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Article

Economic value assessment of industrial heritage in Tangshan, China

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Abstract: Industrial heritage is a legacy from the past that we live with today and pass on to future generations. The economic value of this heritage can be defined as the amount of welfare that it generates for society, and this value should not be ignored. However, current research based on economic analysis has mostly focused on qualitative statements instead of quantitative assessment. This study proposes an innovative methodology combining qualitative (field research) and quantitative (willingness to pay and contingent valuation) methods to assess the economic value of industrial heritage. The industrial heritage of Tangshan, China, was chosen as a case study, and the research found that museums and cultural creative parks are effective ways to conserve industrial heritage. The entrance fee can be used to represent the economic value of the heritage site. There was a positive correlation between the influence of economic value and the entrance fees residents would prefer to pay. The results indicate the locals would prefer lower entrance fees for the transformed heritage museums (The average current cost: $2.23). Locals were most concerned about the entrance fees for the Kailuan Coal Mine and Qixin Cement Plant Museums, which have both been renewed as urban landmarks for city tourism. Renewal methods have been applied to six industrial heritage sites in Tangshan; these sites have their own conservation and renewal practices based on city-level development or industrial attributes. Thus, when residents recognize the economic value of a heritage site, they are willing to pay a higher entrance fee. This research demonstrates the economic value of industrial heritage using a mixed methods approach and provides a basis for assessing the value of cultural heritage for urban tourism analysis.

Keywords: cultural heritage; value analysis; economic assessment; contingent valuation method

1. Introduction

The cultural heritage community needs to embrace a wider range of cross-sectoral partnerships (Rodwell, 2018). A city's history and culture are mostly displayed through heritage, which also offers a way to attract tourists to the city. As one type of modern heritage, industrial heritage is meaningful for the retelling of urban history. Along with China's rapid urbanization, the growth of information technology has necessitated the upgrading or rebuilding of some traditional industrial sites (Xu and Tan, 2019). In the late twentieth century, industries established started to face severe recession (Liu and Chuang, 2022). In cities across China, the sites of these traditional industries were replaced or technologically transformed by modern building design. Thus, many industrial sites were destroyed rather than conserved. Exterior walls were remodeled, and interiors were restructured, producing a contradiction between the conservation of industrial sites and modern urbanization (Cheng and Yuan, 2021). Urban industrial communities and their heritage are shaped and influenced by a

constellation of economic, social, and cultural reforms, leading to massive ongoing changes in industrial heritage.

Industrial heritage is a relatively new concept; as a cultural practice, practitioners play a significant role in defining and developing its workings and doings (Veldpaus and Wacogne, 2021). It has been rapidly adopted in urban projects, especially in the form of adaptive reuse for urban regeneration. Heritage is treated as the "passive victim" of rapid urbanization, which threatens its existence rather than as an active agent that can substantially contribute to the sustainable development of cities (Fouseki et al., 2021). It is widely accepted under the philosophy of sustainable development and has led to new approaches and principles regarding the protection and improvement of natural, cultural, and architectural heritage (Cheng and Yuan, 2021). Modern global processes are characterized by deindustrialization and urban redevelopment (High, 2013). China has developed industrial heritage conservation methods in recent years, such as transforming industrial heritage into museums, landscaped gardens, and sites of integrated exploitation and utilization (Liu et al., 2021). Industrial heritage conservation in China began in Shanghai (Wang, 2009). In 1900, Shanghai formed China's industrial basis, and research on industrial heritage conservation began there as well. Conservation in Shanghai began with concerns about industrial and historical buildings. Between 1900 and the 1920s, Shanghai grew into a modern city. Some industries were introduced from other countries while traditional industries also rapidly developed. In the 1930s, Shanghai's factories accounted for more than 50% of all factories in China, and by 1949, the city had more than 10,000 factories, making it China's largest industrial city.

Since 1999, industrial heritage has captured a significant amount of attention, and its conservation has been increasingly emphasized by researchers. Since 2003, conservation has been focused on industrial heritage; the World Expo that year was held in Shanghai, a city that is currently undergoing major redevelopment and the destruction of its urban heritage, providing it with a chance to enhance its urban economic and social development. The problem of the conservation and regeneration of the old town area has also been solved, as during the construction of the venues for this expo, several industrial buildings with historical and use value were transformed into museums. Renewing the function of these historical assets and reflecting the characteristics of their era should be part of integrated regional development (Zhou and Sun, 2019). By the early 21st century, many creative industrial parks made use of vacant factory buildings and warehouses with government support. By October 2010, 63 out of a total 75 creative industrial parks were approved by the Shanghai municipal government and were housed in renovated factory buildings and old warehouses. Yangpu Riverside Creation Park, which is on a 5000-square-meter plot, was one successful project. A unique feature of Shanghai's industrial heritage is the presence of large areas of contiguous industrial remains, such as the large industrial area along the Huangpu River, which contains the large-scale industrial buildings of Jiangnan Shipyard, Shanghai No. 3 Steel Works and the Port Machinery Plant; all of these have been maintained as historical and cultural remains for perpetual preservation. The research problems can thus be summarized as follows; China's industrial heritage, and its heavy industry sites in particular, have not been fully evaluated by government or planners, so most conservation analysis only provides a theoretical basis for the value

analysis of industrial heritage based on historical or development surveys. It is thus urgent to assess the role of the industrial heritage in a city based on quantitative data and to evaluate its influence on urban development from the perspectives of tourism, transportation, and culture.

This research proposes an innovative methodology combining qualitative (field research) and quantitative (willingness to pay and contingent valuation) methods to conduct an economic value assessment of industrial heritage. The remainder of the paper is organized as follows. Section 2 is the literature review, section 3 introduces the case study, section 4 discusses the methodology and data, section 5 presents results, and section 6 is the discussion.

2. Literature review

2.1. Industrial heritage conservation analysis

Industrial heritage includes machinery, workshops, mills, factories, mines, processing and refining sites, warehouses, stores, energy-generation sites, and transport-related infrastructure, as well as places used for industry-related social activity, such as housing, places of worship, and schools (Claver et al., 2021). The preservation of industrial heritage pertains to politics, economics, culture, and architecture. Industrial heritage can be considered an irreplaceable feature of a city (Grazuleviciute-Vileniske, 2008). Since the late twentieth century, increasing attention has been paid to the analysis of industrial heritage, as it reflects the significant influence of industrial civilization on the economy, society, and human production (Çakır and Edis, 2022).

Many scholars in the fields of geography and related disciplines have addressed the biopolitics of conservation. Those working on the conservation of historical built forms have sought to find a way to preserve functionally obsolete built forms without damaging the embedded cultural and historical significance in those forms, while still accommodating new socio-economic demands (Xie, 2015). Most conservation analysis methods are qualitative, including literature reviews, surveys, and interviews (Zhou and Li, 2020). Adaptive reuse has been regarded as a desirable conservation option, as it maintains physical forms and ensures continuous, cost-effective use (Yildirim and Turan, 2012; Yung and Chan, 2012). There are several approaches to adaptive reuse. One is compatible reuse, which creates new functions for historical built forms on the condition that they do not impair the historical fabric of a site. The other is most appropriate reuse, which seeks to continue the traditional use or revive its principal functions (Jeon and Shin, 2010). Adequate evaluation and planning processes, expert advice and appropriate funding are required to facilitate proper conservation (Pearson and Sullivan, 1995).

International recognition as World Heritage Sites by the United Nations Educational, Scientific and Cultural Organization (UNESCO) is one way to preserve and conserve heritage sites (De Simone et al., 2019). Cultural heritage can play a strategic role in achieving sustainability goals, as is widely recognized worldwide by the United Nations, UNESCO, ICOMOS, and by many regional and national institutions. To evaluate the services of urban heritage, previous research based on the idea of sustainability and investment flows has been used for comparison with the

degradation of urban heritage (Vernières et al., 2012). The economic value of industrial heritage needs to be assessed in terms of history, culture, humanity, and nature to merge industrial heritage conservation with social and cultural needs.

2.2. Industrial heritage value analysis

Industrial heritage is a legacy from the past that we live with today and pass on to future generations. The economic value of this heritage can be defined as the amount of welfare that it generates for society (Avrami and Mason, 2019). Industries established during the modern era face severe recession, so their economic value should not be ignored. Research on industrial heritage value assessment can be divided into two categories: data based qualitative or quantitative analyses and studies of historical, social, or cultural industry value analysis (Li and Kuang, 2006; Yan et al., 2021). Regarding qualitative approaches, Zhang et al. (2011) used technological value as a factor to assess industrial heritage. Tse et al. (2009), meanwhile, focused on economic value. Focusing on the intangible value of industrial heritage, Le and Yuan (2021) focused on the intangible value of industrial heritage and recommended that intellectual property conservation in China be improved. Lu et al. (2019), meanwhile, analyzed historical information value. Qualitative analysis generally considers heritage value from a theoretical perspective and describes them based on history. However, current research for economic analysis tends to focus on qualitative, rather than quantitative assessment.

Regarding quantitative approaches, Lin and Hu (2013) used multiple regression analysis to quantify perceptions of industrial heritage. This research considered multiple factors and filtered out the main ones that affect the perception of heritage. Dell'Ovo et al. (2021) used a multicriteria approach, combined with economic and qualitative indicators, to define the most suitable function for the adaptive reuse of a multipurpose building in northern Italy. Xie (2015) developed a life cycle model to analyze the value of industrial heritage, and identified postindustrial sites as an important heritage source in the stage of territorialization. Comparing these two approaches, qualitative research tends to focus on the relationship between perceptions and place while quantitative analysis is based on numerical data (de la Torre, 2002). Analytic hierarchy process is often used to evaluate industrial heritage, using independent factors and solving multicriteria decision-making (MCDM) problems based on priorities (Saaty, 1977). However, the results will differ depending on the chosen criteria (Ishizaka and Labib, 2009). MCDM analysis considers the technological development of industrial heritage sites. Mousumi (in Dutta and Husain, 2009), for instance, used MCDM to grade heritage sites in Calcutta. Qualitative analysis can provide a theoretical basis for industrial heritage evaluation while quantitative analysis can reflect the elements that might influence heritage development. Merging these two approaches can offer a mixed method to better assess the value of industrial heritage.

The contingent valuation method (CVM) is the most widely used approach for assessing the economic value of heritage (Botzen and van den Bergh, 2012; Liu and Chuang, 2022). It can also help determine the value that people attach to public goods (Brander and Koetse, 2011). CVM uses questionnaires to assess heritage value

preferences and investigate respondents' economic preferences. The questionnaire is based on the trade-off between personal income and environmental quality. The maximum price that respondents are willing to pay is also combined and taken as the value of the heritage (Lin et al., 2020). When using CVM to quantify respondents' economic values, scenarios are designed based on the research objective (Liu and Chuang, 2022; Liu et al., 2020). Using questionnaires to examine donations for a historic site, Chambers et al. (1998) found that high-income female respondents were more concerned about historic heritage and had a higher willingness to pay. Despite such work, few studies have focused on intangible value in terms of the economic value of industrial heritage, which is often combined with willingness to pay (WTP). Liu and Chuang (2022) analyzed the urban heritage of ancient urban trees in Qiedong-Wang-Gong and made management suggestions for decreasing respondents' willingness. Furthermore, the validity of CVM was verified by Lin et al. (2020), who investigated respondents' WTP for heritage renewal sites in Tangshan. Kim et al. (2007) used 10 given prices to reveal the economic value of heritage for users or tourists in levels exceeding its monetary benefits. In future research, the categories and other economic expenses of renewal sites could be developed to further quantify respondents' WTP.

Since 2018, China has published several editions of the List of Industrial Heritage Protection of China. The conservation of the industrial heritages in these lists has been undertaken on an ongoing basis. This research selects the industrial heritage in Tangshan, China as a case study. Although there has been progress in the conservation of Tangshan's cultural heritage, many problems still exist. This study focuses on the industrial heritage of this city to provide a scientific basis for industrial heritage development and cultural industry promotion in China. The objectives are to first conduct an economic value assessment of heritage and propose a method to quantitatively assess industrial heritage value. CVM is used to evaluate intangible economic value. The findings can provide a reference for future industrial heritage renewal and the economic value assessment of other industrial heritages. However, previous research has tended to analyze heritage value in multiple ways, without focusing on the economic perspective for industrial heritage value analysis. The economic value of heritage can be defined as the amount of welfare that it generates for society. The welfare produced by heritage is greater than the financial benefits that certain historical objects or areas can produce through exploitation for tourism purposes; benefits external to the market economy should also be included. It is therefore meaningful to assess economic value when evaluating the welfare that heritage provides to society.

3. Research case study description

3.1. History of industrial heritage in Tangshan

China's industrial heritage implies both tangible and intangible value and reflects the country's history of industrial development. Tangshan is one of northeast China's heavy industrial bases. Based on data from the List of Industrial Heritage Protection of China (first edition) published in 2018, there are six industrial heritage sites in Tangshan. Their locations are shown in **Figure 1**, and they are listed in **Table 1**. For

case study analysis, the primary data were collected based on a literature review and field research, which are effective for qualitatively describing industrial heritage.

Industrial heritage conservation is developing rapidly in Tangshan. As an industrial city, Tangshan's socioeconomic development has been supported by coal. Kailuan Coal Mine Plant is a typical representative of industrial heritage in Tangshan in terms of historical, cultural, and technological dimensions. It introduced the coal industry in China and promoted industrial development throughout the whole country. Meanwhile, Qixin Cement Plant was China's first cement plant. These two plants both provided impetus for China's industrial development.

Table 1. Six industrial heritage sites in Tangshan, China.

No.	Name	Year founded	Description
1	Kailuan Coal Mine	1877	One of the largest coal mining companies in northern China, it laid a foundation for the development of the coal mining industry and traditional industry in China. It was the first coal mining company with large-scale mechanized mining sites. The Kailuan National Mining Park was developed based on the previous coal mining sites. The renewal of the national mining park includes projects for tourism, leisure, history, and culture.
2	Tangshan Railway Site	1881	The first standard-gauge railway in China, it was established by Kailuan Coal Mine Company and called the Tang Xu Railway. It was mainly used to transport coal. In the year of its establishment, the first steam engine train in China was built. The remaining industrial heritage sites include steel rails, platforms, and the overline bridge. The railway museum was opened in 2018.
3	Luan River Iron Bridge	1892	Construction of the bridge began in 1892 and was completed in 1894. It was the first bridge used for railway in China. The raw materials included iron, steel, cement, and stone. It became a vital transportation crossing for coal. In 1974, a new road was built to replace the bridge, and the bridge was phased out of service. It became a protected site in Tangshan in 1998.
4	Qixin Cement Plant	1889	China's first cement production company. In 1907, a company that had produced fine cotton soil became the Qixin Cement Plant. With improvements in fineness, intensity, and chemical composition, the company's products started to surpass those produced in Europe and began to be sold outside of China. Museum sites started to be designed and constructed on the site of the Qixin Cement Company in 2011. By transforming the old buildings of the cement company, this industrial museum combines industrial tourism and cultural activities. It is now famous for its creative and cultural products.
5	Tang Xu Railway Repair Plant	1880	Developed by the Kaiping Mining Bureau, it was China's first company for railway production. China's first railway train was produced in this plant. In the 1930s, it became China's most advanced modern railway plant with the largest production capacity. It later became a section of the Tangshan Earthquake Memorial Museum.
6	Tangshan Porcelain Plant	1914	Built in 1914, this was China's first plant to produce porcelain based on modern machine manufacturing technologies. It introduced the modern slurry molding process technology to produce gray porcelain. Later, it was mainly engaged in producing sanitary pottery porcelain. Also, the first ceramic flooring tile in China was made in this plant. Today, the plant's workshops and several other buildings remain and have become industrial heritage sites.

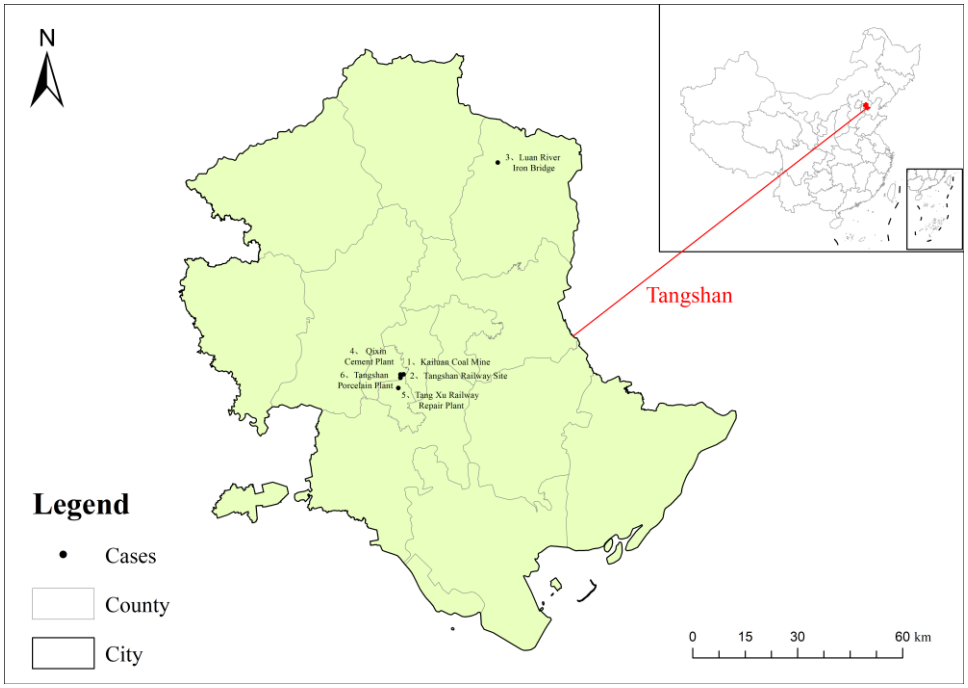

Figure 1. Location of heritage sites in Tangshan, China.

In the economic dimension, the conservation of industrial heritage promotes tourism. From 1995 to 2015, tourism developed rapidly in Tangshan and became a dominant industry. The Kailuan Coal Mine Museum and Qixin Cement Plant Museum both attract tourists. Meanwhile, other forms of industrial tourism, study tourism, and scenic tourism have been exploited, becoming symbols of the city's economic development. Meanwhile, industrial heritage conservation should meet the requirements of low pollution and low resource input. The cultural industry has not only promoted the development of the iron, steel, coal, and cement industries but also inherited the industrial culture of these industries.

In the cultural aspect, industrial heritage in Tangshan has its own attributes in terms of architectural style. The Kailuan Coal Mine Museum has a neoclassical architectural style, with a red-brick exterior and loess interweave. The Qixin Cement Plant Museum integrates elements of the entire plant and maximally retains the original space. Furthermore, the productive facility, production technology, and process flow of these heritage sites represent the higher technical levels of the time and can be instructive for contemporary analysis.

3.2. Industrial heritage renewal in Tangshan

Among the six industrial heritage sites in Tangshan, four have been transformed into museums: Kailuan Coal Mine, Tangshan Railway Site, Qixin Cement Plant, and Tangshan Porcelain Plant. They have been conserved and renewed mostly since the late twentieth century, and the museums were built on the original sites. Several original machines or workshops were reused or moved into museums. The museums not only record the history of the industrial heritage but also indicate the value of heritage in terms of social, economic, environmental, and cultural history. The city has its own conservation and renewal characteristics. Its industrial heritage is mostly renewed by museums or memorial halls, as several are related to historical

development or were the first plants in China of their kind, especially in heavy industry.

Transforming industrial heritage into museums is one means of heritage renewal. Qixin Cement Plant is transforming into a museum called the China Cement Industry Museum. This plant represents the origin of China's cement industry, and it produced the first bucket of mechanism cement in China. With the movement of this plant, the workshop has been retained in its original place, and then a cement industry museum was built there. Also, Kailuan Coal Mine has been conserved as the Kailuan Museum, which introduces procedures for coal mining and coal transportation. Tang Xu Railway Repair Plant will be rebuilt as the China Railway Source Museum. As the origin of China's railway industry, Tangshan produced China's first standard-gauge railway, first self-run railway company, first railway plant, and first railway station. The Railway Museum is a means for the city to tell the cultural history of this industry's development.

The Luan River Iron Bridge was renewed for sightseeing or travel. It has characteristics related to transportation. As opposed to building museums or memorial sites, the most effective means of conservation is to reinforce the heritage at the original place and tell the historical stories. The Tang Xu Railway Repair Plant was transformed into a memorial hall and into government protected historical and cultural sites. The memorial hall memorializes the history and technologies and conserves the workshops, ornaments, and even the original vegetation cover.

The six selected industrial heritage sites are first categorized based on their history or background, as well as renewal methods. The findings of the qualitative analysis indicate that these heritage sites have their own conservation and renewal practices based on the city's development or the industry's attributes.

4. Methodology

4.1. Data collection

Field research is a qualitative method of data collection that may involve conducting interviews with people remotely to understand how they behave in a social environment and how they react to situations around them. Scientific field research includes objectives, and it can be conducted systematically and repeatedly. Field research typically begins in a specific setting, but the cause and effect of certain behaviors can be difficult to analyze due to presence of multiple variables in the natural environment. Field research looks for correlations, and the small sample size makes it difficult to establish causal relationships between two or more variables.

A literature review was also conducted regarding the six industrial heritage sites to gather information on each site's history, economic benefits, transportation, influence, location, and development status. The historical information was obtained from several museums and memorial halls and from the literature, including the building date, materials, construction history, and historical background. The history of the industrial heritage sites that have been renewed into cultural or art design areas were obtained through several cultural products designed based on the characteristics of the heritage. Information concerning economic, social, or environmental benefits were obtained through urban or industrial development yearbooks. All of the

information was recorded, analyzed, summarized, and collected systematically.

4.2. Contingent valuation method

CVM is useful for evaluating the value of public goods in a hypothetical market and expressing respondents' willingness to pay (WTP). The most important issue in using CVM is the choice of questions to capture information about respondents' preferences. This study's questionnaire included questions about respondents' WTP for a specific service related to industrial heritage. A payment card approach is used with three WTP levels (0–20 RMB, or $0–$2.79). There are two items for each respondent: 1) "the heritage in this city gives economic information (A. strongly disagree, B. disagree, C. neutral, D. agree, E. strongly agree)"; 2) "how much do you prefer to pay for the entrance fees of heritage museums (A. less than 10 RMB or $1.39, B. 10–20 RMB or $1.39–$2.79, C. more than 20 RMB or $2.79)."

Aside from the questions, some socioeconomic data was collected for the respondents (e.g., age, gender, occupation, educational background). The survey was conducted for two weeks, including weekdays and weekends, from 26 April 2023, to 10 May 2023. All questionnaires were distributed online. A total of 249 questionnaires were distributed, and 239 valid questionnaires were retrieved, for a completion rate of 95.98%. All samples are analyzed using SPSS 27.0.

5. Results

5.1. Economic WTP

The questionnaire respondents were local residents of Tangshan, China. Various statistical analyses are used according to data type. **Table 2** presents the results for the respondents. Women account for 68.2%, and the average age is 32.4; 63.2% are students and, correspondingly, 68.6% have an undergraduate educational background. This could have influenced their WTP for entrance fees since students are mostly supported financially by their families.

The value of industrial heritage has been promoted online, through renewal methods, and at conferences, such as the 2023 Hebei Provincial Tourism Development Conference, held at the renewal site of the Qixin Cement Plant. Thus, the cultural or historical economic value of the industrial heritage sites was fully known by the local residents. This is indicated by the results for the fourth question, where respondents tended to be neutral in demonstrating the economic information.

The current regular admission fee for the Kailuan Coal Mine Museum is 36 RMB (or $5.02), and that for the Qixin Cement Plant Museum is 25 RMB (or $3.49). The other two museums are free but not as well renewed as the previous two. The respondents indicated that they would prefer lower admission fees for these museums, at an average of 16.9 RMB (or $2.23). Respondents were mostly concerned about the fees for the Kailuan Coal Mine and Qixin Cement Plant museums, which are both renewed urban landmarks for tourism in Tangshan. Thus, the current entrance fees exceed the respondents' WTP. The number of tourists visiting these two museums is small, especially for the Qixin Cement Plant Museum. Local residents tend to walk around or go sightseeing outside these museums rather than go inside. Thus, entrance

fees are a barrier to promoting industrial heritage.

Table 2. Data for respondents' socioeconomic background.

Variable		Respondent	Percentage	Average	Standard deviation
Age	A. 18–25 B. 26–35 C. 36–45 D. 46–60	A. 146 B. 43 C. 41 D. 9	A. 61.1% B. 18.0% C. 17.2% D. 3.8%	1.64	0.90
Gender	A. Female B. Male	A. 163 B. 76	A. 68.2% B. 31.8%	1.32	0.47
Occupation	A. In school B. Government staff C. Merchant D. Other	A. 151 B. 13 C. 8 D. 67	A. 63.2% B. 5.4% C. 3.3% D. 28.0%	1.96	1.34
Educational background	A. High school or less B. Undergraduate C. Master's or PhD	A. 16 B. 164 C. 59	A. 6.7% B. 68.6% C. 24.7%	2.18	0.53
The heritage in this city provides economic information.	A. Strongly disagree B. Disagree C. Neutral D. Agree E. Strongly agree	A. 2 B. 54 C. 163 D. 18 E. 2	A. 0.8% B. 22.6% C. 68.2% D. 7.5% E. 0.8%	2.85	0.59
How much do you prefer to pay for heritage museum entrance fees?	A. Less than 10 RMB B. 10–20 RMB C. More than 20 RMB	A. 100 B. 112 C. 27	A. 41.8% B. 46.9% C. 11.3%	1.69	0.66

The entrance fees of industrial heritage sites reflect their economic value, as they have mostly been turned into museums. The history of their conservation or renewal can be traced in the museum, and the income can be used to promote the museum itself. The entrance fee is thus an effective way to quantitatively illustrate the economic value of the industrial heritage for locals. The renewed museums are also platforms for local governments to demonstrate their ability to conserve and renew industrial heritage, while their income is used to judge the popularity of heritage sites among locals. The results indicate that residents tend to pay lower prices for museum entrance and do not realize the economic value of these heritage sites. Residents mostly spend time or money on tourism instead of acquiring knowledge in the museums, so they would like to lower the entrance fee. In further renewal work, managers and governors need to pay attention to promoting the value of and the knowledge that could be acquired in the museum to highlight the economic value of the industrial heritage site.

5.2. Influence of economic value

The SPSS analysis reveals a positive correlation between the economic value influence and the entrance fee respondents are willing to pay (see **Table 3**). Thus, the more aware respondents are of the economic value of the heritage site, the higher their WTP. Economic value is a public good, and its value is mostly embedded in cultural values. The tangible economic value is the entrance fee, income from heritage focused products created based on cultural creative industries, and income from tourism. Meanwhile, the intangible value implied in industrial heritage includes the intangible cultural heritage or the city's spirit. Intangible heritage tends to be more fluid, and it

raises more questions about the value of conserving a particular form of heritage over time when the cultural context in which it was produced has changed.

The results demonstrate that the economic value could be reflected by the museum entrance fee, and willingness to pay can indicate this value quantitatively. The managers or governors of industrial heritage sites can emphasize the entrance fee for renewed museums more clearly for locals, and highlight the costs behind the heritage sites. This may increase willingness to pay among residents and promote better heritage renewal.

Table 3. Binary/ordered regression of the questions.

		Age	Gender	Occupation	Education	WTP	Economic value
Age	Pearson's correlation	1	0.127*	0.776**	0.006	0.074	0.047
	Sig. (2-tailed)		0.050	0.000	0.929	0.257	0.470
Gender	Pearson's correlation	0.127*	1	0.113	0.073	−0.024	−0.008
	Sig. (2-tailed)	0.050		0.080	0.259	0.709	0.897
Occupation	Pearson's correlation	0.776**	0.113	1	0.069	0.063	0.003
	Sig. (2-tailed)	0.000	0.080		0.291	0.334	0.958
Education	Pearson's correlation	0.006	0.073	0.069	1	0.085	−0.047
	Sig. (2-tailed)	0.929	0.259	0.291		0.190	0.467
WTP	Pearson's correlation	0.074	−0.024	0.063	0.085	1	0.247**
	Sig. (2-tailed)	0.257	0.709	0.334	0.190		0.000
Economic value	Pearson's correlation	0.047	−0.008	0.003	−0.047	0.247**	1
	Sig. (2-tailed)	0.470	0.897	0.958	0.467	0.000	

* Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed).

6. Discussion

This research analyzed the economic value of industrial heritage from qualitative and quantitative perspectives, and the results showcased the relationship between the entrance fees for the renewed museum and the economic values of the heritage. The analysis provides a basis for assessing the economic value of other industrial heritage sites. It is difficult to find standard economic analysis tools that well reflect the cultural and historic dimensions needed for industrial heritage assessment. Using the museum entrance fee as an indicator is a way to analyze income, which can then be used for further industrial heritage site renewal or promotion.

Based on the qualitative analysis, including the literature review and field research, the conservation and renewal methods for industrial heritage can be traced from a historical perspective. Combined with quantitative analysis, the current economic value can be assessed, while also laying the groundwork for future research. This combined methodology thus appears to be useful for further economic value analysis.

This research does not highlight the economic value of intangible heritage. Few studies have attempted to assimilate both tangible and intangible aspects of cultural

heritage sites into a unified interface. The ones that have done so used various different methods across different scales. Multicase studies include qualitative and quantitative perspectives. Regarding qualitative methods, Massaro et al. (2019) suggested that they can help researchers discover new variables and complex processes in social contexts. Gummesson (2006) showed that qualitative management research allows researchers to capture many intangible factors that create value for the literature. This method can also bring practical evidence from more than one case, allowing for cross comparisons between different realities. Multicase methods have mostly been used for the analysis of social contexts or management (Biancone et al., 2023). Therefore, future research could examine the use of digital and visualization technologies in heritage documentation to highlight the importance of considering the intangible elements of industrial heritage sites.

7. Conclusion

Taking industrial heritage in Tangshan, China, as a case study, this study uses CVM and questionnaires to propose a quantitative method to assess the economic value of heritage. Renewal methods have been applied to the six industrial heritage sites chosen for this research. It is found that these heritage sites have their own conservation and renewal practices based on city development or industrial attributes. The questionnaire reveals that respondents would prefer lower entrance fees for these museums, at an average of 16.9 RMB (or $2.23) for regular admission. The respondents are mostly interested in the fees for the museums of the Kailuan Coal Mine and the Qixin Cement Plant, which are two renewed urban landmarks for tourism in Tangshan. SPSS correlation analysis shows a positive correlation between economic value influence and the entrance fee respondents are willing to pay. Thus, the higher the economic value of heritage recognized by respondents, the higher the entrance fee they are willing to pay. Finally, intangible heritage tends to be fluid, raising questions about the value of conserving a particular form of heritage when the cultural context in which it is produced has changed.

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