Research on Sustainable Development Strategies of Resource Depleted Cities under Eod Innovation Mode

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Abstract. Under the development orientation of Chinese modernization, the construction of ecological civilization and sustainable development region is more and more important to the state, as the original non-renewable resources, after a long period of uncontrolled exploitation, resource depletion of resource cities resource-exhausted areas, want to take advantage of the green development of the east wind, to open up a new road of transformation in line with the characteristics of the region, but also need appropriate strategies and rational thinking, this paper takes Fuxin City as an example. This paper takes Fuxin City as an example, evaluates its transformation development data over the past two decades by using factor analysis, and explores the fundamental reasons for its slow transformation development. The study finds that the current organizational model of Fuxin City's transformation development mainly consists of governmental task forces, enterprises and social groups, and promotes urban development transformation through the triple mechanism of overall coordination, innovation diffusion and demand perception. However, the operational efficiency of this model in urban renewal has been reduced due to the lack of social participants, the weakness of government-enterprise synergy, and the lack of in-depth technological integration. Therefore, this paper attempts to construct the EOD urban partnership model based on the platform governance theory, drawing on the successes of existing models and the urban partnership system, and taking the city information model (CIM) platform and generalized artificial intelligence technology (AGI) as the kernel, and constructing the EOD urban partnership model from the five aspects of the expression recognition mechanism, empowerment and release of energy mechanism, feedback and learning mechanism, betting coordination mechanism, and regulatory access mechanism, as well as putting forward relevant policy recommendations. In addition, we propose relevant policy recommendations in order to promote the green and high-quality development of Fuxin City in the future.

Keywords: City Information Modeling (CIM) platforms ; Sustainable Development ; Eco-Oriented eod Model; Generalized Artificial Intelligence Technology (AGI)

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1 Introduction

China is a coal rich country, with coal as the main energy source. 65% of chemical raw materials and 85% of urban residents use coal as fuel[10]. This shows the importance of coal energy for China's production and development. However, with the excessive exploitation of resources and non renewable natural limitations, many resource-based cities have entered a period of depletion. At the same time, most resource-based cities in China have faced a large number of social problems due to their single industrial model and weak economic growth momentum over the years. The demand for urban transformation is urgent. As the first batch of transitional cities, Fuxin has been trying to transform and develop for the past 20 years, but the results have been minimal. What are the reasons that hinder Fuxin's transformation and development? What is the reason for the slow progress of Fuxin's transformation? Given the limited amount of indicator data and analysis materials in Taiping District, Fuxin City, this article evaluates its transformation and development based on the data indicators of Fuxin City over the past 20 years, identifies key factors that affect transformation, and formulates relatively suitable transformation strategies in order to provide new ideas for the subsequent development of Fuxin City.

2 Construction of Evaluation Indicators for the Effect of Urban Transformation in Fuxin City

In order to find the root cause of development constraints, this article analyzes the transformation data of Fuxin from 2002 to 2021. To ensure the accuracy of the evaluation, the transformation evaluation indicators mainly refer to literature such as "Research on the Transformation System and Evaluation of Resource Based Cities" [6]. and "Research on the Transformation Evaluation of Resource Exhausted Cities in China" l[7].After fully considering the current development situation of Taiping District in Fuxin City and the difficulty of obtaining data, we organize ourselves to construct the transformation effect evaluation system shown in Table 1.

Table 1. Fuxin City Transformation Effect Evaluation Indicator Systemarbon emission evaluation index system of prefabricated buildings

Level 1 indicator	Level 2 indicator	Level 3 indicator	Coding
Social system A	Basic security and life	Social security and employment expenditure A_{11}	X_1
	Quality of life A_1	Per capita disposable income A_{12}	X_2
		Engel's coefficient A_{13}	X_3
		Health technicians per 10,000 population A_{14}	X_4
	Scientific and educational level A_2	Expenditures on science and technology A_{21}	X_5
		Expenditure on education A_{22}	X_6

		Number of students enrolled A_{23}	X_7
	Employment A_3	Unemployment rate A_{31}	X_8
	Population growth A_4	Number of people with household registration in the region A_{41}	X_9
		natural population growth rate A_{42}	X_{10}
Economic system B	Economic development B_1	Total investment in fixed assets B_{11}	X_{11}
		GDP growth rate B_{12}	X_{12}
		GDP per capita B_{13}	X_{13}
		General public budget growth rate B_{14}	X_{14}
		Total retail sales of consumer goods B_{15}	X_{15}
	Industrial structure B_2	Secondary sector GDP as a percentage of GDP B_{21}	X_{16}
		Value added of tertiary sector as a share of GDP B_{22}	X_{17}
		Value added of tertiary industry B_{23}	X_{18}
Resources&Environment Systems C	Resource stock C_1	Total sown area of crops C_{11}	X_{19}
		Total water supply C_{12}	X_{20}
	Depletion of resources C_2	Electricity consumption of society as a whole C_{21}	X_{21}
		Energy consumption per unit of GDP C_{22}	X_{22}
	environmental governance C_3	Number of days with air quality at or better than Class II as a percentage of the year C_{31}	X_{23}
		Forest cover C_{32}	X_{24}
		Drinking water quality compliance rate C_{33}	X_{25}
		Industrial wastewater discharge C_{34}	X_{26}
		Industrial solid waste disposal utilization rate C_{35}	X_{27}
	environmental pollution C_4	Sulfur dioxide emissions C_{41}	X_{28}

Note: The data of relevant indicators come from 《 Research on Transformation System and Evaluation of Resource Cities》, 《Research on Evaluation of Economic Transformation of Coal Resource Depleted Cities》

Considering that traditional AHP experts generally use a 1-9 scale method for scoring, which has many subjective components, in order to reduce the subjective one-sidedness of the AHP method, resulting in a lack of objectivity and accuracy in the calculated weights, this article uses factor analysis to evaluate comprehensivelyOnlin group members.

3 Evaluation and Analysis of the Effect of Urban Transformation in Fuxin City

3.1 Process of Factor Analysis

Taking the factor analysis process of the social system as an example, data from Fuxin City over the past 20 years were analyzed and processed. Correlation tests were conducted using SPSS software to obtain KMO and Bartlett's test (Table 2). KMO>0.7 (0.708) was suitable for factor analysis; The Bartlett's sphericity test has a large value (186.568) and its corresponding significance is less than 0.00 (0), making it suitable for factor analysis. Extract common factors using principal component analysis. Due to the fact that the feature root must be greater than 1, the total variance explanation is obtained

Table 2. Fuxin City Transformation Effect Evaluation Indicator Systemarbon emission evaluation index system of prefabricated buildings

KMO and Bartlett's test		
KMO sampling suitability quantity		0.708
Bartlett's sphericity test	Approximate chi square	186.568
	Freedom	45
	Significance	0

Total variance explanation

Component	Initial eigenvalue			Extracting the sum of squared loads			Sum of squared rotational loads		
	Total	Variance percentage	Accumulated%	Total	Variance percentage	Accumulated%	Total	Variance percentage	Accumulated%
1	6.608	66.078	66.07	6.608	66.078	66.07	5.371	53.706	53.7
2	1.351	13.505	79.58	1.351	13.505	79.58	2.588	25.877	79.58
3	0.768	7.675	87.25						
4	0.508	5.084	92.34						
5	0.249	2.489	94.83						
6	0.218	2.182	97.01						
7	0.15	1.497	98.51						
8	0.084	0.839	99.34						
9	0.054	0.544	99.89						
10	0.011	0.108	100						

By studying the explanation of total variance and the gravel plot, two factors were extracted, namely F11 and F12. The eigenvalues of two main factors are 6.608 and 1.351, both of which are greater than 1; The cumulative contribution rate is 79.583%, which is greater than the standard value of 70%. All of the above prove that the selected two factors are more appropriate. According to this method, the components of the economic system and the resource&environment system were extracted separately, denoted as the main factors F21, F22, F31, F32, and F33.

3.2 Evaluation of Urban Transformation Effect Based on Factor Analysis Results

Summarize the main factors and their eigenvalues, as well as cumulative contribution rates of each subsystem through analysis using SPSS software. Due to the fact that the weight of the main factor is obtained through its contribution rate, the main factor contribution rate normalization is used to objectively assign weights to the main factors of each system

Table 3. Weights of Main Factors

Primary indicators	Principal factor	Eigenvalue	Accumulated contribution rate	Factor weight
Social System	F11	6.608	6.08%	0.83
	F12	1.351	79.58%	0.17
economic system	F21	4.527	56.59%	0.67
	F22	2.214	84.28%	0.33
Resource&Environmental Systems	F31	4.303	43.03%	0.54
	F32	2.403	67.06%	0.31
	F33	1.224	79.30%	0.15

Using SPSS software, perform the operations of "analysis dimensionality reduction factor score" to obtain the historical scores of the main factors of each subsystem. After summarizing, obtain the "Weights of Main Factors" (Table 3) ,"Main Factor Score Table" (Table 4).

Table 4. Master Factor Score Table

Time	F11	F12	F21	F22	F31	F32	F33
2002	-0.65367	-1.66362	-1.48598	-0.02387	-2.44827	0.85535	-1.13142
2003	-1.18164	-1.1244	-1.434	0.2195	-2.20305	-0.61447	-0.68144
2004	-1.06993	-0.94048	-1.29361	0.22471	-0.2504	-0.99465	3.15674
2005	-1.05819	-0.83844	-1.20191	-0.24549	-1.01709	0.2645	0.30216
2006	-1.09298	-0.78702	-1.04498	-0.08269	-0.98853	0.26481	0.46471
2007	-0.80281	-0.11447	-0.98707	0.1756	-0.76041	0.34108	0.14459
2008	-0.58781	-0.16157	-0.79891	0.42014	-0.15078	-0.04698	0.90354

2009	-0.60997	0.27743	-0.50795	0.62768	-0.05664	-0.22468	0.61059
2010	-0.33457	0.38149	-0.01676	1.11772	0.32804	-0.09875	0.80738
2011	-0.41791	1.49863	0.45036	1.32532	0.75199	1.67899	0.3723
2012	-0.53667	1.85801	0.92575	1.53692	0.83266	1.59546	0.27746
2013	-0.46544	1.95934	1.3843	1.52744	0.78441	1.33311	0.16578
2014	0.07461	0.99402	1.35389	0.84823	0.74207	1.3306	-1.1533
2015	0.81885	0.80534	1.06449	-0.33841	0.78012	0.6256	-0.67522
2016	0.7605	0.19727	0.56693	-1.71017	0.60268	-0.66163	-0.32719
2017	1.43102	-0.28327	0.32717	-1.49224	0.51936	-0.58473	-0.29029
2018	1.2435	-0.3565	0.39662	-1.2651	0.40212	-1.48334	-1.40183
2019	1.43872	-0.29565	0.29064	-1.2981	0.61731	-1.29278	-0.63954
2020	1.44676	-0.74524	0.90545	-0.91061	0.68469	-1.21953	-0.69458
2021	1.59764	-0.66086	1.10558	-0.65658	0.82975	-1.06796	-0.21045

According to Table 4, the scores of each subsystem in the comprehensive evaluation of urban transformation effects in Fuxin City from 2002 to 2021 are plotted as follows Figure 1:

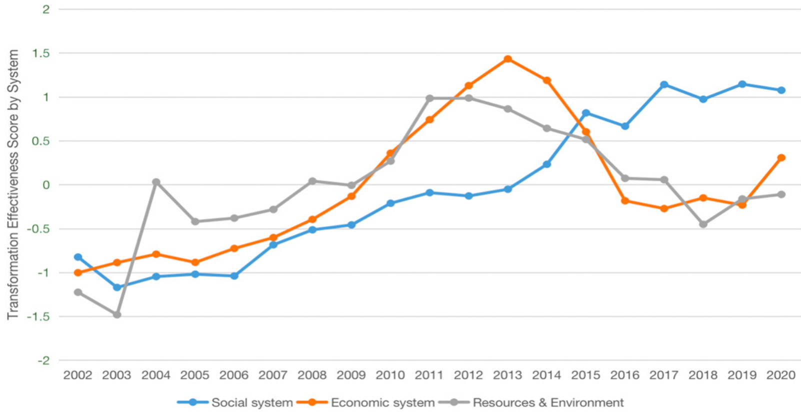

Fig. 1. Score chart of each subsystem for evaluating the urban transformation effect of Fuxin City based on factor analysis method（Author's self-made）

3.3 Evaluation Analysis

(1)Social analysis.As shown in Figure 2, the overall social system evaluation of Fuxin City showed an upward trend from 2002 to 2021, with slight fluctuations in the middle.

Among them, there was a significant decline in 2003, 2016, and 2018. Soft, in a downward trend;

(2)economic analysis.From Figure 2, it can be seen that the overall economic system evaluation of Fuxin City showed a fluctuating upward trend from 2002 to 2021, with significant fluctuations in recent years. Among them, the annual average from 2012 to 2018 was in a declining slope state. Based on the indicator data of these six years, it is found that in 2012, the GDP growth rate, general public budget growth rate, and the proportion of added value of the tertiary industry to GDP in the economic system all decreased by 2.77%, 1.5%, and 0.72%, respectively;

(3)Ecological&Environmental Analysis.As shown in Figure 2, the ecological and environmental system evaluation of Fuxin City from 2000 to 2020 showed similar trends to the economic system, with an upward trend observed from 2002 to 2011. But starting from 2012, there has been a downward trend, with a noticeable decline in 2016 and 2018.

(4)Comprehensive analysis. It is not difficult to see that the transformation effect of the three systems, the economic system and the ecological environment system on the transformation of the city is still more significant, and the traditional methods used by the city, Fuxin City in the transformation of the transition period is also trying to use, but still the effect is not good, the root of the industry and the transformation of the division of the overly distinct, no integrated planning, which is also a common problem of the transformation of resource-based areas, while Fuxin City, the current transformation of the organizational model mainly At the same time, the current transformation organization model of Fuxin City is mainly composed of governmental task force, enterprises and social groups, which promotes the transformation of urban development through the triple mechanism of overall coordination, diffusion of innovations and demand perception. However, the operational efficiency of this model in urban renewal has been reduced due to the lack of social participants, the weakness of government-enterprise synergy, and the lack of in-depth integration of technology. In view of this, this paper attempts to construct an organizational structure under the Eod Innovation Model, based on the theory of platform governance, drawing on the successes of the existing model and the urban partnership system, and taking the CIM platform and AGI technology as the core, to solve the problem of the Eod Innovation Model. Organizational structure under the innovation model as a solution to the existing dilemma

4 Sustainable Development Strategy of Taiping District, Fuxin City Under the Eod Innovation Model

Based on the status quo of Fuxin City's transformation, the existing organizational model of urban transformation is difficult to meet the requirements of high-quality development of the city in terms of participation and interaction of the main parties, and because of the characteristics of its wide coverage, multiple demands, and long project cycle, it needs the deep integration of digital technology and a high degree of interaction among stakeholders to ensure a rapid response to the needs[1]. Therefore, platform governance theory is introduced as a supplement to the existing eod model. The essence of platform governance theory is based on multilateral public platforms, ecosystem resources and cooperative governance rules to connect and promote mutual cooperation among multiple interest groups so as to create public value. Its operation includes the following five aspects: attracting users, matching supply and demand, empowering and releasing energy, creating and distributing value to maintain the balance of interests, and expanding the scale of the platform. In the field of urban renewal, the government, enterprises and the public seek to share power, responsibility and benefits through the partnership model on a multi-platform, multi-sectoral and multi-channel basis, and continue to explore the form of renewal and technological innovation through competitions in order to realize sustainable urban development.

4.1 Phase 1: Overall Layout to Build the Foundation

The overall planning is the basis for the implementation of the EOD program. In terms of organizational structure, the organizational model employs a top-down approach to promote project implementation through the synergy of urban and municipal joint departments[8]. The approach breaks down departmental barriers, allowing for integrated planning and holistic deployment by various authorities. The city partner model experience borrowing refers to the entrepreneurs originating from the business model of the enterprise as a general partner or executive affairs partner to bear unlimited joint and several liabilities, and to execute the voting rights. The management team and technical backbone and other core employees as limited partners, according to the amount of contributions to bear limited liability, for the general partner to share the risk, and thus improve the risk of innovative inputs to the business model change applied to the city management, reshaping the relationship between the government, enterprises and individuals.

4.2 Phase 2: Model Building

Taking the realization of high-quality urban development as the fundamental goal of the EOD city partner model, based on the city information model (CIM) platform and generalized artificial intelligence (AGI) technology to realize the quick response of the government departments, reinforce the relationship between the government, enterprises and the social masses, and enhance the level of regional development to realize the platform-based governance of the EOD project. The specific operation process is as follows: First, the government builds a big data CIM platform, formulates platform guidelines, and plans the general layout of EOD. Secondly, the government departments at district and county levels will cooperate with each other to formulate the EOD project task force, study, approve and consider the specific implementation plan, and construct the government collaboration mechanism of up and down linkage and departmental coordination[4]. The task force according to the actual needs of screening, the formation of partner companies. Third, the enterprise is responsible for the specific realization, and cooperation with local residents and technology alliance. In terms of mechanism function, the urban CIM platform and general artificial intelligence technology (AGI) as the kernel to drive each mechanism, to express the identification mechanism, empowerment and release mechanism, feedback and learning mechanism, betting and coordination mechanism, as well as regulatory access mechanism together to form the EOD city partner model, as shown in Figure 2

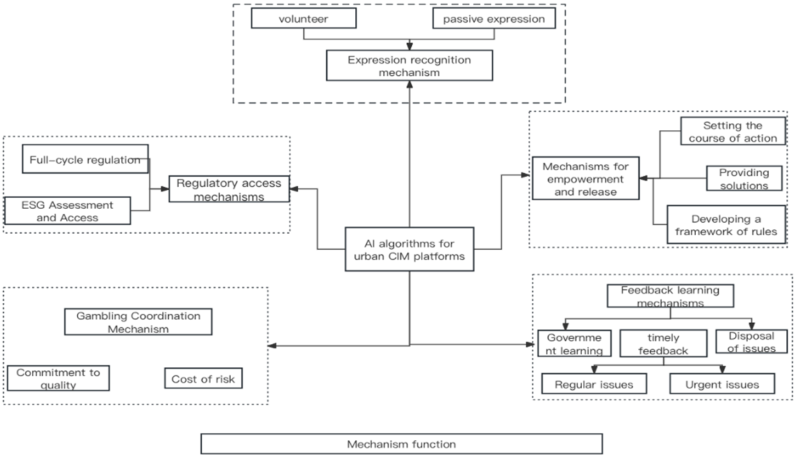

Fig. 2. EOD City Partner Model

4.3 Phase 3: Each Division Has its Own Responsibilities and Mechanisms are Linked

The first mechanism in the EOD urban partnership mechanism is the expression recognition mechanism, which refers to a mechanism that fully understands and absorbs information about the needs and preferences of stakeholders[2] The expression recognition mechanism has two aspects for obtaining information, one is active expression. Using the CIM platform as a gathering place for information and citizen telephone hotlines, mini program apps, and other channels, we integrate residents' needs, questions, and other issues related to environmental updates. We use AI's precise screening and identification functions to quickly assign update tasks to relevant enterprises. The second is passive expression. Supported by big data such as monitoring probes, IOT, and remote sensing, real-time capture of corporate and civilian behavior within the EOD project area, obtain environmental related demands, predict risks, and respond quickly. Next is the empowerment and empowerment mechanism. With the assistance of big data and AI technology, local governments grant certain updating autonomy to implementing entities, citizens, and technology alliances, and fully utilize the professional capabilities of all relevant entities in a bottom-up manner. The feedback learning mechanism is born to respond quickly to the needs of partners, promoting the replacement of professional knowledge through normalized learning and communication. Guided by the needs of a multi-agent environment and using the CIM platform as a data center, a closed-loop docking from the demand end to the execution end is carried out to achieve real-time feedback on update issues, rapid response, and iterative upgrading of update capabilities. The coordination mechanism for gambling is aimed at making gambling agreements on the future effectiveness of EOD projects between local governments, enterprises, and residents, and paying the costs accordingly. Specifically, the basic stage of the EOD project is environmental remediation, with significant environmental improvement effects as agreed upon by the three parties involved, and government subsidies and land appreciation benefits from updates as consideration[3]. And in this process, the CIM platform and AI technology are used to accurately calculate the effectiveness and various investments of the EOD project, thereby motivating all parties to adopt multiple measures to ensure the achievement of expected goals[5]. Finally, the regulatory access mechanism ensures the effective implementation of procedures. The development of cooperation scale and maintenance of high-quality performance determine whether the EOD city partnership model can succeed in the future. Therefore, properly improving the mechanism is conducive to the long-term operation of the model. This mechanism is divided into two aspects: first, based on the CIM platform and AI monitoring algorithms, strengthening data supervision throughout the EOD project process, improving the construction of information disclosure platforms, and clearing out enterprises that do not meet the requirements[9]. Secondly, based on big data, tailored measures should be taken to set green evaluation standards and entry thresholds for enterprises, ensuring that EOD city partners always meet the requirements of industrial linkage, green environmental protection, and innovative features.

5 Conclusions

This paper reveals the fundamental influencing factors affecting the transformation and development of Taiping District of Fuxin City by evaluating the transformation of Fuxin City over a period of twenty years. Combined with the status quo of its transformation and its geographical characteristics, based on the development of modern information technology, the improvement of the information technology infrastructure construction and the increasing sophistication of the technologies such as big data and AI algorithms, this paper establishes an innovative mode of coordinated planning in the EOD model, which strengthens the enthusiasm of the enterprises and the residents in expressing their needs, and creates the pattern of urban renewal in the division of labor and cooperation between the government, the enterprises, and the residents, which deepens the interactive relationship, improves the efficiency of the urban renewal, and leads the realization of sustainable development in resource-exhausted regions.

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