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A REVIEW OF DRIVING FACTORS CONTRIBUTED TO FIRM'S ENVIRONMENTAL MANAGEMENT

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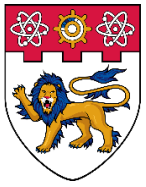

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A Review of Driving Factors Contributed to Firm's Environmental Management

Since the 21st century, severe climate change and environmental protection storms have swept across all fields of global politics and economy, and governments and enterprises are inevitably involved. Faced with massive pollutant emissions and increasing global warming, governments around the world have introduced increasingly stringent environmental protection measures and are working together to find new solutions to protect the environment and mitigate climate change. In this process, enterprises also play an important role, because currently 80% of environmental pollution is considered to come from the production and operation activities of enterprises. Fortunately, more and more companies have realized the importance of environmental issues, and they incorporate more demands for environmental protection from society into their operations, striving to establish their green image.

With the rise of green consumption and the change of the focus of corporate value evaluation, undertaking environmental responsibility has become an inevitable requirement for sustainable development of enterprises. Therefore, identifying the driving factors and their mechanisms of action that affect corporate environmental behavior is of great significance for further helping companies improve environmental management in the future, and it can also provide a reference for the implementation of subsequent environmental regulations. In previous research, there have been lots of empirical studies testing the factors that drive the motivations of firms to improve their environmental management. Generally, it can be divided into external factors and internal factors, of which regulation, market, and community are usually summarized as the most important sources of external factors, while enterprise characteristics are the source of internal factors. The literature review is organized by respectively introducing regulation, market, community, and corporate characteristics first, then displays several China's environmental policy instruments and their evaluations.

1 Environmental regulation

In many previous studies, environmental regulation is usually listed as the primary factor driving the improvement of firms' environmental management (Liu, 2009; Zhang et al., 2009, 2008). Environmental regulation is to regulate various behaviors that pollute the public environment for the purpose of protecting the environment, which converts the cost borne by the whole society into the private cost borne by firms who pollute the environment. The pressure from environmental regulation encourages firms to consider environmental responsibility in their

strategy-making (Rugman and Verbeke, 1998). There are two main forms of environmental regulation, including administrative-based environmental regulation and market-based environmental regulation. The former directly regulates and controls firms' environmental management through legislation, norms, standards, etc., while the latter indirectly takes effects by taxation, subsidies, prices, etc. (Zhao et al., 2015). The government is the main stakeholder in regulation and it plays an important role in influencing firms' environmental management practices. Through command-and-control regulations, the government can impose penalties, fines, lawsuits, and even revoke business licenses on companies that fail to meet the requirements. Therefore, companies responding to regulatory requirements may need to invest resources and manpower to control the environmental impact of their production processes (Qi et al., 2013), such as investment in abatement technology (Jorgenson and Wilcoxen, 1990), capital investments in very costly pollution control technologies (Kagan et al., 2003), the purchase of environmentally friendly raw materials, the establishment of environmental management systems, and the reduction of pollutant emissions (Liu, 2009), and stress on environmental management practices (Gangadharan, 2006), etc. Market-based regulations, such as government environmental subsidies, are government actions aimed at solving environmental problems and helping companies improve environmental protection equipment, technology, and processes (Xu et al., 2021). The forms of environmental subsidies mainly include cash payments, tax incentives and exemptions, government investment in environmental protection, and government loans at preferential interest rates (Liu et al., 2020). From the perspective of mechanism, on the one hand, environmental subsidies can provide monetary support and incentives for environmental technology innovation, and compensate for the cost of upgrading or adopting environmental technology (Ren et al., 2021). This is because improving environmental management requires more input and additional costs, and companies are often reluctant to engage in environmental innovation without subsidies (Klette et al., 2000). On the other hand, the policy stipulates that subsidized projects must comply with national industrial policies and circular economy development, and produce significant environmental, economic and social benefits, which also guides local industries and Enterprises are developing in a cleaner and more environmentally friendly direction (Ren et al., 2021).

It can be seen from the above that regulations have played a positive role in the environmental management of enterprises, green technology innovation, industrial upgrading, etc. (Cai and Li, 2018; Chan et al., 2016; Wang et al., 2011; Zhang et al., 2009). However, regulations also have some disadvantages. Generally, command-and-control environmental regulation mainly relies on administrative intervention and requires a large amount of government resources, while market-incentive environmental regulation mainly relies on market mechanisms and requires the

government to establish and regulate the market. Taking environmental subsidy policy as an example, when the market mechanism is immature or imperfect, it may lead to information asymmetry and ineffective market regulation (Besharov and Smith, 2014). Specifically, when the government lacks accurate information about corporate environmental activities, it may lead to the misallocation of environmental subsidy funds; another situation is that some subsidized firms may use the money for non-environmental technological innovation activities due to weak market regulation. Moreover, with the continuous deepening of supervision, the pressure on enterprises is also increasing. First, more frequent auditing and inspection by governments, and second loss of environmental legitimacy among non-government stakeholders (Ren et al., 2021). Hence, to alleviate these pressures, some companies tend to engage in low-cost, less time-consuming innovations, such as applying for ISO14001 environmental management certification. Environmental management system certification mainly relies on the strength of third-party certification agencies (Yang and Yao, 2012), so the supervision cost of environmental management system certification is relatively low. Meanwhile, the expected goal of environmental management system certification even exceeds the requirements of current environmental laws and regulations, so the environmental benefits are relatively higher (Bu et al., 2020). For enterprises, environmental management system certification can not only effectively monitor enterprises, but also alleviate information asymmetry.

2 Market pressure

Market pressure is also an important factor affecting corporate environmental behavior and driving firms to improve environmental management (Liu, 2009). Its main stakeholders include consumers, suppliers, competitors, investors, and multinational companies. Many studies have shown that market demand is a great force in creating a company's environmental performance (Zhu et al., 2007). Consumers' increasing environmental awareness makes them more inclined to choose environmentally friendly products and avoid using products from companies that are known to be heavy polluters (Wang et al., 2004; Zhang et al., 2008). Kammerer (2009) found empirical evidence that customers' benefits play key roles in green innovation as soon as delivered products add value to the customer. Consumers have started to pressure firms to improve their environmental performance by paying a premium or boycotting firms (van den Bergh, 2008). The strong force of consumers also partly comes from the plenty of competitors in the market. To pursue more profits, producers have to meet consumers' demand for environmentally friendly products, adopt active green innovation strategies, and differentiate their products so as to gain a competitive advantage (Lin et al., 2014).

Similar to the role of consumers, with environmental issues attracting more attention, green

investment has been more popular, and investors mainly exert pressure on enterprises through the financial market. On the one hand, investors believe that listed companies that are actively involved in environmental protection and have good green performance can effectively take into account current investment income and long-term capital appreciation; on the other hand, to avoid risks as much as possible, investors usually consider the environmental risks and losses caused by pollution penalties. Some studies have shown that stock markets in both developed and developing countries react significantly to environmental news (Hamilton, 1995; Stephan, 2002). Suppliers have a direct impact on green production, including products and processes (Zhu et al., 2010). As for a source of "green capabilities", suppliers provide firms with a relatively solid foundation in terms of substance and technologies to produce high-quality ecological products or efficient processes. The incessantly exogenous technical change from suppliers also provides sufficient incentives to spur green innovation within upstream firms (Horbach, 2008). Under globalization, multinational companies are also an important force driving the improvement of corporate environmental management. This is because multinational companies can transfer the more advanced environmental technologies and management systems developed in response to more stringent regulations in developed countries to their subsidiaries (Stalley, 2009). And another reason is that subsidiaries of multinational companies in developing countries may exert pressure on domestic suppliers to self-regulate their environmental performance (Christmann and Taylor, 2001). All in all, under the joint action of multiple stakeholders in the market, enterprises face multiple pressures to improve environmental performance, thus driving the motivation of enterprises to improve their environment.

3 Community pressure

As opposed to "formal regulation" by the government, community pressure can be viewed as a form of "informal regulation". Stakeholders, including residents, industry associations, public media, etc., monitor the environmental behavior of production enterprises through various channels, and drive enterprises to improve environmental management. First of all, the residents of the community where the enterprise is located are the direct stakeholders affected by the production activities, and they mainly exert normative pressure on the company through environmental protection actions or filing civil lawsuits (Liu et al., 2010). Where there is a formal regulator, the community uses the political process to influence the stringency of enforcement; if not, the community usually negotiates with the factory that fails to compensate or reduce pollution (Wang et al., 2004). Second, as a non-governmental organization, industry associations are the bridge between governments and enterprises (Zeng et al., 2011). On the one hand, industry associations know enterprises' production, operation, management, and waste in their industries

best, and have the priority to mastering information such as advanced technologies, waste production and disposal, which are beneficial to industry guidance and environmental management. On the other hand, industry associations can reduce environmental pollution at source and improve regional environmental quality through industry coordination and industry self-discipline, thus it is an effective supplement to legal and administrative means (Liu et al., 2010). Third, the public media has a greater deterrent effect on environmental pollution behavior through the disclosure of environmental information, making enterprises pay more attention to environmental management (Fan et al., 2020). Its influencing mechanism can be explained from the perspectives of reputation and market pressure. The former refers to the media disclosing enterprises' scandals or misconducts, and affecting the reputation of enterprises or managers, which would promote the improvement of corporate governance; the latter refers to the media exerting influence on the capital market by information and comments, then constraining the decision-making behavior of managers, and further reinforce the corporate governance ability (Wu and Memon, 2022). In addition, public disclosure can significantly raise the ante by pressuring regulators toward more accurate and timely record-keeping. With its credibility on the line in a disclosure program, a regulatory agency has a strong incentive to maintain high internal standards (Wang et al., 2004). At the same time, information disclosure can encourage the public to participate in environmental regulation, because it makes up for the shortcomings of insufficient information when the public participates in environmental governance (Shi et al., 2022b).

4 Internal factors of enterprise

The characteristics of the enterprise itself, such as ownership, scale, strategy, vision, financial status, resources, etc., are also factors affecting enterprises' environmental management. Among the so many factors, internal driving forces are resulted from the company's internal motivation (Zeng et al., 2011), i.e., seeking to enter the international market, the reputation of the enterprise, valuing systems of management, and the corporate environmental responsibility for employees' health (Bansal and Hunter, 2003; Egri and Herman, 2000; Roome and Wijen, 2006). These forces work because environmental pollution prevention can provide better performance to enterprises (King and Lenox, 2000). When enterprises gain competitive advantages, the strategies of implementing environmental management, i.e., clean production technologies, product re-design, change of production process, and improvement of resource utilization (Ramus and Steger, 2000; Zeng et al., 2010), will be actively adopted.

The other factors, like scale, environmental responsibility, manager's characteristics, and technological level, are regarded as the key factors to affect firms' environmental behaviors (Zeng et al., 2005). For example, Both Zhang et al. (2008) and Zhang et al. (2009) 's research on Wujin

County and Suzhou Industrial Park in Jiangsu Province respectively show that large-scale enterprises are more active in promoting environmental management plans compared with small and medium-sized ones. Hu et al. (2018) found that corporate environmental responsibility has a significantly positive effect on firm performance, and the positive effect is more pronounced for firms in highly polluting industries, with high asset tangibility and low state ownership. According to Wang et al. (2015)'s survey of 60 energy companies in Shaanxi Province, 33.5% of the managers of enterprises with high environmental performance scores also had the highest level of environmental awareness and environmental behavior. Wang et al. (2015) found that firms' proficiency in leveraging IT technical infrastructure flexibility, IT personnel skills and IT-business alignment enables the integration of IT in the environmental management processes to improve environmental performance, and this IT integration is stronger when the firm is more oriented to environmental sustainability.

Furthermore, Corporate political capital, representing a close relation to the government or politicians, may bring benefits such as preferential treatments, lighter taxation, relaxed regulation, stiffer regulatory enforcement over their rivals, and other useful resources (Faccio, 2010; Fisman, 2001). Especially in China, political capital is viewed as a valuable resource, because it can support green innovation and environmental management through financial and taxation policies, such as tax exemption, funding support, project subsidies, interest-free government loans, and so on (Lin et al., 2014).

5 China's experience in improving corporate environmental management

As the largest developing country in the world, China has been actively exploring policies for energy conservation, emission reduction, and low-carbon development, and has established a relatively comprehensive environmental management system. In addition to the environmental regulatory measures mentioned above, China has also tried some new policy instruments in recent years, which have played an important role in the green innovation and environmental management of enterprises (Liu and Qin, 2016). For instance, China has implemented the low-carbon city pilot (LCCP) policy in three batches since 2010, and selected regions of different types, different development stages, and different resource endowments to carry out pilot projects in stages to explore replicable regional low-carbon development models and effective paths to mitigate carbon emissions.

Different from a single administrative-based environmental regulation and market-based environmental regulation, the LCCP policy, as a comprehensive environmental regulatory instrument, contains both binding clauses and various incentive clauses (Tan et al., 2017; Zheng et al., 2020). And its content includes low-carbon development strategies, supporting policies,

incentive mechanisms, and restraint mechanisms in line with the region, so as to control greenhouse gas emissions in a targeted manner and achieve better environmental protection. Enterprises, as the backbone of the pilot city construction, bear the main responsibility for urban low-carbonization. The implementation of this policy has imposed certain restrictions on the production and development of enterprises, which would affect firms' environmental management. Its influence mechanism comes from two effects, namely the cost effect and the incentive effect. The cost effect means that through the implementation of stricter and more precise environmental regulations, the emission cost will increase, thereby forcing enterprises to innovate in technology and improve environmental management (Cheng et al., 2019). Specifically, under the LCCP policy, local governments formulate stricter emission standards and regulatory measures according to the production and development characteristics of different industries, which forms stronger constraints on the production and emission of enterprises, thereby increasing their costs of production and environmental management. With emission/pollution costs increasing, enterprises would reconsider the allocation of production factors and obtain development opportunities through green innovation. The incentive effect comes from a series of incentive policies in the pilot cities, i.e., financial support, tax relief, financial subsidies, and talent incentives, which directly stimulates the green innovation and environmental management of enterprises (Chen et al., 2021). On the other hand, the pilot cities plan and establish low-carbon industrial parks, introduce advanced green technologies, build more open technology exchange platforms, and raise public awareness of environmental protection to indirectly encourage enterprises to strengthen environmental management and technological innovation (Wang et al., 2019).

To sum up, the LCCP policy is essentially a comprehensive environmental regulation that combines administrative-based and market-oriented environmental regulations, but pilot cities have greater autonomy in low-carbon development plans and policies. Under the LCCP policy, China's cities have introduced many differentiated regulatory instruments, including command-mandatory instruments, market-economic instruments, and voluntary instruments (Wang et al., 2015). The representative measures of command-mandatory instruments are outdated production elimination, coal to gas, coal to electricity, oil to gas, no-coal-burning zone, etc. Market-economic instruments include subsidies for clean energy development, interest-subsidized loans for special energy-saving programs, carbon trade, carbon quota allocation, carbon-neutral platforms, new energy vehicle subsidies, and ecological compensation, etc. And there are diverse measures for voluntary instruments. For example, many cities, like Zhenjiang, Hangzhou, Tianjin, Ningbo, Shanghai, and Wuhan, etc., have established several online platforms to monitor and

manage energy consumption and carbon emission, such as energy monitoring system[1], carbon management system[2], low carbon information platform, and so on. Product carbon footprint certification and audit has been launched in Baoding, Ningbo, and Hulunbei'er. And energy management contract has been adopted in Zhenjiang, Jingdezhen, and Jinchang.

Among so many innovative environmental policy instruments, carbon trading and green finance are two representative market-based instruments with wider coverage and greater influence. In 2011, the National Development and Reform Commission approved seven provinces and cities including Shanghai, Beijing, Guangdong, Shenzhen, Tianjin, Hubei, and Chongqing to carry out carbon emission trading pilots, and officially launched in 2013 (Shi et al., 2022a). The policy regards carbon emission right as a special commodity, allows them to be traded in the carbon trading market, and promotes the rational allocation of carbon emission rights among enterprises, thereby promoting emission reduction (Gao et al., 2020). It can promote the improvement of corporate environmental management from two aspects. First, the cost pressure of emissions urges enterprises to increase green innovation. When enterprises meet the original emission standards, they do not need to purchase carbon emission quotas from the market, which can save costs. Second, cleaner production can enable enterprises to sell their surplus emission quotas through the carbon trading market to obtain additional income(Lin and Huang, 2022). After preliminary trials, China's national carbon trading market officially launched online in July 2021. In the past year, the cumulative number of enterprises participating in the transaction has exceeded half of the total number of key emission units, and the cumulative transaction volume of carbon emission quotas reached 194 million tons, with a turnover of 8.49 billion CNY[3]. The effect of China's carbon trading pilot policy has also aroused extensive research and discussions in academia. For example, Lv and Bai (2021) used trading data from China's seven pilot carbon emission trading markets during 2013-2016 to assess the effectiveness of the carbon emission trading policy from the perspective of corporate innovation. The results show that both a high carbon trading price and high price volatility enhance corporate innovation, which confirms the effectiveness of carbon emission trading policy in promoting corporate carbon-reduction innovation. Based on a sample of selected enterprises covered by the pilot carbon trading policy in China from 2007 to 2018, Qi et al. (2021) conducted an empirical analysis of the influence of this pilot on enterprises' low-carbon innovation using a DID model. They found that the pilot carbon trading policy can improve the level of low-carbon innovation and enhance this effect by easing

1 Hubei (http://www.nyjlhb.com/nyjlhb/f/view-3-0623596589bf490aa3587d38f00a4181.html)
2 Zhenjiang (http://www.news.cn/local/2022-07/04/c_1128802438.htm);
Zhejiang (https://www.zj.gov.cn/art/2021/8/16/art_1229560790_59126854.html);
3 https://www.globaltimes.cn/page/202207/1270724.shtml

the financing constraints faced by enterprises, and the effect was found to be most significant on state-owned enterprises in the eastern regions of China.

Another representative market-based instrument is green finance, which is also a comprehensive environmental regulatory instrument, including green credit, green bonds, green stock index and related products, green development fund, green insurance, carbon finance, etc. the green finance policy essentially reduces the supply of funds to highly polluting enterprises, thus forces high-pollution and high-emission enterprises to transform and upgrade to clean and environmentally friendly enterprises (Huang and Zhang, 2021). Meanwhile, the policy can guide the allocation of financial resources to green projects, stimulate the development of new industries such as environmental protection, new energy and new materials, promote green technological innovation and bring environmental improvements (Lu et al., 2022). Taking green credit as an example, many studies have confirmed its positive effect on corporate low-carbon technology innovation and industrial structure upgrading, but there are different findings on the mechanism and impact. Hu et al. (2021) found that the green credit policy can stimulate green innovation in heavily polluting enterprises by exerting credit constraints, thus achieving green transformation in an emerging economy. On the contrary, based on the research on China's 2,825 listed companies from 2007 to 2018, Hong et al. (2021) found that green credit guidelines mainly limited green technology innovation through reducing debt financing, rather than financing constraints. Additionally, Chen et al. (2022) believed that the policy promoted enterprises' low-carbon technology innovation by increasing their R&D investment and management efficiency. Even so, most of the research agreed the positive effects were more significant for state-owned and large enterprises (Hong et al., 2021; Hu et al., 2021).

This paper provides a relatively comprehensive review of the driving factors that affect corporate environmental management, and introduces the corresponding impact mechanisms. In terms of research data and methods, most studies use questionnaire surveys or public data from listed companies. The survey data include surveys conducted by both authors and official organizations. With survey data, the ordinary econometric regression model, the structural equation model, and simple descriptive statistical analysis are the most popular methods employed in analyzing key drivers. The survey data from official organizations, such as a survey on the state corporations' social responsibility undertaken by the World Bank and the China Center for Economic Research of Peking University (Bu et al., 2020; Qi et al., 2013). Research based on public data of listed companies is usually analyzed using econometric methods. While regarding the research on regulatory policy evaluation, many scholars use DID technique, a method based on

quasi-natural experiments, to test the impact of a certain regulatory instrument/mean (Pan and Yao, 2021; Zhang and Vigne, 2021). It is hoped that the above literature review can provide a reference for future research on firms' environmental management improvement in Singapore.

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