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Research on sustainable development of resource-based small industrial and mining cities—A case study of Yangquanqu town, Xiaoyi, Shanxi Province, China

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Abstract

Among all the 119 counties (cities, districts) in Shanxi province, China, there are 94 counties with coal resources, and 80% are resource-based mining cities. Since 2008, a number of small coal mines have been shut down due to the integration of coal resources in Shanxi Province, as well as merger and reorganization of large state-owned coal mining enterprises are under efficient operations. This series of integrations highlights the issue of channels of employment in industrial mining cities in Shanxi province, followed by issues such as urban labor triage, underdeveloped urban functions, and function transformation lagging behind industrial transformation, shortage of follow-up sustainable development driving force and so on. This paper takes small industrial mining cities in Shanxi province as the research subject, taking their function transformation and various problems during the sustainable development as the main content, to propose relevant strategies for the sustainable development; therefore, this study is with great significance to all-leveled resource-based industrial mining cities, which are in transition period, in Shanxi province.

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1. Introduction

Since 2008, a number of small coal mines have been shut down due to the integration of coal resources

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in Shanxi Province. This series of integrations highlights the issue of channels of employment in industrial mining cities in Shanxi province. In this paper, we get rid of the misleading concept of achieving sustainable development by emphasizing industrial transformation but neglecting function transformation, and proposed five strategies to promote the transformation and development of urban functions. It is hoped that the lessons learned from this research can be transferred to similar planning exercises for small industrial mining cities in China and elsewhere that cities are undergoing rapid transformation. Sustainable development of this study is meant to encompass a more balanced consideration of environmental, social, and economic values, as opposed to planning in the past which have tended to favor economic growth at the expense of other values.

2. Background

2.1. Concept of resource-based small industrial mining cities

Resource-based small industrial mining cities are driven by the exploitation of mineral resources, being characteristic with resource-based leading industries and professionalized production. In these small cities, more than 40% of the workforces are directly or indirectly engaged in the exploitation, production and business operation of certain resources with the same feature. The direct cause of its formation is the limited exploitation of non-renewable resources.

2.2. General situation of resource-based small industrial mining cities

Shanxi province is rich in coal and mineral resources, with 62,000 square kilometers coal-bearing area, which accounts for 40% of the total land area. The identified coal resource reserves are 265.2 billion tons, accounting for 26% of coal resources nationwide. Shanxi province is the typically resource-based.

Resource-based industrial mining cities in Shanxi are constructed or developed by relying on resource development. Their leading industries are mining and quarrying industries and primary processing industries, centering on resource development. Among all the 119 counties (cities, districts), 94 are with coal resources, 80% of which are resource-based industrial mining cities.

2.3. Development of resource-based small industrial mining cities

After the founding of People's Republic of China, the development resource-based small industrial mining cities in Shanxi can be divided into four phases:

- The first phase: period of rapid development(After the founding of People's Republic of China -1980)
Features: implementation of heavy industry priority strategy; as the basic material production sector for industrialized development, resource-based industries are with extremely important roles, and resource-based cities are also with prominent positions among the layout of national productivity.
- The second phase: early period of recession(1980 -1990)
Features: the transition period from planned economy to market economy; the development of Shanxi mining and industrial cities, especially coal-based cities, meets with recession.
- The third phase: the plight of development(after the mid-90s)
Features: market economy is gradually improved, and the concept of sustainable development is deeply rooted, but the plight of development of resource-based cities has become more prominent. "Four mine-related issues" (mining town, mining industry, mines, miners) and "three-dimensional rural issues" (concerning agriculture, countryside and farmers) are defined as the difficult points in the sustainable development in China.

- The fourth phase: transitional period of development("The tenth five-year plan" to now)

Features: with the implementation of strategy of revitalizing the old industrial base and policies supporting the sustainable development of resource-based areas, resource-based small cities, which are with a large amount and wide coverage, gradually become one of the research highlights due to their urgent demand of transformation to boom sustainable development.

2.4. Current problems of unsustainable development

2.4.1. Alarming waste and damage of resources

Since the Reform and Open-up, Shanxi has exploited 8 billion tons of coal in total, but the consumption of resources is as high as over 20 billion tons; exploitation of 1 ton of coal consumes 8 tons of mineral resources, which are associated with coal resources; annual coal bed gas due to the emissions of coal exploitation is about 6 billion cubic meters, equivalent to half of the annual amount of the first stage of " West-to-East Gas Pipeline Project"; damaged area of water has reached 20,000 square kilometers, with per ton of coal digging consuming 2.48 tons of water.

2.4.2. Serious ecological destruction and environmental pollution

The area of resource-based small industrial and mining cities in Shanxi province is 8,000 square kilometers, but the underground goaf reaches 5,000 square kilometers; 13 resource-based industrial mining cities in Shanxi province are included on the list of the nation's top 30 cities with the most serious air pollution; the food production in major resource-based industrial mining cities in Shanxi declines by 117 million kg each year, leading to a economic losses with 94 million yuan; area with alarming geological disasters reaches 2940 square km, with an annual increase of 94 square kilometers of subsidence area, the range of occurrence of secondary geological disasters involving 1,900 villages with million of people affected; the waste water from mines in Shanxi province seriously pollutes the surface water body, polluted rivers with a total length of 3753 km; the coal gangue stockpiles from Shanxi resource-based small mining cities has reached 1.1 billion tons, with an annual increase of 50 million tons.

2.4.3. Grim safety situation in coal mine production

There are frequent mining accidents, and the death toll accounts more than 70% of deaths throughout the industrial and mining accidents.

2.4.4. Highlighted resource exhaustion issues

It is estimated that by 2020, among resource-based small mining cities, one-third of state-owned coal mines and half of town-owned coal mines will have been shut down due to resource exhaustion. In addition, some typical mining cities will lose the resource-based economic pillar, facing a full swing transformation of all its industries.

2.5. Summary

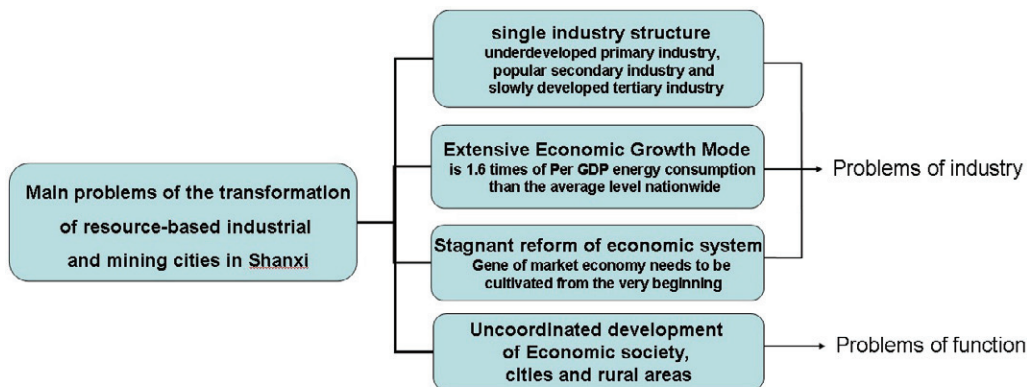
Coal resources in Shanxi province is a double-edged sword for the development of its small cities. On one hand, the coal resources promote the current development of local economy; on the other hand, they also inevitably threaten the benefits of future survival and development. As to the series of "survival and development" issues, resource-based industrial and mining cities are in urgent need of guidance under the nation's and province's new policies to achieve the planned and targeted urban transformation to realize the sustainable development.

3. Core issue

3.1. Misleading concepts of the sustainable development

Undoubtedly, for resource-based small industrial mining cities, the mission is to get rid of the dependence on the original resource industries; therefore, the focus of cities' leading industries should be shifted from exploitation and processing of non-renewable resources to other industries. Finding new leading industries has become the best way to the realization of striding transformation and of sustainable development of resource-based cities in Shanxi province.

Table 1. Main problems of the transformation of resource-based industrial and mining cities in Shanxi



To be more specific, the transformation of resource-based industrial mining cities is mainly attributed to the industrial transformation and urban function transformation: industrial transformation is the most critical part of the transformation of resource-based industrial and mining cities, thus the city transformation will be lack of basis without industry transformation. Meanwhile, transformation of urban functions is the guarantee of industrial transformation, which is difficult to succeed without urban function transformation. From some perspective, for such cities the industry transformation and the urban function transformation are tightly connected and are indispensable. To a certain extent, the transformation of resource-based industrial mining cities is a process of self-denial, self-sublation and self-innovation of urban development.

However, on the way of development and transformation of resource-based small industrial mining cities, relevant departments and urban planning workers are influenced by physical form-exploration planning and economic indicators, lacking of recognition or ignoring the significance of urban function transformation. The current urban planning only focus on the economy transformation and development but neglect the transformation and development of social function; or even worse, they equal the urban transformation and development with the urban economy transformation and development. The

expectation of urban planning is that the effectiveness of the measures of urban development can be indicated from economic and industrial data, largely ignoring the cities' social and cultural functions. Transformation and development of small cities are trapped in the misleading areas, which attach more importance to industry transformation than to urban function transformation, and have priority on the industry transformation over urban function transformation, resulting in a serious obstructed sustainable development.

3.2. Core issue of sustainable development

In the nation's "Twelfth Five-Year Plan", it mentions the contents on the sustainable development of small cities: "To enhance the public service function and residence function of small cities...to take advantage of resources and ecological security barrier; to strengthen infrastructure construction and environmental protection; to develop science and technology education; to support the development of characteristic industries". Furthermore, in the current society which pursues the harmony between human beings and the nature, the core issue of the sustainable development of resource-based small industrial mining cities goes to the propose of and solutions to these issues. The targets are to gradually recognize and emphasize the importance of urban function transformation, to establish and improve the work of urban transformation, and to equal the significance of urban function transformation and industrial transformation.

Since 2008, a number of small coal mines have been shut down due to the integration of coal resources in Shanxi Province, as well as merger and reorganization of large state-owned coal mining enterprises are under efficient operations. This series of integrations highlights the issue of channels of employment in industrial mining cities in Shanxi province, followed by issues such as urban labor triage, underdeveloped urban functions, and function transformation lagging behind industry transformation, shortage of follow-up sustainable development driving force, citizens' lack of confidence of the future of urban development and so on.

In order to achieve the three-dimensional transformation and sustainable development, and to get rid of the misleading concept of achieving sustainable development by emphasizing industrial transformation but neglecting function transformation, resource-based small industrial mining cities need to improve the public service infrastructures, enhance and improve the function of small cities, explore historical and cultural characteristics of small mining cities, enhance the city image, attract popularity among the public, reshape urban residents' local consciousness and urban pride and promote transformation and development of urban functions.

4. Strategies ---- a case study of Yangquanqu town, Xiaoyi, Shanxi Province, China

4.1. Geographical location conditions

Yangquanqu, located in the west of Xiaoyi, Shanxi province, is a town on the economic development axis; it is the key development region in the city. The town area covers 74.3 square kilometers with a total 40000 population. The township is only 25 km away from Xiaoyi, within the fringe areas of Xiaoyi and the key market fallout range.

The township locates in the valley of Duizhen River, with mountains on its two sides. The township area is with a belt shape; therefore, its space for development is rather limited. Furthermore, combined with serious environmental pollution brought by industries and transportation and the limited land in the city, the conditions for urban development are rather poor, seriously hampering the city's further development.

4.2. Introduction of the current situation in the town

Yangquanqu is rich in coal and bauxite resources, with coal, bauxite production and primary processing as its leading industries. Xiaowu road goes across the town from east to west. Meanwhile, Yangquanqu is the termination of Jiexi railway, which is mainly used for coal transportation, connecting Taiyuan.

Yangquanqu, located on Liuxiao economic development axis and Jie-Xiao-Fen complex economic location, is also a significant part of the energy and raw material base in Shanxi province. It is close to the central area of the economy developing zone of Shanxi with a convenient connection in space.

In terms of rich mineral resources, convenient transportation and good location characteristics, Yangquanqu is with a mixed distribution of minerals, towns and villages: the residential area in Liuwan mining region is in the northwest of the town, with 25,000 people, accounting for over 60% of the total population in the town. The mining region also has more matured public service facilities and better urban function structures. The township takes a belt shape of layout along the road with 3000 people and far-from-perfect urban functions. There are several natural villages scattered around the township.

As Shanxi Government to further promote the implementation of the policy concerning on reorganization and mergers of small and medium sized coal enterprises, super-heavy industry chain in Yangquanqu is in a semi-stagnant stage. Major mining enterprises reduce production and lay off staff, which leads to a lack of power for sustainable development in the city, a unhealthy development mode, which refers to urban function relying on urban industry; thus, transformation and upgrading of urban function are desirable.

4.3. Strategies for urban restructuring and development

In terms of the mixed distribution of minerals, towns and villages in Yangquanqu, coupled with its lack of fund for development, malformation of industry structure, limited space for urban development, mixed transportation function and inadequate employment capacity, five strategies are proposed to promote the transformation and development of urban functions.

4.3.1. public service strategies: improving facilities and taking services as priority

Investment on schools, stadiums, cultural and leisure establishments, medical institutions and other urban public infrastructures needs to be increased, to further improve basic supportive public service facilities, improve the living environment, enhance the quality of urban services, to effectively promote restructuring and development of urban functions, and to ensure the orderly and safe operation of public utilities. During the practice, remarkable achievements in certain phases are gained.

Furthermore, private investment should be encouraged into fields of infrastructure, public utilities, policy-based housing construction, social cause and so on. According to relevant policies of National Development and Reform Commission and local government, the idle funds during the exit of small and medium sized private mining enterprises due to restructuring should be invested into the construction of urban infrastructure and public service facilities, to improve the hardware of the city, providing good material guarantee for the improvement of urban functions.

4.3.2. industry strategies: to consolidate foundation and pursue ecological transformation

For most small cities, the advantages of agricultural industry and ecological resources are the basic

conditions to distinguish themselves from big cities. During the urban development and construction of Yangquan town, the favorable ecological conditions are ignored due to pursuing the immediate economic interests and blind single-way development of mineral resources. The scope of land for urban construction, mineral resource reserve and underground goaf in Yangquan town mainly concentrates in the east area, while most of the land in the west is for agriculture, with a better ecological condition than that of surrounding areas. The pattern of urban development should be adjusted by consolidating the significance and position of agriculture, in order to fulfill the transformation from traditional farming to modern and ecological farming.

4.3.3. land use strategies: land consolidation for compound use

Land for urban development in Yangquan is limited, and urban infrastructure and public service facilities layout suffer from non-available land. However, the layout of urban construction land is with a significant trace of the development of private mining industry in Yangquan. In 2008, mining industry went through a restructure, and the drop out of small private mining companies, which were at the bottom of the industry chain, offered new space for urban development, giving new space and opportunities for urban infrastructure construction, the improvement of various urban functions and more efficient compound use of urban land.

4.3.4. transportation strategies: to alleviate pressure of transportation and improve its function

Yangquan is with a east-west layout along its original road (Xiaowu road), which is the lifeline for the transportation of the city, shouldering the dual functions of daily transportation and mining transportation, but the conflict between these two functions are increasingly irreconcilable, becoming obstacles to the layout of urban living and service, hindering the enhancement of urban functions. In order to effectively alleviate the pressure of inner city goods transportation and strengthen the daily transportation function, first of all, an outer ring road should be built along the mountains in the south to shoulder the functions of goods transportation and transit transport, in this way, the goods transportation function of Xiaowu road is effectively separated from its daily transportation function; secondly, exit road for Xinliu minerals should be planned to connect 340 road, which is in east-west direction, and the outer ring road, in order to involve the outer ring road into a wider range of goods transportation to better its function; in addition, the four north-south inner city roads should be connected to strengthen the connection between the urban area and living area in mining regions, to realize the combined development of these two areas and share the public service infrastructures; finally, the waterfront environment of the city should be purified, and a waterfront pedestrian system should be established to strengthen the connection among mountains, water and the city, creating a good environment for urban transformation and its function enhancement.

4.3.5. employment strategies: mergers and reorganization for further development

Through the comparative analysis of productivity of 11 prefecture-level cities after the mergers and acquisitions among medium and small coal mining enterprises in Shanxi province, it concludes that the number of mines in Luliang region (Yangquan belongs to Luliang city) decreases by 60%, but its productivity has remained relatively stable. From this perspective, the lack of employment opportunities in Yangquan is mainly due to the current corporate restructuring, and the production has not yet on a

normal level. When the production goes back to a normal state, the number of employees in coal mining industry will also go up and the city will be infused with vitality again.

5. Conclusion

For historical reasons, areas, such as Shanxi, which rely on resources and development of heavy industries, have more serious social transformation and economy restructuring problems, compared with other regions in China. Based on this fact, small cities should seize new opportunities for development, adopt standardized and energy-saving requirements to launch a new round of constructions. The problem of space for further development should be solved by respecting the ownership of land in mineral, towns and villages, while meeting residents' demand for improved function, enhanced quality and more attracting environment. Meanwhile, small cities also should pursue a more efficient use of urban land to nurture and enhance new urban functions, prompting cities' gradually weaker degree of attachment to the coal resources and restructuring of urban function, to embark on a new path of sustainable development.

Because of constraints of research duration and related data and information, this paper takes Yangquan town as an example, proposing strategies of transformation of urban function and sustainable development of some small cities in Shanxi province, which are with better transportation and ecological conditions but trapped in a plight of development due to the mergers and restructure among coal mineral enterprises.

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