), indicating that variation among these individual attributes has no significant impact on the evaluation results.

Table 2. Reliability analysis.

	Cronbach's alpha	Cronbach's alpha based on standardised terms
Qijiang Park	0.987	0.990
Shougang Park	0.993	0.994

Tables 3 and 4 demonstrate the mean values of perceived importance and satisfaction and the gap between them. The average importance for each of the CES in Qijiang Park are (from highest to lowest) sense of place > recreation > cultural heritage and spirituality > aesthetics > education. In contrast, the average satisfaction with the delivery of these CES is recreation > cultural heritage and spirituality > aesthetics = sense of place > education. The results for the average importance of each CES in Shougang Park are recreation > aesthetics > cultural heritage and spirituality > sense of place > education. The average satisfaction with these CES in descending order is aesthetics > recreation > cultural heritage and spirituality > education > sense of place, which is significantly different from the perceived importance. Notably, the mean value of total satisfaction with CES provided by two parks is higher, at 4.07 for Qijiang Park and 3.84 for Shougang Park, than the respective mean values of total perceived importance.

Table 3. Mean value of importance (I) of CES by functional division.

		Recreation	Aesthetics	Cultural heritage and spirituality	Education	Sense of place	All types of services
Qijiang Park	Industrial heritage area	3.53	4.14	3.65	2.97	4.58	3.77
	Recreation area	4.62	3.27	4.26	2.37	3.93	3.69
	Natural ecological area	4.52	4.34	4.02	3.67	4.45	4.20
	Overall park	4.22	3.92	3.98	3.00	4.32	3.89
Shougang Park	Industrial heritage area	3.56	3.96	3.89	3.12	3.72	3.65
	Recreation area	4.29	3.57	2.42	2.29	2.13	2.94
	Natural ecological area	4.52	4.34	4.02	3.67	4.45	4.20
	Overall park	4.12	3.96	3.44	3.03	3.43	3.60

Table 4. Mean satisfaction (S) value of CES by functional division.

		Recreation	Aesthetics	Cultural heritage and spirituality	Education	Sense of place	All types of services
Qijiang Park	Industrial heritage area	4.74	4.60	4.87	4.63	4.86	4.74
	Recreation area	3.94	3.46	3.96	1.83	3.09	3.26
	Natural ecological area	4.52	4.34	4.02	3.67	4.45	4.20
	Overall park	4.40	4.13	4.28	3.38	4.13	4.07
Shougang Park	Industrial heritage area	3.01	3.66	3.69	4.16	3.24	3.55
	Recreation area	4.42	4.12	3.82	3.56	2.88	3.76
	Natural ecological area	4.52	4.34	4.02	3.67	4.45	4.20
	Overall park	3.98	4.04	3.84	3.80	3.52	3.84

Table 5 lists the CES for each functional area within these two quadrants, with their evaluated satisfaction values. The CES attributes in the high importance half for both the natural ecological area of Qijiang Park and the recreation area of Shougang Park are also in the high satisfaction quadrant, demonstrating that the public is satisfied with the CES provided by the two types of functional areas. The aesthetics of the industrial heritage area and the sense of place in the recreation area in Qijiang Park and the aesthetics and sense of place of the industrial heritage area and the natural ecological area in Shougang Park have high perceived importance but failed to satisfy the respondents. This suggests a discrepancy between design intent and public perception. Therefore, specific improvements to the design and management strategies of these specific functional areas are needed to enhance the CES they provide.

Table 5. CES in the higher importance quadrants.

Functional divisions		CES in the two higher importance quadrants	
		In the low satisfaction quadrants	In the high satisfaction quadrants
Qijiang Park	Industrial heritage area	Aesthetics	Sense of place
	Recreation area	Sense of place	Recreation, cultural heritage and spirituality
	Natural ecological area	/	Recreation, aesthetics, sense of place
Shougang Park	Industrial heritage area	Sense of place	Aesthetics, cultural heritage and spirituality
	Recreation area	/	Recreation, aesthetics
	Natural ecological area	Aesthetics, sense of place	/

4.2. *Relevance of public perception to the sustainable value of industrial heritage parks*

In this study, the public expressed positive satisfaction with attributes of the CES in both parks. Specifically, the public's overall satisfaction with the CES of both Qijiang Park and Shougang Park reached over 3.8, exceeding the average perceived importance. Thus, there is a positive correlation between the public's perception and sustainable value.

Tables 3 and 4 visualise the differences in perceived importance and satisfaction of the park's functional areas to the CES. As previously said, a certain area's function and context work together to establish the CES it offers. It is critical to comprehend audience desire for CES to inform decision-making while creating and running industrial heritage parks.

Based on the above data, it can be concluded that recreation, aesthetics, sense of place and cultural heritage and spirituality are the four most valued CES attributes of industrial heritage parks. Scholars revealed six dimensions of public perception of nature, from most to least significant: Experience, scientific understanding, emotional connection, utilitarian perspective, connection with nature, and superiority over nature [46]. The rankings in Table 3 can be interpreted in terms of these six dimensions. Given the significance of recreation and aesthetic values, this theory contends that the predominant of industrial heritage parks is experiential. In addition to experience, the public feels and evaluates industrial heritage parks through emotional connections. This can be seen in the public's evaluation of the perceived importance of two types of services, sense of place and cultural heritage and spirituality. Furthermore, public perception also demonstrates the special role of industrial heritage parks in providing a sense of belonging, especially to local residents, and in passing on the spirit of the city's history and heritage in urban renewal. As the importance and satisfaction of different functional areas within the park vary for each CES, the design of functional areas needs to incorporate public preferences with emphasis given to those areas with more highly valued CES. Using these value scatter plots, designers and managers can create industrial heritage parks not only through functional management targets but also by determining the importance of each CES according to its location and functional requirements.

Table 4 show the variation in the mean values of satisfaction with the CES for the two parks. The comparison among Tables 3 and 4 identifies the performance of the CES in each functional area of the industrial heritage parks. For example, in terms of sense of place, the industrial heritage area enjoys the highest perceived importance but not as high satisfaction. Moreover, while the services in the recreation areas ranked first in both importance and perceived satisfaction, the mean satisfaction value was lower than the mean importance value. Perceived importance indicates public expectation, consideration should be given to improving the provision of a sense of place in industrial heritage parks.

5. Discussion

5.1. *Differences in the delivery of CES among functional areas*

The different functional areas of industrial heritage parks are important determinants in the delivery of CES and in guiding public perception. These can vary within a functional area. For example, industrial heritage parks can take the forms of industrial heritage areas, recreation areas and natural ecological areas. Diverse human-nature interactions that are thought to be associated to CES could happen by offering a variety of situations, confirming the hypothesis of Gobster et al. [47]. The above

results also reflect the significance of functional divisions, where the public's perception of overall satisfaction with the CES was not influenced.

5.2. Practicability of the CES-ISA framework

Evaluation methods play a significant role in the expanding field of CES research. The CES-ISA framework can be used to improve the design and management of industrial heritage parks and to explore CES delivery strategies for improving the reuse of other industrial heritage sites in the future. Yet, this study has some methodological drawbacks. It may be challenging for some interviewees to comprehend CES because they were picked from an academic point of view. As a result, the preciseness of the answers might be impacted if they partially filled out the questionnaire based on their assumptions about the CES.

5.3. Policy and practice recommendations for sustainable industrial heritage parks

The results of the analysis support the hypothesis of this study and suggest that Qijiang Park and Shougang Park' policy measures are worth summarizing and replicating. Specifically, first is the continuation of the historical lineage. The design of industrial heritage parks should retain the original plant and machinery in moderation and use old industrial structures and facilities as creative resources for new functions and forms. In addition, attention should be given to the ecological environment. It is crucial for a sustainable industrial park to respect local natural attributes, such as topography, vegetation and water resources. Furthermore, waterfront trestles, wetland plant communities and other water-friendly and eco-friendly cultivated shore areas can be designed to address the changing water levels of waterfront industrial heritage parks.

However, there are several problems, which should be of greater concern to all industrial heritage park managers. The recommendations are as follows.

First, ritual exhibitions and scene reenactments are important ways of creating a sense of place for the public. Original factory employees can be recruited to create cultural scenes and carry out cultural performances with industrial characteristics to create historically informed content. Second, public participation can be strengthened by collecting suggestions from residents through telephone interviews and public meetings. Platforms online can be utilized to create immersive cultural scenarios through virtual reality and community imagination, allowing the public to become 'actors' on the 'stage'. It is also possible to integrate the ornamental function of the equipment used to produce the landscape into the use function to interact with the public and promote local identity. Third, recreational facilities should be added to recreation areas to improve the park infrastructure. Additional facilities for rain and shade, drinking water and lighting installations should be considered without affecting the landscape of the park. Last, designers and managers should adjust their strategies in a timely manner in response to gaps in public perceptions to balance professional considerations in design with the wishes of the public. These suggestions might yield insightful results when applied concurrently for policy-makers in the field of urban renewal led by industrial heritage parks, not only in China but also in other developing countries, to achieve high levels of public satisfaction and sustainable industrial heritage parks.

5.4. Contributions and limitations

There are three ways in which this research adds to the literature. First, we propose an operational and revisable theoretical framework that emphasises a comprehensive, cross-disciplinary method to explore the link between public perception and the sustainable value of industrial heritage parks within the context of CES for the first time. Second, it is the first time that the CES-ISA framework has been used to quantify the performance of industrial heritage reuse interventions in urban renewal, providing new research ideas for CES interventions in industrial heritage related research. Of course, ISA is one research method grafted onto CES. We believe that, due to the dual complexity of industrial heritage reuse and urban renewal, there are more research methods that can be grafted onto CES to further enhance the effectiveness of CES interventions in industrial heritage research.

Notably, the study areas are two typical successful industrial heritage parks in China, and the findings of this study could have certain inspiration and reference significance for other areas of similar industrial heritage parks to get involved urban renewal in developing countries (especially the Asian countries around the Pacific Ocean), such as Thailand, Malaysia, Indonesia, or Vietnam. Considering the present and upcoming issues of slight sustainability in industrial heritage reuse projects that are prevalent in urban renewal in developing countries, the findings possibly offer helpful recommendations for comparable industrial heritage reuse projects, especially industrial heritage parks, in the process of high quality and sustainable urban renewal.

However, this strategy does have some drawbacks that should be acknowledged. First, there are differences in the perception of the landscape by local residents and foreign visitors [48]. Therefore, future studies can further explore the differences in the perception of CES and its relationship with sustainable values among different groups by designing separate questionnaires for local residents and foreign tourists. Second, the findings have some relevance to industrial heritage parks in Asian countries on the Pacific Rim, but their applicability to industrial heritage parks in European and North American countries is not yet known. In the future, the scope of application of the CES-ISA framework can be clarified and more precisely determined by considering different countries, types of industrial heritage reuse projects, and relevant policies.

6. Conclusion

We explore the relationship between public perception of industrial heritage parks and their sustainable development under the CES perspective. We aim to enhance public satisfaction and social well-being, and to promote high quality sustainable development of industrial heritage parks in urban renewal. To accomplish this goal, we establish the CES-ISA framework. The results showed that the different functional areas of industrial heritage parks deliver various CES. However, in terms of importance and satisfaction, recreation, aesthetics and cultural heritage and spirituality are the most valued services in industrial heritage parks. The CES-ISA framework also reveals those CES where there is a gap between perceived importance and public satisfaction in different functional areas, such as sense of place and recreation services. In such instances, unfulfilled expectations will be effectively revealed.

In conclusion, we propose an operational and revisable theoretical framework to explore the CES of industrial heritage parks for the first time, providing new research ideas for CES interventions in industrial heritage related research. Apart from that, we argue that public satisfaction with CES can be

an essential criterion for measuring quality industrial heritage parks. However, it should be noted that it is not the only criterion. The proof produced broadens our understanding and information about the differences in the public's perceived importance of and satisfaction with CES in industrial heritage parks. It provides new insights into sustainable industrial heritage parks. Thus, using the CES-ISA framework, designers and managers can ensure that industrial heritage parks provide CES that are highly valued by the public. These results offer new geographical messages and standard for decision-making of sustainable industrial heritage parks intervening in urban renewal, both theoretically and methodologically. The research open interest perspective for future research and could be represent a methodology to be replicate also in other contexts.

Use of AI tools declaration

The authors declare that they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

There are no conflicts of interest in this study.

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