The 6th International Conference on Mining Science & Technology

Case study on the redevelopment of industrial wasteland in resource-exhausted mining area

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Abstract

In the resource-exhausted mining regions, because of the finish of mine production and the phenomenon of idle land resources, the number of industrial wastelands has been increasingly growing. In this paper the causes, characteristics and the developing laws with time and spaces of the industrial wastelands were analyzed in the case of Jiawang mining region firstly. Secondly, the problems and the impact factors of the further development of industrial wasteland were discussed; meanwhile the concept of “innovative integration” of the resource was introduced in order to emphasize the importance of redevelopment of industrial wasteland, which can be regarded as the new resource of the mining region. Finally the strategies and approaches of the redevelopment and reutilization of the mining industrial wastelands were discussed in the view of land development, industrial restructuring, and integration of spatial distribution, ecological environment restoration, protection of industrial heritage in the mining area.

Keywords: resource-exhausted mining region; mining region of Jiawang; industrial wasteland; redevelopment

Due to the non-renewable character and cumulative effects of mineral resource, many mining cities is facing the crisis of resource exhaustion, and their development also faces many difficulties such as backwardness of the city infrastructure and urban construction, sole industrial system and lagging development of the tertiary industry. The closure of mines will bring high unemployment rate and social instability. Abandoned mines, land subsidence, water pollution, hills of gangue and flyash cause the destruction and waste of resources, ecological degradation, and damage to the environmental landscape. Therefore, in the period of recession of the mining cities, the economic, social and ecological environment must be updated and integrated. The purpose of urban renewal is to transit smoothly from industrial society to post-industrial society, and create a certain competitive and livable city. This paper taking the Jiawang mining region of Xuzhou for an example, discusses how to exploit the potential value of industrial waste lands from the perspective of restructuring the resource-exhausted mining region, and proposes the strategies and models of the abandoned land redevelopment.

1. Situation of Jiawang mining region

Jiawang district is the farthest one in the five districts of Xuzhou city, which is approximately 38 kilometers
distant from the central urban area. Jiawang, as a typical resource district, had won the name of one-hundred-year-old coal-mining region. The administrative area of Jiawang District is about 690 km², and the area of coal mining field is 202 km². As the pillar industry of Jiawang District, coal mining has made a tremendous contribution to the development of Xuzhou City, even to the entire Jiangsu Province. At the peak of the mining industry, the amount of coal mines in Jiawang District reached 226. But many coal mines have been shut down one by one since 2001 because of resource exhaustion of coal mining. Four state-owned mines had been closed by the end of 2008. Some small mines have been ordered to shut down. Only a minority of former mine fields are still in production.

The closure of a large number of mines in Jiawang District not only triggered the shrink of mining industry and mining-related industries, but also left behind a lot of industrial waste lands. According to the land resource statistics of Jiawang District, the amount of the industrial lands used by the state-invested companies had increased to 290.0 ha by the end of 2008. In addition, 7466.4 ha of coal mining subsidence lands were emerged, among which 2777.9 ha will be influenced by repetition mining.

The industrial wasteland refers to the area which was used for the industrial production or the related industrial production in the past, but now is partially or completely becoming abandoned or facing the function readjustment because of the resource exhaustion, readjustment of industrial structure, the economic recession and other factors.

From the survey of the Jiawang district, we know that different coal mining industrial wastelands are distributed in different downtown areas. The dispersion of industrial wastelands in city critically impacts the image as well as the developing of the city. For generalized analysis of the formation reason of industrial wasteland in Jiawang District, several kinds of types could be listed.

![Fig. 1. Development of the industrial wasteland in Jiawang since 2001](image)

1.1. Industrial wasteland caused by mine closure and production suspensions

Due to the exhaustion of coal resource and the closure of mines, the original production factories and the service industries all became idle and could not be transformed to fit new functions immediately. Most of the industrial wastelands in Jiawang District were in this situation, such as Xiaqiao mine (closed in 2001), Hanqiao mine (closed in 2008) and so on. Furthermore, some subordinate enterprises of Xuzhou Mining Group had to shut down because of the low output, which also brought massive industrial wastelands. For example, a cement factory was shut down in 2007. Among the industrial wastelands of Jiawang District, the abandoned land caused by the closure of mines and the shutout of enterprises reached 220.8 ha, which occupied 76.1% of the total industrial wasteland in the city area.

1.2. Industrial wasteland caused by the natural change of city area situation

In the industrial wastelands, because of the population loss and functions decay, their original function can not be fully embodied. Taking the 2nd department of Xuzhou Mining Group Hospital in Jiawang District for example, it had lost its advantage as an infection hospital due to the improvement of medical condition and the development of
medical science. Meanwhile the whole land (more than 43 ha) was becoming waste because of the noise from the nearby factories as well as the lack of water, which led to the loss of its original function. In Jiawang, this kind of natural abandoned wasteland accounts for 14.8% of total industrial wasteland.

1.3. Industrial wasteland used inefficiently

Because of the loss of the original function, much land which belongs to mining enterprise should be further developed and utilized. But limited by the ownership, the efficiency of development was low. For example, the platform of chemical engineering companies nearby the railway was functioned as the freight transport basement. But after the debut of state policy which do not allow trains to transport dangerous commodity, the transport line of the company was converted to road. Only a part of the platform land is used as storage land, so it is not fully utilized.

The other example of industrial wasteland is the farming land of Hanqiao mine which is now used as orchard. The value of the land used for mining industry is now far from fully exploited because of the factors such as the shrink of mining, the inconvenient location and so on. These disadvantageous factors of those lands should be taken into consideration for further exploitation and development. This kind of land accounts for 8.9% of total industrial land in Jiawang District.

1.4. Industrial wasteland left over by history

Besides, there are some wastelands caused by reform of enterprises and social system. Coal mining factories are typical state-owned companies. All the time, they take most of the social responsibility. But during the reform of the enterprise, many enterprises and facilities changed their function as social service to the local authority, such as post office, school, road, and so on. The new functions of a lot of lands have not been defined in many coal-mining areas. As the coal resource was exhausted, the roads and railways for coal transporting which belonged to mines were idle. Some of the roads have been transferred to serve the public daily life of the community, while the railways have been completely idle.

2. The negative affection of the redevelopment of industrial wasteland

2.1. Enormous quantity and dispersive distribution

As the coal resource is approaching exhaustion and the coal enterprises go bankrupt, the industrial wasteland of Xuzhou Mining Group in the Jiawang District gradually becomes larger and larger. By the end of 2008, the area of industrial wasteland of Xuzhou Mining Group in the Jiawang District reached 290.0 ha, among which the largest land had an area of 16.9 ha, while the smallest one is less than one acre. Mixed with the urban area, these wastelands were distributed in every corner of the Jiawang District, which had a critical impact on the urban spatial development, the city's image and environment.

2.2. Unclearly defined ownership and lack of integrated planning

At present, amongst industrial wastelands in mining area, most of them belong to the subordinate enterprises of Xuzhou Mining Group. The majority of the lands were transferred and authorized by the government. Only a small number of them can be sold freely. In the existing stock lands of Jiawang District, there are 53.7% for transfer, 46.2% for authorization while only 0.03% land for selling. The allocating right of those lands belongs to the enterprises. However, after the termination of coal production and management, the enterprises did not realize the potential value of those stock lands. Thus, some of them were sold at a low price, while some were abandoned. The lands were not treated in the market mode. Due to the problem of ownership, when the government is making the master plan, it’s difficult to make unified plan and rational development to these land, which led to the breakdown of the city’s spatial pattern and the rational allocation of land resources.
2.3. Complicated status quo

According to investigation and statistics, the industrial wastelands of Jiawang District have a complicated situation. Some of them are now deserted, and others are seldom used. The industrial wastelands are in different shapes or sizes, and distributed in the urban area. The unclear ownership of some industrial wastelands makes it difficult for the redevelopment and utilization. The industrial wastelands are difficult to reuse because of the former various functions and complicated situation.

2.4. Serious environment pollution and ecological degradation

As the original coal production base, the industrial wastelands were suffered from multiple pollutions. The mining activities discharged waste gases and solids, which caused serious pollution to air, water and soil. Although the air pollution can be slightly eased, the solid waste will bring long-term damage to the nearby soil and water. The impact on the nearby community and environment is serious. For example, the mining area is 80 ha in Xiaqiao Mine, and an area of 15 ha was covered with coal gangue. There was an area of 23 ha damaged by the illegal digging of the coal gangue. Destruction of ecosystem caused critical impact on the nearby residential area of Xiaqiao Mining area. The advantage and attraction of the city centre were diminished.

3. Re-evaluation of the industrial wasteland

3.1. Economic output value

In the aspect of the renewal of mining cities, the regeneration and reuse of the Xiaqiao industrial wasteland can acquire a great deal of constructing land. The reuse of land involves many ways: to provide the industrial field for the high-tech business enterprises based on environmental protection; to explore residence zone with mining features in order to make population accumulate in the south of Jiawang district where the environment is worse now; to built up a large base for leisure and education and provide the spaces of amusement and studying for the citizens. No matter which form it develops in, the redevelopment of Xiaqiao industrial wasteland will be beneficial to the local economy.

3.2. Historical and cultural value

Although the mining activities have destroyed the natural physiognomy seriously, the long history and special forms of the industrial wasteland have also formed the special humanism and historical landscape of the mining areas. The places and constructions that were used for mine exploitation have become the symbols of the mining area, which refracts the dynamic changes of the economic and social development in mining cities.

3.3. Ecological value

In Xiaqiao industrial wasteland, new areas with higher ecological value around many buildings or water have appeared. The abundant original biology species can be reserved, and the microorganism circulation provides the living space for many species, which can increase the species of the mining cities. On the other hand, the special manifestation of the industrial square will increase the landscape elements of the mining areas, such as waste dumps, abandoned industrial facilities and factory construction, new water system, etc. The redevelopment of the field will make their mining features emerged in front of people.

4. The goal of redeveloping industrial wasteland

The re-development of industrial wasteland can be regarded as not only an opportunity of economic development, social progress, environmental improvement in urban renewal, but also an opportunity to reshape the image of the city. The city renewal should be based on adjustment of the whole functions and structures in the city, and pay
attention to the comprehensive target of the city’s competitive abilities, urban human settlement and overall social
development instead of purely paying attention to the improvement of the city material space. So after shutting
down the mines, Jiawang District needs to not only integrate the material space, but also integrate the economical
and cultural structure into the whole frame of the city renewal. By synthesizing the material and non-material factors
of the mining city renewal, the main targets of the redevelopment of the industrial wasteland in Jiawang District can
be summed up as follows:

- Explore the potential of the industrial wastelands, and turn burden into resources;
- Improve the whole eco-environment of the industrial wasteland and construct new city space;
- Release the contradiction in the mining cities and create new employment opportunities for the unemployed;
- Create the city landscape with the historical meanings and change the dirty, disorderly and bad image of the
  mining cities in people’s mind;
- Attract investment outside and validly improve the industrial structures of the city.
- Guide and build up a comprehensive new city center of culture, recreation and business based on the old
  industrial base.

5. The strategic analysis on re-exploitation of the wasteland in mining area based on the theory of
"innovation and integration of resources"

"Innovation and integration of resources" is a process of restoring the function of industrial wasteland, in which
"old resources" are converted into "new resources". It plays an important role in helping the mining cities to come
out of the plight of resource exhaustion. However, it is impossible to achieve the maximum effectiveness without
coordination between the industrial wasteland and the surrounding existing excellent resources in the city.

To support the economic transition process of Jiawang District, a large amount of construction land is required
urgently to build new plants. In addition, the expansion of local existing plants, the improvement of basic facilities
and the building of new countryside also call for much construction land. As the Xiaqiao industrial wasteland in
Jiawang District is located in very convenient position, the land should be first considered in the future land reuse
plan. The potentialities of the inventory land should be exploited by introducing multi-industry actively to increase
the efficiency of land use. The redevelopment of the industrial wasteland should be under the guidance of both the
market and the government, which leads to the industry replacement adjusted to the city functions and the ecological
environment.

5.1. Determining the property rights of the industrial wasteland and realization of the harmonious transformation of
the mining region

In the sense of the property rights of land development, the Government of Jiawang District can formulate land-
use and land-trade regulations to define the ownership of the mining wasteland to reduce the resistance during the
process of land development, that is, the rules and regulations on transference, lease, and exchange of wasteland
should be set up and the market mechanisms should be utilized fully. The free circulation of land property rights
between the government and investors should be permitted in the development process. The access to land
ownership, the right of exploitation and the right of operation should be adjusted to the law of supply and demand of
the land in mining area, so that the limited land resources and industrial heritage resources will be optimally
allocated.

The further development of industrial wasteland should be led by government and attended by land owners, users,
investors and local residents and so on. Their interests and financing problems can be discussed in the form of round
tables. The multi-cooperation mechanism should be established in a healthy atmosphere to realize the revival of old
mining cities and to maximize the interests of all participants involved. In fact, this form of cooperation has already
come into being in the process of re-exploitation of industrial wasteland. In the west countries the cooperation
between the government and the civil is usually called "public-private partnerships". That means non-governmental
organization (NGO) gives ideas, councils of expert make professional assessment, and then the government develop
them into formal elements of urban planning. Government and NGO join hands in the entire process of making and
implementing the planning.
5.2. Reducing pre-exploitation cost of wasteland with social and market strength

The costs of land lease, land relocation, land pollution control, and safety assessment account for a significant portion of total costs. In order to create more development opportunities, the government should formulate a set incentive fund of re-development and re-use, and rely on market mechanisms. In addition, the positive policy levers will be applied to attract developers to invest plenty of money into industrial wasteland. In particular, the government can use such measures as grant, subsidy, loan, investment, and tax incentives, as well as transfer of development rights to encourage the injection of funds into the market to reduce the prophase costs of development. According to the case studies in China and other countries, it is clear that all the re-development projects of industrial wasteland were not self-contained, and should follow the "large-scale investment in large-scale income" principle. Besides, it is necessary to establish the cooperation between central and local governments, private sectors, voluntary groups, as well as the local communities and the proper dynamic adjustment of economic input-output in accordance with changes in the external environment.

5.3. Enhancing the effect of planning and the enforceability of the planning projects

In the long term development of the mining cities, the development of coal mining enterprises and local authorities was isolated from each other. In large coal enterprises, "social enterprise" has a significant position, which creates a huge gap between the development of mining area and city. After the termination of coal production, new industries and new features as the essential requirement must implant a new urban area with adaptation. First of all, it is supposed to strengthen the weak connection between wasteland and urban area by breaking the original layout and making organic connections between many aspects of the urban area which was for the purpose of coordinating development of mining city. Therefore it’s essential to break the former ownership boundaries. We should give overall consideration that brings the wasteland into the total stock land of urban construction to cooperate and plan the land. Because the locations, sizes and levels of pollution of the industrial wasteland are different, the subjects of investment are various too. Therefore the key to combine both the internal and external resource advantages together and reach the full potential of industrial wasteland is to take suitable measures.

5.4. Improving the environment and reshaping the ecological landscape

Mine industrial wasteland, as an integral part of the city, tends to occupy an important position in the city spatial structure. In the manner of effective and systematic environment reform and reuse, it will promote and improve the surrounding region as well as urban human settlement. Take Jiawang District for an example, the entire old district is surrounded by different types of industrial wasteland. The obsolete industrial squares of Xiaqiao Mine and Hanqiao Mine are in the south with the two subsidence areas including the Nanhu Lake and the Shanghu Lake. In the northern part of the site, there are a closed cement factory and mountains and waters damaged by mining. The urban environment has undergone severe damages because of limitations of the southern coal mining subsidence area and the northern quarry for a long time. Nowadays for the renovation and ecological restoration of the damaged mountains and waters, the city government will take the opportunity to re-shape the urban landscape and urban image. Eco-landscape established in subsidence area and the wasted quarry will have a positive impact on the surrounding area, and also complement and enhance the urban functions, which make it integrate with the city center.

In the long term process, mine industrial wasteland will gradually form the new ecological environment and become the new habitat of microorganisms and animals and plants, and even become the public space with special ecological values and functions in the city. It has the positive meaning to adjust the urban micro-climate, protect ecological environment of the city and maintain ecological balance. To establish a good environment basis for the industrial wasteland, we should take the following measures: restoring and protecting ecological environment of wasteland, protecting biological diversity, maintaining the uniqueness and integrity of nature and landscape, fulfilling living space of the species, producing and recovering commensalisms.

5.5. Protecting industrial heritage and building special characteristic of mining region
With the industrial reform, a large number of industrial buildings and equipment have been idle. They should be set as an important part of cultural heritage. During the process of function replacement, Hanqiao should take advantage of old mining area and make full use of the historic and cultural heritage actively. The whole set of Hanqiao Mine and industrial production system is relatively complete, of which the system structure and vegetation system should be restored after the mine closure. Hanqiao should also properly make use of industrial heritage to establish new industrial landscape. The guidance on such regeneration is to take advantage of historic and cultural factors in the land development as well as to avoid large-scale demolition and reconstruction. The government should organize the overall assessment on the industrial wasteland of Xiaqiao Mine and Hanqiao Mine as soon as possible, for the purposes of setting up a series of hierarchical classification of protection standards and taking different measures to use the industrial heritages rationally. The planning department should coordinate with the Cultural Relics Administrative Department. They should not only delimit the protection scope of industrial heritage sites, but also prepare for the corresponding industrial heritage conservation planning which should be integrated into the master plan of city construction.

In addition, the use of industrial heritage is an opportunity to build the urban brand. Facing with the intense competitions brought by the economic globalization, it is very crucial to shape a city brand of urban management and sustainable development. We should take measures to identify and preserve the industrial heritage with multiple values and characteristics in the industrial wasteland of the mining area. The Industrial symbols and landscape with special meanings play an important role in re-organizing the environment of urban space in Jiawang District. All of the above measures will enhance the culture and the history of the city and establish the distinctive characteristics of the urban landscape of the mining area, which have a significant value for the Xuzhou city.

Acknowledgements

Fund Project: National Key Technology R&D Program in the 11th Five year Plan of china, “Key technology research of regional planning and economical use of urban land”, 2006BAJ14B07-01.

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