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A literature review of corporate green innovation behavior from the perspective of peer effect and prospect: An integrated theoretical framework

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Abstract: How to promote the change of the development mode through corporate green innovations, to realize the balance between economic and social development and environmental quality is an urgent and important research topic. In this sense, the empirical test of the corporate green innovation behaviors is not only among the key interests of academics, but also has strong policy implications. Different from the previous research on it, this paper attempts to start from the new research perspective of peer effects, uses the research history of corporate green innovation behaviors as an entry point, systematically sorts out and analyzes the influencing factors, the mechanism and peer evolution that affect the corporate green innovation behavior. On the basis of this, an integrated theoretical framework is established, and some certain reference for the development of relevant research on corporate green innovation behaviors has been provided. This paper aims to broaden the research perspective of corporate green innovation behaviors, enrich and improve corporate green innovation theories and methods. The research results will help reveal the "black box" of green innovation activities, and provide government guidance for the diffusion of green innovations.

Keywords: green innovation; innovative behavior; peer effect; impact mechanism
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1 Introduction

The green innovation is an important way to achieve both economic and social development and environmental quality. From the "13th Five-Year Plan" (2016-2020) to the "14th Five-Year Plan" (2021-2025), China's economic development is changing lanes, from high-speed growth to high-quality development. The "Five Developments" proposed by the Fifth Plenary Session of the 18th Central Committee of the Communist Party of China established the concepts of "green development" and "innovative development". To achieve a win-win for environmental, economic, and social benefits, green innovation concepts, and the realization of green transformation should be an important task. The report of the 19th National Congress of the Communist Party of China has pointed out the ideas and measures for China's ecological civilization construction and green development in the future, such as building a market-oriented green technological innovation system, effectively guiding the transformation and upgrading of corporations, promoting technological innovations, and moving towards green production. That is, to speed up green innovation, promote ecological economics and corporations' green development, cultivate new growth points, and provide a new way out and new energy for transformation. At present, under the new normal of China's economic transformation and development, corporations are facing the dual constraints of resources and environment. Promoting the transformation of economic and social development methods through corporate green innovation and shaping sustainable competitiveness is an urgent and essential research topic[1].

The green innovation of corporations is the micro foundation that supports the country's green development and innovative development strategy. As the main component of economic development, corporations adopt green innovation methods to respond to the new normal and adapt to the new normal, which has attracted great attention from government

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departments, academia, and corporations themselves[2,3]. Current research on green innovation is mainly concentrated on two directions: the macro-level (country, industry) and the corporation's micro-level. Among them, in terms of corporation-level research, domestic and foreign scholars have carried out a series of studies on green innovations from different disciplines and perspectives, such as innovation economics, environmental economics, strategic management, industrial organization[4-9]. Although these green innovation studies from different perspectives focus on different green innovation issues, they have not yet reached a consistent conclusion[10]. The research of innovation economics mainly uses the general innovation theory to discuss the driving factors and mechanism of green corporate innovation. The research from environmental economics perspective focuses on the impact of environmental regulation on corporate competition and the impact of different environmental regulation types on corporate innovation behaviors. The research-based on strategic management's perspective mainly focuses on the impact of green innovation strategy on corporate competitive advantages. The research from an industrial organization perspective mainly explores corporate-scale, inter-corporate cooperation and other factors on green innovation behavior. Generally speaking, the current academic research on corporate green innovation is still in the exploratory stage, and there are a lot of areas worthy of further in-depth research, especially in the driving mechanism and internal mechanism of corporate green innovation behavior, which needs further in-depth research[3-11].

This paper provides a new idea for studying corporation green innovation behaviors based on the perspective of the peer effect. The early research is based on the theory of social psychology. Relevant research shows that a specific subject's behavior will be affected by other subjects' behavior in the group. This phenomenon is called the "peer effect"[12]. Its essential characteristics are as follows: ① peer effect exists throughout the decision-making process, and peer behavior can change its decision-making behavior by changing the preference, expectation, and action choice set of decision-makers; ②there is an active interaction between the decision-maker and peers in behavioral decision making; ③ the spillover effect of peers behavior causes the fluctuation of decision-makers' behavior at the reference group level to be several times that at the individual level[13]. The peer effect reflects that acorporation does not always face the optimal decision of market selection alone but is also influenced by the group it is in, which leads to changes in its behavior and results.

This perspective enriches the classical economic theory, that is, in addition to considering the interaction between individuals and the market, the influence of "peers" is added, which has important theoretical reference and practical guidance value[14]. Compared with Western developed countries, China's corporate green innovation practices are currently at a preliminary stage of development, with relatively insufficient practical experiences and the immature development of intermediary agencies in the market. At the same time, companies do not act in an "atomic" state. The economic behavior of corporate green innovations is inherently socially embedded. In a traditional relational social environment like China, social relations and informal systems have a more widespread and profound impact on economic activities. This "relationship" itself is neutral, and it is also an essential factor that promotes the closeness and trust of the "group". The above shows particular practical significance in studying corporate innovation behaviors' peer effect under Chinese management practice.

It has novel and academic values to systematically study the peer effect and internal corporate green innovation mechanism. Research on corporate green innovation has always been an important issue of concern to scholars, but according to the review of the published literature, few studies are examining the interaction of corporate green innovation behaviors. Domestic and foreign research on the peer effect focuses on the frontier research of management, economics, and finance. Research issues also focus on corporate investment and financing decisions[15] and corporate financial decisions[12,16], corporate capital structure[13,17], corporate trust-breaking behavior and social responsibility[18-20], which is different from the research focus of this paper. This paper focuses on the micro-dynamic basis of corporate green innovation behavior, the interactive influence of corporate green innovation behaviors. We are systematically combing and studying the peer effect and internal mechanism of corporate green innovation behaviors.

This paper can also meet the development of current management theory and practice from the following aspects. The specific research significance includes: Firstly, studying the group relevance of corporate green innovation behavior based on the perspective of the peer effect can enrich the current research perspectives of corporate green innovation research to a greater extent; Secondly, conduct a systematic and logical analysis of the formation mechanism and internal influence mechanism of the peer effect of corporate green innovation behaviors, and build an integrated research framework, which will help reveal the "black box" of real companies in green

innovation activities; Finally, in terms of practical guidance, the research in this paper can clarify the formation mechanism behind the clustering characteristics of green innovation activities carried out by corporations, and help to make policy recommendations from the perspective of public management.

1 The historical evolution of the research on the impact of corporate green innovation behavior and peer effect

In order to propose an integrated analysis framework based on the research of corporate green innovation behaviors from the perspective of the peers, this paper systematically reviewed the relevant domestic and foreign authoritative journals on the research of corporate green innovation behaviors and the peer effect from 2001 to 2020, including special articles such as *The Journal of Finance*, *Finance*, *Econometrica*, *Financial Economy*, *Economic Review*, *Chinese Industrial Economy*, *Economic Management*, as well as management studies such as *AMJ*, *AMR*, *SMJ*, *MS*, *Nankai Management Review*, *Science Research*, *Foreign Economics and Management* in comprehensive and review journals of economics. On this basis, this paper attempts to start from the interactive perspective of the influence of the peer effect on corporate green innovation behavior, taking the historical evolutionary context of the corporate green innovation behavior research as the starting point, and summarize and refine the individual and organizational context influencing factors that affect the corporate green innovation behavior. This section also reviews the current research status of corporate green innovation environmental regulations closely related to the research issues in this paper to fully understand the historical development and current research status of corporate green innovation behaviors and peer effects.

1.1 Related research on green innovation behavior of corporations

Scholars with different academic backgrounds carry out green innovation research from different perspectives, reflecting green innovation research characteristics from different disciplines or theoretical perspectives[6,21]. This part mainly introduces research on corporate green innovation behavior, closely related to this research topic. It will start from two aspects: the influencing factors of corporate green innovation behaviors and the results of green innovations (output evaluation and regional research of output).

1.1.1 Influencing factors of corporate green innovation behavior

In recent years, although domestic and foreign scholars have carried out extensive research on corporate green innovation behaviors from different perspectives, they have not yet reached a consistent conclusion[10]. More and more scholars are also focusing on the influencing factors of corporate green innovations. The current research on influencing factors can be summarized into the following three aspects: research on the institutional level, research on the organizational level, and research on the individual level.

First, the research on the institutional level is mainly explained by stakeholders and the institutional theory.

The stakeholder theory believes that companies' main incentive to get engaged in green innovations is the need to face pressure from stakeholders[22,23]. The institutional theory believes that the green innovation is an effective way for corporations to cope with institutional pressures and enhance organizational legitimacy. A series of studies also show that institutional pressure is the main driving force for corporations to carry out green innovation activities[24]. Since the system theory can better explain the corporate social responsibility behavior, it has become the leading theory for analyzing the factors affecting corporate green innovation behaviors.

Second, the research on the organizational level is mainly explained from the perspective of a resource-based view. According to the resource-based view, the basic characteristics of the corporation (such as scale, years of establishment, industry), the resources and capabilities of the corporation (such as organizational redundancy, network embeddedness, innovation ability), and the strategic orientation of the corporation (such as green development strategy) are the core factors that affect the green innovation activities of the corporation[25,26].

Thirdly, the research on the individual level is mainly explained from the higher-order theory and principal-agent theory. Research in this area focuses more on the impact of corporate executives' cognition (such as environmental awareness, support, and commitment, behavioral intention) on corporate green innovation behaviors at the individual level[27].

1.1.2 Results of corporate green innovation behavior

At present, domestic and international researches on the results of corporate green innovation behaviors are still in the exploratory stage. The existing research focuses on corporate green technology innovation, and the main research topics include aspects of green innovation and regional research output evaluation of the green innovation output, etc.[28].

In terms of green innovation output evaluation, related research mostly focused on green innovation's technical characteristics and the connotation of green innovation. For example, Costantini et al.[29] believed

that green technology should be an innovative technology that contributes to environmental improvement. Therefore, the relationship between green technological innovation and the ecological environment should be used as a reasonable evaluation of output. Feng[30] believes that green innovation has the essential characteristics of considering economic, social and environmental benefits. Other related studies explain the content of green innovation. For example, based on the product life cycle theory, Pujari[31] evaluate the green innovation of products by reducing product materials, energy consumption, and pollution prevention.

In terms of regional research on green innovation output, the preliminary research results are relatively prosperous. Representative studies, such as Ref. [32], first proposed spatial innovation systems. The path dependence theory discussed the evolution paths of technological innovations in different types of regions in different periods and stages. Sun et al.[33] studied the spatial agglomeration effect and the spillover effect of the green innovation output in different China provinces by using spatial econometrics. The research results showed that each province had a significant positive spatial spillover effect in geographical space. Peng et al.[34] proved that the distribution of green innovation in China has obvious spatial agglomeration characteristics. However, these studies tend to focus on the macroscopic level, and the enterprise-level still needs to be further in-depth. A few scholars, such as Cao and Zhang[35], have explored the evolutionary impact of the tripartite stakeholders' regulatory behaviors (government, enterprises, and public consumers) on the diffusion of corporate green technology innovations by constructing a tripartite evolutionary game model.

1.2 Related research on peer effects at the firm level

1.2.1 A rising research perspective

Studies on the peer effect first originated in the field of sociology. Relevant studies indicate that individuals in the social reference group will learn specific individuals' behaviors and attitudes in the reference group. Studies on the peer effect are mainly found in sociology, pedagogy, economics and management[12,19,36]. From the perspective of research objects, the peer effect research is divided into individual-level research and enterprise-level research.

Internationally, studies on groupings at the individual level and the impact of groupings on individual and family financial decisions and behaviors, have been validated by a large number of studies[37-39]. Recent studies have found that there are also apparent externalities and peer effects in corporate decision-making. For example, Leary & Roberts[16] found that the peer effect is more important than other factors affecting the determination of corporations' capital structure. The influence of this kind of clustering effect is also found in other important decisions of firms such as cash holdings[40], investment decisions[15], dividend policy[41] and important decision-making events (such as mergers and acquisitions and initial public offerings) in the reaction of the stock market[42].

Domestic research on the peer effect has just started, mainly studying the peer effect's verification and exploring the peer effect's formation mechanism. For example, Zhong and Zhang[13] proved for the first time that the capital structure and debt maturity structure decisions of China's listed companies are significantly influenced by peer decision-making, and further pointed out that peer effects show asymmetry in directions and scopes. Wan et al.[12] took M&A events of A-share listed companies as an example to study the industry peer effect and its formation mechanism in M&A decisions. Su et al.[43] examined the fact, internal formation mechanism and external characteristics of the peer effect of financial institutions' leverage decisions, and provided a micro explanation of the pro-cyclical characteristics of China's financial leverage. Yan et al.[44] studied the influence of the peer effect on important company decisions by building a numerical simulation model system, such as financing decisions, investment decisions, R&D investment.

1.2.2 A topic worth studying

Through public literature retrieval and review, we can find few studies on the peer effect of green innovation behavior of corporations and even less systematic studies on its specific influencing mechanism. However, existing studies have shown that organizations or individuals can reduce their uncertainties by imitating and learning from other individuals or groups when making decisions[45]. Information exchange and imitation learning among individuals in a group can help individuals make decisions so that the results of decisions among individuals in a group show a certain similarity (i.e. the peer effect)[46]. Specifically, when making management decisions, corporations can make rational decisions through their own analysis and also make decisions by referring to the management behaviors already implemented by other corporations. In high uncertainty, social reference factors can partially replace rational decision-making factors, and the degree of decision-making based on social reference factors shows a high positive correlation with the degree of environmental uncertainties faced by corporations.

Based on the theoretical framework of social psychology and organizational behavior[47], the two pathways of information-based imitation and competitive imitation can be used to explain the influence mechanism of the peer effect on green innovation

activities of firms. First, in terms of information acquisition imitation mechanism, for corporations adopting green innovation decision-making, considering the convenience of information acquisition and the similarity with the characteristics of imitation objects, it is a lower risk choice to learn from companies that are more similar to them. Secondly, in terms of competitive imitation mechanism, to enhance their competitive advantage and maintain their industry position, corporations usually closely watch their competitors' actions in the same industry to take corresponding countermeasures in time[48]. Finally, the corporate green innovation is characterized by high risks, high investment and long return cycles[2,49]. Corporations face great uncertainties when carrying out green innovation activities. Theoretic green innovation of corporations is likely to produce the peer effect. Therefore, there will be many new inspirations and research values for studying corporate green innovation behavior from the perspective of the peer effect.

1.3 Related research on green innovation policy

The existing literature on green innovation environmental regulation itself mainly includes the connotation and extension of environmental regulation, the classification of environmental regulation tools, the choice of environmental regulation strategies, etc. Although strong negative externalities of environmental problems have long been a consensus, the connotation and extension of environmental regulations are still changing and constantly adjusting[50]. With the economic incentive and constraint policies based on market regulations (such as environmental taxes, subsidies), as well as the behavior norms based on the conscious awareness of the masses (such as information oversight, public reports), the environmental regulation has been continuously included in the scope[51]. Scholars usually divide environmental regulation tools into three types: the command control type based on administrative orders, laws and regulations; the economic incentive and constraint type based on market regulations; and other implicit environmental regulations related to environmental protection concepts, environmental protection awareness, environmental protection attitudes and environmental protection cognition[52]. Scholars also classified environmental regulations into other categories[53,54]. In essence, no matter what type of environmental regulation tool, its way of actions is to internalize polluting corporations' external costs. Then, change the game equilibrium between polluting corporations and the government representing public interests[55], prompting corporations to re-choose production strategies conducive to the ecological environment.

Research on environmental regulations and green development at home and abroad mostly focuses on the impact of environmental regulations on corporate green (technological) innovations, industrial pollutant emissions and industrial green total factor productivity[56-61]. Ding and Fang[62] system reviewed the research of domestic environmental regulations and green innovations and found a significant positive relationship between environmental regulations and green innovations, and the effects of different types of environmental regulations on green innovations are different. Simultaneously, the relationship between them is affected by regulatory variables such as industry, region and period.

In general, the existing research has provided abundant results for the research on corporate green innovations. However, further research is needed on environmental regulation mechanism affecting corporate green transformation through green innovations. Moreover, the impact results of different types of environmental regulations on corporate green innovation behaviors may be different, and the types and contents of environmental regulations in different regions are inherently heterogeneous[63-65]. The present study is also based on the industry or more provinces, such as insufficient samples, the problem of a low degree of freedom[66]. It is necessary to clarify further the environmental policy of green innovations of the corporate microscopic dynamic mechanism, which requires the empirical analysis based on data of subdivided fields at the enterprise level[67]. Obviously, the key to green development transformation's success is to design a scientific and reasonable combination of environmental regulations and green innovation policies to guide and motivate corporations to carry out green innovation and diffusion.

2 An integrated research framework for corporate green innovation behavior from the perspective of peer effect

Different from previous studies on the classification, characteristics and process of corporate green innovation, this paper attempts to start from the new research perspective of the cohort effect, correctly sort out and analyze the influence mechanism of corporate green innovation behaviors on the micro-level from the perspective of the peer effect, and tries to answer the following questions. First, we verify whether the peer effect incorporates green innovation behavior and clarifies the main influencing factors of the peer effect of corporate green innovation behavior: how the corporate size factors, corporate governance level, and other factors affect the peer effect. Secondly, based on the

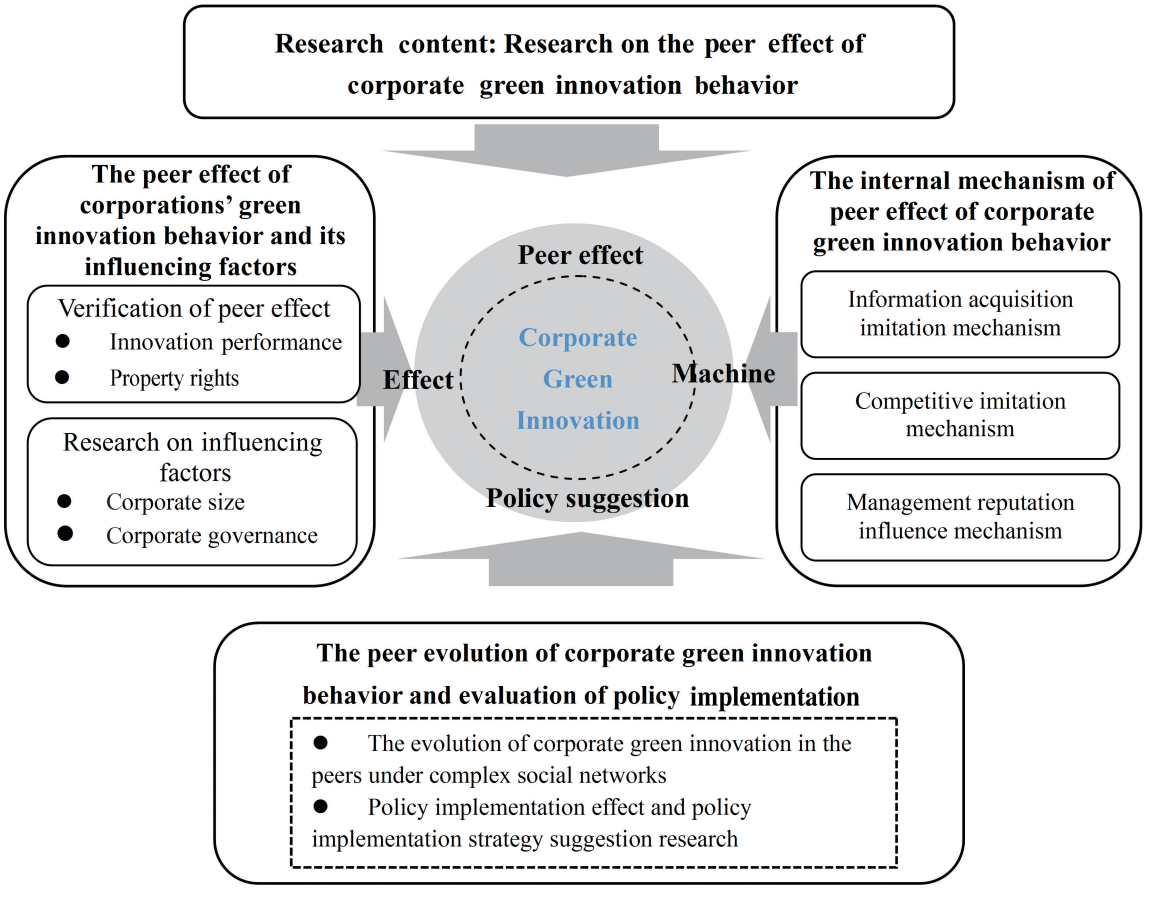

Figure 1. Research framework of peer effects on green innovation behavior of corporations.

sociological theories and the related theories of organizational behavior, this paper systematically analyzes the specific mechanism of the peer effect of corporate green innovation behaviors, which is discussed from three aspects: information acquisition imitation mechanism, competitive imitation mechanism and manager reputation influence mechanism. Finally, the co-group evolution based on green innovation behaviors of corporations is studied. In this way, the existing researches are integrated to establish a systematic analysis framework (the research framework is shown in Figure 1).

2.1 Explanation of the peer effect of corporate green innovation behavior and influence factors

Green innovation behavior is the environmental improvement and innovation activities of corporations in product innovation and manufacturing process innovations to achieve resource conservation and environmental friendliness, such as pollution prevention, energy conservation, green product design, and waste recycling. This section focuses on corporate green innovation behavior and explains whether there is a problem with the group effect, and its main influencing factors are discussed mainly from the following two sub-aspects.

2.1.1 Research on peer effect test

The environmental uncertainty faced by corporations in decision-making and decision-makers' bounded rationality is the root causes of the peer effect. Decision-makers with limited information will learn and imitate the peers' decision-making behavior to make the most beneficial decision, which leads to the convergence characteristics of the decision-making among individuals in the group. In terms of corporate green innovation behaviors, the corporate green innovation has the characteristics of high risks, high investment, and long return periods[2,68]. Therefore, corporations will face enormous challenges when carrying out green innovation activities, leading to the peer effect. In addition, domestic and foreign research on the peer effect of important corporate decisions[12,13,15-17] also provides some inspiration and reference for the follow-up research.

Future research can focus on the following three aspects: First, an empirical test model is constructed to verify whether the Chinese scenario's corporate green innovation behavior has a peer effect. Secondly,

according to the research of Ref. [68], inter-organizational imitation behavior is subject to the logic imitation law (corporations with better performance and higher operational efficiency are more likely to be the objects to be imitated and learned) and the inner-after-outside law (corporations are more inclined to imitate objects with the closer relationship or related characteristics). Based on this, we can study whether the peer effect of the green innovation behavior is closely related to peer corporate green innovation performances. Finally, the paper studies whether the same nature (such as the same property right nature) of the same cluster of corporations is the more obvious the cluster effect of green innovation behaviors.

2.1.2　Influencing factors of peer effect

In order to have a deeper understanding of the peer effect of corporate green innovation behaviors, this section will further explain other factors that may affect it. In theory, there may be many factors that affect the peer effect, which need to be clarified through literature research, focus interviews, grounded research and other methods. Due to space limitations and consideration of the principle of importance, and based on the previous literature review, this paper mainly considers two possible core influencing factors of corporate size and corporate governance.

In terms of the corporation size. Previous studies have shown that a firm's size influences the degree of learning and imitation[16,69]. For the green innovation behavior of corporations, according to the information acquisition imitation mechanism, the larger the corporation, the more extensive its information sources and the richer its accumulated knowledge. It is more likely to become the object of learning and imitation other corporations. Simultaneously, according to the competitive imitation mechanism, large scale corporations mean that they are in a more advantageous competitive position in the market, and green innovation activities will undoubtedly further enhance their competitive advantages. In order to narrow the gap, other corporations in the peers are more likely to model the innovation behavior of the scale leader. Based on this, future research can construct two new frequency variables of the peers of green innovation behaviors: large-scale peer corporate green innovations (peer-big) and small-scale peer corporate green innovations (peer-small). From the peer group's perspective, explore the benefits of the corporate scale and build a regression model to verify.

In terms of corporate governance factors. Previous studies have shown that corporate governance factors can significantly affect the implementation of important decisions[70]. On the one hand, according to the law of logical imitation, the higher level of corporate governance, the higher the probability of success and efficiency of green innovation activities, the more likely it is to be the object of imitation and learning. On the other hand, according to the law of "internal before external", corporations with low corporate governance levels are more likely to "smell the same" and imitate and learn from each other. Corporations with higher corporate governance levels tend to choose peer corporations that are more reasonable than their governance structure. Based on this, future research can construct two new frequency variables of the peers of green innovation behaviors: high-level corporate governance peer green innovations (peer-high) and low-level corporate governance peer green innovations (peer-low). From the peer perspective, new variables are introduced for research on corporate governance.

2.2　Explanation of the internal mechanism of the peer effect of corporate green innovation behavior

If there is peer interaction between green innovation behaviors of corporations, what is the internal mechanism? This part mainly explains this core problem from three aspects of the mechanism of action: information acquisition imitation mechanism, competitive imitation mechanism and manager reputation influence mechanism.

2.2.1　Verification of information acquisitive imitation machine of peers

In order to make effective decisions, corporations can obtain high-quality decision-support information resources through internal learning and external learning. Research shows that these two learning channels can replace each other in some cases[71]. Experience summary of corporation historical practice is an important way of internal learning. The richer the corporations' history practice experience is, the lower the degree of external learning and imitation to obtain the information needed for decision-making will be lower[72]. Similarly, for corporations with rich green innovation practice experience, they mainly guide the next decision-making behavior through internal learning and have the lower motivation to imitate and learn from other corporations in the peers, which leads to lower consistency with other corporations in the peers. Therefore, if we can verify that the green innovation practice experience has a negative moderating relationship with the relevance of the green innovation behavior of the target corporation and other corporations in the peers, then we can prove that the generation of the peer effect is partly due to the information acquisition imitation mechanism. Based on this, future research can verify this conjecture. For example, an empirical model's construction proves whether the peer group effect's formation is partly based on the

information acquisition imitation mechanism.

2.2.2 Verification of the peer effect competitive imitation mechanism

In industries with fierce competition, to gain competitive advantages and reduce their own decision-making risks, corporations will be more inclined to refer to other corporate green innovation behaviors in peers. Based on social psychology and organizational behavior, previous studies have found that corporations in the peer industry are likely to imitate strategic decisions for competitive purposes[73]. With the continuous improvement of domestic market competition, corporations play a more prominent role in corporate decision-making.

In other words, if we can test that the degree of industry competition has a positive moderating relationship with the peer effect of corporations' green innovation decisions, then we can prove that the peer effect is partly due to the competitive imitation mechanism. Future studies can prove that the group effect's formation is partly based on the competitive imitation mechanism by constructing an empirical model and using the Herfindal-Hirschmann index (HHI) to measure industry competition.

2.2.3 Verification of the influence mechanism of manager reputation under the peer effect

The more managers attach importance to their reputation, the stronger the tendency to maintain similar green innovation behaviors with peers. According to Ref.[74], corporate managers' labor market is entirely competitive, but information asymmetry between corporations (labor demand side) and managers. In order to ensure that their personal reputation is at the average level of the market, managers will not make decisions based on their private information (which will increase the risk of the personal reputation) but tend to imitate the behavior of managers in the peers' corporations. Zwiebel[75] believes that in the managerial labor market, the demand side of power inferred the type of management by observing its relative performance, and managers who were "outliers" would be unable to get a job or be fired. As a result, managers have an incentive to try to be consistent with other managers' behaviour. Based on the above, future research can prove that the formation of the peer effect is at least partly based on the manager reputation's influence mechanism by building a model of the mutual influence of managers' reputation among peers.

2.3 Explanation of the peer evolution mechanism of corporate green innovation behaviors

This section mainly explains the extended issue of corporate green innovation behaviors, that is, based on the complex social network theory to analyze the peer evolution of corporate green innovation behaviors. At the same time, this section also gives relevant future research directions.

Corporations do not act in the state of "atomization". The economic behavior of corporate green innovation is inherently socially embedded. Corporations can obtain the resources and information needed for decision-making through the embedded social relationship network, weakening network members' opportunistic behavior[76]. Corporate green innovation behavior is characterized by obvious externality and interaction, which requires full cooperation among corporations to form a green ecological industrial chain[77]. The internal and external social relationship network embedded in a corporation is a key resource that affects corporate decision-making[78]. Corporate green transformation is influenced by the internal and external social network[79]. The complex social network formed by the government, the upstream and downstream of the supply chain, consumers, corporations themselves and the interaction among them is the key influencing factor and driving force of corporate green innovation behavior[80-82]. Therefore, a good social network is conducive to resource-based corporate green innovation decision-making information of other external corporations. Participating in green innovation cooperation among corporations can improve their green participation and promote green innovation activities[83].

In recent years, domestic and foreign scholars have carried out a large number of research on the characteristics, construction content, symbiosis form, operation mode, construction mechanism and construction conditions of the eco-industrial network[84-86]. However, existing research ignores the autonomy, diversity, and complexity of micro-subjects and does not pay enough attention to micro-subject consciousness and behavioral transformation research. Management studies show that decision-makers have rational thinking ability and can make decisions independently. In a specific period, although major events inside and outside the group of the corporation affect the decision, most adopters of green innovation behavior can still rely on their judgment to make decisions and take corresponding adoption behaviors. According to the green behavior information, these green innovation adopters will choose the green innovation mode suitable for their development according to their corporate development stage and needs. Alternatively, by imitating and learning from other corporations with green innovation activities in the peers, the peers' green adoption behaviors are completed, which further evolves into a green behavior adoption network. Therefore, future research can analyze corporate green innovation's peer behaviours

under the stable state of network evolution and build an econometric model to study the peers' evolution of corporate green innovation behavior under the complex social network.

Finally, the government is the main body of corporate green innovation policy formulation and implementation. Comparing green innovation activity effects of different environmental policy tools has a strong policy inspiration for policymakers. Simultaneously, the effect of environmental policy implementation is directly related to whether environmental regulation and its implementation strategy need to be supplemented, modified, improved and adjusted. Future research can also study the implementation effects of environmental regulations and the corresponding implementation strategies based on the above research topics. For example, the environmental policy system of corporate green innovations is constructed and based on this, the effectiveness evaluation model of corporate green innovation environmental policy is constructed, and the effectiveness of various types of environmental regulations is quantitatively evaluated. In addition, a model of the impact of green innovation environmental policies on corporate green innovation activities is constructed to analyze the implementation effect of green innovation policies.

3 Conclusions

Climate warming, environmental degradation, resource depletion and other problems have seriously affected the sustainable development of economy and society. Promoting the transformation of development mode through corporate green innovations and achieving the balance between economic and social development and environmental quality is an urgent research topic with important practical significance. The research on the peer effect is a research topic that has gradually emerged in recent years. Recent research has found that there are obvious external effects and peer effects in corporate decision-making. The domestic research on peer effect has just started,the main research is about the validation and exploration of the peer effect mechanism problem. From the new perspective of peer effect, this paper studies corporate green innovation behaviors, which will produce a lot of new enlightenment and research value.

From the perspective of peer effect, this paper focuses on the validation of corporate green innovation behaviors and its influencing factors, the internal mechanism of action, the peer evolution of corporate green innovation behaviors and the research on the implementation effect of relevant policies. At present, the academic research on green innovations is still in the exploratory stage, and there are many deficiencies, especially in the driving factors and internal formation mechanism of corporate green innovation behaviors need to be further studied. This paper focuses on the micro-dynamic basis of corporate green innovation behavior, studying the interaction of corporate green innovation behavior, and systematically study the peer effect and internal mechanism of corporate green innovation behaviors. At the same time, there are relatively few assessments on the evolution of corporate green transformation behaviors and the implementation effect of environmental regulation policies based on the above studies. The integrated research framework proposed in this study can further enrich and improve the theories and methods of corporate green innovation behaviors, help reveal the "black box" of the actual corporate green innovation activities, and provide a reference for the government to guide green diffusion innovations and policy formulations.

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Conflict of interest

The authors declare no conflict of interest.

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同群视角下企业绿色创新行为的研究述评与展望
——一个整合性分析框架

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摘要:如何通过企业绿色创新来推动经济社会发展方式转变,实现经济社会发展与环境质量兼顾,是一个紧迫且具有重要现实意义的研究主题.因此,对企业绿色创新行为进行系统的分析论证,不仅是经济学界关注的重点议题,其结论还具有较强的政策启示.区别于以往企业绿色创新的相关文献,本文从同群效应这一新的研究视角出发,以企业绿色创新行为研究的历史演进脉络为切入点,对影响企业绿色创新行为同群效应的影响因素、作用机制以及同群演化的研究成果进行了系统梳理和评析.在此基础上,提出一个整合性的理论分析框架,并给出了未来的相关研究方向.研究成果有助于拓宽企业绿色创新行为研究视角,揭示企业开展绿色创新活动的"黑箱",也可以进一步地丰富企业绿色创新的理论与方法,同时为当前开展企业绿色创新行为的相关研究提供一定的借鉴和参考.

关键词:绿色创新;创新行为;同群效应;作用机制