Environmental regulation and firm compliance

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ABSTRACT,
The research investigates the influence of greenhouse gas emission regulations, specifically on carbon emission trading scheme policy(ETS), on firms' compliance strategies and decision making. The study combines the perspective from institutional theory, stakeholder theory, and compliance strategies theory, and identifies three compliance strategies(reactive, proactive, strategic). By interviewing three firms from China, the studies show that carbon emission trading scheme policy influences firm decisions in relation to financial and human resources, investment priorities, and operational decisions. The study contributes to environmental regulations aligned with firm performance, offering insights on how to balance the economic performance with sustainability goals.

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Keywords
Carbon emission trading scheme, compliance strategy, institutional theory, stakeholder theory, investment priorities, operational decisions, financial resource allocation

1. INTRODUCTION

There is an increasing environmentals risk nowadays towards the firms, as climate change has become a significant factor to consider when firms are making decisions and future strategies. Greenhouse Gas(GHG) as one of the majority risks in the environmental field, policies and regulations have been developed and implemented globally. For instance, The Paris agreement in 2015 aims to establish an enhanced transparency framework to track the progress in climate change mitigation and to cut down global emission (UNFCCC, 2015). These regulations aim to create environmental sustainability while ensuring the alignment of economic development.

China, as one of the largest economies in the world and also one of the main greenhouse gas emitters, has developed and implemented some concrete policies and regulations to drive down the environmental impact. For example, China has introduced an industry -specific emission limit in 1996(Administrator, 2019), and this indeed enhanced sustainability but also created significant challenges and impacts to firms operations in China. The growing numbers of new environmental policies increased the complexities for firms in China in balancing the financial performance and the potential cost for compliance. For example, policies like carbon pricing created new costs to manufacturing industries, which influenced firm's investment framework and priorities(Aldy & Stavins, 2012). Furthermore, the carbon trading policy launched in 2021 sets a price for carbon emission which encourages the firms to transition into a sustainable and green practice. This policy created the largest emission trading system in the world, and offers firm financial incentives by treating carbon output as a monetary term. Under this policy, each firm is assigned a different emission allowance depending on the carbon intensity standard, and additional purchases in the market are required if the firm exceeds the emission allowance. In conclusion, this policy leads to financial and operational impact on firms such as cost management and strategy adjustments(Zhao et al., 2024). The enhanced complexity not only influences the way and efficiency for firm operations but also the risk assessment for long term uncertainty.

China as a geographically large country with over 23 provinces, regulations and policies varies in different regions. The difference between policies could have a strong potential impact on companies' compliance strategy and decision-making. For example, the carbon emission trading policy sets lower carbon allowance in GuangDong compared with Shanghai, whereas Shanghai with higher carbon allowance also faces a higher emission baseline which causes higher compliance costs. Therefore, the firms in Shanghai would be more willing to adopt green practices instead of purchasing carbon allowance(Ma et al., 2023). This aspect remains undiscovered and underdeveloped. Furthermore, the unique economic environment in China due to rapid economic growth and centralized decision-making (bureaucracy) generated a critical knowledge gap in this study. More specifically, the influence of centralized policy making on local firms' specific needs and compliance strategy remain unexplored.

1.1 Research objectives and question

This research aims to explore how environmental regulations, especially Greenhouse gas emission(GHG) policies such as carbon emission trading schemes shape the compliance strategies and decision-making in firms that operate in China. By focusing on this particular context, the study is able to examine the uniqueness of the Chinese economic environment, and also identifies challenges and potential opportunities that companies face when adapting changes against the external environment. Furthermore, be aware that the study may not successfully conclude on data generalization, the data gathered on this aspect may lack representativeness. Considering the research purpose, this study will be focusing on answer the following question

"How does carbon emission trading scheme shape firms' compliance strategies and firm decisions in China"

To dive deeper and answer more specifically, following sub questions will help in gathering useful information

1. *Which specific compliance strategies are adopted in corporations when facing policy shifts?*
2. *Which specific firm decisions are influenced in corporations when facing policy shifts ?*

The sub question will be answered through interviews with owners and managers of certain firms.

1.2 Academic and practical relevance

The goal of this research is to contribute into the field of spatial finance specifically on environmental risks aligned with firm performance. The prior studies often interpret regulation influence at a national level, overlooking the policy variation in regional context(Wu & Tham, 2023). In this research, data will be collected and studied in the province context and provide an understanding on firm-specific strategy. By exploring the influence of environmental data and regulations on firm performance, this research integrates the understanding of environment, operational decision-making and compliance strategies.

The practical relevance of this study is that the understanding of the interplay between environment policy and firm decision can effectively help the firms to

integrate sustainability into their business strategies and decision-making, which eventually create a framework that balances the sustainability and economic objectives. There is emerging research in the field of spatial finance that studies the impact of regulations on firm strategies, and highlights how policy encourages the firms' transition into environmentally friendly practices. For instance, one of the researchers indicated that there is a direct relationship between environmental regulations and the firm's profitability(Chen et al., 2022). This study focuses on the context of provinces in China, it can serve as a reference to firms in other provinces or even other countries.

2. THEORETICAL FRAMEWORK

Theory has been studied on the topics of institutional theory, stakeholder theory and environment economics within a global context.

2.1 Institutional theory

Institutional theory refers to providing a framework to gain deep understanding of how firms adapt to external changes especially in the contexts of social, competitive and regulatory pressures(Lin & Sheu, 2012). Based on Institutional theory, the concept of institutional isomorphism was introduced by DiMaggio and Powell in 1983. The main generalization of this concept explains how firms within the same industry apply similar business strategies to align with external regulations and institutional norms which eventually achieve legitimacy(Dimaggio & Powell, 2000).

Institutional isomorphism can be identified as three main types, which are coercive, mimetic and normative isomorphism(Dimaggio & Powell, 2000). Coercive isomorphism occurs when firms are facing external environment pressures such as changing laws, regulations and social normatives, which forces the firms to adapt with changes. For example, firms may comply with the environmental regulations by changing manufacturing strategies in order to avoid heavy penalties from the government(Dimaggio & powell, 2000). Mimetic isomorphism refers to firms imitating the practices from organizations in the same industry that successfully adapted to the changes. For example, a firm may apply a green supply chain strategy from the competitor's company due to its successful application, which decreases the uncertainty of change for the firms (Lin & Sheu, 2012). Normative isomorphism refers to firms applying to a standardized practice that is developed by professional associations in this industry(Dimaggio & Powell, 2000).

In terms of greenhouse gas emission regulations, the theory assumes that firms will adjust their compliance strategies and operational decisions to ensure compliance with the policies in order to avoid sanctions and penalties. Building on the mechanisms of institutional theory, understanding the three main types of isomorphism will help the study for deep analysis. In this context, coercive isomorphism explains how firms adjust their compliance strategy when facing strict regulations such as the carbon emission trading scheme set by the Chinese government. Mimetic isomorphism explains how firms study and innovate the sustainable practices based on the competitors or partners in the same industry. Normative isomorphism explains how different standards and practices developed by the municipalities of different cities shape the local firms' compliance strategies and operational decisions. For example, one of the empirical research focused on how emission trading schemes impact the firm behavior. The study shows that when the environmental regulations are changed, firms tend to study from industry competitors and leaders which fit the description of mimetic isomorphism.. The imitation helps the firm to adjust their process and practices, leading to change in cost strategy and resource allocation which eventually aims to maintain competitive advantage(Gupta et al., 2021).

2.2 Stakeholder theory

Stakeholder theory was developed by Freeman in 1984, which emphasizes the importance of the role of stakeholders such as investors, customers, communities and regulators, etc in firm behavior. The theory suggests that firms should extend their responsibility beyond just its shareholders but also take responsibility for a broader range of stakeholders who are influenced by the firms (Freeman, 1984). For example, investors and customers who have environmental sustainability awareness often demand firms that apply sustainable practices, pushing firms to integrate environmental sustainability into their financial strategies and decision-making(Donaldson & Preston, 1995). In terms of greenhouse gas emission regulations, this theory helps the study to explore how firms shape their decision-making process when facing external pressures such as policy shifts, and how firms take stakeholders into consideration when balancing the financial interests. More specifically, firms need to align their compliance strategy and operational decisions with the expectation from the external stakeholders such as the government, customers and local communities. For instance, firms could ignore the carbon emission limit by purchasing more emission allowance whereas the local customers could be more willing to purchase eco-friendly products. This conflict would create a financial impact and firms will need to apply strategy to balance this conflict, and by using stakeholder theory in this study to understand such firm behavior. Ferron Vilchez in 2017 analyzed various stakeholders such as customers, investors and policy makers, the results indicated that firm decisions on strategy implementation are strongly influenced by the stakeholder pressure, and often being more responsive to the practices that are demanded by the stakeholders.

2.3 Environmental economics

Environmental economics is a branch that falls under the economic subject. The main purpose of this branch is to study the relationship between the environment and economy, and also to focus on how effective environmental policies can be developed to address pollution challenges while balancing sustainability and economic growth(Stavin, 2007). One of the key concepts to notice from this branch is Benefit-Cost Analysis. The model (Figure 1) is used by environmental economists to evaluate the validity of environmental policies and regulations.

$$PVNB = \sum_{t=0}^{T} \{(B_t - C_t) \cdot (1 + r)^{-t}\}$$

Figure 1

Bt represents benefits at time t, Ct represents costs at time t, r represents the discount rate, and T means the terminal year of the analysis. The positive result of a PVNB value indicates that the regulations have a potential to become efficient. (Stavins, 2007). To provide a simplified example, the firm may use this model to assess whether the benefits of reducing greenhouse gas emission outweigh the cost of transition into sustainable strategies. In relevance to this study, the model is able to enhance the understanding of financial trade-offs and potential opportunities that are associated with environmental regulations.

2.4 Compliance strategies

Compliance strategy refers to a practice that an organization applied to comply with the regulations, policies, legal requirements and ethical standards that are developed by the nation or society. These practices are important for firms to mitigate external risks such as legal requirements, drop of reputation, and furthermore to achieve successful operation sustainability(Widjaja, 2024). There are three types of compliance strategies which are reactive, proactive and strategic compliance strategy. Reactive compliance strategy refers to firms that only respond to regulations due to the external pressure such as penalties and legal punishment. The firm tends to minimize the changes within the firm which decrease the impact of the changes and meet the regulation standards at the basic level (Fazli et al., 2023). For proactive compliance strategy, firms tend to actively engage in the changes of regulations and policies, seeing it as an opportunity for the firm to gain competitive advantages by process innovation and integrating sustainable practices(Fazli et al., 2023). For strategic compliance strategy, firms tend to integrate the compliance into their core business strategies, using regulation changes to create an opportunity for market differentiation. The firms often implement the compliance process beyond its requirement, using the change as a driver to generate long term sustainability(Valcozzena et al., 2025). For example, a firm intends to strengthen its social responsibility, and it could be done through promoting a transparent process to maintain the current firm performance, yet the firm decided to integrate sustainability methods into the core business plan in terms of benefits from a long term perspective (Valcozzena et al., 2025).

2.5 Research frameworks

In this section, a research framework would be developed here by integrating the previous theories that are introduced including institutional theory, stakeholder theory and compliance strategies. To analyze the regulations impact on the firm performance, three main factors are considered and explained in the framework which are institutional consideration, stakeholder expectation and strategy adoption. Institutional consideration to see how firms comply with the regulations(coercive isomorphism) while innovating future strategy towards successful firms(mimetic isomorphism) and professional standards(normative isomorphism). Stakeholder expectation to see how firms balance between the financial interest and the demand of stakeholders such as customers who favours the green products. Strategy adoption concluded the strategy choices based on the intensity institutional consideration and stakeholder excitation. For example, a firm may use proactive compliance strategy by imitating the success strategy from the other firms while aiming to achieve the expectations of the stakeholders in order to gain competitive advantages. Apart from that, firm decisions are also affected under this framework. For instance, different institutional considerations may lead to investment priorities, asking firms to decide whether investments in sustainability practices should be prioritized. Stakeholder expectations may influence the operational decisions. For example, if the customers favor green products, then the firm may change their decision in the production process in order to achieve reduction in greenhouse gas emission. Furthermore, marketing decisions can also be affected as the firm may change the marketing strategy to promote the environmental friendly characteristics of the products. In general, decisions vary under the different components in this framework, changing the resource allocation in compliance and innovation in sustainability initiatives. A visual representation of the framework is developed in Appendix B, Figure 2 (Zhu et al., 2008), (Klassen & Whybark, 1999), (Eccles et al., 2014).

3. METHODOLOGY

3.1 Research design

The study will be conducting a qualitative method for the research design. Qualitative method allows the study to be conducted in a real-life setting with naturally occurring data to find the sequences in which

participants' meanings and practices are deployed (Silverman, 2015). The primary data source for data collection will be mainly involved with in-depth interviews. An inductive approach will be chosen for this study; an inductive approach refers to starting with no pre-existing theoretical assumptions and "let the data speak" which to generate concepts and patterns based on the data collected (Timmermans & Tavory, 2012). This approach is determined to have the most alignance with the aim of this research, which is to observe and conclude the relationship between environmental regulations and corporate governance. The data collection and analysis will take place in a continuous process within around 40 days and more details are described in section 3.2.

3.2 Interview

3.2.1 Sampling approach

The sampling population of this study will focus on small firms that have less than 200 employees and operate in JiangSu and ZheJiang province in China. Non-probability sampling will be used, more specifically, a selective sampling approach will be conducted since the samples will be selected in a non-random way. The power of selective sampling is that it allows researchers to select information-rich cases which generate valuable insights by studying in depth on those cases(Coyne, 1997). Only firms operating in industries that are significantly influenced by the Greenhouse gas emission regulations such as manufacturing and transportation will be selected. The target respondents will be mainly managers, owners, shareholders or any individuals that are relevant and insightful with the firm's compliance strategies and operational decisions. The respondents are selected due to their high capability of knowledge and experience in the field of business management and environmental regulations which help this study to acquire concrete results. The following table(1) will provide a list of the respondents that have been selected (note: only three respondents have been contacted at this phase, and the plan is to conduct five interviews in total).

Table 1 Respondents

Nr.	Respondent Firm	Repondent role	Way of participation
1	Plastic manufacturing	Owner	Face to face interview
2	5A tourist attraction park	Environmental protection department manager	Face to face interview
3	Environmental technology firm	Operational manager	Face to face interview

3.2.2 Data collection

Interview helps the study to generate valuable insights by in-depth exploration of the co-constructed meaning produced by interviewees and interviewers(Silverman, 2015). The purpose of conducting interviews is to gain more information on the topic of environmental regulations and corporate governance in the context of China. The experience and understanding shared by the respondents can effectively help the study to examine the relationship between Greenhouse gas emission regulation and firm's financial strategies and decision-making which eventually provide insights for answering the research question. The interview will be an open-ended form and held in a semi-structured way, which allows the respondents to have more flexibility in sharing their perspectives and experiences(Silverman, 2015). The full interview guidelines will be shown in Appendix A. Some relevant example questions will be provided here to gain a brief insight such as "To what extent does the greenhouse gas emission regulations influences' your firm's financial strategy? ", " What are some of the challenges when the firm is trying to comply with the regulations?","What is the cost difference when you are complying with the greenhouse gas emission regulations ?". Furthermore, sub questions and additional questions could be asked during the interview for better understanding, and it may not be written in the interview guidelines. The interviews will be conducted face to face in China, and will be recorded with the permission from the respondents for the purpose of data transcription and analysis. The interview will take approximately 30 minutes and questions may be combined.

3.2.3 Data analysis

The data collected from transcripted interview will be then analyzed by thematic analysis method(Kiger & Varpio, 2020). Thematic analysis is a method that maximizes flexibility in exploring emerging patterns and allows in-depth study on respondent's lived experience and perspectives(Kiger & Varpio, 2020). It also fits with the inductive approach of this study, enabling insights generation directly from the data(Kiger & Varpio, 2020). The method will follow a six-step framework. 1), familiarize the data by studying in-depth and repeated reading. 2) valuable quotes and features will be coded by systematic process, and 3) combining these initial codes to further 4) generate concepts and themes. 5), reviews the code and themes to ensure no further concepts can be extracted from the dataset. 6), categorize and study all the themes generated to provide knowledge and definition for the final analysis(Kiger & Varpio,2020).

4. RESULT

4.1 Interviews

The results of the interviews reveal concepts on how firms operating in China adapt their compliance strategies based on various aspects such as stakeholder pressure and institutional consideration. Firm A, a management firm that runs the national touristic park for

the state. Firm B, a plastic manufacturing firm that produces different types of plastic products by using the plastic mold. Firm C, a green technology firm that manufactures equipment that address environmental issues such as energy-saving equipment. These three firms are located in two different provinces which are Jinagsu and Zhejiang. This represents that Firm B is facing a different regulatory environment compared to Firm A and C. For example, the regulations may vary due to the different economic status, leading the local government to adopt different emission standards. Based on the research, the implementation of environmental regulations in Zhejiang province has become an issue to enterprises and residents' living due the negative impact caused on local economic development (Xiong et al., 2024). Therefore, Zhejiang province is adapting different environmental measures which are applied to firm C. The full quotes and codes that reveal the findings can be found in Appendix C.

4.2 Compliance strategies

The interviews show that firms use a range of strategie to comply with the carbon emission trading scheme policy..

4.2.1 Reactive compliance strategy

Reactive compliance is evident from firms minimizing changes to meet the basic requirements to avoid penalties (Fazli et al., 2023). Based on the respondent's descriptions, all three firms are engaged in mandatory compliance at the foundational level. It was indicated during the interview that the largest external pressure is often considered coming from the regulatory authorities and the government due to the extreme penalties that are set for regulation violations such as instant shut down as expressed by the respondent:

"Those who exceed the emission standards will face fines, orders to correct violations and other penalties. In serious cases, they may be ordered to restrict production, suspend production for rectification, or even be reported to the government for closure. " (Firm A)

Firm B as a plastic manufacturing firm located in ZheJiang province, is facing changes in environmental regulations. The data reveals that the regulatory landscape in Zhejiang Province experienced significant changes due to the COVID-19 pandemic. This causes Firm B to encounter different regulatory environments before and after the pandemic. Before the pandemic, strict emission limits were set for the manufacturing factories, requiring firms to follow it. However, the economic drop caused by the pandemic had a significant impact on the province, leading to a decline in the local economy. Many factories faced bankruptcy and were unable to sustain operations under the existing regulatory framework. In response to these challenges, the local government revised its approach by eliminating the emission limits for manufacturing factories. This policy adjustment aimed to preserve factory operations and ensure employment opportunities for local communities; this phenomenon is commonly referred to as "livelihood businesses" which prioritize people's living above all other policies such as environmental regulations. The respondent expressed:

"In fact, especially in the past few years of the epidemic, the entire economy has been severely depressed. Therefore, more effort, both the government's and ourselves, must be put into protecting people's livelihood and employment. It is true that only when you have solved the problem of food and clothing, will you consider your quality of life and the environment"(Firm B)

In conclusion, Firm B chose to adopt a reactive compliance strategy mainly due to the economic pressure. As a plastic manufacturing factory, it requires total innovation on the manufacturing technologies in order to adopt a proactive compliance strategy. However,the size of Firm B limits the economic foundation which cannot cover up the costs of strategy transition. As a result of adopting this strategy, firm B has more regulatory flexibility. The minimum internal changes within the corporations allow the firm to reduce the costs and challenges when adapting to future policy shifts. However, the policy can be a two sided change, which means if the environmental regulations become stricter rather than looser in the future. This would create challenges when needed to quick adaptation to the new regulation standards.

4.2.2 Proactive compliance strategy

Beyond the basic regulatory requirements, proactive compliance strategy is identified in firms that transform regulatory pressure into opportunities to gain competitive advantage (Fazli et al., 2023). Based on the interview, firm A actively reports the emission data through carbon trading management platform for verification as expressed by the respondent:

"regularly submit carbon emission reports through the Jiangsu Carbon Emission Trading Management Platform and accept third-party verification, and also we obtain quotas through government allocation and paid bidding" (Firm A)

Also, Firm A focuses more than just complying with the carbon emission limit, it also emphasizes the importance of various environmental aspects. For example, improving the water quality by establishing the wetland within the part as expressed by the respondent:

"Our park builds multi-level ecosystems such as wetlands, forests, and grasslands to form a complex carbon storage network. For example, the 10-hectare wetland on the northwest side of the park not only

purifies water quality, but also fixes carbon through plant photosynthesis" (Firm A)

In addition, The interviews shows that Firm A's compliance strategy follows a multi-dimensions focus, demonstrating a commitment that exceeds mere basic regulations but also to gain economic advantage from it as expressed by the respondent:

"The compliance strategy reflects the three-dimensional path of "mandatory compliance, ecological carbon sink and green operation". By strictly enforcing carbon market rules, tapping the carbon sink potential of ecosystems, and promoting low-carbon operations, it not only fulfills environmental responsibilities, but also provides a practical example for the carbon neutrality path of urban green spaces. In the future, it is necessary to further deepen data governance, activate the carbon sink market, and achieve the coordinated improvement of ecological value and economic value" (Firm A)

In conclusion, Firm A chose to adopt a proactive compliance strategy mainly due to the characteristics of its business goal. Firm A as a touristic park, environmental regulations can be seen as an opportunity to gain competitive advantage due to the characteristic of the firm. For example, improving the carbon storage network to ensure compliance but also improves the park scenery which attracts more visitors. As a result of adopting a proactive compliance strategy, it helps the firm to align the sustainability objectives to economic goals.

Firm C actively engages with the compliance initiatives through investment on environmental projects such as carbon capture and zero-carbon industrial park as expressed by the respondent:

"Our company has invested heavily in carbon capture and utilization technologies, aiming to establish zero-carbon industrial parks. These projects are not just about compliance but about leading the transition toward a green economy" (Firm C)

Firm C also focuses on transitioning the greenhouse gas emission regulation to its competitive advantage, green technologies are adopted although the firm is already selling their quota due to the low emission as expressed by the respondent:

"Our renewable energy facilities, including solar panels and wind turbines, supply over 60% of our operational energy needs" (Firm C)

In conclusion, Firm C chose to adopt a proactive compliance strategy mainly due to the high alignment between the firm's business strategy and environmental regulations. As quoted:

"We provide technical services and sell carbon capture equipment to high-emission companies to help them reduce emissions." (Firm C)

Firm C identifies the carbon emission trading scheme as an opportunity for firms to lead in the emerging sustainability and green technology market. As a result of adopting proactive compliance strategy, firm C achieved high energy efficiency, reduced dependency on non-renewable energy, optimized energy cost efficiency while fulfilling the commitment to environmental regulations.

4.2.3 Strategic compliance strategy

The strategic compliance strategy is defined as firms integrating the compliance into their core business model using regulation changes to create an opportunity for market differentiation (Valcozzena et al., 2025). Based on the information collected from the Interview and after the data analysis, it is shown that none of the three firms are adopting a strategic compliance strategy. This is due to the regulatory uncertainty, therefore often risky for firms to integrate an uncertain policy into its' core business model and strategies. The regulatory uncertainty is evident from the responses of Firm B where the local government of Zhejiang province implemented significant policy shifts before and after the COVID pandemic.

4.3 Impact on firm decisions

The carbon emission trading scheme shapes the firms' compliance strategy as well as the Firm decisions. The main influences emerged from the interviews are categorized into three dimensions which are financial and human resources, investment priorities and operational decisions.

4.3.1 Financial and human resources

Firm A allocate more funds on sustainable projects such as renewable energy and carbon offset initiatives as it stated in the interview:

"Special funds are allocated for energy-saving projects, carbon offset initiatives, and renewable energy facilities." (Firm A)

As also stated by Firm C on allocating financial resources on achieving their sustainability goals:

"We allocate funds to build zero-carbon industrial parks, integrating photovoltaics, recycling, and energy optimization."(Firm C)

The above two quotes present how the carbon emission trading scheme incentivizes firms to allocate financial resources and human resources to projects that can lower the emission. These decisions allow firms to ensure they

do not exceed the carbon allowance which avoids further cost to purchase it.

4.3.2 Investment priorities

Firm C priority investment in the green technologies that help the firm to reduce emission and also to enhance long term sustainability objectives as stated in the interview:

"Investments are prioritized for renewable energy facilities like solar and wind power to reduce dependency on fossil fuels." (Firm C)

These quotes present how the carbon emission trading scheme shifts the firm's investment priorities towards sustainability and highlight the firm's commitment of achieving green energy efficiency.

4.3.3 Operational decisions

Firm A also adapt changes to daily operation by implementing new methods in order to ensure compliance and alignment with the sustainability goal, it stated in the interview:

"We introduced smart irrigation systems that optimize water usage, saving both resources and energy while maintaining the ecological balance in the park." (Firm A)

Also, more measures on green operation were introduced as stated in the interview:

"We have introduced green operations, such as optimizing traffic with new energy vehicles and upgrading to energy-efficient systems." (Firm A)

As a result, these operations adjustment optimized energy efficiency while lowering the operational costs by reducing the emission. As evident from the interview:

"Optimizing irrigation systems, reducing vehicle emissions, and adopting green supply chains have significantly improved efficiency." (Firm A)

"Energy conservation measures not only reduce emissions but also lower operational costs." (Firm A)

In general, these quotes revealed complicated relationships between carbon emission trading scheme policy and firms' compliance strategy and decisions. While the themes emerged from the findings on environmental regulations and firms' strategy, it can serve as a foundation for understanding the border context of implications.

5. DISCUSSION

By conducting interviews and thematic analysis, the research aims to answer the following question:

"How does carbon emission trading scheme shape firms' compliance strategies and firm decisions in China"

The findings of this research indicates that whether the firm adopts a different compliance strategy such as reactive, proactive and strategic depends on the regulatory environment of the province. It is shown in the results that a firm operating in a province that is less strict about greenhouse gas emission regulation, for example sets no limit with the emission, will often chooses to adopt reactive compliance which meets the minimum regulatory requirement to avoid penalties. However, this can also be due to the fast changing regulatory environment of the province. For example, the different emission limits in ZheJiang province before and after the COVID pandemic limits the strategy planning for the firms. Therefore, minimal changes in the firm to meet the basic regulation requirement minimize the impact of the changing regulatory environment. For firms operating in provinces that have a strict and stable regulatory environment. The results show that these firms often choose to adopt proactive compliance, which integrates sustainability into the strategy to gain competitive advantage from the regulations. For example, firm A building the wetlands to fix the carbons while improving the park scenery to attract more visitors.

The findings also emphasize the significant impact of the carbon emission trading scheme on firms' operational decisions. The research highlights how the adjustments are influenced within the firm such as resource allocation, investment priorities and daily operations. For example, firms establish a carbon management team to monitor the carbon emission, allocate resources on renewable energy projects, and prioritize investment on sustainable projects such as zero-carbon industry parks. These operation adjustments demonstrate how the regulatory pressure influence the firms' decisions and transform the intangible regulations into tangible actions within the firm, connecting the external pressure and internal business strategies

5.1 Theoretical implications

From the viewpoint of the theoretical background in this research, it contributes to the understanding of spatial finance, especially on environmental risks and firm performance. Focusing on Institutional Theory, Stakeholder Theory, and Compliance strategy, this research offers insights into the interplay between firm decisions, stakeholder consideration and strategy adaptation in response to greenhouse gas emission regulations. For institutional Theory, the study confirms the existence of coercive Isomorphism within the firms. For example, mandatory emission reporting and third party audit to meet the requirements from the external stakeholders such as the government which align with

prior study (Dimaggio & powell, 2000). The research also finds that certain firms also put extra efforts on compliance such as investing in green technologies and conducting public awareness campaigns due to social influence which fits the concept of Normative Isomorphism (Dimaggio & powell, 2000).

For Stakeholder theory, the findings of this research emphasize the importance of considering all stakeholder groups that are affected by the firm's decisions(Freeman, 1984). The study shows how diverse parties such as the government, customers, and communities shape the operational decisions and compliance strategy of a firm. For example, the research illustrates how the government has a significant influence on firm's strategic decisions and compliance adaptation by changing the regulatory environment and implementing violation penalties.

For compliance strategy, the findings refine the current framework by showing the interplay between different compliance approaches. For reactive compliance, the study shows how certain firms put minimal effort on adjustment to meet the regulation requirements (Fazli et al., 2023). For proactive compliance, the study shows further depth of the proactive framework. For example, firms actively engage with the regulations that transform the regulatory challenges into opportunities. Furthermore, the findings extend the theoretical framework by pointing out the combination method of reactive and proactive compliance strategies adopted by firms, which shows the complicated regulatory context the firms are facing.

To conclude, from the theoretical perspective, the research has generated insights on how greenhouse gas emission trading schemes influence firms' compliance strategy and operational decisions, and also how adopting these compliance strategies help the firm to integrate sustainability into the business strategies. Furthermore, a list of aspects within the firm that are affected by regulations are determined in appendix C. This research can therefore serve as an available literature for spatial finance, and can be used as a reference to further explore the firm performance under a province-context.

5.2 Practical implications

From the practical perspective, the results emerged from the interview and insights generated in this research offer firms that operate in China a framework to help them to integrate sustainability into their business strategies and decision making. To be more specific, firms are recommended to extract insights from the success compliance strategies adopted by the interviewed firms, and also operation decisions to maintain the balance between sustainability and economic objectives.

5.3 Limitations and future research recommendations

This research contains several limitations. First of all, the sample size remains relatively small as there were only three firms interviewed. This is mainly due to the topic selection as carbon emission remains a sensitive topic in the Chinese regulatory environment. There are not many firms that are willing to reveal their perspective towards environmental regulations as well as their business and compliance strategies. However, the firms selected provided rich and meaningful information which helped the researcher to generate valuable insights. There is one exception from the respondents which is Firm C. The research did not analyze firm C as in depth as other two firms, this is due to the strategy changes caused by regulatory uncertainty. Therefore, not many relative quotes are generated from the interview, as shown in the appendix C. In the future, prior study on the firm's background in relation to the research topic and selecting suitable respondents can avoid this situation. Furthermore, the firms interviewed are operated in two different provinces in China, this means that this research is limited in Chinese cultural and political context. Therefore, when conducting future research, the researchers should extend their considerations to different cultural and political contexts. Secondly, the researcher bias may have influenced the data analysis as there is only one researcher coding the interviews. To minimize this potential bias, more researchers can be included when interviews are being coded in the future research.

For future research, it is recommended to integrate with the emerging trends. For example, including digitalization and artificial intelligence in the research topic to explore how these technology advancements play a role in shaping firms' compliance strategies and operational decisions. Furthermore, the research would also benefit by conducting a quantitative method such as a survey. The quantitative method with numerical statistics allows the research to test the hypothesis of compliance strategy and environmental regulations on a larger scale.

6. ACKNOWLEDGEMENTS

I would like to thank Dr. Huang and Dr. Morales for all their support and valuable feedback. Also, I would like to thank all the participants of the interviews for supporting me with all their efforts.

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Appendix A

Interview guildline

Note: all interviews will start with asking permission for recording and data processing.

The interview starts with a few background questions, introduction about the respondents' role in the firm. Then a brief talk through with the overall interview structure and themes.

Warm up questions:
Can you introduce the firm you are working at and what is your role in the firm?
How long have you been doing business in this industry ?

Question 1: What is your perception about the current environmental regulations in China ?

Question 2: Among all the environmental regulations, what is your perspective specifically towards greenhouse gas emission regulations ? sub question: have you ever heard about the Chinese national emission trading scheme policy?

Question 3: Does the organization of yours' strictly follow the national emission trading scheme policy ? sub questions: if not, to what extent you fail to comply with and why is that ?

Question 4: Can you tell me about the current compliance strategy the firm is using? Sub question: To what extent does the national ETS(emission trading scheme) policy influence the strategy

Question 5:What makes the firm adopt the current compliance strategy? Do you consider other strategies to be possible? sub question: What do you think would be different now if the firm adopted another compliance strategy ?

Question 6: How do you make a compliance strategy? Do you study from other firms or based on your experience ? sub question; what are the decision making process looks like and who are involved in the process?

Question 7:. Does the regulation influence your operational decision - making processes like resource allocation or investment priorities ?

Question 8: What are some of the challenges when the firm is trying to comply with the regulations?

Question 9: Do you see any opportunities or advantages when compiling with these regulations ?

Question 10: What are the consequences if you fail to comply with the regulations? Sub question: Do you have any "strategies" on how to avoid the consequences?"

Question 11: Do you ever communicate with other firms that are in the same industry as yours? Sub question: if yes, how often is it and what topics do you usually discuss?

Question 12: Is there anything you would like to add or is there any insights you would like to share ?

Appendix B

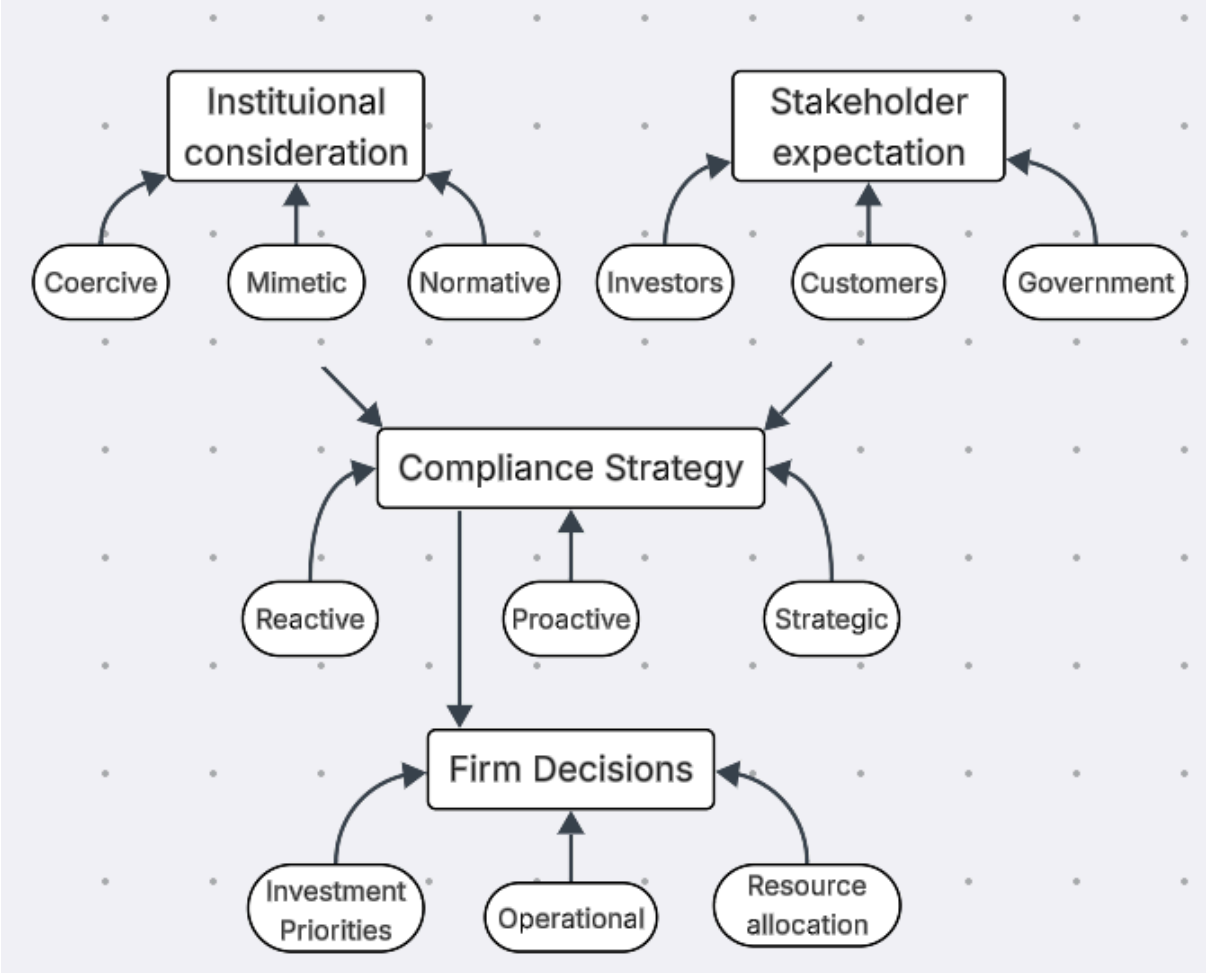

Figure 2 researche framework
Firm decisions

Appendix C

Quote	1st order concept	2nd order theme	Aggregate dimensions
"The company regularly submits carbon emission reports through the Jiangsu Carbon Emission Trading Management Platform."(Firm A)	Carbon reporting and third-party verification	Proactive Compliance	Compliance Strategies
"We have introduced green operations, such as optimizing traffic with new energy vehicles and upgrading to energy-efficient systems."(Firm A)	Adoption of energy-efficient practices	Proactive Compliance	Compliance Strategies
"Promoting energy-saving technologies not only helps reduce emissions but also positions us as a leader in the green technology market."(Firm A)	Integration of compliance into business strategy	Proactive Compliance	Compliance Strategies
"We have asked a third party to do some on-site assessments and calculations for us, collect and organize data, and form a report."(Firm C)	Engagement with third-party verification	Proactive Compliance	Compliance Strategies
"Our company invests in resource recycling, such as recycling waste oil, lithium batteries, and other materials."(Firm C)	Investments in resource recycling	Proactive Compliance	Compliance Strategies
"We provide technical services and sell carbon capture equipment to high-emission companies to help them reduce emissions."(Firm C)	Integration of services into compliance	Proactive Compliance	Compliance Strategies
"Policy and regulatory requirements compel us to comply with the Jiangsu Carbon Emission Trading Management Measures."(Firm A)	Mandatory compliance	Government Influence	Stakeholder Influence
"Public education campaigns on low-carbon living and environmental protection are conducted to strengthen our community engagement."(Firm A)	Community awareness and public trust	Community and Public Image	Stakeholder Influence
"National policies require us to transition to green and low-carbon technologies in our operations."(Firm C)	Alignment with national regulations	Government Influence	Stakeholder Influence
Dedicated teams for carbon management are in place to handle emissions accounting, reporting, and compliance strategies."(Firm A)	Establishment of specialized carbon teams	Resource Allocation	Operational decision
"Special funds are allocated for energy-saving projects, carbon offset initiatives, and renewable energy facilities."(Firm A)	Allocation of financial resources for sustainability	Resource Allocation	Operational decision
"Investments are prioritized for renewable energy facilities like solar and wind power to reduce dependency on fossil fuels."(Firm A)	Investment in renewable energy technologies	Investment Priorities	Operational decision

"We actively trade carbon quotas to achieve compliance and generate financial returns."(Firm A)	Participation in carbon markets	proactive compliance	Compliance strategy
"Optimizing irrigation systems, reducing vehicle emissions, and adopting green supply chains have significantly improved efficiency."(Firm A)	Operational upgrades for efficiency	Operational Adjustments	Operational decision
"Existing technologies for large-scale operations often lack compatibility, limiting the scope for emission reductions."(Firm A)	Incompatibility of current technologies	Technical Challenges	Challenges and Opportunities
"Upgrading to energy-efficient technologies involves significant upfront costs, which strain financial resources."(Firm A)	High initial costs of compliance measures	Cost-Related Challenges	Challenges and Opportunities
"Frequent updates to policies and fluctuating carbon market prices make long-term planning difficult."(Firm A)	Uncertainty in regulatory and market conditions	Regulatory Uncertainty	Challenges and Opportunities
"Compliance with regulations and transparent reporting have strengthened our brand image and attracted investment."(Firm A)	Positive branding through compliance	Enhanced Corporate Reputation	Challenges and Opportunities
"Energy conservation measures not only reduce emissions but also lower operational costs."(Firm A)	Cost savings from energy efficiency	Cost Optimization	Challenges and Opportunities
"Meeting compliance standards opens doors to green financing options such as green bonds and loans."(Firm A)	Access to sustainable financing opportunities	Green Market Opportunities	Challenges and Opportunities
"We allocate funds to build zero-carbon industrial parks, integrating photovoltaics, recycling, and energy optimization."(Firm C)	Resource allocation for zero-carbon parks	Resource Allocation	Operational Decisions
"Investments are prioritized toward renewable energy projects like photovoltaics and low-carbon manufacturing processes."(Firm C)	Investment in renewable energy and green projects	Investment Priorities	Operational Decisions
"We optimize factory operations with energy-efficient technologies and smart systems to reduce carbon emissions."(Firm C)	Operational upgrades for energy efficiency	Operational Adjustments	Operational Decisions
"Once carbon trading policies are implemented, we would likely collaborate with industry peers to discuss feasible strategies."(Firm B)	Collaboration within the industry for compliance	Mimetic isophorism	Stakeholder Influence
"If the government enforces stricter carbon policies, we would innovate and adapt our green compliance strategies accordingly."(Firm B)	Policy-driven innovation in compliance	Reactive compliance	Compliance Strategies