บทความวิจัย

ผลกระทบของแผนการปฏิรูปสีเขียวและมาตรการทางภาษีของสหภาพยุโรป ต่อการส่งออกของไทยไปยังสหภาพยุโรป

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บทคัดย่อ

งานวิจัยนี้ศึกษาผลกระทบของมาตรการปรับราคาคาร์บอนก่อนข้ามพรมแดนของสหภาพยุโรป (CBAM) ต่อการส่งออกเหล็กและเหล็กกล้าของประเทศไทยไปยังสหภาพยุโรป แผนการปฏิรูปสีเขียวและมาตรการทางภาษีของสหภาพยุโร ปเป็นนโยบายของคณะกรรมาธิการยุโรปที่มุ่งส่งเสริมการเปลี่ยนผ่านไปสู่ความเป็นมิตรต่อสิ่งแวดล้อม พร้อมกับแผนการทำให้ยุโรปเป็นทวีปแรกที่ปลอดคาร์บอนภายในปี พ.ศ. 2593 ซึ่งรวมถึงมาตรการ CBAM ที่จะเรียกเก็บภาษีกับสินค้าที่มีการปล่อยคาร์บอนสูงที่นำเข้ามาในสหภาพยุโรป การวิจัยนี้ (1) ประเมินผลกระทบของ CBAM ต่อการส่งออกเหล็กและเหล็กกล้าของประเทศไทยไปยังสหภาพยุโรป (2) สำรวจการรับรู้และความพร้อมของบริษัทส่งออกไทยเกี่ยวกับ CBAM (3) เสนอแนวทางนโยบายเพื่อบรรเทาผลกระทบด้านลบและใช้ประโยชน์จากโอกาสที่เป็นไปได้สำหรับประเทศไทย การศึกษาได้ระบุประเด็นเกี่ยวกับการเพิ่มขึ้นของต้นทุนและการสูญเสียความสามารถในการแข่งขัน การวิจัยนี้ใช้การสัมภาษณ์แบบกึ่งโครงสร้างกับบริษัทส่งออกไทยสิบแห่ง ที่ตั้งอยู่ในเขตอุตสาหกรรมต่างๆ ในกรุงเทพมหานคร สมุทรปราการ และชลบุรี

การศึกษาบ่งชี้ว่า ผู้ผลิตไทยควรนำวิธีการผลิตที่เป็นมิตรต่อสิ่งแวดล้อมมาใช้เพื่อจัดการกับผลกระทบเหล่านี้อย่างมีประสิทธิภาพ นอกจากนี้ยังแนะนำว่า ผู้กำหนดนโยบายไทยควรทำให้มั่นใจว่ากฎหมาย CBAM มีการดำเนินการควบคู่กับการสนับสนุนด้านเครื่องมือและเทคนิคที่เหมาะสมเพื่อลดต้นทุนเริ่มต้นแก่ผู้ประกอบการธุรกิจเหล็กและเหล็กกล้าของไทย ผู้ส่งออกต้องนำเอานวัตกรรมและปรับปรุงระบบพลังงานเพื่อให้สินค้ายังคงอยู่ได้ในสหภาพยุโรป ข้อกำหนดทางกฎหมายและระบบการสื่อสารที่เพียงพอกับหน่วยงานส่งออกและสถาบันในสหภาพยุโรป เป็นสิ่งสำคัญในการจัดการกับ CBAM เพื่อรักษาการเข้าถึงตลาด ผลการวิจัยจากการสัมภาษณ์เผยให้เห็นว่าบริษัทไทยมีความกังวลเกี่ยวกับต้นทุนที่เพิ่มขึ้นและความเสียเปรียบทางการแข่งขัน บริษัทต่างๆ แสดงความต้องการการสนับสนุนด้านเทคนิคและการสื่อสารที่ชัดเจนเพื่อบรรเทาผลกระทบเหล่านี้

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THE IMPACT OF THE EUROPEAN GREEN DEAL ON THAILAND'S EXPORTS TO THE EU

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Abstract

This research investigates how the Carbon Border Adjustment Mechanism (CBAM) will impact Thailand's exports of steel and iron to the European Union (EU). The European Green Deal (EGD) is the European Commission's policy that aims to promote a green transition, along with the plan to make Europe the first continent to be climate neutral by 2050. This includes the sought-after Carbon Border Adjustment Mechanism (CBAM), which levies tariffs on carbon-importing goods to the EU. This research (1) evaluate how CBAM would affect Thailand's exports of steel and iron to the EU (2) explore the perceptions and preparedness of Thai export firms regarding CBAM (3) provide policy recommendations to mitigate adverse effects and leverage potential opportunities for Thailand. The study identifies concerns regarding cost rise and competitive loss based on semi-structured interviews with ten Thai export firms. The ten companies interviewed are located in various industrial regions of Thailand, including Bangkok, Samut Prakan, and Chonburi.

It has also indicated that Thai manufacturers should embrace environmentally friendly production practices to manage these impacts effectively. The study also suggests that Thai policymakers should ensure that the CBAM legislation is accompanied by viable instrumental and technical support to reduce the initial cost borne by iron and steel traders in Thailand. Exporters must embrace innovations and improve their energy systems so that their products remain relevant in the EU region. Legal specifications and adequate communication systems with exporting entities and EU institutions are essential in managing CBAM provisions to sustain access to the market. The findings from the interviews revealed that Thai firms are concerned about the increased costs and potential competitive disadvantages. The companies expressed the need for technical assistance and clear communication to mitigate these impacts.

Keywords : European Green Deal, Carbon Border Adjustment Mechanism, Exporting country – Thailand, Iron and Steel industry in EU, Climate Policy

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Introduction

The European Green Deal (EGD) represents a comprehensive approach by the EU on how it intends to coordinate climate change and environmental degradation, aspiring to turn the continent into the first climate-neutral continent in 2050 (Papa et al., 2021). This approach is grand because it avails policies and actions intended to curb greenhouse gas emissions, champion sustainable energy, and advance circular economy. One of the central measures within this approach concerns the Carbon Border Adjustment Mechanism (CBAM), which will offset carbon seepage by taxing imported goods on their CO_2 emissions. Carbon leakage refers to the mobility of firms or industries to other countries with less stringent emissions reduction measures, hence proven to be a global threat to climate change mitigation. CBAM also contributes to persuading foreign producers to limit the carbon content of their products since they end up paying tax on the included quantity.

The EU's CBAM proposal, a tool designed to safeguard the bloc's internal industries and environment, presents Thailand with threats and opportunities (Magacho et al., 2024). This is even more so when it comes to the iron and steel industries, which have extensive carbon dioxide emissions, and their share in the EU market may become significantly more expensive, which can lead to a loss of competitiveness. It is to be noted that these industries are enormously essential for Thailand both in terms of GDP and employment. Consequently, any changes in the regulations affecting these areas may result in profound shifts in the country's economy. On the other hand, the CBAM could benefit Thailand in the long term as it can prompt the modernization of the country's industrial sector towards more incredible innovation and environmental responsibility.

Over the years, incorporating, sustainable manufacturing strategies has gained more importance in enhancing the economy. The companies' sustainability practices showed an average of 25% higher worth than those that did not practice the same (Harik et al., 2015). In addition, it has been revealed that the P/E ratio of firms committed to sustainability was 15% higher on average within a decade (Penman, 2012). This argument is evidenced by the figures highlighted above, which show that sustainable manufacturing is effective not only from the standpoint of the environment but also from the standpoint of improving business results, which indicates that environmentally friendly activities are cost-effective.

The paper aims to evaluate the impact of CBAM on Thailand's exports of steel and iron to the EU and assess the preparedness of Thai export firms. It is, therefore, important for Thai policymakers and companies to understand and make sense of these when dealing with globalization and the current changes in the global trading system. It is pertinent to understand Thailand exporters' attitudes towards these regulations and their readiness and response to avert potential issues. This research also seeks to establish how the Thai government can assist local industries in responding to these emerging challenges to embrace sustainable development initiatives at the international level.

Research Objectives

The primary objective of this research is to evaluate the impact of CBAM on Thailand's exports of steel and iron to the EU. Additional objectives include assessing the preparedness of Thai export firms and proposing policy recommendations to mitigate adverse effects and leverage potential opportunities.

Theoretical Framework

This paper relies on the two related theories of international trade and environmental economics. It adopts two main perspectives to examine the influences of the European Green Deal and CBAM on Thai exports. The global trade framework provides an understanding of how trading partners interact, the factors that determine the volumes and nature of the trade, and the effects of specific trading policies (Perdana & Vielle, 2022). This theory posits that countries can reap the most benefits by focusing on producing relatively efficient goods. Nonetheless, tensions can be occasioned by trade policies throwing the equilibrium by changing the cost factors of traded products and, hence, export patterns and competitiveness.

Environmental economics concentrates on the effects of economic activity on the environment or the impact of the environment on economic activities. In this field, the idea of 'the polluter pays' supports reshaping prices in the market to include the impact cost that the environment faces. Its introduction, CBAM, meets these principles by applying tariffs to imports according to the emissions associated with their production, thus internalizing the cost of environmental impact. This mechanism seeks to provide equal opportunities to the producers in the EU who are bound by strict emission rules, therefore eliminating carbon leakage and other challenges that could impede overall emissions reduction globally.

Integrating these theoretical perspectives supports how the environmental regulations in one region can influence the trading networks of exporting countries such as Thailand. CBAM can best be viewed as a non-tariff barrier that will shift the playing field in the trade policy. Thus, for the Thai exporters, particularly iron and steel exporters, it means the shift in cost structure caused by carbon intensity. CBAM tariffs are designed to ensure that firms reduce their emissions and that exporters who do not bring their emissions to the required level may face higher levels of competition.

The theory of environmental economics makes it clear that how such policies may offer long-term advantages. When the EU implements carbon tariffs, it pressures international manufacturers to use environmentally friendly techniques when manufacturing their goods, making their production a plus to the environment. It could further translate to acceptable industrial style and method changes for Thailand, mimicking the international fight against climate change.

Literature Review

Research has recently explored the European Green Deal (EGD) and its effects on trade policy and outcomes –literature that only continues to grow as climate policies and their ramifications on the global economy. The European Commission launched the EU Green Deal (EGD) in December 2019 to shift the EU

economy to a net-zero emission economy by 2050 (Bäckstrand, 2022). This entails rules that promote spur emission reductions and encourage investments in green projects and technologies. One of the most discussed issues regarding the EGD is the Carbon Border Adjustment Mechanism (CBAM), that intents to fight carbon leakage and put EU industries on the same competitive footing with prescriptive carbon standards.

Since CBAM aims to apply a carbon price on imported goods and services for which there is no domestic carbon demand, it can serve as the tool to put a lid on and get a ratio between cost and benefit. It is an approach with benefits, including a level playing field for carbon intensiveness (Jakhar, 2024). This mechanism aims to balance the cost of carbon between domestic products falling under EU carbon pricing and imported products from countries with less ambitious climate policies. As a mechanism to tax carbon leakage, under CBAM, the EU will use a carbon tariff on imports to add the cost of emissions in countries where the standards are considered lax to incentivize foreign producers to strive for responsible production and do it in line with the EU's stringent climate targets.

While CBAM targets industries that contribute significantly to CO_2 emissions, such as iron and steel, it reduces subsidies in those sectors (Mehling & Jakob, 2024). These industries are crucial to many developing countries, particularly Thailand since they account for a portion of the GDP and employment. For instance, the iron and steel segment or products have been revealed to consume a lot of energy and release immense carbon emissions, causing higher costs through the new carbon tariffs. At the same time, its competitiveness in the EU market could be affected. This impact is even more apparent for Thailand because it is an iron and steel exporter to the EU and has restricted access to advanced green technology.

Previous research has indicated that developing nations are also in for more significant issues because of higher carbon intensity levels and limited access to cleaner technology (Perdana & Vielle, 2022). This is the case with many developing countries such as Thailand; their industrial segments must be more effectively established in energy conservation and emissions management methodologies. This creates a technological disadvantage that enables these countries to struggle and spend large amounts to meet international environmental measures such as those in the CBAM.

However, there are also financial and infrastructural factors that could pose a problem and hinder the progress of the development of such technologies. The shift towards a green manufacturing approach is costly due to the need for new technology, manufacturing capital, and human capital. In many developing countries, the biggest challenge is often attracting sufficient funding and developing the proper knowledge and skills. Also, those countries' low-quality or obsolete industrial structures limit their capabilities to accommodate environmentally friendly processes.

The literature also examines the effects of the EGD and the CBAM on global trade, including the larger economies of scale. A general idea of environmental policies is that they can alter trade relations by increasing costs, therefore decreasing the competitiveness of carbon-producing companies and products from countries outside the EU (Cosbey et al., 2021). It may also demand a shift in value chains, with exporters

from developing nations likely to face early pressure to supply the EU market despite changes. Specifically, for Thailand, this entails not simply looking at its direct losses to the iron and steel sector but also the externalities that it will bring to other sectors of the economy as well.

As one of the significant drivers of investment in RE technologies and energy efficiency, CBAM could catalyze innovation and investment in cleaner technologies in the rest of the world as well (Sejdiu, 2023). The enormous concern of exporters for the EU's carbon tariffs will likely provide a powerful incentive for improving technology and adopting new effective technologies with few emissions. The latter has been argued to be capable of furthering other welfare improvements that enhance technology diffusion in reducing greenhouse gas emissions objectives. Thailand could improve its industrial supply-side capability and achieve a sustainable industrialization process if the country participates in this technological change.

Potential disadvantages of compliance with CBAM include increasing exporters' production costs due to regulations that may reduce exporters' profit margins, resulting in unemployment and business closures in sectors vulnerable to CBAM (Magacho et al., 2024). The remaining risk is more trade tension and conflict arising from perceived self-implementation of unfair trade practices since countries outside the EU may perceive CBAM as a protectionism regime. To address these risks, some research advises that the EU source funds to assist developing countries in shifting to cleaner production. It could involve providing funds, technology, and training or boosting capacities to develop these standards. Such measures would assist these countries in acknowledging CBAM and, at the same time, encourage cooperation in mitigating climate change.

This is in line with the fact that aside from the economic and technological concerns, the two policy instruments also face political and social problems. Political pressure is one of the main barriers to achieving the necessary reformation in developing countries' healthcare policies, as policymakers must manage the political context within and beyond their national borders. It involves the regulation of stakeholder concerns for industrial bodies, environmental agencies, and the standard population within the international environment, who may equally have varying outlooks on the cost and utility of global environmental regulation compliance.

Conceptual framework

This conceptual model of this study assumes the EU’s Policy for a Green Economy as the independent variable and the European Commission as the independent variable. The dependent variables are the number of steel and iron export from Thailand to the EU, price factor of steel and iron export from Thailand to EU, and the position of Thailand in competition with other countries for the export of steel and iron in the EU market. This framework assists in the understanding of shifts in the European environmental policy, hence its influence on the Thai exporters in steel and iron.

Research Methodology

The research adopts an exploratory design to obtain a specific and in-depth understanding of how much the CBAM has affected Thailand's iron and steel exports to the EU. Qualitative research is used in this study since it is effective when complex issues are to be addressed and understanding the concentrates industry counterparts' attitudes. This approach becomes relevant for expressing the focus on the impact of the approaching changes in the regulations with the export firms.

Selection of Firms

Ten export firms from the Thai iron and steel industry were chosen for the study. The ten companies interviewed are located in various industrial regions of Thailand, including Bangkok, Samut Prakan, and Chonburi. Selection criteria included export intensity, defined as the proportion of total sales attributable to exports, export value to the EU, and level of internationalization. This purposive sampling ensures that this study is unique to only those firms greatly affected by the CBAM and will afford the researcher a paramount chance to deduce much of its effects. This is important to ensure that the firms in the sample provide different insights and that similar characteristics do not influence panelists' responses.

Key Informants

For this study, the target population comprised specialist working for or directly involved in managing the export functions of their companies or in export compliance. The following individuals were chosen for this study because they are most likely to know and be involved in the firm's export operations; thus, the information gathered is credible and current.

Data Collection

Interviews of face-to-face and semi-structured types were conducted with specialists of the selected firms who managed or participated in the export activities of their companies or were responsible for export compliance. Case selection Semi-structured interviews were used as the data collection method since they offer flexibility to ask questions that touch on specific issues of interest in a structured form. Every interview lasted between sixty and ninety minutes and included subjects like: Awareness and understanding of CBAM, the Perceived impact of CBAM on export operations and competitiveness, Preparedness and strategic responses to CBAM, Challenges and barriers to adopting greener production practices, Expectations from the government and industry associations.

Face-to-face or virtual interviews were administered depending on the willingness and accessibility of the participants. All interviews were audio-taped and transcribed; participants' anonymity and confidentiality were maintained for themselves and other participants to avoid compromising the accuracy of the data analysis.

Data Analysis

To perform qualitative analysis, the responses were coded thematically based on the identified guiding themes, subthemes, patterns, and variations. Thematic analysis involves several stages: Thematic analysis involves several stages:

1. Familiarization: Immersion in the data can be achieved by reading and rereading the interview transcripts.
2. Coding: Generating initial codes to categorize significant data features.
3. Theme Development: Collating codes into potential themes and sub-themes.
4. Reviewing Themes: Filtering and validating themes to guarantee they precisely signify the data.
5. Defining and Naming Themes: Evidently clarifying each theme and its scope.
6. Reporting: Synthesizing the findings to construct a coherent narrative.

This approach offers a refined framework that captures different reactions and measures firms have taken concerning CBAM.

Triangulation

Triangulation was used in the study to increase the credibility of the established research findings. To ensure the accuracy of the findings gathered, data triangulation was triangulated, and the data collected through various methods was compared. One strength of the study was the use of interviews, surveys, and documents to ensure to validate claims from participants' views. This approach eliminated biases and gave an extensive view of the research problem. Triangulation in the study was further described, including the sources and methods and the ways through which they provided a stronger foundation for the study.

Validation and Reliability

To ensure the reliability and validity of the findings, several measures were taken:

Triangulation: Comparing the interview data to pinpoint the tendencies and inconsistencies.

Member Checking: To ensure that the assembled codes and themes are accurate and to get some feedback, some participants were consulted and given an overview of the analysis.

Peer Debriefing: Informal conversations with other professionals and practitioners involved in the coding and selection of the themes to minimize the researcher's influence on the final analysis.

Ethical Considerations

Ethical issues formed the basis for foreign policy research right from its inception. The verbal consensus was sought and obtained from all the participants with a clear explanation of the purpose of the research, the duration of the study, and where and how the results would be utilized, and also highlighting their right to withdraw from the study at any time if they wish to do so. To ensure that the findings and

observations made are accurate, anonymity and the respondents' confidence were maintained when conducting the study to ensure that the firms and individuals sampled could not be identified.

Limitations

The limitation of this study is that this research surveyed only ten firms, which may need to give complete pictures of Thailand's whole iron and steel sector. In the same way, the conclusions are industry- and country-specific to some extent, and their applicability to other sectors and countries cannot be assumed. Recommendations for the next study suggest that future work could focus on finding a larger sample size and include quantitative and qualitative data for a richer picture.

Results

A key theme evident from the interviews is that exporters are greatly worried about the cost increase that the new policy of CBAM will implement. All ten firms also stated the impact of carbon tariffs, which financially burden their operations. This denies that it believes they will adversely affect its revenues, and hence, it may need to catch up in maintaining bargain prices in the EU market.

Many firms cited market share and export volume as a cause for concern, given the changing business environment and the impact of the BSE crisis. They stated that they would have no choice but to pass on the costs associated with CBAM to customers, which could lead to EU customers sourcing products from other non-EU regions with or with less regulation on emissions. Such a transformation might potentially cause a decrease in the extent to which many of these firms can compete in the EU – a large market that is very important for many companies.

Due to the adversities prompted by CBAM, some entities are trying to offset their carbon emission rates to negate the effects of carbon levies. However, several constraints often face the translation process implemented in such efforts. Among the key risk areas, the high costs of adopting innovative technologies and practices are a significant concern. Another major challenge is that firms need more technical tools, resources, and experienced human capital to deploy sustainable strategies successfully.

Based on the interviews, the firm must prepare for the new CBAM regulations. Several firms still need to fine-tune their policies on the new policy on the grounds of uncertainty regarding the complexity of the implementation and implications of the policy change. Several firms declared that more specific directions and assistance were required to help them deal with these transformations.

One of the common sentiments that can be identified across the interview process is the lack of sufficient support from the Thai government and industrial associations. BCTs have been compelled to seek government support through subsidies or tax exemptions to help them recover from the expenses incurred in adopting environmentally sustainable technologies. They also look for technical assistance and training that will enable them to improve their ability to promote sustainable practices. Furthermore, there is a need

for a better explanation and direction on how some companies can level up with the new CBAM rules and regulations.

Having considered the threats and challenges organizations face, this section will discuss the strategic responses and adaptation plans concerning the challenges. However, it has been observed that there are still some firms that are in the process of engaging in a strategic planning process to cope with CBAM. Some of these initiatives involve energy management, purchasing less carbon-intensive materials, and attracting more new customers in countries other than the EU. For instance, one organization is sinking millions of shillings into renewable power to light its production plants to lower the overall organization's emission of greenhouse gases. Another firm in the industry is discussing with suppliers to buy materials provided in the market that meet better environmental standards.

Opportunity Cost, per the understanding of many stakeholders, is the cost an organization incurs by taking an action other than what gives the utmost returns; that is, the next best thing it could do if it were not for the chosen action.

Discussion

Based on the analysis of the current research, it can be concluded that Thailand's iron and steel exports have a strong enough potential to face considerable changes due to the Carbon Border Adjustment Mechanism (CBAM) while opening up specific opportunities simultaneously. This is so since Thai exporters regard the carbon tariffs likely to be set at higher levels as an imposition that enhances costs and erodes profit margins by driving down Thai exports' market share in the already competitive EU market. The decline in competitiveness in the EU suburban countries means that Thai firms should promptly start preparing for the change of regulations.

The first of the trade issues highlighted applies to Thai exporters in that CBAM is a cost-increasing policy measure according to a primary challenge identified in the study. The additional costs passed on by carbon tariffs make Thai iron and steel products less desirable in the EU markets and shift to more lenient partners within the region. It could lead to a great deal of decline in the exporting tones of Thailand to the EU, which ultimately has the potential to destabilize the entire economic system of the sector. Investors should also be concerned about higher costs, which have yet to become apparent to most firms due to their lack of readiness to implement cost-saving measures against these additional costs.

Some firms are already exploring greener production methods, which is encouraging; however, huge hurdles persist. Some of the reasons why large numbers of SMEs need to embrace new technologies and processes fully include the high costs incurred in migrating to new technologies. The problem is that many firms need more financial capital to support extensive sustainability initiatives, including SMEs with significantly less margin for funding sustainable projects. Furthermore, there needs to be more technical skill in setting the standards for using resource-efficient and low-carbon technologies.

CBAM also signals an opportunity for Thailand to adapt and evolve from continuing with business-as-usual towards more eco-friendly manufacturing. More so, through the acquisition of green technologies, Thai firms can prop up their sustainable competitiveness in the long run. Sustainable production is also relevant to the general tendencies on an international level. It can also have potential new market opportunities that would enhance the image of Thai production materials in the foreign market. Some companies may gain competitive advantages if they minimize their environmental impact because of a growing international demand for eco-friendly goods.

A broad range of industry associations still have an essential role regarding the government's importance and responsibility in influencing policies. This highlights the significance of government intervention in this process as a critical transformation focus. This means that firms looking forward to adopting green technologies may need to be subsidized or offered tax exemptions since the initial outlay may be too steep. Therefore, capacitation support, such as training and assistance, is required to enhance firms' capabilities in promoting sustainability. Effective SEC communication and direction on compliance with CBAM regulations can assist firms in implementing acceptable strategies toward the new requirements. BWB The rules require an industry support structure with the backing of government policies and industry associations to ensure firms develop and grow under the new policies at full potential.

Congruence with Research Problem and Objectives: The main research question focused on relating the looming CBAM regulations to the Thai exporters of iron and steel. The study's objective was assess firms' awareness of CBAM, perception of its effects on their business besides the competitiveness and strategies that firms are implementing in readiness for it. These objectives correlate with the findings, whereby the firms have differing knowledge and readiness concerning CBAM. This is more on competitiveness since firms are expected to incur higher costs and may be knocked off market share in the EU. That is why strategic responses include activities to enhance energy efficiency and decrease carbon emission, but there are issues with integrating sustainable changes into the production process.

Congruence with Scope and Research Boundary: In this context, the research was limited to ten firms from the Thai iron and steel industry. These firms were determined and identified according to some developments such as export intensity or internationalization. This purposive sampling ensured the study targeted firms with severe implications from the implementation of CBAM. Within this scope, these findings build relevancy as the selected firms were able to elaborate on several difficulties and critical actions required about CBAM. The fact that the identity of the decision-making firms was diverse also enriched the analysis since it was possible to compare the regional differences in the responses and readiness.

Triangulation and Reliability: With the help of the semi-structured interview, combined with the thematic analysis, the data gathering and analysis method was quite reliable. Comparison review data, member checking and peer debriefing were applied to synthesize the results and increase their reliability

and validity. Since similar patterns have been observed in all the selected firms, it strengthens the findings and conclusions.

Recommendations

Financial Support: The Thai government should follow up on financial incentives to support the firms in its country in adapting to green technology. This may include extending credit at concessionary rates and offering tax exemptions to ease the transition cost of green practices.

Capacity Building: Strong capacity is the key to creating investment capabilities. Government and industry associations should provide technical training sessions and seminars to improve understanding and applied skills in environment-friendly production strategies. This could also be achieved by fostering collaborations with international organizations to establish technology transfer and sharing of innovations.

Infrastructure Development: Transforming manufacturing industries is critical since they must shift industrial capabilities towards low-carbon systems. To this end, both the private and the public sectors have the potential to carry out significant work to create an adequate infrastructure that would include using renewable energy sources and improving the systems to manage waste.

Regulatory Clarity and Guidance: The government needs to be clear on which end-users of steel will be affected by CBAM and to what extent to ensure that they meet their compliance standards. Firms covering the regulations must get detailed guides and frequent information updates to prepare adequately. Creating advisory services or a helpdesk to help particular firms address specific questions is also effective.

Innovation Incentives: As seen in the Temple University example and the R&D grants and innovation competitions, increasing the number of resources dedicated to innovation can stimulate new technologies and methods. The partnership with the academic community and governmental agencies' representatives and cooperation with business companies would lead to positive changes and the development of concrete innovations suitable for the Thai iron and steel market.

New Body of Knowledge

The study adds to the current literature regarding the effects of the CBAM on developing countries' export industries; therefore, this research will focus on Thailand's iron and steel export industry. Altogether, by elucidating the findings of this research concerning the firms' preparedness and strategic actions, it unveils the practical implications and prospects of CBAM that have yet to be explored comprehensively before.

Enhanced Understanding of CBAM Impact: The paper's findings shed light on the Thai firms' perception of CBAM applied to the iron and steel industry notably. It also needs to uncover a range of levels of awareness and preparedness amongst the firms, notifying them of the difficulty in managing new regulations. This understanding increases the depth of knowledge on different international trade regulations and their effect on developing nations.

Strategic Responses to Regulatory Changes: Based on the study, the recent strategic actions that some firms are undertaking due to CBAM have been as follows: increase energy efficiency and green production processes. These findings give meaning to the institutions' measures being put in place early enough to manage the expected effects of CBAM, thereby contributing to the existing literature on sustainability and compliance with environmental standards in the global market.

Challenges in Implementation: The research gives some insights into some of the challenges that firms encounter while adopting CBAM, such as lack of capital, and inadequate technology, among others, which the government and industries should complement. These challenges also create a need for policy support and capacity development for firms to practice better business models, which contributes to enhancing the literature review on policy measures and capacity upgrading in international business environments.

Regional Variations in Responses: The incorporation of firms from various industrial regions of Thailand helps in finding regional differences in firms' responses and readiness levels. Such geographic dispersion enriches the knowledge of how domestic environments affect firms' preparedness to address change in international regulations, which is informative for policymakers and industries.

In conclusion, for Thailand's iron and steel manufacturers exporting to the EU, the European Green Deal and the CBAM may pose threats. This has led to an enormous cost increase and reduced competitiveness, forcing the government and private sector to consider possible corrections. The Effectiveness of Thai Exporters in Coping with the Negative Impacts of These Regulatory Changes and Capturing the Opportunities Thai exporters can avoid the negative implications of these changes and make the most of such advancements in the manufacturing cycle by embracing the concepts of green production and expanding the export markets. It, therefore, directs attention to the need for the industry to have a common front in the journey towards creating a sustainable future.

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