Research on the Influence of Environmental Regulation on Enterprise Green Innovation Performance

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Abstract: according to summarizing the research status of environmental regulation, expected economic benefits of green innovation and enterprise green innovation performance at home and abroad, this paper discusses: (1) the affect of different types of regulation on green innovation performance, and divides environmental regulation into command control type, market incentive type and voluntary disclosure type, and discusses which way of environmental regulation can improve enterprise green innovation performance more effectively; (2) Taking the expected economy of green innovation as an intermediary variable, this paper discusses its intermediary mechanism between environment and enterprise green innovation performance; (3) Divide enterprise green innovation performance into two dimensions: economic performance and environmental performance, and analyze the effect of different kinds of environmental regulations on different dimensions of enterprise innovation performance.

1. Introduction
With the sustained and rapid development of China's economy development level, environmental problems have become one of the important issues of concern to all walks of life. The progress of science and technology has brought great material wealth to mankind, but it has also produced a series of negative problems such as resource shortage, environmental pollution, abnormal climate and ecological deterioration. Green innovation is an economic behavior that emphasizes improving environmental performance. Because of its characteristics of high investment, high risk and double externalities, the driving force of enterprise green innovation is insufficient. Therefore, this research of this paper is of great significance to the environmental behavior of enterprises.

From the research of scholars at home and abroad: (1) Environmental regulation will have a negative impact on the green innovation performance of enterprises. Wen et al. (2020)[1] think that GDER has a negative impact on heterogeneous innovation investment, and executive compensation has different moderating effects: it strengthens the negative relationship between GDER and research investment, and weakens the negative relationship between GDER and development investment. (2) Environmental regulation has a positive impact on enterprise green innovation performance. Cai (2020)[2] put forward that The panel Poisson fixed effect model is used to study the influence of direct environmental regulation on green technology innovation of listed companies in China's high pollution industries (3) Different environmental regulations have different impacts on the green innovation performance of enterprises. Liao(2020)[3] proves that Market tools and information tools have a significant positive impact on the three dimensions of enterprise environmental innovation, while command and control tools only have a significant positive impact on ecological organization innovation; Ecological organization innovation, ecological process innovation and ecological product innovation play an
important role in improving the reputation of enterprises. Ma Fuping et al. think that designing
scientific and reasonable environmental policy tools can positively influence the green innovation
performance of enterprises.

Scholars at home and abroad have made rich achievements in influencing factors and performance
evaluation of enterprise green innovation performance. However, there are still the following
shortcomings: First, the related investigation about the different impacts of different environmental
regulations on the green innovation performance of enterprises is not standardized, and the factors
through which different kinds of environmental regulations affect the green innovation performance of
enterprises are not thoroughly studied; second, most studies failed to put forward policy
recommendations.

This paper mainly discusses the following issues: (1) the environmental regulations are divided into
command control type, market incentive type and voluntary disclosure type, so as to explore which
way of environmental regulations can improve the performance of enterprises more effectively; (2)
Taking the expected economy of green innovation as an intermediary variable, this paper discusses its
intermediary mechanism between environmental regulation and green innovation performance;

2. Problem description and model hypothesis

2.1. Environmental regulation and enterprise green innovation performance relations and assumptions
Under certain conditions, the government will choose different environmental regulation tools. Green
innovation can not only provide value for consumers and enterprises, but also reduce the impact on the
environment. Green innovation performance is multidimensional, including economic performance,
social performance, environmental performance, R&D performance, technical performance and so on.
This paper argues that the performance of enterprise green innovation includes economic performance
based on financial output and competitive advantage, and environmental performance based on
environmental protection results.

Command-controlled environmental regulation generally means that the government sets technic-
al standards and performance standards for enterprises. Although faced with this type of environment-
tal regulation, enterprises may reduce green innovation due to increased sewage costs, from a
long-term perspective, in the face of command-controlled environmental regulation, enterprises may
make green innovation decisions for long-term development and economic benefits, and improve
production processes and processes to meet the requirements of this type of environmental regulation.
Enterprises are determined to develop for a long time and actively carry out green innovation.
Market-inspired environmental regulation requires enterprises to carry out environmental protection
by using market rules, and uses incentives to guide enterprises to improve their green innovation
performance. Enterprises can choose environmental regulations that can take into account the
requirements of the government and their own economic interests. Some voluntary disclosure
environmental regulations can be put forward by enterprises or industries, and the implementation of
such environmental regulations requires the active participation of economic subjects, which is not
mandatory. Enterprises in pursuit of their own economic interests will be affected by voluntary
disclosure environmental regulation [6].

This study puts forward the following assumptions: H1: Environmental regulation has a highly
positive effect on green innovation performance; H1a: Command-controlled environmental regulation
has a significant positive effect on the environmental performance of green innovation; H1b:
Market-inspired environmental regulation has a significant positive effect on the environmental
performance of green innovation; H1c: voluntary disclosure environmental regulation has a significant
positive effect on the environmental performance of green innovation; H1d: Command-controlled
environmental regulation has a significant positive effect on the economic performance of green
innovation;
2.2. The relationship and hypothesis between environmental regulation and expected economic benefits of green innovation

With the existence of command-controlled environmental regulations in society, enterprises should not only calculate the internal costs, but also consider the environmental protection costs caused by this type of environmental control. The increase of external costs will promote enterprises to consider how to reduce costs. In the case of market-driven environmental regulation in society, such as the implementation of sewage charge system, enterprises treat more pollution in pursuit of high expected economic benefits, thus paying less sewage charges. In the case of voluntary disclosure environmental regulation in society, enterprises will choose whether to participate according to their own situation, and the participation of general enterprises will improve their own expected economic benefits. According to the above analysis, we put forward the following assumptions: H2: The expected economic benefits of green innovation have a great effect on the performance of green innovation.

H2a: Environmental regulation has a significant up effect on the expected economic benefits of green innovation.

3. Research design

3.1. Sample selection and data collection

Questionnaires are mainly distributed in the following two ways. One is to fill in the paper version directly, and entrust students and friends in industrial enterprises and students and friends familiar with related issues to help distribute them. The second is to fill in e-mails, which are mainly distributed randomly to relevant industrial enterprises by using enterprise and individual mailboxes. A total of 400 copies were issued and 308 copies were recovered. Among the 490 questionnaires collected, 398 were valid, accounting for 81.2%, and the overall situation of collection was good.

3.2. Variable measurement

Environmental regulation is the main research variable of this paper, referring to the previous literature, from five aspects: the strictness of environmental standards, the attention of environmental supervision departments to enterprises, the restriction requirements on new product development of the enterprise, the cost of sewage discharge of the enterprise, and the punishment for violating the regulations. The voluntary environmental regulation is measured from four aspects: whether the enterprise voluntarily participates in environmental protection actions, whether the enterprise's environmental management standards pass certification, whether the enterprise can timely and accurately release information to the outside world, and whether the enterprise regularly listens to the opinions of experts or relevant departments on environmental impact assessment. This paper evaluates the expected economic benefits that green innovation may bring to enterprises from the aspects of cost reduction, new market development and competitiveness improvement.

4. Data analysis and results

4.1. Correlation Analysis and Reliability and Validity Test

Cronbach's α coefficient reliability method, which is widely used in empirical research, is used for reliability analysis, and the coefficients are all greater than the acceptable 0.70. Correlation analysis is an index used to measure the close relationship between two or more variables, which is widely used in academic research. In this paper, using the data collected from the investigation and SPSS21.0 software, the correlation between environmental regulation and its dimensions, the expected economic benefits of green innovation, and the green innovation performance of enterprises is discussed. As shown in Table 1

|       | OCER  | MDER  | EDER  | ER   | EEB  | EPA  | EPB  | EP   |
|-------|-------|-------|-------|------|------|------|------|------|
| OCER  | 1     |       |       |      |      |      |      |      |
| MDER  | 0.862 | 1     |       |      |      |      |      |      |
4.2. Hypothesis test

With environmental regulation (ER) as the independent variable and enterprise green innovation performance (EP) as the dependent variable, the related structural equation model is set.

The fitting index values such as $\chi^2_{\text{df}} = 20629$, $RMR = 0.042$, $CFI = 0.912$, $GFI = 0.718$, $RMSEA = 0.081$ all meet the requirements of reference values, which shows that the model has good fitness and does not need to be modified.

The estimated values of path coefficients of various variables of the model and the results of hypothesis showed in Table 2: (1) The standard estimated value of path coefficient of 1) ER and EEB is 0.527, which is significant at the level of 0.001, so it is assumed that H2 holds, which indicates that environmental regulation can positively influence the expected economic benefits of green innovation; (2) The standard estimated value of path coefficient of 2) ER and EP is 0.242, which is significant at the level of 0.001, so H1 is assumed to hold.

5. Conclusion

From the research results, it can be concluded that command-controlled environmental regulation has a great positive effect on the environmental performance of enterprise green innovation, so the government-led environmental regulation has a strong effect. At present, people's active participation has a weak influence on enterprises, so government departments are still the most important guides of environmental regulation. Moreover, when choosing which environmental regulations to formulate, government departments should formulate policies scientifically and reasonably according to the actual situation of industries and enterprises, and should formulate more market-driven environmental regulations. So that enterprises will be more willing to participate, and then can effectively solve environmental problems. Combined with the conclusion of this paper, it can be seen that voluntary disclosure environmental regulation also positively affects the environmental performance of enterprises' green innovation, because this environmental regulation not only enables enterprises to actively participate, but also guides the public to actively join, so we should improve public participation and cultivate public awareness of environmental protection.

References

[1] Wenqing Wu, Yongqian Liu, Chia-Huei Wu, Sang-Bing Tsai. An empirical study on government direct environmental regulation and heterogeneous innovation investment[J]. Journal of Cleaner Production, 2020, 254.

[2] Xiang Cai, Bangzhu Zhu, Haijing Zhang, Liang Li, Meiying Xie. Can direct environmental regulation
promote green technology innovation in heavily polluting industries? Evidence from Chinese listed companies[J]. Science of the Total Environment, 2020, 746.

[3] Zhongju Liao. Environmental policy instruments, environmental innovation and the reputation of enterprises[J]. Journal of Cleaner Production, 2018, 171.

[4] Geffen C A, Rothenberg S. Suppliers and environmental innovation The automotive paint process[J]. International Journal of Operations & Production Management, 2000, 20(2): p.166-186.

[5] Brunnermeier S B, Cohen M A. Determinants of environmental innovation in US manufacturing industries[J]. Journal of Environmental Economics and Management, 2003, 45(2):278-293.

[6] Frondel M, Horbach J, Rennings K. End-of-pipe or cleaner production?: an empirical comparison of environmental innovation decisions across OECD countries[J]. Social Science Electronic Publishing, 2007, 16(8): 571–584.