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## Study on the influences of industry transformation on the sustainable development of resource-exhausted city space

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### Abstract

Resource-exhausted cities, a special type of cities relying heavily on resource economy, take on some distinct characteristics in the development of industrial structure and urban space. The resource-oriented industrial structure has determined the loose and mixed layout of urban space, the structural imbalance of major functional land use, the crisscrossing pattern of towns and villages and the unreasonable spatial development sequence. The existing urban spatial pattern can no longer meet the demand of urban development. Considering that the evolution of the spatial structure of resource-exhausted cities is a slow process lagging behind industrial transformation, this paper analyzes the industrial transformation manifested in urban spatial structure and reveals the mechanism through which the industrial transformation affect the sustainable development of urban space, so as to provide guidance to improve the coordination and harmony of urban spatial structure and industrial structure, further promote the smooth transformation of resource-exhausted cities and achieve the sustainable development.

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*Keywords:* resource-exhausted city; industrial transformation; urban spatial structure; sustainable development; influences;

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### 1. Research Background

#### *1.1. The predicaments and complicated development environment of resource-exhausted cities during the period of rapid urbanization*

Currently, China is experiencing the rapid development of urbanization. Against a background of sustainable economy growth and urbanization, a type of cities are developing difficultly or even facing

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survival crisis, that is the resource-exhausted cities, which emerge on exploiting natural resources and now face industrial transformation. There are totally 118 resource-based cities relying on coal, forest, oil and others in China, among which 44 cities are listed successively as resource-exhausted cities. In recent years, due to the impacts of gradual exhaustion of resources, the increase of mining costs, the supply-demand changes of resource products as well as the increasingly sharp and rooted contradictions, the resource-exhausted cities are confronting with various complicated predicaments, which have severely hindered their sustainable development. The predicaments are mainly manifested in the following aspects: the crisis of resource and environment upon which the cities develop; the deterioration of living and ecological environment; the highly simplified and unbalanced industrial structure; the sharp contradiction between the management system and the interest mechanism. Resource-exhausted cities have become the “problem cities” in China’s sustainable development.

### *1.2. Contradictions between urban development and urban spatial patterns of resource-exhausted cities under low-leveled industrial structures*

Since ancient times, the social and economic development has always been the internal cause of the advancement of urban spatial pattern. The resource-oriented industrial structure has determined the loose and mixed layout of urban space, the structural imbalance of major functional land use, the crisscrossing pattern of towns and villages and the unreasonable spatial development sequence. The existing urban spatial pattern can no longer meet the demand of urban development in the following aspects. First, while the demand of urban construction land keeps increasing, the land is still divided into pieces by mining covered areas, subsidence areas, railways and high-tension cables. The highly dispersed urban spatial pattern leads to the low efficiency of urban land use, thus hindering the city from developing into a regional center with powerful attracting and radiating force. Second, the city functions are in disorder. The facts that the residential land, the public service facilities land and the industrial land are mixed together and that industrial land is scattered randomly make it hard for the cities to establish cooperative relations and to achieve scale merit, thus becoming disadvantageous for the transformation of city industrial patterns from the extensive mode to the intensive mode. Third, influenced by traditional land use patterns, enterprises and organizations of each leveled use land so randomly that the city is mixed with the mining areas of mixed functions in current city layout, which not only increases the costs of the construction and the operation of city supporting facilities, but also causes the waste of the land, thus becoming unfavorable for city’s unified management. Fourth, the contradiction between resource exploitation and city construction becomes increasingly sharp. Many cities are mixed with mines, and some cities and towns are even located in the mining areas. Such city layout has led to the predicament of “construction-mining- moving”, thus influencing citizens’ living and life quality.

## **2. Analysis of the evolution of spatial structures of resource-exhausted cities during the period of industrial transformation—taking Jiaozuo City as an example**

### *2.1. Development of industrial structures and urban space in Jiaozuo*

Jiaozuo City develops on the basis of coal industry and its coal mining history can date back to the middle of the 19th century. Although resource industry once played a dominant role in national economy, the benefits of the resource-based industry sharply fall down and other problems like city unemployment and pollution also appear with the gradual exhaustion of coal resources. Under such background, Jiaozuo begins its hard and enduring industrial transformation. In 1999, Jiaozuo announced clearly to transform the city industrial pattern and develop vigorously the tourism. In May 2008, Jiaozuo was listed officially

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