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Research on the Influence Mechanism and Optimization Strategies of Green Technology Innovation among Heavily Polluting Enterprises in Liaoning Province

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Introduction

The report of the 20th National Congress of the Communist Party of China emphasizes that respecting, conforming to, and protecting nature are inherent requirements for building a modern socialist country in all respects. Chinese modernization is characterized by harmony between humanity and nature, explicitly advocating for green development and promoting this harmony as a crucial component of accelerating the construction of a new development paradigm and fostering high-quality development. This provides clearer direction for China's sustainable development path. However, heavily polluting enterprises, which have contributed significantly to China's economic growth, predominantly belong to the manufacturing and heavy industries. Their high-energy-consumption and high-pollution development models not only lead to insufficient endogenous economic growth momentum but also become major obstacles to environmental improvement.

Research Questions

This research focuses on heavy-polluting enterprises in Liaoning Province. It aims to systematically sort out the current situation of green technology innovation in these enterprises through in-depth investigations, accurately analyze the existing problems, identify the influencing factors of their green technology innovation, explore how these factors affect their green technology innovation, and formulate optimization strategies for green technology innovation in heavy-polluting enterprises in Liaoning Province.

Methodologies

Using questionnaire surveys and structural equation modeling, it investigates and analyzes the key influencing factors and mechanistic pathways of green technology innovation in these enterprises. From the perspectives of government, enterprises, and the public, the study proposes targeted and systematic optimization strategies to enhance the green technology innovation capabilities of these enterprises, thereby promoting their transition toward greener development models.

Hypotheses

Hypothesis 1. Policy regulations and other factors promote green technology innovation in heavily polluting enterprises.

Hypothesis 2. Enterprise-related factors promote green technology innovation in heavily polluting enterprises.

Hypothesis 3. Societal public factors promote green technology innovation in heavily polluting enterprises.

Tables

Table 1. Initial SEM goodness-of-fit measurement

Exponent	Measurement model	Acceptable standards	Good standard
X^2/df	2.638	<3	<2
GFI	0.865	>0.80	>0.90
AGFI	0.833	>0.80	>0.90
NFI	0.889	>0.80	>0.90
CFI	0.912	>0.80	>0.90
RFI	0.823	>0.80	>0.90
RMR	0.064	<0.80	<0.50
RMSEA	0.092	<0.80	<0.50

Table 2. Correcting SEM goodness-of-fit measurement

Exponent	Measurement model	Acceptable standards	Good standard
X^2/df	2.201	<3	<2
GFI	0.888	>0.80	>0.90
AGFI	0.872	>0.80	>0.90
NFI	0.912	>0.80	>0.90
CFI	0.933	>0.80	>0.90
RFI	0.856	>0.80	>0.90
RMR	0.037	<0.80	<0.50
RMSEA	0.066	<0.80	<0.50

Tables

Table 3. Correcting the SEM path parameter estimation results

Path	Standardized path coefficient	Standardized path coefficient	C.R.
GIC←PR	0.231	0.283	6.837
GIC←TR	0.360	0.385	3.583
GIC←ES	0.223	0.257	3.682
GIC←MD	0.182	0.201	2.135
GIC←IS	0.078	0.104	2.333
GIC←EP	0.331	0.393	2.989
GMC←PR	0.149	0.177	5.722
GMC←TR	0.309	0.358	4.267

Conclusion

This study identifies policy regulations, enterprise-specific factors, and societal public factors as significant positive influences on green technology innovation in heavily polluting enterprises in Liaoning Province.

Recommendations include

Government: Improve environmental laws, strengthen policy enforcement, enhance supervision, and use fiscal incentives.

Enterprises: Increase R&D investment, develop talent, adopt advanced technologies, and foster entrepreneurial environmental awareness.

Public: Promote green markets, enhance consumer awareness, strengthen industry-academia collaboration, and leverage public oversight.

The findings provide theoretical and practical guidance for green technology innovation, supporting regional sustainable development and an eco-economic balance.
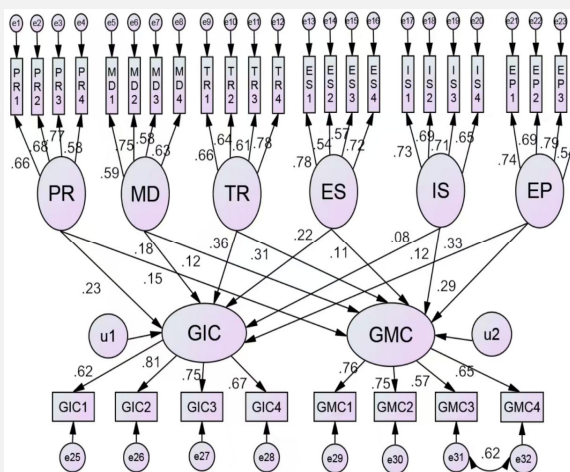
Figure

Figure 1. Path analysis diagram