Regional Development Environment, Local Government's Character Behavior, and Sustainability: Empirical Evidence from China

Środowisko rozwoju regionalnego, działania władz lokalnych i zrównoważony rozwój: dowody empiryczne z Chin

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Abstract

After the rapid economic growth through reform and opening-up over 40 years, Chinese governments are seeking transformation for high-quality and sustainable development currently. Regional economic development is related to internal and external environments as well as local government's character behaviors. Employing Neuro Linguistic Programming (NLP) and Consciousness-Context-Behavior (CCB) theory, we construct a theoretical framework to measure the relationships between regional development environment (RDE), local government's character behavior (LGCB), and regional sustainable capability (RSC). We collect the data of 30 provinces in mainland China from 2001 to 2020 to conduct hypothesis testing and empirical analysis. The results show that both RDE and LGCB are associated with RSC, and LGCB significantly mediates the relationship between RDE and RSC. However, the effects of different RDE elements on RSC are heterogeneous. Our study enriches regional sustainable development theory. It arouses us to better understand LGCB and attach importance to the roles of RDE and LGCB in regional sustainability. The enlightenment is important to global developing countries.

Key words: regional development, sustainable capability, character behavior, development, environment, empirical analysis

Słowa kluczowe: rozwój regionalny, zrównoważona zdolność, działania, rozwój, środowisko, analiza empiryczna

1. Introduction

As an emerging economy, China's miracle in economic development over the past 40 years are worthy of other developing countries' attentions (Lu et al., 2019). Based on reform and opening-up, it has created many opportunities for rapid development in the past decades through industrialization, infrastructure investment and population growth. However, at the cost of rapid development, the problems such as environmental degradation, unbalanced development and increased pressure on social stability have emerged, challenging Chinese future development (Lu et al., 2019). Because of a clear understanding of such challenges, Chinese government has put forward the goal of high-quality development in current transition period, and proposed *mass entrepreneurship and innovation* and *carbon peaking and carbon neutrality* strategies. China is a country with numerous provinces, of which the sustainable development issues are diverse and complex. Different provinces' efforts for sustainability are rich and universal, suitable for the learning of other developing regions.

The United Nations has put forward 17 goals in regard to sustainable development including the eradication of poverty and hunger, as well as health and well-being. Around the goals, scholars have carried out many studies (Khizar et al., 2021; Sajjad and Shahbaz, 2020). They aim to enhance sustainable capability from economic, social and environmental perspectives. In developed countries, the key to sustainable capability is market power. They would optimize market mechanism and adjust public policies for capital access, so as to let social and commercial capital enter the areas requiring the enhancement of sustainable development capability (Sheth and Parvatiyar, 2021). Unlike them, China's central and local governments play a more important role in economic and social development (Lin and Hong, 2022). In China, government will is the most powerful force to drive regional sustainable development. Through fiscal investment and transfer payment, governments can support the areas that need to enhance sustainable development capability. Policies can be released to lead social and market capital to enter certain fields or prevent them from entering areas protected by governments (Hong et al., 2020). State-owned enterprises can indirectly motivate private capital to enter the supported areas (Li et al., 2020). In a word, government behaviors play a crucial role in China's regional sustainable development.

The effectiveness of China's central government actions involving sustainable development is related to its socialist road, democratic centralism and Confucian culture (Tan et al., 2021). However, there are huge differences in the conditions and goals of sustainable development faced by different regions. Local governments should maintain consistency with the central government in governance behavior, but the differences make them heterogeneous. The heterogeneity is mainly driven by two factors. First, the behavior pattern of a local government is consistent in a certain period of time. During the long-term governance, Chinese local governments of various regions have formed their own unique characters, which influence their thoughts and actions. Second, the occurrence of behaviors needs the opportunities created by environmental conditions (Hou et al., 2021). The advantages, characteristics, and constraints of sustainable development vary with the development environments of different regions. Hence, RDE has an important impact on local governments' decisions on the strategies and measures for sustainable development, and affects the effect of strategy implementation.

Our study aims to measure the relationships between RDE, LGCB, and RSC. It expands regional sustainable development theory and inspires developing countries to better understand the rules of sustainable capability's formation and make strategies for sustainable development. We collect the data of 30 regions in mainland China from 2001 to 2020. Hong Kong, Macao and Taiwan are not considered because their data formats are inconsistent with mainland regions. Tibet is also excluded because of many lacking data. We use entropy-weighted TOPSIS method to measure the variables. Panel regression analysis is used to test the proposed hypotheses, so as to form new theoretical viewpoints. We focus on answering the question *how do RDE and LGCB affect RSC?*

2. Literature Review

2.1. Sustainability science and sustainable capability
Sustainable development was defined as the development that meets present needs without jeopardizing the ability of future generations to meet their needs (WCED, 1987). With the deepening of human research on future development, it has been constantly developed to be an interdisciplinary concept involving agriculture, economy, education, and ecology (Kajikawa et al., 2007). The key to achieving sustainable development goals is to cultivate sustainable capability. A triangular framework of regional sustainable development was proposed from economic, ecological and social perspectives. The framework has already included the contents of sustainability in population growth, resource utilization, and agricultural development and sci-tech progress (Hou et al., 2021).

2.2. Government character and character behavior
Organizational character is the common personality shared by different individuals in an organization (Guo et al., 2008). Neubert et al. (2009) defined it as the traits developed by organizations for meeting challenges or taking opportunities. Moore (2015) proposed that it can be measured by the degree of virtue an organization possesses or the degree of wisdom and virtue the organization uses in the pursuit of success and excellence.
LGCB refers to the behaviors consistent with and driven by the character traits of local government organizations. Big Five theory is suitable for depicting it. Governments with different characters show different behavioral preferences. For example, Nam (2015) found that an open government would be committed to opening government data and promoting people's freedom of access to information for leading citizens' autonomy and collaboration. LGCB has a significant effect on RSC. For instance, Navarro-Galera et al. (2019) showed that information disclosure and sharing by open governments can enhance people's trust and improve the efficiency of public services, in turn, enhance regional sustainability.

2.3. Regional development environment
RDE is the sum of the geographical location of a region and its economic, political, sci-tech, cultural, and demographic environments. It provides opportunities and constraints for local governments to generate sustainable de-

velopment strategies and implement sustainable development programs (Ji and Darnall, 2020). Sustainable capability improvement is a systematic issue, which relies on the interaction between local government's internal resources and external development environments (Galera et al., 2015). The environmental factors of RSC include financial environment, political environment, industrial structure and technologies, ecological environment and carrying capacity, resource conditions and policies, infrastructure, and demographic and social conditions.(Yahya et al., 2022).

3. Theories

According to NLP theory, the logic of human to recognize and process things is divided into six layers: environment, behavior, ability, belief, identity and system. Among them, the first three are called low layers, which we can realize. The changes in high layers radially affect the changes of low layers. Low-layer changes cumulatively affect high-layer changes, when low-layer changes accumulate to a certain extent (Kotera and Sweet, 2019).

According to CCB model, individuals form cognition and consciousness of external events based on their personalities and values, and the consciousness further stimulates individual behaviors by the strengthening of environmental factors. Environmental factors constitute the conditions for the occurrence of individual behaviors. However, specific actions are still driven by individual's personality traits (Wang and Wang, 2011).

In the study, NLP and CCB theories in individual field were introduced to explore the relationships in regional sustainable development system. From organizational perspective, the mechanism for improving RSC was summarized into three aspects. First, cognitive mechanism. As a conscious subject, a local government actively perceive the development environment of its region, evaluate the opportunities and threats within environments, and then make strategic responses to improve RSC. Second, practical mechanism. In regional sustainable development system, a local government accumulates knowledge, and improve its capabilities through continuous practices and reforms in sustainable development. The promotion of practical effects and efficiencies is reflected as the improvement of RSC. Moreover, the local government could actively explore and exploit its characters for formulating good strategies and taking actions to promote sustainable development. Third, integrative mechanism. The actions taken by local governments in sustainable development are not only related to their characters, but also restricted by RDE. Therefore, local governments' best plans for actions is to select appropriate behavioral strategies based on the comprehensive evaluation of the pros and cons of their development environments and their unique preferences driven by characters, and then improve their sustainable capabilities through dynamic behavioral adjustment. In other words, the improvement of RSC is the result of the integration of cognitive mechanism and practical mechanism.

Along with the logic of antecedent-behavior-consequence (ABC), we set RDE as the antecedent, LGCB as the mediating behavior, and RSC as the consequence, to generate a theoretical framework for our research, as shown in Figure 1.
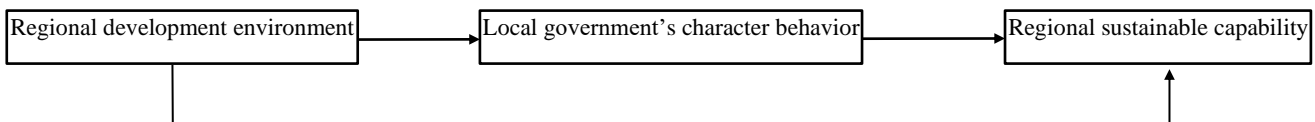

Figure 1. Research framework

4. Hypothesis

4.1. The relationship between RDE and LGCB

The occurrence of LGCB needs the support of place, platform and resources provided by RDE. Behaviors highly rely on environmental conditions. They are the results stimulated by favorable environmental factors. Good environments can create opportunities for local governments. First, cultural environment strengthens governments' creative behaviors. Wang et al. (2017) found that extroversion culture can strengthen the impacts of organizational resources and leadership on local government innovative behaviors. Second, technological environment supports the openness of government. Data open access and information disclosure are main manifestations of government open behavior. Alderete (2018) indicated that many governments around the world were using information and communication technologies to construct transparent, efficient and inclusive organization. Third, economic and social environments have an impact on government's social responsibility. Dongwoo and Jung (2019) stated that the capabilities and behaviors of local governments to shoulder social responsibilities are constrained by their financial budgets. Local governments in developed regions are more capable and inclined to be responsible. Fourth, ecological environment enables local governments to carry out agreeable behaviors. Xu and Sun (2021) proposed that improving urban living environment has become an important measure for Chinese governments to fulfil their duties and improve the relationship with citizens. Ecological environment and resource conditions constitute the basis of the implementation of residential environment improvement. Finally, social harmony is the foundation of local government's stability maintenance behaviors. Only by establishing law-based government and creating harmonious culture can we break the dilemma of maintaining stability. We therefore propose the hypothesis H1: there is a significant positive correlation between RDE and LGCB.

4.2. The relationship between RDE and RSC

Regional sustainable development is supported by various environments. RDE provides resources and creates platform for the formation and promotion of RSC. First, the role of intellectual environment. Wang et al. (2006) conducted an integrative analysis of human capital, environmental factors and sustainable economic development capability of 31 Chinese regions. They found that with the continuous economic growth in China, the pressure of ecological environment protection was gradually increasing, and human capital investment has become the main power supporting the sustainable development of regional economy. Second, the role of educational environment. As reported by Kemmis and Mutton(2012), Australian government proposed that educational level determines the future of the country and put school education and social education on the agenda of sustainable development. Third, the role of political environment. Carayannis et al. (2021) measured the relationship between democracy and environment and found that countries with higher political freedom are more likely to have higher environmental performance. Fourth, the role of social environment. According to Sol et al. (2018), the promotion of regional sustainability is carried out in a network of social governance, which is rooted in regional social culture, and the RSC is enhanced in the process of mutual learning and collaboration among network nodes. Network characteristics and social culture have positive effects on sustainability. Fifth, the role of economic environment. Peng et al. (2007) confirmed through the investigation of rural areas in China that industrial structure transformation has an impact on regional environmental changes, and industrial structure upgrading is conducive to optimizing the relationship between people and environment, thus promoting the realization of the goals of regional sustainable development. Sixth, the role of infrastructure environment. Xu and Wu (2018) presented that in China, one of effective measures for maintaining sustainable economic development in the transition period is to increase investment in transportation infrastructure. Finally, the role of ecological environment. Kammerbauer (2001) proposed that ecological sustainability is related to the complexity, stability, and elasticity of ecosystems, which with different characteristics have different capabilities in resource generation and waste degradation. Strengthening ecosystem health is in favor of the carrying capacity of regional ecological environment. Therefore, the research hypothesis H2 is proposed: there is a significant positive correlation between RDE and RSC.

4.3. The relationship between LGCB and RSC

Regional sustainable development is a long-term and systematic task led by local governments. The improvement of RSC needs to be supported by continuous actions. The characteristics and behaviors of local governments therefore affect it. First, the influence of government's open behavior. From the perspectives of monopoly economy and social welfare, Soderbaum and Brown (2010) proposed that an open, pluralistic and democratic economic development model and relevant policies made by local governments promote regional sustainable development. Second, the impact of innovative governments' actions. Studies have shown that local governments' strategies in ecological innovation, knowledge and technological innovation, and organizational and management innovation contribute to the improvement of regional sustainability (Tsai and Liao, 2017). Third, the impact of government accountability. Responsible governments develop longer strategic plans, provide better infrastructure resources and public services, use resources more cautiously and efficiently, and their attentions are paid more to self-reform or the protection of regional environments (Ji and Darnall, 2020). Fourth, the impact of governments' agreeable behaviors. The appropriate behaviors implemented by local governments improve the image of government organizations and enhance residents' satisfaction with government public services and the loyalty to the city (Kim, 2017). Finally, the impact of governments' stability maintenance behaviors. One of important goals of government is to maintain social stability. In today's China, maintaining stability is the most important political function of the central government. The measures in maintaining stable military input, financial and price stability, and public opinion monitoring and governance enhance people's confidence in work, life and a bright future, and inject vitality into sustained economic and social prosperity (Shin, 2019). The hypothesis H3 is proposed as follows: there is a significant positive correlation between LGCB and RSC.

4.4. The mediating effect of LGCB

According to the behavioral theory in psychology, the occurrence of behaviors requires stimuli and a series of stress responses. For a local government, its decisions has great influence on regional development, so its behaviors should be rational (Whitehead et al., 2011). The occurrence of rational behaviors not only needs the stimulus from environments, but also the environments can provide opportunities for the rational behaviors to obtain benefits. Superior RDE is therefore necessary for the occurrence of LGCB, since it plays a role in providing stimulus and creating high yield conditions.

According to dynamic capability theory, the notion refers to timely strategic and action adjustments made by an organization in order to seize opportunities or avoid threats when facing dynamic changes in external environments. The psychological quality and experience skills accumulated in behavioral practices help reintegrate resources and realize the value of innovations (Klievink and Janssen, 2009). Regional sustainability is a kind of dynamic capability. Its formation and evolution processes can be interpreted by dynamic capability theory (Linde et al., 2021). According to it, RDE plays a stimulating role in generating dynamic capability, and LGCB forms the

process that carries the improvement of dynamic capability. Hence, the hypothesis H4 is proposed: LGCB plays a significant mediating role in the relationship between RDE and RSC.

5. Methodology

5.1. Variables

Dependent variable: *RSC*. The study takes economic, social and ecological sustainability as the main structure of regional sustainability. In addition, we consider the sustainability in population, resource, agriculture, science and technology, and education involved in sustainable development goals of United Nations as the support structure of *RSC* (Hou et al., 2021). Inspired by Smetana et al. (2016), we develop the measurement index system of *RSC* on basis of National Bureau of Statistics of China, as shown in Table 1. Similar to Li et al. (2018), an entropy-based TOPSIS model is constructed to comprehensively evaluate *RSC*. The evaluation results are taken as the value of the dependent variable.

Table 1. The indicators for evaluating *RSC*

Structure	Dimension	Elements	Observed indicators
Main structure	Economic sustainability	a. industrial structure; b. economic growth; c. labor efficiency	a. share of tertiary industry; b. GDP deflator; c. total labor productivity
	Ecological sustainability	a. sewage treatment; b. carbon emissions; c. waste treatment	a. daily sewage treatment capacity; b. carbon emission intensity; c. harmless treatment capacity of household garbage
	Social sustainability	a. unemployment management; b. administrative punishment; c. crime	a. unemployment rate; b. local fiscal forfeiture revenue; c. crime rate
Support structure	Population sustainability	a. population growth; b. population quality; c. aging	a. natural growth rate; b. average years of schooling; c. proportion of elderly population
	Resource sustainability	a. energy consumption; b. energy production; c. land	a. energy consumption per unit output value; b. total amount of energy production; c. relative land resource carrying capacity
	Agricultural sustainability	a. modernization; b. pesticide use; c. production capacity	a. total power of agricultural machinery; b. pesticide use; c. grain output
	Sci-tech sustainability	a. sci-tech achievements; b. technology trade; c. new product output	a. the number of granted invention patents; b. the proportion of technological market turnover in GDP; c. the proportion of new product output value in total industrial output value
	Sustainable education	a. compulsory education; b. college teachers; c. output capacity	a. junior middle school educated population; b. the number of full-time college teachers; c. the number of graduates

Independent variable: *RDE*. We focus on six dimensions including economic environment (*EcE*), infrastructure (*InE*), ecological environment (*ElE*), social environment (*SlE*), intellectual environment (*IlE*) and political environment (*PIE*) to measure *RDE* (Gao and Meng, 2021). Among them, the first three are hard environments that provide resources, funds, places, and facilities for sustainable development, and the latter three serve as soft environments which focus on the creation of harmonious culture and friendly relations. Inspired by Wang and Li (2020), we develop the evaluation index system of *RDE* as in Table 2 on basis of the accessibility of data. Entropy-based TOPSIS method is used for measuring the variable.

Table 2. The indicators for measuring *RDE*

Structure	Dimension	Elements	Observed indicators
Hard environment	EcE	a. marketization; b. urbanization; c. consumption	a. degree of marketization; b. urbanization rate; c. total retail sales of consumer goods
	InE	a. transportation; b. communication; c. living facilities	a. highway mileage; b. long-distance optical cable line length; c. gas penetration rate
	ElE	a. forest; b. water; c. wetland	a. forest coverage rate; b. total water resources; c. wetland area
Soft environment	SlE	a. community affairs; b. social recreation; c. social welfare	a. number of residential committee units; b. TV program coverage; c. social welfare homes units
	IlE	a. educational environment; b. cultural environment; c. innovative environment	a. number of basic education schools; b. number of public library industry institutions; c. number of R&D personnel
	PIE	a. public scale; b. personnel quality; c. trade union organization	a. the proportion of employees of civil administration departments in total population; b. the proportion of employees of civil administration departments with a bachelor's degree or above; c. the number of basic trade union organizations

Mediating variable: *LGCB*. Drawing on Big Five theory, we measure LGCB from five dimensions including innovative behavior (*IB*), open behavior (*OB*), responsible behavior (*RB*), agreeable behavior (*AB*) and behavior for maintaining stability (*SB*). Among them, *IB* refers to the behaviors of local governments to realize novel and unique social and economic value by supporting enterprise innovation and social reform; *OB* refers to the behaviors of local governments to encourage foreign cultural exchanges and trade for export-oriented growth; *RB* refers to the behaviors of local governments to fulfil their duties and actively undertake social responsibilities; *AB* refers to the behaviors to construct livable environments and develop friendly relationships between government and people, and between people and environments; and finally *SB* refers to the behaviors to actively maintain social stability and stimulate coordinated and steady development. Since there is a lack of literature on *LGCB* at present, we selected observed indicators from China Statistical Yearbook, and independently developed the indicator system, as shown in Table 3. The method for variable measurement is entropy weight TOPSIS.

Table 3. The indicators for measuring *LGCB*

Dimension	Elements	Observed indicators
IB	a. R&D investment; b. education investment; c. cultural investment	a. the proportion of R&D expenditure in fiscal expenditure; b. education expenditure in fiscal expenditure; c. the number of mass cultural exhibitions
OB	a. international trade; b. foreign investment	a. total amount of import and export; b. foreign investment; c. registered capital of foreign-invested enterprises
RB	a. medical care; b. elderly care; c. public service	a. the proportion of medical assistance expenditure in government expenditure; b. the number of people receiving social pension insurance; c. the proportion of civil affairs expenditure in government expenditure
AB	a. consumption security; b. employment security; c. income security	a. consumer price index; b. the proportion of spending on social security and employment in government spending; c. the elasticity of personal income
SB	a. medical supervision; b. social security; c. labor security	a. the number of health supervision institutes; b. the proportion of financial public safety expenditure in financial expenditure; c. the number of labor cases

Control variables. According to Song and Hwang (2018) and Sun et al. (2022), the control variables were set as follows. a. Area of land (*AL*) was set as a variable to control the difference caused by regional scale. b. The number of prefecture-level cities (*NC*) was set as a variable to control the difference caused by the size and number of cities in the region. c. The number of enterprises above designated size (*NE*) was set as a variable to control the economic differences between regions. d. The urban-rural consumption gap (*UG*) was set as a variable to control the urban-rural heterogeneity and contradictions within a region. e. The shortest distance to port (*DP*) was set as a variable to control the geographical advantages of a region.

5.2 Data

The sample of our study is 30 regions in mainland China. Tibet is not included due to serious data deficiency. The time window is set from 2001 to 2020. Data sources include EPS database, CSMAR database, China Economic Net, China Statistical Yearbook, China Industrial Statistical Yearbook, China Energy Statistical Yearbook, China Population and Employment Statistical Yearbook, and China Education Statistical Yearbook. Some missing data are supplemented from the statistical yearbook of each region.

Data collection and processing follow the following procedures. a. We collected the data of the observed indicators, and predicted missing data with multiple interpolation method. b. In order to meet the requirements of comprehensive evaluation, extreme value processing method was adopted to process data in advance. The processed data are dimensionless, less affected by extreme values, and the value interval is [0,1]. c. In order to reduce the influence of the volatility of data on research results, the data were processed by tail shrinkage before regression analysis.

5.3. Methods

Our study consists of two steps for data analysis. First, we used comprehensive evaluation method to measure the variables. The method is entropy-based TOPSIS. Entropy is a widely used method to determine weights objectively. Its principle is that the weight is proportional to the difference of the data of an indicator (Smieja, 2015). The observed indicators of each variable are all quantitative with a large number of samples, suitable for the entropy weighted method. TOPSIS is an information aggregation method based on both positive and negative ideals. Its evaluation results are obtained through the measurement of closeness between the evaluation object and ideals (Shih et al., 2007).

Second, we used panel regression model to test the hypotheses. Hausman test found that the fixed-effect model was more suitable for our study, so we constructed a hierarchical regression analysis model with fixed effects to measure the direct effects. Bootstrap program was used to test the mediating effect of *LGCB*. The test was completed by SPSS process plug-in, wherein the confidence interval was set as 95% and the sampling times as 5000.

6. Results

6.1. Evaluation results

The entropy-based TOPSIS method was used to comprehensively evaluate the values of *RDE*, *LGCB*, and *RSC* of 30 regions on the mainland during the twenty-year period, from 2001 to 2020. The mean level and change trend of the evaluation results are shown in Figure 2. As can be seen from the figure, *RDE*, *LGCB*, and *RSC* of all observed regions in China have shown an obvious growth trend in the period, and most variables have tended to grow at the same rate. ElE is an exception, almost stable in the past without a significant growth trend. To some extent, the trend of accompanying development reflects and proves the possible causal relationships between our concerned variables.
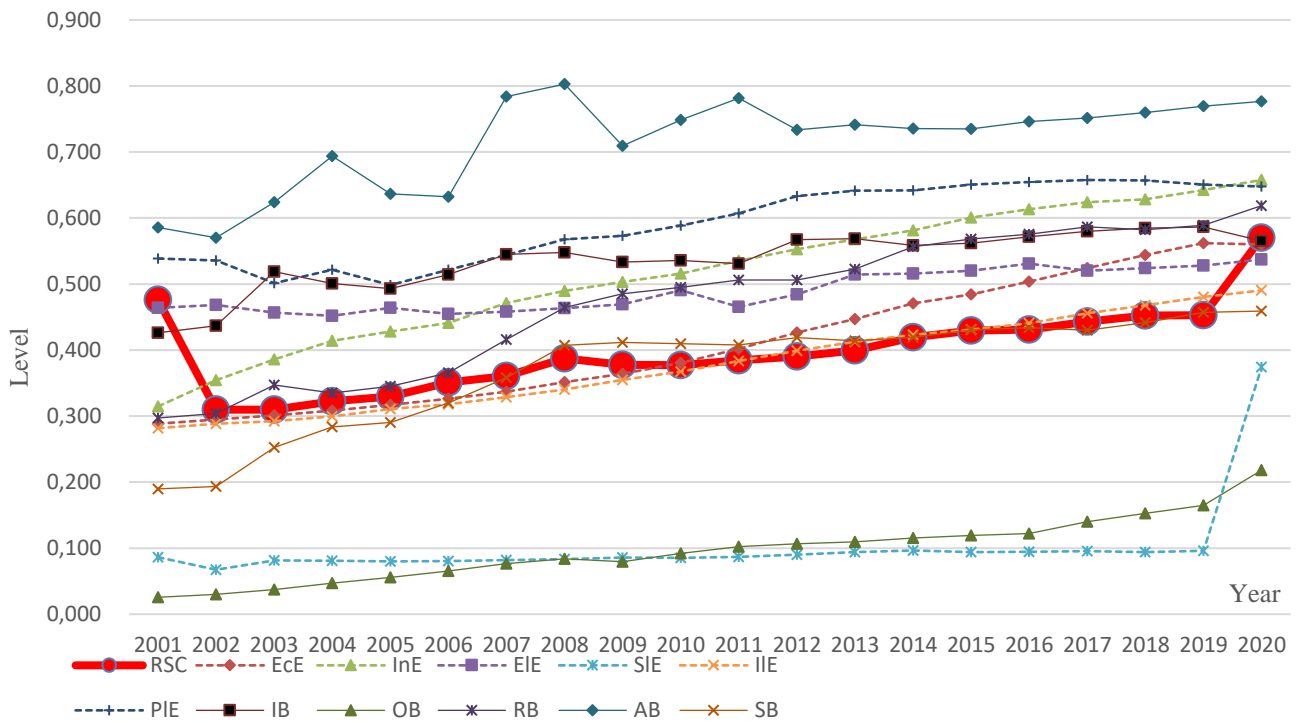

Figure 2. The average level of *RDE*, *LGCB*, and *RSC* of Chinese regions from 2001 to 2020

The average level and annual growth rate of *RSC* in different regions from 2001 to 2020 were calculated and divided into high and low levels according to the mean value. The results were thus presented in four quadrants, as shown in Figure 3. According to the figure, some of China's eastern coastal regions, such as Beijing, Shanghai, Zhejiang and Guangdong, have relative advantages in both the level and growth rate of *RSC*, which are consistent with their economic development level after entering the new century. The average level of *RSC* in the regions of northeast and central China such as Heilongjiang, Liaoning, Anhui, Hubei and Hunan are in the middle, but their growth rates are obviously low, revealing low potential in sustainable development. On the contrary, a few western region such as Guizhou, Yunnan and Xinjiang have got a faster pace, according to their relatively higher growth rate. In the future, they are expected to achieve leapfrog development based on the support of national policies and their efforts on characteristic tourism and energy resource development. Their sustainable development model is worthy for other countries or regions that have similar conditions in resource and environment. Finally, the regions such as Gansu, Qinghai, and Hainan of which the performances in *RSC* are worst are western or island regions. They have the common problem of lack of conditions for economic and ecological development.

The evaluation results in Figure 2 and Figure 3 not only show the status quo, trends and problems of *RSC* of Chinese regions from a macro perspective, but also provide inspirations for other countries and regions in *RSC* development. The consistency between our findings and the current situation of China's regional economic development reveals strong explanatory power of *RSC* variable. The results also indicate the scientificity of the evaluation index system and entropy-based TOPSIS model in our research. Hence, the results of comprehensive evaluation can support the following regression analysis.

To prepare for regression analysis, a descriptive statistical analysis was conducted. The results are shown in Table 4. The mean value and standard deviation of variables are in line with expectations, and no significant anomaly has been found. There are significant positive correlations among most variables, laying a good foundation for confirming our research hypotheses.
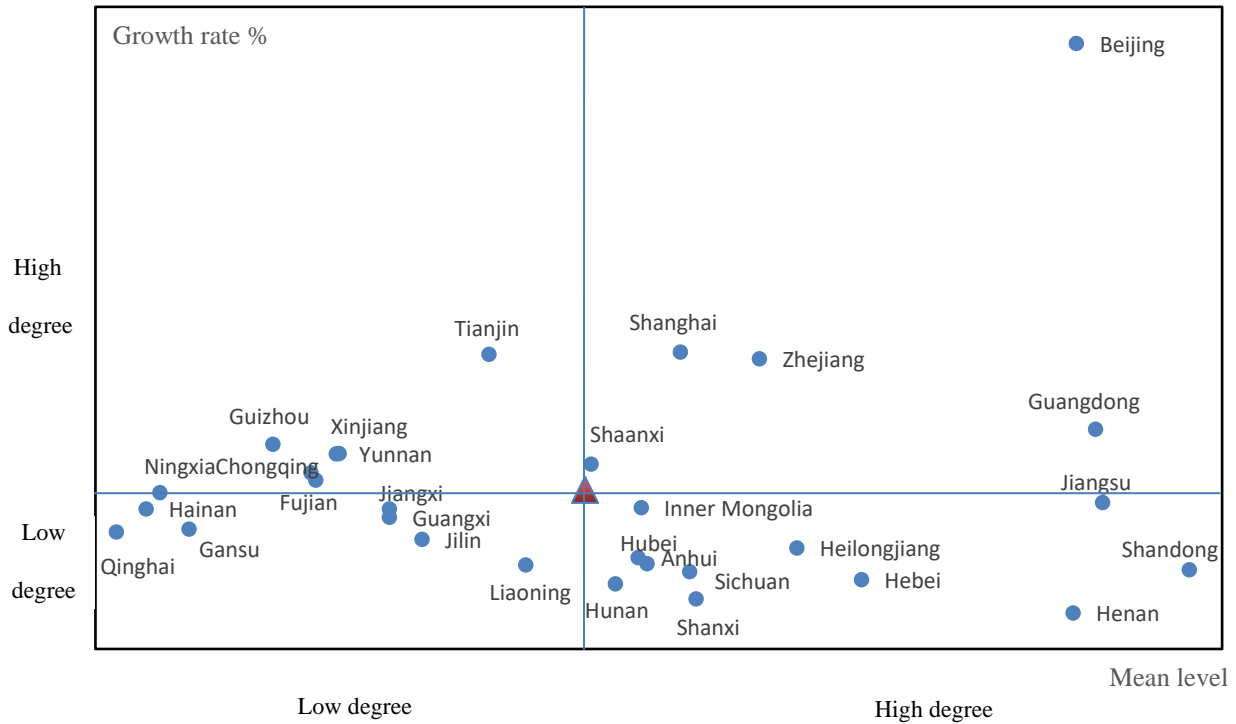
Figure 3. Average level and annual growth rate of 30 regions' *RSC* from 2001 to 2020 (demarcation point: mean level=0.399, growth rate=0.991%)

Table 4. Descriptive statistical analysis

Variable	Mean	SD	Correlations										
			2	3	4	5	6	7	8	9	10	11	12
1. *RSC*	0.399	0.102	0.691***	0.474***	0.035	0.611***	0.674***	0.639***	0.505***	0.537***	0.551***	0.179***	0.592***
2. *EcE*	0.410	0.154		0.529***	-0.001	0.485***	0.608***	0.616***	0.658***	0.770***	0.709***	0.252***	0.664***
3. *InE*	0.516	0.140			0.423***	0.496***	0.743***	0.672***	0.363***	0.256***	0.752***	0.423***	0.670***
4. *ElE*	0.489	0.173				0.245***	0.233***	0.176***	-0.091*	-0.044	0.200***	0.008	0.242***
5. *SlE*	0.101	0.088					0.583***	0.500***	0.398***	0.424***	0.474***	0.089*	0.492***
6. *IlE*	0.378	0.161						0.831***	0.651***	0.467***	0.671***	0.168***	0.756***
7. *PlE*	0.592	0.135							0.635***	0.440***	0.638***	0.144***	0.651***
8. *IB*	0.536	0.138								0.606***	0.489***	0.007	0.669***
9. *OB*	0.097	0.144									0.451***	0.048	0.617***
10. *RB*	0.473	0.132										0.551***	0.685***
11. *AB*	0.716	0.082											0.288***
12. *SB*	0.371	0.149											

N=600; *** $p<0.001$; ** $p<0.01$; * $p<0.05$.

6.2. Direct effects

Table 5 shows the effect of *RDE* on *LGCB*. The odd models are benchmark model containing only control variables, while the even models are saturated model containing total variables. Comparing the difference of R^2 (ΔR^2) between the paired odd and even models, we found that *RDE* has significant and strong marginal explanatory

power for the five dimensions of *LGCB*. Among them, the effects on *RB* and *SB* are particularly strong. Table 5 also shows that *EcE* has a significant positive effect on all dimensions of *LGCB*, revealing the decisive role of *EcE* in local development. *InE* has significant positive impacts on local governments' *RB*, *AB* and *SB*, but has negative impacts on their *IB* and *OB*. The effect of *ElE* on *LGCB* is not as strong as expected. *ElE* has positive effects on *RB* and *SB*, but has negative effects on *IB* and *AB*. Surprisingly *SlE* has a weak effect on *LGCB*, only positively related to local governments' *OB*. Consistent with our expectation, *IlE* has a significant and strong effect on *LGCB*, effectively promoting *IB*, *OB*, *AB* and *SB*. Finally, the effect of *PlE* on *LGCB* is weak. *PlE* has a significant positive impact on *IB*, but also has weak negative impacts on *OB* and *SB*, and even has no significant effect on *AB* and *RB*. In general, most dimensions of *RDE* have significant positive impacts on *LGCB*, but a few environmental factors also have negative effects or the assumed relationship is not significant. Therefore, we formed our conclusion that H1 has partially passed the test.

Table 5. Direct effects of *RDE* on *LGCB*

Models		IB		OB		RB		AB		SB	
		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
Constant		0.452***	0.388***	-0.138***	-0.029	0.184***	0.137***	0.611***	0.618***	0.113**	0.098**
Control variables	AL	-0.158***	-0.065*	0.017	0.097***	-0.170***	-0.244***	-0.069**	-0.082***	0.067*	0.020
	NC	0.014	-0.079***	-0.105***	-0.027	0.078***	-0.051***	0.017	-0.020	0.063***	-0.109***
	NE	0.109***	-0.009	0.123***	-0.072*	0.522***	0.102***	0.260**	0.036	0.226**	-0.136***
	UG	0.400***	0.195***	0.490***	0.254***	0.171***	-0.067***	-0.058**	-0.122***	0.389**	0.134**
	DP	-0.057	-0.024	0.132***	0.052*	-0.179***	-0.168***	-0.098***	-0.066**	-0.022	-0.003
Explanatory variables	EcE		0.158**		0.640***		0.301***		0.125**		0.247***
	InE		-0.186***		-0.296***		0.457***		0.424**		0.279***
	ElE		-0.086***		-0.016		0.073***		-0.063**		0.050*
	SlE		-0.023		0.138**		0.002		-0.060		-0.026
	IlE		0.460***		0.149***		0.141***		-0.060		0.510***
	PlE		0.151**		-0.133**		0.030		-0.073		-0.099*
Goodness of fit	R^2	0.466	0.649	0.568	0.725	0.472	0.771	0.180	0.369	0.420	0.698
	Adj R^2	0.461	0.642	0.565	0.720	0.467	0.767	0.173	0.357	0.415	0.692
	ΔR^2	0.466	0.183	0.568	0.157	0.472	0.299	0.180	0.189	0.420	0.278
	ΔF	103.543***	50.999***	156.288***	55.756***	106.105***	127.986***	26.123***	29.335***	86.055***	89.962***
	DW		1.795		1.681		1.451		0.749		1.361

*** $p<0.001$; ** $p<0.01$; * $p<0.05$. DW displays the value of Durbin-Watson.

Table 6 shows the direct effect of *RDE* on *RSC*. The models M11 and M18 are benchmark model and saturated model respectively. From the difference of R^2 between the two models, it can be seen that the interpretation power of *RDE* on *RSC* reaches 27.8%, which is relatively strong. The models M12-M17 show the impacts of a single dimension of *RDE* on *RSC* respectively. The results show that all dimensions have significant effects on *RSC*. All effects are positive except that the effect of *ElE* is negative. As shown by M18, when all dimensions of *RDE* work together, the driving force for improving *RSC* comes from *SlE*, *EcE*, *IlE* and *PlE*, while the effects of *InE* and *ElE*

are significantly negative. *InE* has changed from a independently positive effect to a jointly negative effect, implying that substitution effects exist among different dimensions of *RDE*. Since the correlation between *InE* and *IlE* is the largest value in matrix, we guess that *IlE* could replace *InE* to some extent in the development of *RSC*. To sum up, the hypothesis H2 is also partially accepted.

Table 6. Direct effects of *RDE* on *RSC*

Model		M11	M12	M13	M14	M15	M16	M17	M18
Constant		0.128***	0.159***	0.115***	0.132***	0.145***	0.095***	-0.018	0.103***
Control variables	*AL*	0.020	0.054**	0.000	0.055*	0.016	0.023	0.043	0.115***
	NC	0.057***	0.092***	0.024	0.065***	0.022	-0.062***	-0.008	0.020
	NE	0.241***	-0.009	0.162***	0.247***	0.176***	0.139***	0.160***	0.087***
	UG	0.149***	-0.054**	0.125***	0.150***	0.080***	0.028	0.041*	-0.085***
	DP	0.044	-0.003	0.059*	0.059*	0.055**	0.073***	0.075**	0.050**
Explanatory variables	*EcE*		0.507***						0.284***
	InE			0.161***					-0.223***
	ElE				-0.064**				-0.073***
	SlE					0.500***			0.336***
	IlE						0.423***		0.224***
	PlE							0.381***	0.155***
Goodness of fit	R^2	0.355	0.541	0.375	0.363	0.493	0.538	0.480	0.681
	Adj R^2	0.350	0.537	0.369	0.357	0.488	0.533	0.475	0.675
	ΔR^2	0.355	0.186	0.020	0.008	0.138	0.183	0.125	0.326
	ΔF	65.455***	240.837***	19.048***	7.672**	161.161***	234.217***	142.928***	100.242***
	Durbin-Watson	1.075	1.072	1.038	1.115	1.216	1.003	1.109	1.393

The explained variable is *RSC*. *** $p<0.001$; ** $p<0.01$; * $p<0.05$.

Table 7 shows the effect of *LGCB* on *RSC*. The models M19-M23 show the independent effect of each *LGCB* dimension, while model M24 shows the joint effects of all *LGCB* dimensions. According to the results of M19-M23, five *LGCB* dimensions all have significant positive effects on *RSC*, and the effects of *OB*, *SB* and *RB* are particularly strong, while the effect of *AB* is weaker. The result of M24 shows that when all *LGCB* dimensions act together, the effect of *AB* becomes no longer significant. The explanatory power of *LGCB* to *RSC* reaches 12.9%. It is concluded that the hypothesis H3 has been supported.

Table 7. Direct effects of *LGCB* on *RSC*

Model		M19	M20	M21	M22	M23	M24
Constant		0.028	0.167***	0.080**	0.048	0.097***	0.111**
Control variables	*AL*	0.055*	0.015	0.064**	0.029	0.001	0.039
	NC	0.054***	0.087***	0.037**	0.055***	0.040***	0.057***
	NE	0.217***	0.205***	0.104***	0.206***	0.179***	0.127***
	UG	0.060*	0.008	0.104***	0.156***	0.043*	-0.040
	DP	0.056*	0.006	0.091***	0.057*	0.050*	0.046
Explanatory variables	*IB*	0.222***					0.073*
	OB		0.287***				0.174***
	RB			0.263***			0.132**
	AB				0.132**		-0.051
	SB					0.272***	0.125***
Goodness of fit	R^2	0.404	0.427	0.417	0.365	0.447	0.484
	Adj R^2	0.397	0.421	0.411	0.358	0.442	0.476
	ΔR^2	0.048	0.071	0.061	0.009	0.092	0.129
	ΔF	47.993***	73.901***	62.283***	8.678**	98.943***	29.508***
	Durbin-Watson	1.123	1.142	1.008	1.049	0.953	1.031

The explained variable is *RSC*. *** $p<0.001$; ** $p<0.01$; * $p<0.05$.

6.3 Mediating effects

All control variables, independent variables and mediating variables were introduced to build model M25. Its regression analysis result is shown in Table 8. Comparing the R^2 of M25 and M11, we found that the change is 0.343, indicating that the joint effect of *RDE* and *LGCB* has a marginal explanatory power of 34.3% on the improvement of *RSC*. Comparing the R^2 of M25 and M18, the change is 0.017, much smaller than the ΔR^2 (0.326) of M18 to M11. Therefore, *RSC* is still mainly explained by *RDE*. The results of comparative analysis show that

the improvement of *RSC* is affected by both direct effect and mediating effect. The direct effect of *RDE* is the dominating one, but *LGCB*'s partial mediating role is auxiliary.

Table 8. Joint effects of *RDE* and *LGCB* on *RSC*

Model		M25
Constant		0.122***
Control variables	*AL*	0.104***
	NC	0.019
	NE	0.100***
	UG	-0.056**
	DP	0.047*
Independent variables	*EcE*	0.315***
	InE	-0.303***
	ElE	-0.087***
	SlE	0.346***
	IlE	0.243***
	PlE	0.186***
Intervening variables	*IB*	-0.141***
	OB	-0.053
	RB	-0.032
	AB	0.043
	SB	0.120**
Goodness of fit	R^2	0.698
	Adj R^2	0.689
	ΔR^2	0.343
	ΔF	60.055***
	Durbin-Watson	1.444

The explained variable is *RSC*. *** $p<0.001$; ** $p<0.01$; * $p<0.05$.

Table 9. Total effect analysis

Indirect effect							Direct effect			Total effect
Independent variables	Mediating variables	Effect	Boot SE	95% confidence interval		Significant	Effect	95% confidence interval		
				LLCI	ULCI			LLCI	ULCI	
EcE	*IB*	0.004	0.016	-0.027	0.037	No	0.440	0.350	0.530	0.507
	OB	0.015	0.019	-0.023	0.054	No				
	RB	-0.015	0.027	-0.068	0.039	No				
	AB	-0.012	0.014	-0.040	0.012	No				
	SB	0.076	0.034	0.011	0.145	Yes				
InE	*IB*	0.015	0.008	0.000	0.032	Yes	-0.049	-0.147	0.048	0.161
	OB	0.005	0.007	-0.005	0.021	No				
	RB	0.113	0.036	0.043	0.185	Yes				
	AB	-0.017	0.020	-0.058	0.020	No				
	SB	0.094	0.039	0.015	0.165	Yes				
ElE	*IB*	-0.003	0.004	-0.010	0.004	No	-0.100	-0.145	-0.055	-0.064
	OB	-0.010	0.005	-0.021	-0.003	Yes				
	RB	0.028	0.009	0.013	0.047	Yes				
	AB	0.001	0.002	-0.004	0.006	No				
	SB	0.018	0.008	0.004	0.036	Yes				
SlE	*IB*	0.015	0.009	0.002	0.038	Yes	0.387	0.310	0.465	0.500
	OB	0.039	0.015	0.015	0.074	Yes				
	RB	0.018	0.015	-0.011	0.051	No				
	AB	0.000	0.003	-0.005	0.006	No				
	SB	0.040	0.022	0.001	0.087	Yes				
IlE	*IB*	-0.184	0.017	-0.051	0.015	No	0.407	0.329	0.486	0.423
	OB	0.047	0.015	0.022	0.081	Yes				
	RB	-0.019	0.025	-0.067	0.031	No				
	AB	0.003	0.008	-0.014	0.018	No				
	SB	0.003	0.033	-0.061	0.070	No				
PlE	*IB*	-0.003	0.015	-0.032	0.027	No	0.307	0.235	0.379	0.381

In order to deeply explore the mediating path of *LGCB*, Bootstrap program was used to conduct sampling statistical test on the direct and mediating effects. The results are shown in Table 9. It shows that six dimensions of *RDE* are

significant to the total effect on *RSC*. In addition to the negative total effect of *ElE*, the total effects of other dimensions are all positive, confirming the core idea of our study. As for the negative effect of *ElE*, resource curse theory may explain it. Table 9 also shows that only a part of mediating paths are significant. However, on the significant paths, the coefficients are all positive. In summary, the hypothesis H4 is partially accepted. In detail, *LGCB* plays a full mediating role in the relationship between *InE* and *RSC*, but only plays partial mediating roles in the relationship between other environmental factors and RSC.

6.4. Path analysis

Through the summary of the above results, the impacting paths of *RDE* and *LGCB* on *RSC* can be drawn as in Figure 4. There is heterogeneity in the effects of *RDE* dimensions on *RSC*. *EcE*, *IlE*, *SlE* and *PlE* have the same affecting mechanism. They directly improve *RSC* and also indirectly affect it by the mediation of *LGCB*. *InE* cannot directly influence *RSC*, but exerts an indirect effect through promoting *LGCB*. Though *ElE* promotes local governments' *RB* and *SB*, thus indirectly affecting *RSC*, it is more of a cursed resource, against the development of *RSC*. The current situation of regional development in China is in line with the findings. Some regions (e.g. Yunnan, Xinjiang, Jiangxi, Shanxi and Liaoning) with abundant natural resources and beautiful ecological environments are backward in the development of economy, society, science and technology, causing trouble in sustainability.
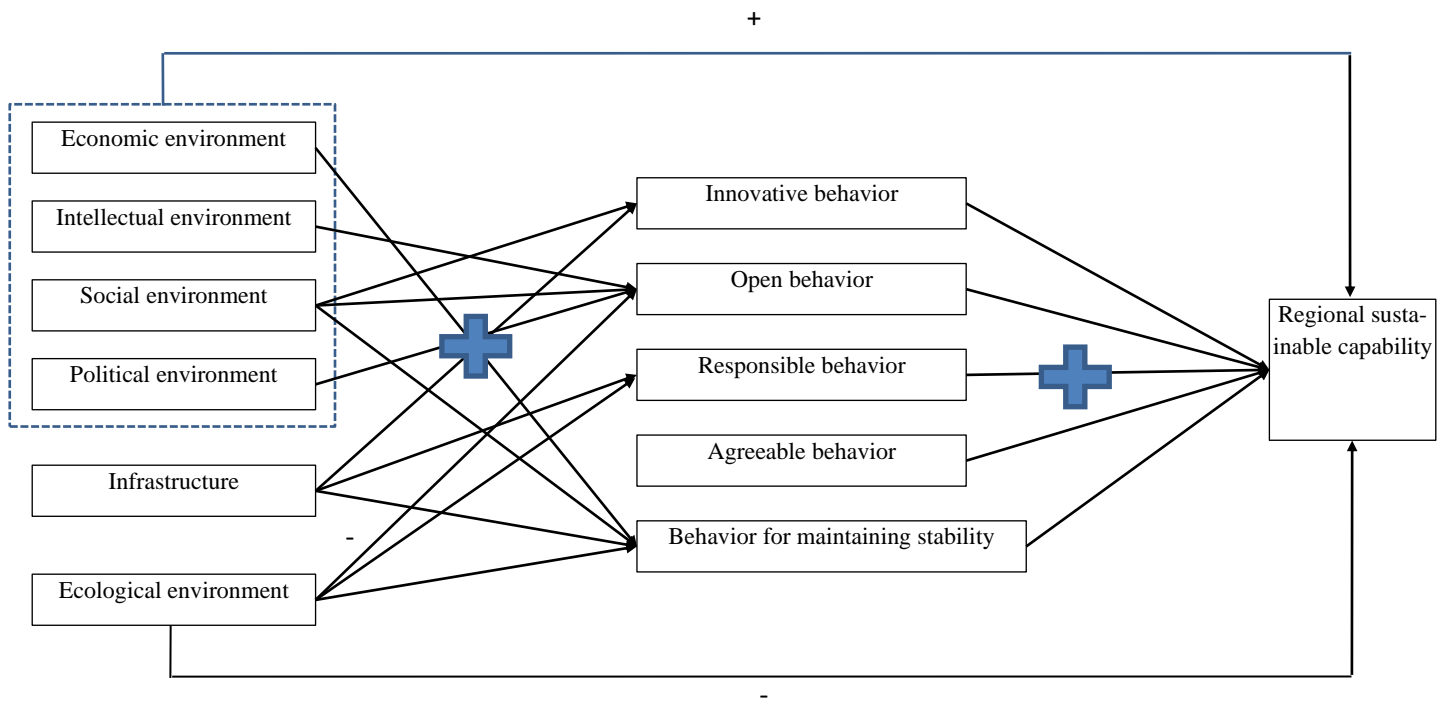
Only the relationships between *ElE* and *OB*, and between *ElE* and *RSC* are negative.
Figure 4. Affecting paths among *RDE*, *LGCB*, and *RSC*

7. Discussion

First, it confirms and also challenges resource dependence theory from perspective of regional sustainable development. The theory emphasizes the role of environment in organization's survival and development. RDE significantly supports or restrictively influences the improvement of RSC (Zhong et al., 2021). Our results largely agree with the view. However, it is in doubt that all environmental factors positively affect regional sustainable development. Liu et al. (2021) and Hou et al. (2019) presented that the long-term sustainable development of a region is dependent on the utilization of natural resources, but our study seems to challenge their conclusions and supports resource curse theory conversely, which is opposite to resource dependence theory to some extent. In fact, many scholars (e.g. Dou et al., 2022) have paid attention to the problem of resource curse in regional sustainability. The phenomenon is obvious in China, a country with rich natural resources. In China many regions are rich in resource but poor in economy. Irrational development of resources even causes them a lot of problems such as fragile ecology, environmental pollution, and single industrial structure, which threaten their sustainability (Gu et al., 2011). It is therefore not surprising that *ElE* has a significant negative impact on *RSC* in China. Compared with previous studies, our contribution is that we distinguish two directions of environmental actions – curse or blessing. It provides theoretical enlightenment for developing countries to make better strategies for sustainable development.

Second, it deepens the theory of organizational character in the field of government management. It is a tradition that compare government organization to human being. However, so far, government character was mostly used to discuss the balance or coordination of government and market, i.e. the visible hand and invisible hand (Jabbar, 2016). Up to now prior studies focused on the exploration of the roles of government as a broker, social people, and a housekeeper or servant (Ozsoy, 2009). They discussed social, economic, and cultural behaviors of governments, but few touched on the psychological and characteristic behaviors (Chu et al., 2017). Different from them, our study integrated many new notions such as open government, innovative government, and responsible government together, and extracted local government's character traits from different behavior patterns of government. We introduced Big Five theory to construct the framework of the study, expanding the application of organizational character theory. It made a new classification for government behaviors, deepening our understanding of government's behaviors and functions.

Third, it enriches dynamic capability theory. Dynamic capability is a strategic management theory widely used to explain the generation of organizational capability. It effectively explains how organizations cope with changes in external environments and achieve sustainable competitive advantage on basis of the adaption of dynamic strategy (Klievink and Janssen, 2009). However, the research on the relationship between government's dynamic capacity and regional sustainable development is still lack. According to Foss (2016), only a full study of the micro mechanism can help us explore the root of the formation and improvement of organizational performance at the macro level. Consequently, even if dynamic capability theory can be used to reveal the formation rules of *RSC*, it is also necessary to explore the microscopic mechanism. Our study meets the requirement. We introduced NLP and CCB theories into the personification of local government's behaviors, and used ABC analysis framework to generate the integrative logic of our study. We then proposed a new theory to explain the mechanisms for enhancing *RSC*, including cognitive mechanism, practical mechanism and integrative mechanism. The combination of epistemology and practice has taken us a big step forward in exploring the theory of regional sustainability. It makes up for the deficiency of Andersson et al. (2022) in predicting the formation of *RSC* from resource- or behavior-based perspective, lacking knowledge as an important antecedent.

Finally, it helps us understand the role of infrastructure construction in regional sustainable development. In a long period, the rapid growth of China's economy was driven by continuous high investment in infrastructure. Prior studies have proved that the investments in housing construction, transportation, and municipal administration can significantly promote the growth of regional economy (Ma, 2019). However, in recent years, the governance philosophy of Chinese governments has transformed and upgraded. They tended to advocate high-quality development on basis of innovation, coordination, green, openness and sharing. To some extent, our study coincides with the development idea of Chinese governments. As found in the study, the direct effect of *InE* on *RSC* is negative, but it has an indirect positive effect through the mediation of *LGCB*. The discovery challenges the results of the studies simply answering whether infrastructure investment has a positive or negative effect on *RSC*, and explains the motivation of Chinese governments to change their concepts and patterns for sustainable development.

8. Conclusions and Implications

8.1. Conclusions

Based on the data analysis of 30 regions in mainland China from 2001 to 2020, we empirically examined the relationships among *RDE*, *LGCB*, and *RSC*. Our conclusions are mainly in three aspects. First, environmental factors affecting the improvement of *RSC* include *EcE*, *SlE*, *ElE*, *InE*, *IlE* and *PlE*. However, their effects on are heterogeneous. Among them, *EcE*, *SlE*, *IlE* and *PlE* not only have direct positive effects on *RSC*, but also indirectly make positive effects through the mediation of *LGCB*. In contrast, *ElE* has a negative effect on *RSC*, while the effect of *InE* mainly depends on the mediation of *LGCB*. Second, local governments conduct five character behaviors. They significantly and positively promote *RSC*. Third, RDE and LGCB should be integrated. We proposed three mechanisms for promoting *RSC*, i.e. cognitive mechanism, practical mechanism and integrative mechanism.

8.2. Implications

The theoretical implications of our study mainly include three aspects. First, we put forward a new theoretical framework of *RSC*. The framework was constructed by following dynamic capability theory, and was grounded in NLP and CCB theories. It explains the influence of *RDE* and *LGCB* on the improvement of *RSC*. The framework enriches the sustainable development theory from the perspectives of resource-based view and dynamic capability. Second, we introduced Big Five theory to research the character behaviors government organizations, thus establishing the theory of local government's character behavior. The theory expands the application of Big Five theory and makes a new contribution to organizational psychology. Third, we established a comprehensive evaluation index system for measuring *RDE*, *LGCB*, and *RSC* respectively. Although the indicators were selected in Chinese context, they are also in favor of the measurement of relevant variables in future work.

The practical implications also mainly include three aspects. First, we inspire local governments to attach great importance to the construction of *RDE* on basis of the consideration of the heterogeneity of different environmental

dimensions. In post-industrial era, local governments should pay more attention to the construction of soft environments, for example, the measures of talent training, sci-tech innovation, social change, and political reform. We need to understand the disadvantages of *InE* investment and avoid the curse effect caused by *ElE*, so as to lead our countries to overcome middle-income trap. In addition, the mass entrepreneurship and innovation strategy, ecological civilization construction strategy, supply-side reform and the belt and road strategy implemented by Chinese governments in recent years are exemplary measures to improve intellectual, ecological and economic environments, which are worthy of the learning of other developing and emerging countries. Second, we inspire local governments to consciously implement character behaviors. The underlying virtues and characteristics strengthen their roles in promoting local governments to make correct decisions and achieve high achievements in sustainability. Finally, we advise local governments to develop and improve *RSC* by following the logic of environment, behavior and capability, which provides continuous power for development fundamentally.

Acknowledgments

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