



Research article

Does the Central Environmental Inspection actually work?

Ruoqi Li^a, Yuanchun Zhou^{b,*}, Jun Bi^{a,**}, Miaomiao Liu^a, Shanshan Li^b^a State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing, 210023, China^b Green Economy Development Institute, School of Economics, Nanjing University of Finance and Economics, Nanjing, 210023, China

ARTICLE INFO

Keywords:

Central environmental inspection

Performance evaluation

Balanced scorecard

Content analysis

China

ABSTRACT

Central Environmental Inspection (CEI) is a particularly important innovative strategy in the transition of environmental governance in China. The first round of CEI for all provincial regions in mainland China has been finished by the end of 2017, but its actual performance remains to be seen. In this study, a multi-dimensional index system was developed under the framework of Balanced Scorecard. Using the content analysis method, we comprehensively evaluated the performance of CEIs in all provinces inspected from the perspectives of target achievement, local rectification, direct effect, and social involvement. The results indicate that CEI has made encouraging progress in the area of environmental governance and the accumulated experiences of the inspections in the early stage greatly boosted the subsequent performance of CEIs. The provincial performance of the central region was significantly higher than that of other regions. For target achievement, the focal points have been basically realized. Despite some neglect of CEI feedback, local environmental governance is experiencing a promising shift from passive to active in general. For social involvement, the CEI has not only promoted the awakening of public environmental consciousness, but also driven public participation in environmental protection. It is notable that the implementation of environmental co-responsibility between Party and governmental officials needs to be further improved. In addition, the shortcomings of each province were identified as well and policy recommendations for existing problems were offered to guide future optimization of local environmental governance and CEI practice.

1. Introduction

China's environmental inspection entered a new era in 2015 (Gao and Fu, 2017). On Jun 1, a trial version of the *Environmental Inspection Working Plan* was approved by the Central Reform Leading Group. The document emphasized that both the Communist Party of China (CPC) committees and governments should take responsibility for environmental protection when performing their duties (Ge et al., 2016b), which symbolized the beginning of environmental inspections covering “party, governments and enterprises”. In January 2016, the Central Environmental Inspection (CEI) Team was founded and stationed in Hebei, a province with serious environmental problems. Four sets of CEIs subsequently followed. By the end of 2017, all provincial regions in mainland China had been inspected.

Compared with other strategies, CEIs have led to actions that are unprecedented in their rigor. By the end of October 2017, 18,419 governmental officials and enterprises' leaders had been formally interviewed with environmental issues. 103,081 public complaints have been promptly resolved, which are nearly one fifth of those in 2017

(Ministry of Ecology and Environment of People's Republic of China, 2018). Unprecedented punishment followed, with 1,527 violators detained and 18,040 officials severely penalized. Punishments were leveled on officials not only from environmental protection sectors but also from other entities, such as the Development and Reform Commission and state-owned enterprises (Ministry of Ecology and Environment of People's Republic of China, 2018).

Theoretically, under the decentralization system with Chinese characteristics, although the central government maintains the political authority over environmental planning, the vast majority of fundamental enforcements and responsibilities have been decentralized to local governments (Heberer and Senz, 2011; Jiang and You, 2016; Zhang, 2017). Driven by the “promotion tournament”, local governments tend to promote economic development by deregulation, collusion or even becoming violator themselves (Zhou, 2007; Qi and Zhang, 2014; Pu and Fu, 2018). Theories related to “regulation within government” (James, 2000) can provide theoretical guidance for various environmental inspections. Numerous studies confirmed that strengthening inspection and punishment can promote local governments'

* Corresponding author.

** Corresponding author.

E-mail addresses: zhouych11@gmail.com (Y. Zhou), jbi@nju.edu.cn (J. Bi).

implementation of environmental regulation (Pan et al., 2015; Tang et al., 2016). Accordingly, providing unambiguous incentives to local governments by strengthening environmental inspections of local governance are essential (Wu et al., 2017).

Inspection systems have been implemented widely around the world for different goals. For example, Russia, USA, France have applied them to land, agriculture and heritage protection (Wang et al., 2015; Weng et al., 2016). In China, it has been explored for a long time. Its experiences with disciplinary inspection and supervision, land inspection, and police supervision have built foundations for its application in environmental protection (Ge et al., 2016b). The land inspection system was proved significantly effective at enhancing law enforcement (Zhong, 2011), curbing violations (Lv et al., 2012; Tan et al., 2013; Zhong et al., 2014) and reducing the loss revenue from state-owned land (Peng et al., 2012).

Inspection systems for environmental protection is continuously improving, contributing to the improvements of enterprises' compliance and environmental quality (Zhang et al., 2018). Before 2006, enterprises were the major foci of inspection. Environmental departments usually urged the illegal enterprises to correct their violations within a limited time (Chang and Wang, 2016). However, its effect was seriously affected by local protectionism, because pollution enterprises were the primary sources of local revenues (Zhang et al., 2018). In order to solve it, six regional environmental protection supervision centers were established and have played important roles in haze event emergencies (Ge et al., 2016a). However, these centers lack adequate authority which remains a controversial issue for them to fulfill their mission (Shang, 2014). With the development of official interviews organized by the former Ministry of Environmental Protection in China (MEP), inspections of governments were gradually emphasized. However, limited by the vertical and horizontal relationship in China's multi-level governance and the neglect of managerial duties of local Party committees (Liu et al., 2012), environmental inspections were still inevitably interfered by provincial governments (Chen, 2017).

To overcome the limitations of conventional practices, the CEI Team is established under the leadership of the former MEP, with the participation of the CPC Central Commission for Discipline Inspection and the Organization Department of Central Committee of the CPC. Representing the CPC Central Committee and State Council, CEI is endowed with higher authority (Gao and Fu, 2017) and thus more capable of solving the perennial local protectionism. The multi-sectoral composition allows it extricate itself from the single perspective of the environment, and examine local environmental governance from a broader perspective. Unlike previous inspections, not only provincial governments and relevant departments but also provincial Party committees are inspected. The Party committee's duty on local environmental protection is unprecedentedly enhanced (Weng et al., 2017).

The procedures of their work are documented in detail, including preparation, stationing, report writing, feedback, transferring, rectification and filing. The stationing usually last for one month and can be divided into three stages: provincial-level inspection, municipal-level inspection, and targeted supplementary inspection. Feedbacks from the CEI Team are formed into standardized official documents, which require the inspected provinces to respond accordingly within 30 weekdays. As a vital basis for assessment of leading bodies and cadres (Ge et al., 2016b), the inspection results can incentivize local Party committees and governments to enhance environmental protection. The rectification plans are compulsorily made public. Its implementation will be checked in the following round of CEI. By the end of 2018, 20 provinces have been inspected by the CEI Team for a second time.

Numerous studies have evaluated the performance of other inspections, providing references for those of CEI. Econometric models, such as Ordinary Least Square model, are broadly employed in empirical studies of the specific impacts of inspection. Unfortunately, these methods depend heavily on panel data for years, which limits their applicability to the newly established CEI. For a comprehensive

evaluation, much effort has been dedicated to the application of Delphi method, Analytic Hierarchy Process (AHP), membership analysis (Fan et al., 2012; Ran et al., 2014; Wei, 2014). The Balanced Scorecard (BSC), an excellent tool for strategic performance evaluations, has evolved and is now being used for performance evaluations of inspections (Fan et al., 2012; Yu, 2016). With the advantages of combining financial and non-financial perspectives, internal and external evaluations, and short-term and long-term goals, BSC provides a good framework for the comprehensive evaluation of CEI performance.

This study developed a multidimensional index system for CEI evaluation under the framework of BSC. Based on the data derived from two types of official documents through content analysis, the proposed index system was implemented in all 31 provinces inspected to evaluate the actual performances of CEI at provincial level. Unlike previous studies, our study is the first to quantitatively evaluate the performance of CEI. It will enlighten China on future optimization of not only local environmental governance and CEI, but also inspection practices in other fields. Moreover, as the largest developing country with serious environment problems, the case in China is globally relevant, which can provide more experience for other developing or transitioning economies.

2. Methodology

2.1. Background of the Balanced Scorecard

The Balanced Scorecard was first developed by Kaplan and Norton (1992), and then widely used as a strategic management tool for performance evaluation in business and public sectors. Unlike the traditional index system that only considers financial criteria, the BSC concretizes organizational goals and strategy implementation into 4 measurable and operable dimensions of metrics: customer, internal business, innovation and learning, financial (Kaplan and Norton, 1992; Lawrence and Sharma, 2002; Bhagwat and Sharma, 2007).

It is originally the most popular performance management tool in various industries (Figge et al., 2010), such as oil (Kaplan and Norton, 2000), manufacturing (Quezada et al., 2018), and food and beverage (Junior et al., 2018). In addition to conventional enterprise performance evaluations, more and more BSC models focused on sustainability (Figge et al., 2010; Junior et al., 2018) and supply chain management (Bhagwat and Sharma, 2007; Bhattacharya et al., 2014) have been proposed by adjusting the original framework to address social and environmental considerations. With the rapid development of New Public Management, many governments have shifted their value orientations to fulfill governmental responsibilities based on market demand and the interests of the public. The BSC has already been used in public sectors and government strategies in developed countries, such as Italy (Maran et al., 2018), Britain (Mcadam and Walker, 2010), New Zealand (Griffiths, 2003), Australia, Germany and France, and its applications to the governance of developing countries are also being explored (Gao et al., 2018).

The BSC method is appropriate for performance evaluation of CEI from both theoretical and practical aspects. Theoretically, the features of the CEI are consistent with those of BSC. Firstly, CEI has specific work targets, which are core of its evaluation, and correspond to BSC framework (the implementation of organizational goals and strategy). Secondly, CEI is concerned with not only achievement of long-term targets (e.g., environmental quality improvements) but also timely resolution of emergent environmental issues and drivers behind (e.g., policy implementation, accountability mechanism). Taking both intuitive financial situation in the short-term, and the driving factors such as employees' execution and innovation ability in the long-term into consideration, BSC supports the synchronous evaluation of long-term and short-term goals, external phenomena and internal driving forces. In addition, from the perspective of stakeholders, CEI is not a project solely within governments and enterprises; special attention has been

Table 1
Priorities of the first round of CEI in China.

No.	Priority work
1	Focusing on the resolution of environmental issues that are of major concern to the central authorities with strong resentment among the masses and adverse social impact
2	Monitoring progress in regions with deteriorating environmental quality
3	Accelerating the rectification of environmental problems that affect the masses
4	Inspecting environmental protection performance of local Party committees and governments
5	Promoting the implementation of vital mechanisms (ensuring that both Party committees and governments are held accountable and that officials take responsibility for environmental protection when performing their duties)

paid to feelings and feedback of masses. While traditional BSC also takes internal operation process and feedbacks from external stakeholders into account (Butler et al., 1997). At practical level, BSC has been successfully applied in other similar practices evaluation in China, such as land supervision and inspection (Fan et al., 2012; Yu, 2016).

2.2. Central Environmental Inspection Index (CEII) system

A BSC-based CEI Index system was devised to systematically evaluate the performance of the first round of inspections in 31 provinces (except for Hong Kong, Macao and Taiwan) according to its major works and priorities. The major works of it include examining the implementation of Party and state environmental policies, the handling of serious environmental issues and the performance of environmental protection duties by provincial Party committees and governments. Table 1 lists the priority works for inspections.

In the adjusted BSC, the major works of the inspections are the strategic targets as defined under the original framework. The dimensions of financial, internal business, innovation and learning, and customer become target achievement, local rectification, direct effect and social involvement, respectively (Fig. 1). Table S1 shows the fifteen specific indicators selected.

The aim of Target Achievement Index (TAI) is to evaluate the most intuitive output of the inspection, i.e., the identification of issues related to CEI's focal points, which are summarized from the its inter-related major works and priorities. Firstly, based on public choice theory (Quirino, 2018), one of the focal points is to review the implementation of national environmental protection decisions. Secondly, social contract theory (Binmore, 1994) holds that protecting public rights and interests is one of the government's major responsibilities. Thus, the CEI Team should prioritize the rectification of environmental problems affecting the masses. Thirdly, to reduce transaction costs (Garrick et al., 2018), inspectors attach great importance to the

treatment of regions with deteriorating environmental quality. Fourthly, the officials have their own motivations, the absence of inspection and restriction may result in negligence, inaction or even refusal to perform their duties. Inspecting the omissions and chaos of local authorities is also considered a focal point. Besides, effective incentives and accountabilities are capable of ensuring the fulfillment of government duties (Camerer and Ernst, 2006). Accordingly, CEI is devoted to promoting the operation of several important mechanisms to improve the performance of public sectors on environmental protection (e.g., co-responsibility between Party and governmental officials, double duties for all departments and serious accountabilities). The five specific indicators of TAI (from T₁ to T₅) are the proportion of issues related to the above five focal point on the rectification list respectively.

The Local Rectification Index (LRI) reflects the provincial internal implementation of the inspection results. Identifying the most pressing problems is only the first step of CEI. However, the final performance of this strategy is tightly associated with local rectifications. The indicators of LRI incorporate three important attributes: completeness, meticulousness and self-consciousness. Whether feedback from CEI Team has been fully responded to is the most basic criterion for evaluating local rectifications. In this study, the proportion of feedback words mentioned on the provincial rectification list characterizes the completeness. Meticulousness reflects the level of detail in responding to feedback from CEI and can be partly revealed by the average number of specific tasks decomposed from one feedback problem on the provincial rectification list. Apart from the passive rectification commanded by the inspectors, many provinces have presented plenty of self-requirements that demonstrate their conscious efforts to rectify problems by means of greater efforts, higher standards, and stricter requirements. To ensure the data comparability of different provinces, we adopt ratio of self-imposed demands to inspectors' list of feedback problems on the rectification list.

The Direct Effect Index (DEI) demonstrates the short-term

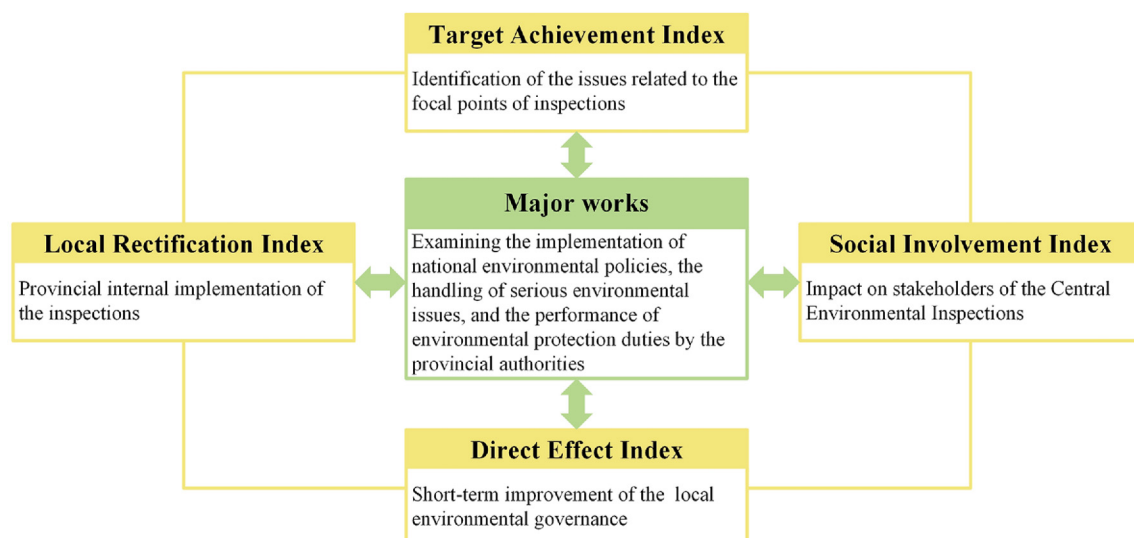


Fig. 1. The framework of the BSC-based CEII system.

improvement of environmental protection actions in each province. The selection of DEI indicators also refers to the focal points of the inspections. First, public welfare must be the governments' highest priority when wielding public power (Binmore, 1994). Second, the high transaction costs remain a large obstacle to intergovernmental cooperation, resulting in serious environmental pollution at provincial boundaries (Garrick et al., 2018). Represented by average time proposed in the rectification list (D_1 and D_2), the efficiencies of rectifying issues related to the above two aspects approximately represent the direct effect of accelerating the resolution of environmental problems affecting the masses and monitoring the treatment in transboundary areas. In addition, according to the principle of combining authorities and responsibilities, clarifying the distribution of authorities and responsibilities is the basis for achieving good environmental governance (Liang and Langbein, 2015). As the focal point of ecological civilization, the implementation of co-responsibility of the Party and governmental officials, double duties for all departments and serious accountabilities are of great importance for the first round of inspections. D_3 , D_4 and D_5 denote the local performance of the three aforementioned mechanisms respectively.

The Social Involvement Index (SII) is regarded as the index of customer feedback on CEI, i.e., to what extent the masses, enterprises, media are influenced. For reasons of data availability, feedback from corporations is not currently included. We introduce Baidu Index to analyze its social impacts from both the public and media perspectives. The long-term impact on public is estimated by the growth rate of provincial Baidu Search Index for "environmental protection" six months before and after the on-site inspection. While the Baidu Media Index for "environmental protection" during the on-sited period, indicates the media feedback, i.e., the attention attracted by the inspections.

2.3. Data source and processing

Two types of official documents are taken as the main data sources. *The Feedback from Central Environmental Inspector* (FCEI) is a summary of problems identified during the on-site inspection. All provinces are required to respond within 30 weekdays. *The Rectification List of Provincial Government* (RLPG) of all 31 provinces has been published. With similar durations before publication, standardized structure and strong authority, these two official documents guarantee the data comparability and reliability of provinces inspected in different sets. TAI data is obtained from RLPGs, while both FCEIs and RLPGs are adopted in LRI and DEI calculations. Based on the content analysis method (Spaltro, 1969; King et al., 2013), the quantification of official documents (text encoding, cross-checking, data processing) is accomplished using MAXQDA. In particular, the proposed average rectification time in D_1 and D_2 is determined with reference to the date of inspector's feedback. The time for the issues that have been corrected or will be immediately optimized is recorded as zero. The number of punished people in D_5 is adjusted by a weighting method (weighting 3, 2, 1 for numbers of people arrested, accountable and interviewed).

As the data source of SII, Baidu Index is a database with massive netizen behavior records, and has contributed to an abundance of research (He et al., 2018; Li et al., 2018). Among various modules, Search Index indicates netizen's levels of concern about a given topic by weighted summing of related keyword search frequencies. Through the statistics of keyword in the news, Media Index characterizes the level of media attention (Baidu, 2018). However, the spatiotemporal differences may result in differences in the background values of social attention. To address this concern, S_1 calculates the growth rates of Search Index, while S_2 introduces last year's monthly average Media Index as background value. Moreover, with the development of social economy, the public awareness of environmental protection has gradually improved, which will contribute to the improvement of attention. To avoid this interferences, S_1 subtracts the growth rate in the

same period last year.

Referring to previous research (Yu, 2016) and the "equal-importance" principle of CEI and indicator selection in this study, our evaluation adopts centesimal system and multilevel averaging weighting method. The normalization methods for the positive and negative indicators are as follows:

$$X_{n,p_k} = \begin{cases} 100 & (x_{n,p_k} \geq (\sum_{i=1}^{31} x_{n,p_i})/n) \\ x_{n,p_k}/(\sum_{i=1}^{31} x_{n,p_i}/n) \times 100 & (x_{n,p_k} < (\sum_{i=1}^{31} x_{n,p_i})/n) \end{cases} \quad (1)$$

$$X_{n,p_k} = \begin{cases} (\max_{31} x_{n,p_i} - x_{n,p_k})/(\sum_{i=1}^{31} (\max_{31} x_{n,p_i} - x_{n,p_k})/n) \\ \times 100 & (x_{n,p_k} \geq (\sum_{i=1}^{31} x_{n,p_i})/n) \\ 100 & (x_{n,p_k} < (\sum_{i=1}^{31} x_{n,p_i})/n) \end{cases} \quad (2)$$

where X_{n,p_k} is the normalized value of indicator n for province k ; x_{n,p_k} is the original value of X_{n,p_k} .

3. Results and discussion

The results show that CEI has greatly strengthened the national environmental protection inspection and already made considerable accomplishments owing to its higher level of authority compared with previous approaches. The average provincial CEII is 81.77. Among the four perspectives (Fig. S1), the TAI scored the highest, averaging 85.16, which indicates that the objectives of the inspectors are basically attained. Both LRI and SII are 82.16, illustrating that CEI has deepened the environmental awareness of local Party committees, governments and the public to some extent. As the average DEI is only 77.61, there is still room for improvement in the specific process of environmental protection.

Fig. 2a shows the enormous regional differences in the CEIIs. The average CEII in central China scores 88.17, which is significantly higher than those in other regions. While the average performances in east, northeast and west China are approximately the same, which are 83.43, 81.56 and 81.35 respectively. Evaluation results of CEII in all the provinces inspected are detailed in Table S2. CEI has the best performance in Guizhou, reaching 93.99. Ranking from 2nd to 6th, the CEIIs of Shaanxi, Hunan, Anhui, Henan, and Hubei also exceed 90. As the pilot province, Hebei lags far behind with a CEII of 60.23, due to insufficient experience in identifying critical problems, improving local performance and social participation. The scores of Guangxi and Inner Mongolia are relatively low as well. For Inner Mongolia, as its SII score is only 60.47, the propaganda work of inspectors should be strengthened through multiple media, thereby improving public environmental awareness. Guangxi has the lowest DEI scores, illustrating the less-than-ideal performance of local feedback. Therefore, their determination to solve eco-environmental problems should be further strengthened.

For a specific province, the sub-index whose value is lower than the corresponding all-province average with the lowest ratio to the average level among all sub-indices, will be defined as its shortcoming. As shown in Table 2, roughly one third of provinces take DEI as a shortcoming sub-index. Their ratios to the national average range from 36.12% to 95.30%. The shortcoming sub-index for Tibet, Sichuan, Hebei, Jiangxi, Heilongjiang, Yunnan and Hainan are all SII, accounting for 61.24%–99.51% of the average. Only 5 provinces take LRI and TAI as their shortcoming sub-index. The above identifications of the shortcoming sub-index for each province can provide a reference for better inspection performance.

Comparisons between groups shows that the inspection performance gradually improved over time (Fig. 2b). Hebei, inspected as a pilot province in the first round of CEI, scores only 60.23. The inspection performances of eight provinces stationed in the first set are considerably improved on the basis of the experiment, with an average CEII increasing by 28.84%. Making greater progress, the average CEII of the two subsequent groups reached 86.93 and 90.65, respectively. It

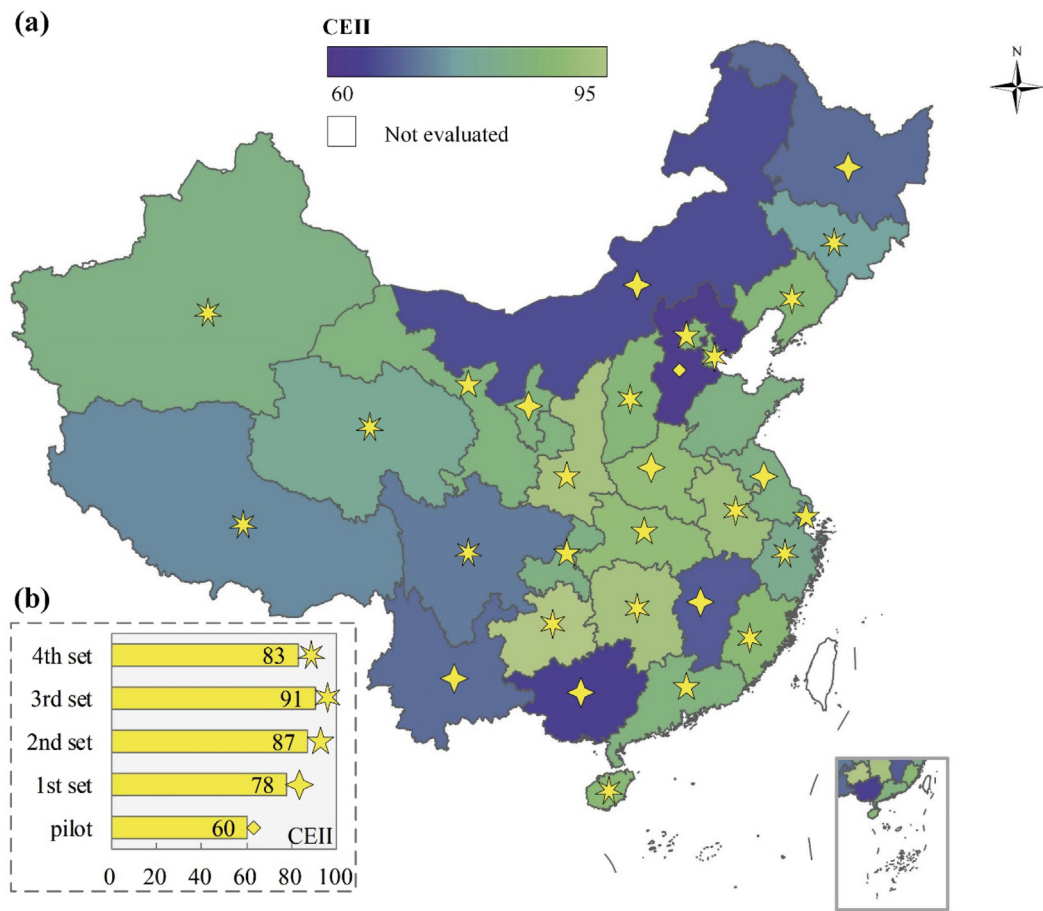


Fig. 2. Comparison of CEII between different provinces (a) and groups' average (b).

Table 2
Shortcoming sub-index for each province.

Province	Shortcoming	Proportion	Province	Shortcoming	Proportion
Guangxi	DEI	36.12%	Yunnan	SII	77.94%
Jilin	DEI	64.69%	Hainan	SII	99.51%
Chongqing	DEI	73.60%	Shanxi	LRI	81.14%
Qinghai	DEI	73.72%	Ningxia	LRI	93.44%
Zhejiang	DEI	76.30%	Guizhou	LRI	96.31%
Gansu	DEI	80.16%	Tianjin	LRI	99.30%
Shanghai	DEI	84.22%	Jiangsu	LRI	99.55%
Guangdong	DEI	85.81%	Inner Mongolia	TAI	73.75%
Beijing	DEI	86.61%	Xinjiang	TAI	80.35%
Liaoning	DEI	93.99%	Anhui	TAI	86.06%
Fujian	DEI	95.30%	Shaanxi	TAI	96.55%
Tibet	SII	61.24%	Shandong	TAI	98.45%
Sichuan	SII	62.86%	Hunan	/	/
Hebei	SII	63.12%	Henan	/	/
Jiangxi	SII	65.03%	Hubei	/	/
Heilongjiang	SII	69.26%			

denotes that timely and effective experience summaries have played an active role in the subsequent inspections. However, compared with the third group, the average performance of the last group has declined, possibly because these provinces are mostly in undeveloped areas.

3.1. Target Achievement Index

The overall results of TAI indicate that the first round of CEI has basically achieved the expected foci on the major works and priorities. Focusing on problems of macroscopic, general, and urgent importance,

the CEI strived for breakthroughs in the focal points, including the implementation of national environmental protection decisions, the rectification of environmental problems affecting the masses, the treatment of regions with deteriorating environmental quality, the omissions and chaos of local authorities and the operation of important mechanisms. The issues related to the above five points take up nearly three quarters of the provincial rectification lists.

Comparing the proportion of problems related to the five focal points (Fig. S2a), striking differences can be found. Great progress has been made in inspecting the environmental performance of local Party committees and governments, and promoting the implementation of vital mechanisms such as “co-responsibility between Party and governmental officials” and “double duties for all departments”. For all provinces, the average proportions of governmental performance issues and policy implementation issues in the rectification lists are 54.76% and 38.60%, respectively. With comparatively low shares, environmental quality and transboundary, and pressure transmission issues account for 15.64% and 12.43% of the provincial lists on average. However, environmental problems around the masses account for the lowest proportion, at 5.50%. The difference in proportion may relate to the type of issues.

The variation coefficient of provincial TAI at a relatively low level demonstrates that the inspections are evenly applied. Predominantly, the provincial TAI is between 75 and 100 (Fig. 3a). Evaluated at 57.08, Hebei has the lowest TAI. The TAI of Inner Mongolia (62.80) and Yunnan (67.58) are also at a relatively low level. Since all those provinces are pilot or were inspected during the first set, the unsatisfactory scores are likely caused by insufficient experience and incomplete understanding of major works and priorities in the early stage of CEI. It is noteworthy that from the perspectives of the five focal points, the

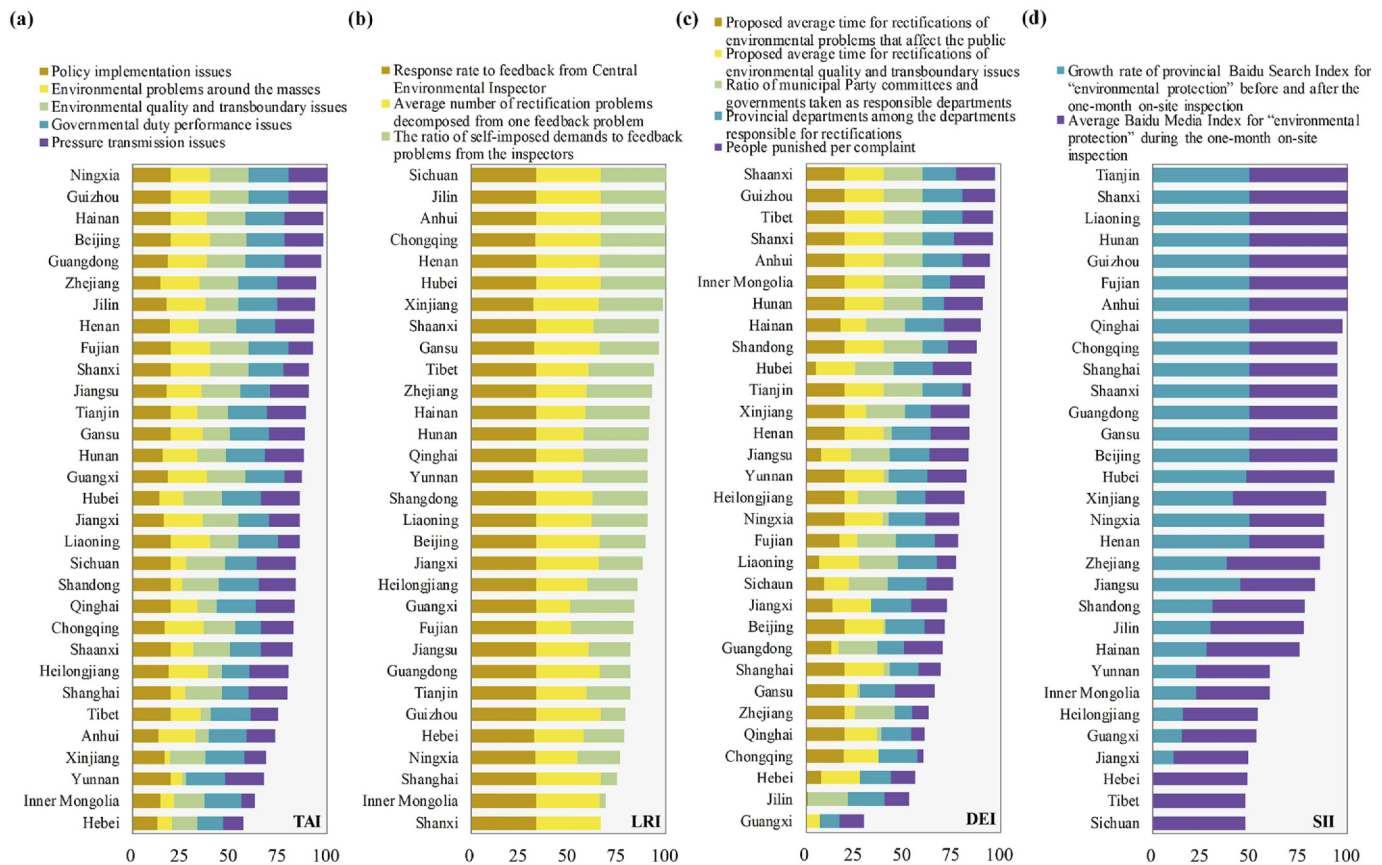


Fig. 3. Target Achievement Index (a), Local Rectification Index (b), Direct Effect Index (c) and Social Involvement Index (d) in 31 provinces.

proportions of problems identified in Guizhou and Ningxia all exceed the national average, thereby their TAI score a perfect 100. In addition, the TAIs of Hainan, Beijing and Guangdong are all above 95. The inspection work in the four advanced provinces can guide the constant optimization of the institution.

3.2. Local Rectification Index

Turning to LRI, the evaluation results show that the CEI feedback has been implemented completely and that local environmental governance is undergoing a shift from passive to active.

In terms of completeness and meticulousness, the detailed responses to CEI feedback have basically been actualized. A total of 1,335 specific tasks were sorted out with corresponding corrective measures, responsible units and completion date according to the 113 feedback from the inspection groups. In general, the average number of specific tasks decomposed from a feedback problem is 12. The rectifications in Chongqing and Anhui are significantly more detailed than the others, with approximately 25 problems per feedback. Conversely, the L_2 in Fujian and Guangxi reached only half of the average. Thus, their meticulousness needs to be improved. Most provinces responded to the FCEI documents word for word. Only in six provinces are there problems that have not been addressed, which should be highlighted in the reviews to ensure that inspection work is completed.

Meanwhile, from the perspective of self-consciousness, CEI has accelerated the formation of endogenous drivers of local environmental governance. Grasping the opportunities of CEI, the provincial authorities have drawn inferences from the inspection feedback and made self-corrections on environmental protection. In addition to feedback from CEI, 628 self-imposed requirements were listed, accounting for 31.99% of the total.

The LRI, ranging from 65 to 100, reflects the implementation gap

between provinces (Fig. 3b). With immense efforts, Sichuan, Jilin, and Anhui obtain full marks in LRI evaluation. While the issues listed in Shanxi's FCEI are all responses to CEI feedback, and its self-requirements are not embodied. Of the 49 specific issues to be rectified in Inner Mongolia, only two are added except for the central orders. The environmental governance of the two provinces is still in a passive mode and their self-consciousness needs to be further enhanced.

Employing the number of tasks decomposed per feedback problem and the ratio of self-imposed demands to feedback problems as the axes, a two-dimensional coordinate system has been established at the center of their average levels to classify the rectifications of the provinces (Fig. 4a). Six provinces that didn't achieve a full response to the inspectors' feedback were excluded. Anhui, Jilin and Sichuan are outstanding provinces with better performance in both dimensions. Among the single-advantage provinces, Hubei, Guizhou, Shanghai and Shanxi are confirmed as the leading rectification provinces, while Hunan, Qinghai, Shaanxi, Zhejiang, Henan, Hainan, Tibet are identified as provinces with higher self-consciousness on environmental governance.

3.3. Direct Effect Index

The results of DEI indicate that the first round of CEI has made impressive achievements.

Compared to previous environmental supervision approaches, the accountability systems have been greatly strengthened by CEI. Various penalties have been imposed in accordance with national policies and inner-party regulations (e.g., *Environmental Protection Law of the PRC*, *Administrative Supervision Law of the PRC*, *The Measures for the Accountabilities of Ecological and Environmental Damage*). By the time FLPG were delivered, 4 officials were interviewed or accountable for every five public complaints. Additionally, detention has been heavily applied in the first round of inspections. The average number of people

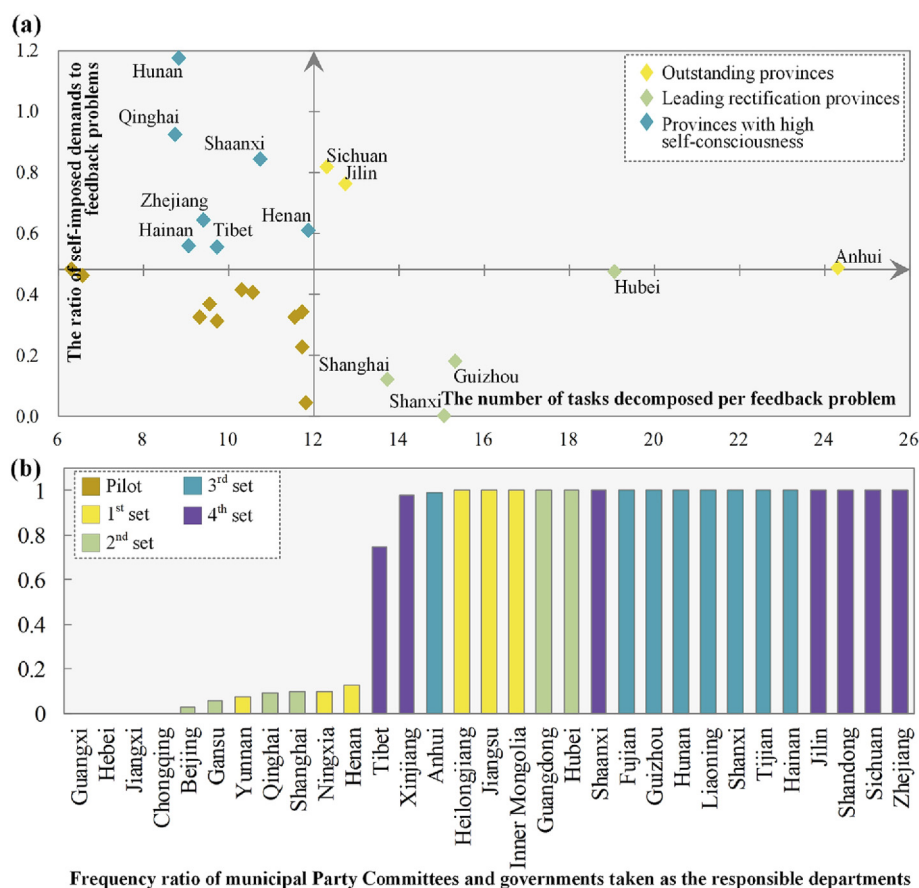


Fig. 4. (a) Local Rectification matrix of provincial meticulousness and self-consciousness. (b) The implementation of “co-responsibility between Party and governmental officials” in 31 provinces.

arrested per hundred complaints is approximately 2.

The obstacles of conventional environmental governance caused by multipart management, ambiguous distribution of authority and responsibilities, and insufficient cooperation have been overcome to some extent, thereby promoting the establishment of an innovative mode of governance with joint efforts from all relevant departments. Approximately 20 provincial departments are considered responsible for environmental protection in the provincial rectification lists.

Notably, the indicator for the frequency ratio of problems for which municipal Party committees and governments are the responsible departments (D_3) is only 67.34, significantly lower than the others (Fig. S2b). As a major innovation to promote ecological progress, environmental co-responsibility between Party and governmental officials is still a vulnerability of CEI, despite certain achievements.

The improvement effects of environmental protection work in Shaanxi, Guizhou, Tibet and Shanxi put them ahead of others, with DEIs higher than 95 (Fig. 3c). In contrast, Guangxi has the lowest DEI (29.68). The absence of municipal Party committees in the responsible departments reflects that the Party committee's duties in the field of environmental protection are still unclear. The proposed average time for rectification of public environmental issues there is as high as 764 days, which is the longest and twice the national average.

In particular, the implementation of accountability mechanisms varies by province. Shaanxi shows the toughest sanctions, with 38 and 72 people being interviewed and held accountable per hundred complaints, respectively. In Jiangxi, there is an arrest in one of every 20 complaints. However, the DEIs of four provincial-level municipalities (Chongqing, Tianjin, Beijing and Shanghai) are all below 60. Inadequate accountability and detention are not in accordance with their orientations and public expectations.

Furthermore, as shown in Fig. 4b, the striking disparity in the performance of “co-responsibility between Party and governmental officials” deserves special consideration. Party committees and governments have been given equal footing when allocating environmental duties in more than half of the provinces. Only a few rectification problems in Beijing, Gansu, Yunnan, Qinghai, Shanghai, Ningxia, and Henan have been assigned to municipal-level Party committees, and the frequency ratios of municipal Party committees and governments are between 0.03 and 0.13. In Hebei, Guangxi and Jiangxi, municipal Party committees are not regarded as responsible bodies in their rectification lists. Moreover, Chongqing directly lists the names of specific cities as responsible departments without further statements. To foster the environmental responsibility consciousness of multilevel Party committees and eventually form the scientific concept of political achievement, the leading position of local Party committees in the transitional environmental governance system should be further affirmed in the coming inspections.

3.4. Social Involvement Index

The results for the social involvement aspect demonstrate the excellent reputation of the first-round inspections. Regarding the public, CEI has not only promoted the awakening of environmental awareness, but also partly driven public participation in the field of environmental protection. On the one hand, the average Baidu Search Index for “environmental protection” increased by 8.90% six months after the on-site inspection. The average growth rate a year ago was -7.36% . On the other hand, 104,447 public complaints were accepted during the month-long stationing period, which is approximately 7 times greater than the number reported via the hotline “12369” and official WeChat

account throughout 2015. The average numbers of cases gradually increased with the increase in set numbers in general (Fig. S3), which are 1,637, 2,223 and 4,494 in the first three sets, respectively. Hence, early inspections have made people recognize their government's determination to combat pollution and thereby earn their trust. However, the number of cases reported in the last set differs considerably among provinces. Public environmental awareness is still limited in Tibet, Qinghai, Hainan, and Xinjiang, resulting in minimal public participation.

From the perspective of media, CEI has enjoyed a high media profile. During the on-site stage, the “environmental protection” Baidu Media Index rose by an average of 17%. To vividly describe the strengthened law enforcement resulting from CEI, metaphors such as “environmental storm” and “imperial commissioners” were used by local newspapers.

With the largest coefficient variation among the four perspectives, the evaluation results of SII in each province fluctuate between 47 and 100 (Fig. 3d). Scoring full marks, the social effects caused by the third set of CEIs have set an example for the others. While in Hebei, Tibet and Sichuan, the growth rates of the provincial Baidu Search Index are even lower than those of the same period a year ago. Ultimately, they score the lowest in the SII evaluation. Specifically, the low score in Tibet may be due to its low internet penetration, qualified resource endowment and relatively backward economy. For Hebei, as the first province to be inspected, the scale effect of CEI has not yet been generated, which may be the primary cause of its failure in SII. These provinces should place more emphasis on publicizing the CEI's progress to ensure that the CEI is seen as an innovation with appreciable achievements.

4. Conclusions and policy implications

Central Environmental Inspection is a critical issue under the integrated reform framework of promoting ecological progress. This paper seeks to develop a comprehensive evaluation approach that leads to a systematic quantification of CEI's actual performance in each province, based on the major projects and priorities of this landmark inspection in the history of environmental protection in China.

An adjusted BSC (CEII) is implemented for the first round of inspections. We found that due to the higher authority of CEI, periodic progress has been made and the national environmental protection inspection has been greatly strengthened, with accurate identifications of problems that are consistent with expectations, positive rectifications by local governments, effective settlements of persistent environmental problems and accelerated public participation. From a regional perspective, the average performance of the central region is significantly higher than those in other provinces. Taking the inspection time into consideration, in general, the accumulated experiences of inspections in the early stage greatly boosted the subsequent performance of CEI.

However, as the first comprehensive experiment of CEI in China, the inspections from 2016 to 2017 are still under exploration, and several problems persist, such as outstanding performance shortcomings in some provinces, neglect of feedback, striking disparities in implementing “co-responsibility between Party and governmental officials”, accountability intensities inconsistent with their positioning public expectations in the 4 province-level municipalities, and inadequate social involvement in undeveloped regions. The main policy recommendations are as follows.

First, a second inspection, characterized by scientific rigor and effectiveness, is of vital importance to answer this question: Is CEI only a form of campaign-style governance or a continuous treatment? On the one hand, the shortcomings identified for each province are important for future inspections, according to which differentiated inspection priorities should be set up. On the other hand, when reviewing the rectification of local authorities, the CEI feedback ignored by some provinces should be taken as the focal points to enable inspection achievements.

Second, good environmental governance is the result of concerted efforts of local Party committees, governments and various departments. As a fundamental innovation in the construction of environmental responsibility system and an important requirement of CEI, the “co-responsibility between Party and governmental officials” in 31 provinces shows striking disparities. Avoiding this problem requires the Chinese central government to further strengthen the environmental protection duties of local Party committees and governments in CEI practices. By taking advantage of its authority, strong political pressures and compulsory measures, the central government should build local cadres to strengthen the sense of responsibility for environmental protection and thus promote economic transformation and development.

Third, extensive and in-depth public participation is a mainstay in accelerating the prompt and effective resolution of problems that affect the public. The transparency of CEI needs to be comprehensively improved. On the one hand, drawing on the experiences of management platforms for daily complaints, a more streamlined route should be developed. Based on the characteristics of the times, the Chinese government should expand the channels for complaints by including online reporting approaches such as WeChat and SINA Microblog into the scope of its work to establish an inspection system with the joint participation of society, thereby protecting the fundamental rights of citizens. On the other hand, to enhance the deep understanding of the CEI's achievements, the inspection results, especially the results of handling tip-offs, should be made public promptly. In particular, public participation in less developed regions, such as Tibet and Xinjiang, should be given more weight.

It must be stressed that the normalization of CEI requires continuous and dynamic performance evaluations as basic guarantees. Quantifying the long-term effects of CEI remains a challenging task, as the first round of inspections have just ended. Due to the non-availability of long-term data, the present CEII is dominated by short-term indicators. Future research could use data such as improvements in environmental quality and the compliance of corporations to realize a multi-time scale evaluation that provides guidance for the continuous optimization of the environmental inspection system in China.

Overall, CEI is a good practice of environmental governance in China's transitional period, which can also provide experience for other countries. For example, countries with similar political systems can explore the establishment of environmental inspection system according to local conditions. Based on the results of this study, regions with better environmental performances are suggested as the pilots, which will play a demonstration role in other regions.

Meanwhile, transparency of the whole process should be emphasized, so as to encourage public participation in environmental protection.

CEII serves as a useful tool for decision-makers in China, allowing managers to evaluate the performance of CEI from various targets and stakeholders, and also provides a reference for the evaluation of other inspection systems. As for index construction, the BSC-based CEII framework, including target achievement, local rectification, direct effect and social involvement, provides a replicable general framework for the evaluation of similar institutions and policies in China, Russia, USA, France etc. (Wang et al., 2015; Weng et al., 2016). In terms of data, the acquisition of quantitative data is often a challenge for such studies. The data collection and processing procedure of official documents in this study can provide a new perspective for other researchers as well.

Acknowledgements

This work was supported by the National Science Foundation of China [grant numbers 71761147002, 71433007, 71874079, 71774077], National Social Science Foundation of China [grant number 18ZDA102] and Six Talent Peaks Project in Jiangsu Province [JNH-B-016]. We want to thank Beibei Liu, Peiqi Gao, Mengdie Ma, Qiming Xu,

and Xinya Zhao for supporting the data collection works.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jenvman.2019.109602>.

References

- Baidu, 2018. Baidu index. index.baidu.com/?tpl=trend&word=%BB%B7%BE%B3%B1%A3%BB%A4, Accessed date: 5 September 2018.
- Bhagwat, R., Sharma, M.K., 2007. Performance measurement of supply chain management: a balanced scorecard approach. *Comput. Ind. Eng.* 53, 43–62.
- Bhattacharya, A., Mohapatra, P., Kumar, V., Dey, P.K., Brady, M., Tiwari, M.K., Nudurupati, S.S., 2014. Green supply chain performance measurement using fuzzy ANP-based balanced scorecard: a collaborative decision-making approach. *Prod. Plan. Control* 25, 698–714.
- Binmore, K., 1994. Game theory and the social contract. *J. Econ. Etudes Hum.* 5, 429–436.
- Butler, A., Letza, S.R., Neale, B., 1997. Linking the balanced scorecard to strategy. *Long. Range Plan.* 30, 153–242.
- Camerer, C.F., Ernst, F., 2006. When does “economic man” dominate social behavior? *Science* 311, 47–52.
- Chang, J., Wang, X., 2016. From inspection on enterprises and local government to inspection on local Party Committees: the historical logic of the changes on environmental inspection model (in Chinese). *Environ. Protect.* 44, 18–23.
- Chen, H., 2017. The legalization of environmental supervision institution: development, problems and suggestions (in Chinese). *Law Rev.* 176–187.
- Fan, B.N., Wang, J.Q., Zhang, X.L., Li, X., 2012. The theoretical framework and performance index system building for national land supervision system (in Chinese). *China Land Sci.* 26, 10–16.
- Figge, F., Hahn, T., Schaltegger, S., Wagner, M., 2010. The sustainability balanced scorecard—Linking sustainability management to business strategy. *Bus. Strateg. Environ.* 11, 269–284.
- Gao, G., Fu, Z., 2017. Supervision mechanism for environmental law enforcement in China. In: *Proceedings of the 2017 2nd International Conference on Politics, Economics and Law*.
- Gao, H., Chen, H., Feng, J., Qin, X., Wang, X., Liang, S., Zhao, J., Feng, Q., 2018. Balanced scorecard-based performance evaluation of Chinese county hospitals in under-developed areas. *J. Int. Med. Res.* 46, 1947–1962.
- Garrick, D.E., Schlager, E., De Stefano, L., Villamayor-Tomas, S., 2018. Managing the cascading risks of droughts: institutional adaptation in transboundary river basins. *Earth's Futur.* 6, 809–827.
- Ge, C., Weng, X., Dong, Z., 2016a. Environmental inspection system: promoting the establishment of supervising governance and accountability regulatory system (in Chinese). *Environ. Protect.* 44, 24–28.
- Ge, C., Weng, Z., Zhao, X., 2016b. Environmental protection inspector: a top instrument for coresponsibility of the Party and governmental officials (in Chinese). *Chin. J. Environ. Manag.* 8, 59–60 + 29.
- Griffiths, J., 2003. Balanced Scorecard use in New Zealand government departments and Crown entities. *Aust. J. Public Adm.* 62, 70–79.
- He, G., Chen, Y., Chen, B., Wang, H., Shen, L., Liu, L., Suolang, D., Zhang, B., Ju, G., Zhang, L., 2018. Using the Baidu search index to predict the incidence of HIV/AIDS in China. *Sci. Rep.* 8, 9038.
- Heberer, T., Senz, A., 2011. Streamlining local behaviour through communication, incentives and control: a case study of local environmental policies in China. *J. Curr. Chines Aff.* 40, 77–112.
- James, O., 2000. Regulation inside government: public interest justifications and regulatory failures. *Public Adm.* 78, 327–343.
- Jiang, K., You, D., 2016. Evolutionary game analysis of environmental regulation strategy from the perspective of decentralization between central and local governments (in Chinese). *China Popul. Resour. Environ.* 26, 139–148.
- Junior, A.N., Oliveira, M.C.D., Helleno, A.L., 2018. Sustainability evaluation model for manufacturing systems based on the correlation between triple bottom line dimensions and balanced scorecard perspectives. *J. Clean. Prod.* 190, 84–93.
- Kaplan, R.S., Norton, D.P., 1992. The balanced scorecard—Measures that drive performance. *Harv. Bus. Rev.* 70, 71–79.
- Kaplan, R.S., Norton, D.P., 2000. Having trouble with your strategy? Then map it. *Harv. Bus. Rev.* 78, 167.
- King, G., Pan, J., Roberts, M., 2013. How censorship in China allows government criticism but silences collective expression. *Am. Pol. Sci. Rev.* 107, 326–343.
- Lawrence, S., Sharma, U., 2002. Commodification of education and academic labour—Using the balanced scorecard in a university setting. *Crit. Perspect. Account.* 13, 661–677.
- Li, S., Tao, C., Lin, W., Ming, C., 2018. Effective tourist volume forecasting supported by PCA and improved BPNN using Baidu index. *Tour. Manag.* 68, 116–126.
- Liang, J., Langbein, L., 2015. Performance management, high-powered incentives, and environmental policies in China. *Int. Public Manag. J.* 18, 346–385.
- Liu, L., Bing, Z., Bi, J., 2012. Reforming China's multi-level environmental governance: lessons from the 11th Five-Year Plan. *Environ. Sci. Policy* 21, 106–111.
- Lv, X., Zhong, T., Zhang, X., Huang, X., Tian, X., 2012. Effects of land supervision on containing the illegal land use in China (in Chinese). *China Popul. Resour. Environ.* 22, 121–127.
- Maran, L., Bracci, E., Inglis, R., 2018. Performance management systems' stability: unfolding the human factor—A case from the Italian public sector. *Br. Account. Rev.* 50.
- Mcadam, R., Walker, T., 2010. An inquiry into balanced scorecards within best value implementation in UK local government. *Public Adm.* 81, 873–892.
- Ministry of Ecology and Environment of People's Republic of China, 2018. Resolution of Environmental Complaints Collected from “12369” Environmental Hotline. .. <http://www.mee.gov.cn/xxgk2018/>, Accessed date: 16 September 2018.
- Pan, F., Xi, B., Wang, L., 2015. Evolutionary game analysis of local government and central government in environmental regulation (in Chinese). *Oper. Res. Manag. Sci.* 24, 88–93.
- Peng, J., Zhong, T., Zhang, X., Huang, X., Zhao, Y., Xiao, L., Jia, H., 2012. Effects of land supervision on the loss of state owned land revenue (in Chinese). *China Land Sci.* 26, 4–11.
- Pu, Z., Fu, J., 2018. Economic growth, environmental sustainability and China mayors' promotion. *J. Clean. Prod.* 172, 454–465.
- Qi, Y., Zhang, L., 2014. Local environmental enforcement constrained by central-local relations in China. *Environ. Policy Gov.* 24.
- Quezada, L.E., Lopez-Ospina, H.A., Palominos, P.I., Oddershede, A.M., 2018. Identifying causal relationships in strategy maps using ANP and DEMATEL. *Comput. Ind. Eng.* 118, 170–179.
- Quirino, C.D., 2018. Irrationality of the public agent and theory of the behavioral public choice: notes on an elephant in the room. *Quaestio Iuris* 11, 965–986.
- Ran, Y.U., Huang, X.J., Zhong, T.Y., 2014. Supervision evaluation index system of provincial governments' land management performance (in Chinese). *China Land Sci.* 28, 17–24.
- Shang, H.B., 2014. Ways to improve the environmental protection supervision system in China (in Chinese). 24. *China Population Resources & Environment*, pp. 38–41.
- Spaltro, E., 1969. In: *In: Holsti, O.R. (Ed.), Content Analysis for the Social Sciences and Humanities*, vol. 14. Addison-Wesley, Reading, MA, pp. 137–141 (content analysis).
- Tan, S.K., Zhang, H.L., Rao, Y.X., 2013. Estimation on the effect of regular land supervision on controlling land law violations (in Chinese). *China Land Sci.* 27, 36–42.
- Tang, X., Liu, Z., Yi, H., 2016. Mandatory targets and environmental performance: an analysis based on regression discontinuity design. *Sustainability* 8.
- Wang, W., Xu, X., Wang, H., 2015. Study on the supervision system of water resources. *J. Beijing Normal Univ. (Nat. Sci.)* 51, 393–398 (in Chinese).
- Wei, N., 2014. Construction of evaluation system of regular land supervision results of quality (in Chinese). *J. Anhui Agric. Sci.* 42, 9952–9953 + 9955.
- Weng, Z., Cheng, C., Ge, C., Wu, B., 2017. Analysis on the environmental protection supervision system in China (in Chinese). *Environmental Protection*, pp. 53–56.
- Weng, Z., Ge, C., Wang, J., 2016. Environmental protection inspector: promote establishing the long-term mechanism of environmental protection (in Chinese). *Environ. Protect.* 44, 90–93.
- Wu, S., Sun, X., Yang, P., 2017. Game analysis of carbon emission regulation under dual governance system (in Chinese). *China Popul. Resour. Environ.* 27, 21–30.
- Yu, H., 2016. Study on a performance index system for farmland conversion regulation based on BSC (in Chinese). *J. Shanxi Agric. Sci.* 44, 1560–1563 + 1576.
- Zhang, B., Chen, X., Guo, H., 2018. Does central supervision enhance local environmental enforcement? Quasi-experimental evidence from China. *J. Public Econ.* 164, 70–90.
- Zhang, X., 2017. Implementation of pollution control targets in China: has a centralized enforcement approach worked? *China Q.* 231, 749–774.
- Zhong, J.X., 2011. Evaluation on the impetus effect of state land supervision on the law enforcement (in Chinese). *China Land Sci.* 25, 3–7.
- Zhong, T., Huang, X., Ye, L., Scott, S., 2014. The impacts on illegal farmland conversion of adopting remote sensing technology for land inspection in China. *Sustainability* 6, 4426–4451.
- Zhou, L.A., 2007. Governing China's local officials: an analysis of promotion tournament model (in Chinese). *Econ. Res. J.* 36–50.