Environment, Development and Sustainability
https://doi.org/10.1007/s10668-024-04551-3

The impacts of urban development orientation of resource-based cities on environmental information disclosure and greenwashing behavior of listed firms in China

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Received: 6 August 2023 / Accepted: 20 January 2024

Abstract
Resource-based cities (RBCs) across the globe grapple with severe pollution issues. Governments strive for sustainable development through planning and policies, yet the extent of environmental disclosure and greenwashing behavior among firms at the micro-industrial level within RBCs remains inadequately explored. This study investigates the influence of RBCs' urban development orientation on firms' environmental conduct. Leveraging China's "Sustainable Development Plan for Resource-Based Cities, 2013–2020" as a quasi-natural experiment, we examine the impact of urban development orientation on firms' environmental information disclosure and their commitment to sustainability. Employing the difference-in-differences methodology and a battery of robustness tests, our findings confirm that RBCs' urban development orientation policies significantly enhance firms' environmental information disclosure, mitigate greenwashing practices, with legitimacy effectiveness being the driving factor behind this positive outcome. Notably, this effect is more pronounced in RBCs with stringent environmental enforcement, a greater presence of local environmental groups, and heightened media attention. Our results underscore the role of long-term governmental planning and strategic design in fostering environmental governance.

Keywords Resource-based cities · Environmental information disclosure · Urban development orientation · Difference-in-differences method, China

Abbreviations

RBC	Resource-based cities
EID	Environmental information disclosure
DID	Difference-in-differences
NGOs	Non-governmental organizations

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Published online: 04 March 2024

1 Introduction

While China's remarkable economic progress has been lauded, it has come at the expense of the environment. Numerous Chinese cities confront severe environmental challenges, impeding their further economic and societal advancement. Among these cities, resource-based cities (RBCs) bear particular scrutiny. RBCs, characterized by industries centered on natural resource extraction, have historically played pivotal roles in China's development. However, these cities face formidable hurdles, including high-energy consumption (Kautish et al., 2021), pervasive pollution, excessive urban expansion, suboptimal resource utilization, and ecological degradation, all of which severely impede economic and social progress (Li et al., 2021; Hu et al., 2023b). These environmental issues exert detrimental effects on public health, worker productivity, property values, and exacerbate social inequalities (Hu et al., 2023a).

This urban development predicament is not unique to China but resonates globally among RBCs. For instance, the Ruhr region in Germany strictly enforces environmental regulations through air quality monitoring, source control, and emission treatment, thanks to national environmental protection legislation, economic policy incentives, and industrial restructuring (Anger & Oberndorfer, 2008; Hassink & Shin, 2005; Rogge et al., 2011; Hu & Zhang, 2022). Similar models of economic and environmental transformation have been applied in numerous other RBCs, including steel-producing cities such as Pittsburgh in the US and Lorraine in France. China has also embarked on an active governance process to promote urban sustainability and mitigate environmental hazards (Zhou et al., 2020). In 2013, the Chinese central government introduced the "Sustainable Development Plan for Resource-Based Cities, 2013–2020," encompassing 262 RBCs, including prefecture-level cities, county-level cities, counties, and municipal districts.

This policy development has garnered scholarly attention, albeit with a predominant focus on the city and industrial levels, often overlooking micro-level facets. For instance, Yu et al. (2016) analyzed Yichun city's challenges and corresponding strategies in industrial transformation. Li et al. (2021) discerned regional variations in the policy's impact on industrial structures. However, sustainable development and environmental governance hinge on firms' actions as they constitute the primary agents of pollution and development. The dearth of research at the firm level propelled this study to explore the impact of RBCs' urban development orientation on environmental information disclosure (EID).

Environmental disclosure functions as a form of self-regulation that fosters pollution control, treatment, and prevention while enabling firms to accrue environmental experience and technology, thus enhancing their environmental management capabilities (Menguc et al., 2010). EID reduces the likelihood of concealing pollution incidents and greenwashing, ensuring that sustainability reports issued by the government accurately reflect air quality. It also enables firms to communicate their environmental efforts to external stakeholders, fostering the perception that they are committed to sustainable development. By disclosing accurate and comprehensive environmental information, firms demonstrate their commitment to transparent environmental management and sustainable practices, making it harder to engage in greenwashing (Costantini & Mazzanti, 2012; Yin & Wang, 2018; Zeng et al., 2012; Hu et al., 2023b).

The development orientation of RBCs is believed to emit positive environmental signals, prompting polluting firms to prioritize environmental concerns, also reducing the prevalence of greenwashing among firms. This orientation entails stringent environmental requirements for resource-based firms, underpinned by legitimacy theory.

Legitimacy theory posits that organizations must be perceived as adhering to social norms and expectations to maintain their social license. In the environmental context, this theory elucidates why firms engage in environmental disclosure and pro-environmental activities. Firms disclose their environmental performance to signal their conformity to social norms, respond to stakeholder demands, enhance their reputation, and bolster legitimacy (Suchman, 1995).

Hence, RBC-conveyed legitimacy signals compel firms to make legitimacy judgments, enact legitimacy behaviors, and demonstrate legitimacy efforts through information processing. In the realm of legitimacy signals relayed by RBCs, deficiencies and leniencies in environmental laws may introduce uncertainty into legitimacy evaluation, weakening the legitimacy pressure on firms. Additionally, the presence of more environmental protection organizations and heightened media scrutiny amplifies legitimacy signals, rendering firms more responsive to legitimacy pressures.

Building upon this backdrop, this study employs the Sustainable Development Plan for Resource-Based Cities in China as a quasi-natural experiment to investigate the impact of urban development orientation on firm environmental behavior. The pilot implementation in 126 prefecture-level cities provides an ideal quasi-natural test, minimizing endogeneity and offering a pristine platform to gauge firms' net impact. We scrutinize this hypothesis using 3522 firm-year observations from 384 firms listed on the Shenzhen and Shanghai Stock Exchanges between 2009 and 2018. Moreover, we conduct robustness tests, including alternative proxies for dependent variables, the exclusion of specific events, and alternative regression models, to underscore the robustness of our findings.

This research contributes to the literature in two primary ways. Firstly, it pioneers the exploration of RBCs' urban development orientation's influence on firm environmental behavior and mitigating greenwashing behavior. The previous research has primarily focused on the pressure exerted by legitimacy reforms on enterprises, largely overlooking the transformative effects of policy reforms. This study enriches legitimacy theory by expanding the sources of legitimacy pressure to include the urban development plan, encompassing a blend of mandatory and instructive regulations. The findings enhance the environmental legitimacy literature by providing empirical evidence on how RBC development initiatives can sensitize firms to their legitimacy vulnerabilities, profoundly impacting their environmental conduct and augmenting our comprehension of corporate engagement in environmental disclosure policies.

Secondly, this study elucidates the conditions that can magnify or diminish the influence of legitimacy. These conditions hinge not only on the strictures of formal law enforcement but also on the involvement of environmental protection organizations and media scrutiny. In doing so, this study extends our understanding of organizational responses to legitimacy by elucidating the contingencies governing firm-level isomorphic and heterogeneous responses to legitimacy shifts, shedding light on why some firms are more inclined than others to embrace environmental disclosure practices amidst comparable legitimacy changes. This holistic perspective enhances our grasp of how legitimacy transformations, shaped by RBC projects, unfold.

This paper is divided into five sections. Section 2 includes the literature review and hypotheses; the methodology is presented in Sect. 3; the findings and related empirical discussion are presented in Sect. 4; and the final section presents the conclusion of the study as well as the theoretical implications, policy implications, limitations, and scope for future studies.

2 Institutional background and literature review

2.1 Institutional background

RBCs, whose economic growth is contingent on natural resource extraction and utilization, cause severe environmental and resource depletion problems. China's RBCs have produced over 50 billion tons of raw coal, crude oil, iron ore, and wood since 1949 (Jianhui Yu et al., 2019a, 2019b). Li et al., 2013, examined the growth of RBCs in China from the perspectives of economics, industry, taxes, and the environment and concluded that these cities lag behind others in development because of inefficient transition policies, unfair taxation, and misleading policies regarding utilizing local resources. Therefore, the sustainable transition of RBCs is crucial for regional productive economic and urban development. In this vein, the China central government has made considerable efforts and released the Sustainable Development Plan for Resource-Based Cities (2013–2020) in 2013.

2.2 Literature review

The literature on resource-based cities (RBCs) has grown significantly in recent years. Fan and Zhang (2021) found that the national plan for sustainable development of RBCs (2013–2020) had notable impacts on social, economic, and ecological aspects but did not significantly influence resource sustainability. This underscores the need for a systematic approach to RBC development that considers resource utilization and its environmental consequences. Such development should encompass the concept of natural resource progression, rigorous asset development planning and management, stringent entry criteria, and the promotion of environmentally responsible asset advancement (Li et al., 2021).

Similarly, sustainable development in RBCs involves strengthening biodiversity conservation, ecological remediation, and the pursuit of green (Awan et al., 2023), circular, and low-carbon development. It also involves recognizing the positive relationship between asset development and urban events (Xing et al., 2021; Hu et al., 2023b). To achieve these goals, it is imperative to explore the potential of assets in mitigating urban challenges, maintain production equilibrium, and effectively control excessive asset utilization. Stricter measures should be taken against illegal and excessive utilization to promote large-scale development and industrial upgrading (Sun et al., 2023).

Corporate environmental information disclosure (EID) serves as a key strategy for government intervention, aiming to steer firms away from unsustainable practices and motivate them to pursue green growth objectives. EID can encourage firms to align their environmental behavior with established standards, bolster their environmental performance and public reputation, enhance access to financing opportunities, and improve economic performance and staying away from greenwashing (Ahmad et al., 2019; Chen & Dagestani, 2023). Research by Cai et al. (2021) explores the impact of environmental information disclosure on haze pollution and economic development, revealing complex dynamics that involve green technology innovation and regulatory effects. Zhong et al. (2021) uncovered the positive influence of environmental information disclosure on sulfur dioxide reduction at the local level, attributing it to target culpability, backward forcing effects, geographical spillovers, warning effects, and learning effects. Sun et al. (2019) confirmed a positive association between government environmental information transparency and corporate environmentalism among publicly listed firms in China.

In response to sustainable development plans for resource cities, corporations must develop robust and efficient asset improvement strategies, refine their asset advancement approaches, effectively manage the aggregation of various production factors, and promote the structured development of large- and medium-sized mineral resources. Li et al. (2017) analyzed environmental crisis-related information disclosure regulations in China and found that during environmental crises, both businesses and local authorities engaged in information disclosure for their own interests, with local authorities exhibiting a more proactive approach due to shareholder pressures. Similarly, Liu et al. (2021) demonstrated that regional-level disclosure of pollutant information transparency significantly improved local industrial structures, encouraged ecological transformations, and depended on state interactions and geographical factors. Feng et al. (2021) highlighted the potential economic stifling effects of air pollution and emphasized the significance of scientific research funding and pollutant financing channels. Zhao and Chen (2022) conducted a comprehensive study on Chinese provincial data, revealing that increased government environmental information disclosure led to heightened green total factor productivity.

These insights reveal a strong logical connection between resource city sustainable development plans and corporate EID. While existing research primarily focuses on macro-level aspects, including sustainable urban development, carbon emissions, industrial upgrading, income inequality, and green transformation, there is a dearth of micro-level performance analysis (Chen & Dagestani, 2023). Given the crucial role of corporate EID in promoting sustainability, it is imperative to investigate the influence of resource city sustainability plans on corporate EID to address this research gap effectively.

3 Theoretical analysis and research hypotheses

3.1 The development of RBCs and corporate EID

Scholars have focused on four areas to promote EID and practice environmental responsibility successfully: formal institutional pressure, stakeholder pressure, internal governance environment, and informal institutional variables. First, the legitimacy pressure of government-led formal law enforcement, such as environmental levies, emission rights, and other required elements, is the primary source of formal institutional pressure (Liu & Anbumozhi, 2009; Zeng et al., 2012). Second, pressure from managers and investors significantly promotes EID, while pressure from creditors and consumers does not. Furthermore, long-term institutional ownership is linked to favorable social environment actions (Chen & Kong, 2011; Mallin et al., 2013). Third, internal governance factors such as business size, profitability, and capital spending contribute to corporate EDI.

Similarly, new CEOs and those with a management science degree are more inclined to provide further environmental data. Political ties help EID by masking the goal of corporate political rent-seeking, which is to preserve the environment (Cheng et al., 2017; Iatridis, 2013; Lewis et al., 2014). Fourth, culture and other informal institutional factors also impact corporate EID. Once et al., 2014, discovered a significant positive correlation between Buddhist culture and environmental activities because Buddhism instils social norms that increase the environmental responsibility awareness of decision-makers.

Formal environmental control is one of the most critical driving forces behind corporate EID. First, the development orientation of RBCs increases the macro-level legitimacy policy, which influences corporate environmental conduct. Before RBC planning, economic

greed may have encouraged firms to ignore environmental concerns, decrease environmental norms, and embrace harmful development ideas. Therefore, RBCs require environmental protection and ecological restoration to sustainably achieve technological improvement and progress, industrial upgrading, and transformation (Yu et al., 2016). Former vast resource enterprises must be integrated into the environmental system and aligned with the standards and legitimacy acknowledged by stakeholders (Suchman, 1995). To encourage long-term sustainable growth, enterprises must demonstrate their environmental efforts through positive EID, increase stakeholder trust in green development, and minimize unfavorable opinions about environmental damage (Buysse et al., 2003).

Second, the development orientation of RBCs improves the level of local environmental legislation, promotes the green transformation of firms, and has a regulatory effect. Under the guidance of RBC development orientation, local governments and environmental protection departments can strengthen environmental legislation (Wang et al., 2022). These bodies will exert tremendous pressure on firms, implement more stringent environmental policies, and improve the intensity of environmental regulation. Furthermore, the environmental expectations of other stakeholders and the environmental efforts of firms are linked through environmental legitimacy (Doshi et al., 2013; Yin & Wang, 2018).

Furthermore, the long-term impact of environmental regulation legislation reflects regulatory influence. The environmental actions of firms are motivated by compliance as a result of short-term, strong regulation; they try to achieve minimal legal requirements, which generally means the employment of old end-of-pipe methods or the purchase of essential emission reduction technologies (Zhou et al., 2022). This approach is not conducive to long-term environmental goals, and only when the compliance effect appears can it "react" to solve the problem (Dixon-Fowler et al., 2013). Therefore, this change in the development direction will promote firms' long-term and sustained commitment to environmental activities.

The development orientation of RBCs will strengthen the supervision of local environmental law enforcement. These environmental enforcement supervisions can produce a robust psychological deterrent against polluting enterprises and achieve the effect of the original intention of green development (Zhang et al., 2021). Moreover, RBC development orientation also entails strengthening social supervision. Development planning encourages all sectors of society to recognize the significance of local environmental concerns, leading to a conscious rise in pollution monitoring and reporting (Liao et al., 2020). Therefore, under the pressure of external supervision, firms will consciously meet stakeholders' environmental legitimacy requirements and improve the EID level. In conclusion, this study proposes the following hypothesis.

H1 The development planning of RBCs will positively impact the EID of firms.

3.2 The moderating effect of environmental enforcement, environmental protection organizations, and media coverage

Under RBC, legitimacy signal transmission, environmental enforcement, the presence of environmental protection organizations in the city, and media attention on enterprises will increase environmental oversight, strengthen the legitimacy signal, and make firms more vulnerable to legitimacy pressure to incorporate proper EID practices.

It is conducive for firms to reduce their opportunism and proactively demonstrate their environmental efforts when local environmental enforcement is more effective

(Md et al., 2017). In this regard, if the environmental reporting information of firms does not meet the requirements of environmental regulations, a higher risk of punishment is expected. At this time, the increased pressure of environmental legitimacy will force firms to improve environmental disclosure quality more actively. Similarly, more effective environmental enforcement corresponds to the stricter enforcement of property rights and the establishment of a more stable legal system, reducing the impact of political rent-seeking on firms (Wei et al., 2017). In contrast, firms may escape punishment due to their excellent relationship with the government even if the EID is ineffective, which weakens the legitimacy restriction restriction (Yu & Yu, 2011). Therefore, this study proposes the following hypothesis.

H2 When local environmental enforcement is more effective, the impact of the RBCs' urban development orientation will be more significant on EID.

Non-governmental organizations (NGOs) are essential environmental stakeholders that can influence firms. Although they have no law enforcement power, they can play a substantial role in law enforcement supervision, thus amplifying the pressure for environmental legitimacy. Local NGOs often have close ties with the local community and are concerned about the local community's long-term development (Lu et al., 2018). When firms display environmentally irresponsible behavior, NGOs will more actively promote the social well-being of environmental awareness and place the environmental problems of firms under more scrutiny by the local society (Pien, 2020). Similarly, local NGOs are professional environmental organizations often familiar with local affairs. When government supervision enforcement is insufficient and local firms negatively approach environmental problems, NGOs are more likely to be aware and play a supervisory role. Therefore, this study proposes the following hypothesis.

H3 When more environmental protection organizations are proximal to a firm's location, the RBCs will significantly impact EID.

There is a consensus in the literature that media coverage can pressure firms through information dissemination and external supervision tools (Wang & Zhang, 2021). The media is an "information transmission" intermediary; its information collection, processing, and dissemination enhance the information stakeholders can acquire (Fang et al., 2009). With the development of information technology and the internet's increasing popularity, the media's intermediary information rolen the capital market is becoming critical (Basir et al., 2018). Under the development planning of RBCs, the media is the first to perceive this change, making transmitting it to relevant audiences easier. Moreover, the environmental efforts and disclosure of firms are also the focus of news media reports, which reduces the information asymmetry between firms and the outside world (Abarbanell et al., 2006; Mill, 2006) and renders the legitimacy of firms subject to more constraints.

This dissemination of environmental responsibility information through the media can meet the information needs of various stakeholders and help firms establish their image better and gain social recognition (Fan et al., 2020). However, frequent media reports will also increase stakeholder awareness of poor environmental performance. In other words, media attention will amplify the "legitimacy" signal of "poor environmental performance" of such firms and use the "magnifying glass" function of the media to

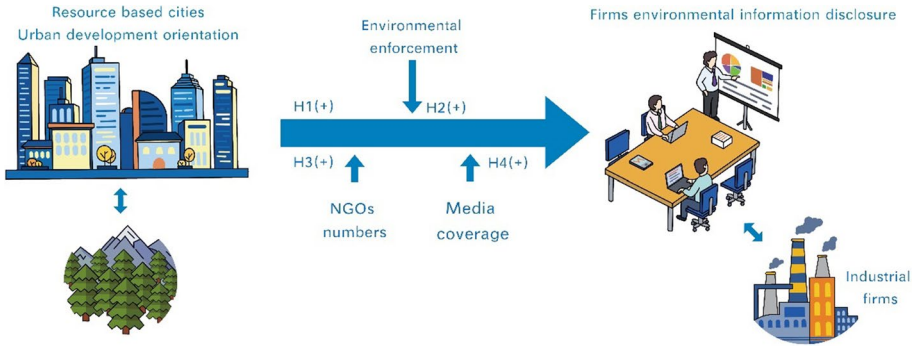
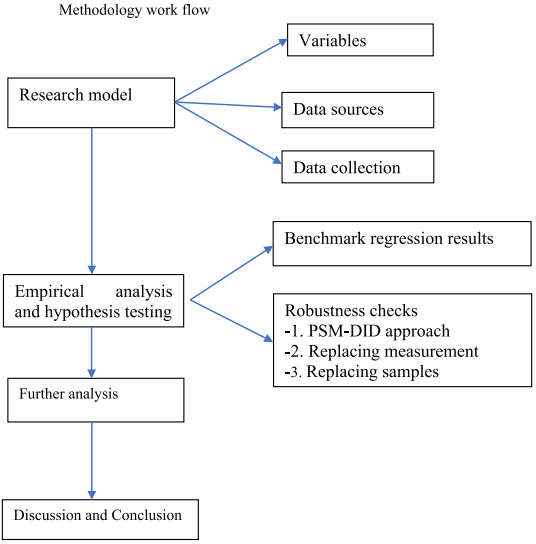


Fig. 1 Conceptual model

Fig. 2 The diagram of the methodological flow



transmit legitimacy signals as much as possible, thus enhancing the supervision of poor EID (Xu et al., 2016). Therefore, this study proposes the following hypothesis:

H4 When the media pays more attention to firms, the RBC will significantly impact EID more.

Our hypotheses are summarized graphically in Fig. 1, and for a better understanding of the method used in this study, we present a schematic diagram of the methodological flow in Fig. 2.

4 Methodology

4.1 Sample and data collection

The study selected 16 heavily polluting industries based on the "Listed Companies' Environmental Verification Industry Classification Table" (2008) for two reasons: First, companies in heavily polluting industries have a more significant impact on the environment and are more sensitive to environmental issues (Ren et al., 2020); second, the disclosure of environmental data is mainly concentrated in heavily polluting industries. Hence, considering data availability, enterprises among heavily polluting industries were selected as the initial sample. To address the sample, financial and ST firms were excluded from the final study sample. The final sample is based on 3522 firm-year observations of 384 resource-based firms (e.g., mining and processing ferrous and nonferrous metals such as coal and iron) in the A-shares of the Shenzhen Stock Exchange and Shanghai Stock Exchange from 2009 to 2018.

Financial and regional data of listed companies were derived from the China Securities Market and Accounting Research (CSMAR) and Wind databases. EID was manually collected from the annual reports of listed firms. Information regarding environmental law enforcement, GDP, and industrial structure at the urban level was collected and supplemented from the China Environmental Yearbook, China Urban Yearbook, and Statistics Bulletin of the National Economic and Social Development.

4.2 Measurement of variables

4.2.1 Dependent variables

Environmental information disclosure (EID): This study constructed the corporate environmental information disclosure index based on the Wiseman index (1982). The index was obtained by summing the scores of eight indicators, including environmental protection investment expenditure or loan offer, environmental protection subsidy or income of exemption and reward, emission compliance of pollutant type and quantity, whether to implement the recognized certification, environmental protection measures and improvement, policy impact, environmental management objectives, and other environmental-related income and expenditure items. The total score of each index is 2. If both qualitative and quantitative disclosures are present, 2 points will be obtained; if only qualitative disclosure is present, 1 point will be obtained; and if there is no disclosure, no point (0) will be obtained. The data are derived from the firm's annual reports.

4.2.2 Independent variables

*Urban development orientation (RBC*post)***:** This study's primary variable of interest is calculated as the interaction between RBC and post. RBC is the firm dummy variable of the treatment group, whereas the post is the time dummy variable of the control group. If a company's registered address is in any of the 126 cities evaluated in the *2013 Sustainable Development Plan for Resource-Based Cities* (2013 -2020), the variable RBC takes the value of 1; otherwise, it takes the value of 0. The study determined 2009–2013

as the pre-policy period, and the post value becomes 0; 2013–2018 as the post-policy period, and the post value becomes 1.

4.2.3 Moderating variables

Environmental enforcement (Legal): Referring to Huang & Chen, 2015, this variable was measured by the province's environmental administrative punishment cases.

The number of environmental protection organizations (NGO): Drawing on the practice of Chung (2020), the number of NGOs provided by the China Development Bulletin website[1] was used to measure this variable. The website was founded by a British individual named Nick Young in 1996. In 2001, the site launched a directory of Chinese NGOs for independent readers who wish to understand the development of Chinese NGOs and philanthropy. Compared with some Chinese official yearbooks that only provide simple quantitative statistics, this is an independent and professional third-party website and provides detailed information on aspects such as NGO address, founding date, purpose, service scope, and personnel, among other details.

*Media coverage (Media)***:** Following the work of Luo et al. (2021), media report data were manually collected by using the "Baidu news search engine"[2] as a measurement tool. Specifically, news headlines containing complete names of the enterprises featured each year were searched to obtain the number of news releases.

4.2.4 Control variables

Some characteristics were chosen as control variables to capture the influence of other possible determinants of EID performance and avoid omitted variable bias. The variables are as follows:

*Firm size (Size)***:** Large firms have more resources to invest in EID (He & Shen, 2019). The size of a company was measured by the natural logarithm of its total assets.

*Firm age (Age)***:** Organizational inertia increases with firm age, hindering innovation (Guan & Yam, 2015). We major it by the number of years since the company's foundation. However, some studies show that the higher the firm's age, the more likely it is to invest in EID (Slawinski & Bansal, 2015).

Financial leverage (Lev): Firms with a high asset–liability ratio may face tremendous debt pressure, meaning that they have no extra resources to invest in EID (Rong et al., 2017). This paper used the asset–liability ratio to measure financial leverage.

*Return on assets (ROA)***:** As is generally known, EID is closely related to corporate profitability (Rennings, 2000). The ROA was measured by dividing the net assets by the total assets.

Firm ownership (Ownership): If a firm is state-owned, its value is 1; otherwise, it is 0.

Independence of the board of directors (Independence): Independent board members have more substantial supervision power. The board of directors' independence measures the proportion of independent directors included on the board.

*Per capita economic development level (Per-GDP)***:** According to the environmental Kuznets curve (EKC) theory proposed by Grossman and Krueger (Bo, 2011; Grossman

[1] http://www.chinadevelopmentbrief.org.cn

[2] http://news.baidu.com

& Krueger, 1995; Suri & Chapman, 1998), the relationship between economic growth and environmental pollution presents an inverted U-shaped curve. Therefore, per capita GDP is introduced to control the impact of regional development levels on firm pollution (Tan & Lu, 2015; Tan et al., 2015).

*Industrial structure (indus-tru)***:** Qin and Yu (2016), noted that the environmental pollution level of an area is closely related to its industrial structure (Hu, 2023). In this paper, the industrial structure is measured by the proportion of industrial added value in GDP, which reflects the impact of industrial structure on environmental pollution.

*Regional pollution emission (pollution)***:** In this study, the total industrial SO_2 emissions were used to represent the overall local pollution level (Tan & Lu, 2015; Tan et al., 2015).

4.3 Model

The difference-in-differences model is one of the most commonly used methods to evaluate specific policies and make the empirical results more robust, but it has some causal effects, such as common trends and other linear regression assumptions (Angrist & Pischke, 2019).

To test the impact of RBCs on EID and the role of various moderating factors, this paper adopts the difference-in-differences (DID) method to identify the cause and effect in a bid to identify firms with little endogeneity (Cheng et al., 2017). In addition, missing and unobserved firm characteristics and potential time trends in patent applications may influence study estimates. To resolve this issue, the study controlled the fixed effect. The DID model is as follows:

$$EID_{it} = \beta_0 + \beta_1 RBC_i * post_t + \beta_2 Controls_{it} + Industry_c + Year_t + City_w + \varepsilon_{it} \quad (1)$$

where EID_{it} is the dependent variable representing the environmental disclosure of firm i in year t. $Controls_{it}$ is a set of control variables, including firm- and region-level controls; and $Industry_c$, $Year_t$, and $City_w$ represent industry, time, and city fixed effects, respectively. To correct for potential heteroscedasticity and autocorrelation within the firms, we cluster the standard errors at the firm level (Rong et al., 2017).

5 Empirical results and discussion

5.1 Descriptive statistics

Table 1 contains the descriptive statistics of all variables involved in our baseline regression. The statistics show that the average value of EID in all samples is 5.708, and the standard deviation is 3.859, thus indicating enough variation in the data of listed companies regarding EID. Pearson correlation coefficients between variables are reported in Table 1. No high correlation is observed between variables.

5.2 Baseline regression results

This section presents the empirical analysis of the impacts of RBCs' urban development orientation on EID. In column 1, the coefficient β_1 of RBC*post is 1.915, a positive number significant at 5%. This suggests that compared with non-pilot areas, EID in the RBC pilot areas improved.

Table 1 Descriptive statistics and correlation analysis

	EID	RBC*post	Legal	NGO	Media	Age	Size	LEV	ROA	Independence	Ownership	Indus-stru	Per-GDP	Pollution
Panel A: Descriptive statistics														
Mean	5.708	0.469	6504.474	0.845	54.118	16.908	22.232	0.511	0.406	0.350	0.368	45.013	89,766.65	67,215.93
S.D	3.859	0.322	6138.071	3.338	84.964	4.898	1.309	0.500	0.236	0.064	0.051	11.493	75,502.78	77,038.78
Panel B: Correlation analysis														
EID	1													
RBC*post	0.043	1												
Legal	0.236	0.134	1											
NGO	0.159	0.091	0.269	1										
Media	0.204	0.021	0.042	0.069	1									
Age	0.394	-0.027	0.179	0.167	0.149	1								
Size	0.429	0.092	0.098	0.112	0.172	0.175	1							
LEV	0.137	0.030	−0.088	−0.029	−0.016	0.030	0.378	1						
ROA	0.153	0.051	−0.035	−0.037	0.008	0.036	0.322	0.325	1					
Independence	−0.112	−0.044	−0.001	0.028	0.029	−0.049	−0.041	−0.124	−0.340	1				
Ownership	0.035	−0.056	0.001	0.058	0.016	0.069	0.021	−0.014	−0.026	−0.021	1			
Indus-stru	−0.113	−0.094	−0.105	−0.136	−0.027	−0.112	−0.028	−0.016	0.049	0.011	−0.034	1		
Per-GDP	0.052	0.355	0.260	0.507	0.068	0.141	0.105	−0.094	−0.072	0.038	0.065	−0.218	1	
Pollution	−0.235	0.242	−0.203	−0.150	−0.076	−0.176	−0.025	0.047	0.086	−0.030	−0.061	0.224	−0.072	1

Columns 2–4 summarize the results of the moderating effects. Model 2 shows the moderating effect of legal effectiveness. The coefficient of RBC*post *Legal is positive and significant ($\beta = 0.001, \rho < 0.01$), suggesting that the effectiveness of the law promotes the EID of RBC. Thus, Hypothesis 2 holds. Model 3 shows the moderating effect of the number of environmental protection organizations. The coefficient of RBC*post *NGO is positive and significant ($\beta = 0.844, \rho < 0.01$). In other words, when there are more local environmental protection organizations, the effect of RBC on EID is more substantial. Therefore, Hypothesis 3 is confirmed. Model 4 demonstrates the moderating effect of media focus. The coefficient of RBC*post *Media is positive and significant ($\beta = 0.008, \rho < 0.01$). In other words, RBC has a more substantial impact on EID for firms with greater media attention. Therefore, Hypothesis 4 holds true (Table 2).

5.3 Robustness checks

5.3.1 The propensity score matching DID (PSM-DID) approach

To solve the problem of selection bias, this paper uses the PSM matching method to carry out further PSM nearest neighbor matching on the sample data before the RBC pilot plan was introduced (2009–2013).

The pre-policy period (2009–2013) data were used to estimate the probability logit regression of treatment companies. Next, by using the k-nearest neighbor matching substitution (k = 1) and setting the caliper to 0.01 * standard error of the propensity score, each RBC firm was matched with a non-RBC firm. In Stata, the psmatch2 command executes the PSM process. Group A in Table 3 shows that independent variables positively correlate with all covariates. Group B in Table 3 shows significant differences in covariates between the treatment and control groups before pairing, but these differences are no longer significant after pairing. This shows that our matching process is effective. The results were 2242 fixed-year observation samples. Group C in Table 3 shows that the coefficient at the level of 0.01 is positive and statistically significant, indicating that there is still a significant positive relationship between RBC*post and EID, which is consistent with the baseline regression results.

5.3.2 Replacing the dependent variable with alternate proxy

This study used environmental protection investment and green patents to reevaluate the dependent variable. Table 4 shows that the RBC*post score on EID is significant, supporting our analysis.

5.3.3 Subsample test: The influence of other events excluded

The firms that are influenced by some specific factors were excluded from the sample, and the model is estimated again since these specific factors can influence the estimation results. First, the firms in Shanghai, Beijing, Guangzhou, and Shenzhen, the four highly developed megacities in China, were deleted from the sample. This is because megacities' high levels of economy and civilization can independently impact firms' environmental behavior.

Second, the firms of Fujian, Hubei, and other carbon pilot provinces and cities were deleted from the sample to exclude the policy impact of pilot carbon trading. As an

Table 2 Baseline regression of difference-in-differences tests

	(1)	(2)	(3)	(4)	(5)
Age	0.009	0.009	0.009	0.008	0.008
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Size	0.692***	0.693***	0.692***	0.694***	0.694***
	(0.090)	(0.090)	(0.090)	(0.090)	(0.090)
LEV	0.953***	0.926***	0.975***	0.950***	0.951***
	(0.287)	(0.288)	(0.281)	(0.286)	(0.283)
ROA	−0.499	−0.579	−0.528	−0.568	−0.595
	(0.982)	(0.982)	(0.971)	(0.973)	(0.971)
Independence	−1.173	−1.141	−1.384	−1.238	−1.324
	(1.336)	(1.337)	(1.334)	(1.336)	(1.334)
Ownership	0.326*	0.325*	0.327*	0.329*	0.327*
	(0.191)	(0.191)	(0.191)	(0.191)	(0.191)
Indus-stru	−0.013	−0.013	−0.015	−0.012	−0.014
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Per-GDP	−0.000*	−0.000*	−0.000*	−0.000*	−0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Pollution	−0.000	−0.000	−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Legal	0.000	−0.000**	0.000	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NGO	0.037	0.030	−0.809***	0.022	-0.530*
	(0.037)	(0.037)	(0.222)	(0.037)	(0.308)
Media	0.005***	0.004***	0.005***	−0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
RBC*post	1.915**	1.811**	1.578*	1.593*	1.485*
	(0.863)	(0.864)	(0.862)	(0.871)	(0.867)
RBC*post**Legal		0.001***			0.000*
		(0.000)			(0.000)
RBC*post *NGO			0.844***		0.555*
			(0.218)		(0.307)
RBC*post *Media				0.008***	0.004*
				(0.002)	(0.002)
Constants	−15.702***	−15.809***	−15.517***	−15.879***	−15.67***
	(2.422)	(2.421)	(2.414)	(2.411)	(2.425)
Year FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
City FE	Y	Y	Y	Y	Y
N	3522	3522	3522	3522	3522
R-square	0.702	0.703	0.706	0.704	0.712

Note: standard errors are reported in parentheses. *p < 0.1, **p < 0.05, and ***p < 0.01

Table 3 The propensity score matching DID (PSM-DID) approach

Variables						Dependent variable: RBC*post	
Group A: Logit model used to find propensity scores							
Size						0.191***	
						(0.030)	
Independence						− 2.417***	
						(0.645)	
Age						− 0.026***	
						(0.008)	
Indus-stru						− 0.023***	
						(0.004)	
Observations						3522	
Year FE						YES	
Indus FE						YES	
City FE						YES	
Variables	Unmatched	Mean			%Reduct	T-test	
	Matched	Treated	Control	%bias	|bias|	t	P>|t|
Group B: Test of the effectiveness of the propensity score matches							
Size	U	22.289	22.011	22.7	88.1	5.49	0.000
	M	22.206	22.169	2.7		0.94	0.330
Independence	U	0.369	0.377	− 12.8	99.2	− 3.3	0.001
	M	0.367	0.366	− 0.1		− 0.4	0.958
Age	U	16.815	17.153	− 6.6	35.2	− 1.62	0.106
	M	16.868	17.072	− 4.2		− 1.51	0.129
Indus-stuc	U	44.436	46.969	− 22.3	78.8	− 5.6	0.000
	M	45.363	44.819	4.6		1.64	0.117
Variables						Dependent variable: EID	
Group C: The impact of RBCs urban development orientation on EID, PSM sample							
RBC*post						1.934**	
						(0.869)	
Controls						YES	
Observations						2242	
R-squared						0.694	
Year FE						YES	
Indus FE						YES	
City FE						YES	

This table presents the regression results of the PSM-DID. The variable definitions are provided in Appendix. Note: standard errors are reported in parentheses. *$p < 0.1$, **$p < 0.05$, and ***$p < 0.01$ (two-tailed)

Table 4 Alternative measures

	(1) Environmental protection investment	(2) Green patents
RBC*post	1.679***	1.023**
	(0.068)	(0.509)
Controls	YES	YES
Observations	3522	3522
R-squared	0.776	0.766
Year FE	YES	YES
Indus FE	YES	YES
City FE	YES	YES

Table 5 Alternative samples

	Alternative sample 1 Excluding four super cities	Alternative sample 2 Excluding emission right cities	Alternative sample 3 Excluding low-carbon cities
RBC*post	2.63***	1.726*	1.77**
	(0.895)	(0.976)	(0.911)
Controls	YES	YES	YES
Observations	2904	2571	2652
R-squared	0.703	0.709	0.755
Year FE	YES	YES	YES
Indus FE	YES	YES	YES
City FE	YES	YES	YES

effective environmental regulation policy, emission rights have a positive impact on the environmental efforts of firms (Ren et al., 2020; J Yu et al., 2019a, 2019b). We exclude the interference of this factor through these overlapping samples. As shown in Table 5, these results are still robust.

Finally, the firms of the first and second batches of low-carbon cities were deleted from the sample to exclude the impact of the policy. As shown in Table 5, the results are still robust.

5.4 Further analysis

The enhancement of environmental information disclosure serves to mitigate the likelihood of greenwashing, primarily by bolstering the transparency and oversight of environmental responsibilities among enterprises and organizations. This, in turn, acts as a catalyst for motivating them to undertake a greater array of environmentally conscientious measures.

To further assess whether the RBC plan contributes to a reduction in greenwashing, we empirically examined its impact on corporate greenwashing behavior. Drawing on Chen and Dagestani (2023), we used discrepancies in various environmental, social, and governance (ESG) scores as a metric to gauge the extent of greenwashing. Higher values indicate a higher degree of greenwashing by the enterprise. As shown in Table 6, the coefficient

Table 6 Further analysis

	Greenwashing
RBC*post	−0.116**
	(0.054)
Controls	YES
Observations	3522
Year FE	YES
Indus FE	YES
City FE	YES

associated with RBC plan is statistically significant in a negative direction, signifying that RBC plan significantly reduces corporate greenwashing behavior.

5.5 Discussion

Firstly, this study, based on Institutional Theory and Resource Theory, provides an explanation for the findings: Resource-based cities (RBCs) effectively enhance environmental disclosure levels and mitigate "greenwashing," findings supported by Liu and Anbumozhi's (2009) research. On the one hand, according to Institutional Theory, resource-based city pilot programs may require companies to mandatorily disclose environmental indicators (Suchman, 1995), including pollution emissions, energy consumption, and resource utilization. This mandatory requirement reduces the opportunities for companies to engage in "greenwashing." Additionally, resource-based city pilot programs exert strong enforcement pressures, effectively combating inappropriate environmental behaviors by companies. These pilot programs encourage public and media participation in environmental monitoring, creating non-official pressures that urge companies to act more responsibly (Wu et al., 2018). On the other hand, drawing from Resource Theory, resource-based city pilot programs stimulate proactive environmental governance by companies through incentive and penalty systems, thereby reducing the potential for greenwashing. These pilot programs also enhance transparency in company information (Sun et al., 2023) and involve various stakeholders, ultimately attracting more resources.

Secondly, considering the influence of external factors on corporate environmental information disclosure, we primarily investigated the roles of environmental enforcement, environmental organizations, and media coverage in the relationship between resource-based cities (RBCs) and environmental information disclosure. In resource cities with strong enforcement capabilities, companies tend to disclose high-quality environmental information. This finding aligns with the research of Md et al. (2017), which found that environmental enforcement reduces corporate opportunism. An explanation for this result is that regions with more effective environmental enforcement imply cleaner politics, effectively reducing companies' potential for rent-seeking behavior or greenwashing (Grafton & Williams, 2019). Non-governmental organizations (such as environmental organizations) can amplify the positive impact of RBCs. This conclusion is supported by the research of Albino et al., 2012. One possible explanation is that NGOs collaborate with official pressure to increase regulation and disclosure, as well as to inspire public environmental awareness (Li et al., 2018). Alternatively, NGOs can file lawsuits against non-compliant

companies, which can impact a company's social image (Wang & Lo, 2022), thereby inhibiting greenwashing behaviors.

Furthermore, we also discovered that media coverage plays a positive moderating role. Signal theory and stakeholder theory explain this finding (Abarbanell et al., 2006; Parmar et al., 2010). As a medium for impartial and timely information dissemination, the media can alleviate information asymmetry between corporate managers and external stakeholders (Mill, 2006). In other words, the media can indirectly disclose corporate environmental information, increasing the attention of external investors (Chen & Hao, 2022; Fan et al., 2020). Alternatively, companies can adjust their strategies by perceiving the environmental demands of the public and societal stakeholders through media coverage (Lyon & Montgomery, 2013).

6 Conclusion

This study adopts the *Sustainable Development Plan for Resource-Based Cities, 2013–2020,* as a quasi-natural experiment to explore the impact of city development planning on firm EID behavior. Employing a difference-in-differences (DID) methodology, we establish causal relationships and account for potential endogeneity among firms. Our analysis yields several key findings regarding the impact of the RBC urban development orientation policy on EID: First, the RBC policy significantly and positively affects EID among firms. Second, the announcement of the planning initiative leads to a noticeable increase in EID within RBC pilot areas compared to non-pilot areas. Third, the effectiveness of environmental enforcement plays a crucial role in reinforcing the impact of the RBC policy on firm EID. Fourth, the presence of local environmental protection organizations amplifies the effect of the RBC policy on EID. Lastly, firms receiving greater media attention exhibit a more pronounced RBC-EID effect.

This study makes several valuable contributions that are highly beneficial to various stakeholders, including policymakers, government agencies, firms, investors, non-governmental organizations (NGOs), and the general public in the investigated bloc:

Policy Guidance: For policymakers and government agencies, this study offers essential insights into the relationship between city development planning and environmental behavior in firms. By demonstrating the positive impact of the Sustainable Development Plan for Resource-Based Cities (RBCs) on firms' environmental information disclosure (EID), the paper serves as a valuable resource for those involved in urban and economic development planning. It showcases how policies focused on environmental sustainability can effectively drive positive changes in corporate practices. Policymakers can use these findings to refine existing policies and develop new initiatives that promote environmental responsibility and sustainable growth in cities.

Promoting Sustainable Development: The research highlights the significance of integrating environmental considerations into the early stages of city development. It underscores the importance of mitigating the adverse effects of resource extraction on the environment and promoting sustainable development practices. Stakeholders involved in city planning and development can leverage these insights to prioritize eco-friendly initiatives and ensure that urban growth aligns with long-term environmental sustainability goals.

Business Strategy: Firms operating in RBCs will benefit from this study by gaining a deeper understanding of how urban development policies impact their environmental behavior. The findings emphasize the advantages of proactive environmental governance and transparent information disclosure. Corporate leaders can use this knowledge to develop more responsible business strategies, foster innovation in environmental practices, and enhance overall firm performance.

Investment Decision-Making: For investors, both individual and institutional, the paper offers valuable information for investment decision-making. It highlights how firms in RBCs that adhere to sustainable practices and maintain high levels of EID can be more attractive from an environmental, social, and governance (ESG) perspective. This knowledge empowers investors to make more informed choices that align with their values and risk tolerance.

NGOs and Environmental Advocates: Non-governmental organizations (NGOs) and environmental advocates will find this study particularly useful. The research demonstrates the significant impact of local environmental protection organizations on enhancing the effectiveness of RBC policies. NGOs can use these findings to collaborate with official pressure and inspire public environmental awareness. By working together, they can advance environmental regulations and hold non-compliant companies accountable.

Consumers and the General Public: The study indirectly benefits consumers and the general public by encouraging responsible environmental practices in firms operating within RBCs. It promotes greater transparency, reduces the risk of "greenwashing" behaviors, and ultimately leads to a healthier and cleaner living environment for local communities. When firms prioritize sustainability, it benefits everyone living in and around these urban areas.

In summary, this paper offers valuable insights that contribute to sustainable development, informed decision-making, and responsible corporate behavior. Its findings have broad relevance for stakeholders involved in shaping the future of urban development and economic growth within the investigated bloc.

6.1 Theoretical implications

The contribution to the literature mainly lies in the following aspects. This study provides new evidence on the impact of the development orientation of resource-based cities on the environmental innovation behavior of micro-firms, which expands the literature on corporate environmental behavior. The results suggest that the development orientation of RBCs can significantly impact the environmental innovation behavior of micro-firms. First, it releases positive environmental legitimacy signals, which cause relevant polluting firms to focus more on environmental problems. Second, by explaining how the legitimacy pressure caused by the city's development planning affects the EID behavior of firms, we broaden the sources of legitimacy pressure and demonstrate how a mix of mandatory and instructive regulation works, thereby enriching the existing legitimacy theory and extending the dynamic factors of corporate environmental behavior.

Therefore, we demonstrate the conditions under which the influence of legitimacy pressure can be adjusted to be stronger or weaker. It needs not only the influence of the rigid constraints of formal law enforcement but also the social participation of environmental protection organizations and the soft constraints of the participation and supervision of media.

6.2 Practical implications

Economic development is a paramount goal for both developing and developed countries, each with unique developmental needs. However, embracing a "pollution before treatment" approach is not a viable option for any of these nations. They must instead integrate environmental considerations into their development agendas. This is particularly important for RBCs because many cities in developing countries rely on mineral resources for growth; however, this does not mean that these cities should develop a single resource, leading to a "resource curse." Policymakers should prioritize sustainable development procedures at the early stages of city development planning to avoid a pollution paradise and the resource curse. Policymakers should encourage firms to adopt environmental innovation practices, minimize the adverse effects of resource extraction on the environment, and promote sustainable development.

Based on our findings, we can conclude that China, as an emerging economy, serves as a prime example for other nations to follow at both micro- and macro-levels. The policies enacted by the Chinese government have established a significant precedent for sustainable development within a rapidly growing economy. By emulating these policies and practices, other countries can embark on a similar journey toward a more sustainable and environmentally responsible future.

Company managers should facilitate the implementation of a multi-disciplinary approach as advocated by policymakers to promote sustainable development within their organizations. For instance, this might include training programs across all company departments. Such initiatives aim to enhance overall firm performance while also reducing the likelihood of "greenwashing" behaviors, which may occur due to employee misperceptions.

6.3 Implications for future research

First, the conclusion of this paper is relatively limited, as it does not provide evidence concerning the environmental behavior of other enterprises in RBCs, such as the green innovation of firms, which is worthy of further study. Second, the environmental behavior of firms is influenced by many factors. Future studies could investigate the effects of internal governance and external environmental pressure on the environmental innovation behavior of micro-firms in RBCs. Third, further research could expand the analysis by including a more extensive set of policy measures, additional control variables, and longitudinal data to investigate the relationship between city development planning and environmental innovation behavior.

Appendix: Definitions of the variables

Variable	Code	Measurement method
Environmental information disclosure	EID	According to the enterprise's annual report, eight indicators are calculated, such as environmental protection investment expenditure or loan, environmental protection subsidy or incentive income, pollutant type and quantity, and emission standard
Treat	Treat	If a company's registered address is in any of the 126 cities evaluated in the *2013 Sustainable Development Plan for Resource-Based Cities* (2013–2020), the variable takes the value of 1; otherwise, 0
Change	Change	We determined 2009–2013 as the pre-policy period, and the change value becomes 0; we determined 2013–2018 as the post-policy period, and change value becomes 1
Environmental enforcement	Legal	Number of environmental administrative punishment cases in the province
Environmental protection organizations	NGO	Number of environmental protection organizations
Media coverage	Media	Number of news regarding each enterprise
Firm age	Firm age	Years of the existence of the business since the date of registration
Firm size	Firm size	Natural logarithm of its total assets
Firm nature	Ownership	If a firm is a state-owned enterprise SOE, its value takes 1, otherwise 0
Independence of the board of directors	Independence	Proportion of independent directors in the board of directors
Return on assets	ROA	Net assets/total assets
Financial leverage	Lev	Total asset/total liability
Per capita economic development level	Per GDP	GDP/population
Industrial structure	Indus-stru	Proportion of industrial added value in GDP
Regional pollution emission	Pollution	Total industrial SO2 emissions

Acknowledgements Comments from the editor and the anonymous referees are gratefully acknowledged. However, the usual disclaimer applies.

Data availability Data are available upon request to the authors.

Declarations

Conflict of interest The authors declare no potential conflict of interest that could have impacted the outcome of the study.

Ethical approval Not applicable.

Consent to participate Not applicable.

Consent for publication Not applicable.

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