Developing Institutional Structural Frameworks for Promoting The Eco-Industrial Towns under The Context of Thailand

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Abstract

This paper explores the development of institutional structural frameworks for promoting eco-industrial towns in the context of Thailand. Eco-industrial towns are sustainable development models that aim to integrate industrial activities with environmental stewardship and social well-being. The study examines the unique challenges and opportunities in Thailand and proposes a comprehensive framework to facilitate the establishment and successful operation of eco-industrial towns.

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The research identifies the need for a holistic approach that balances economic growth, environmental protection, and community engagement. Drawing on international best practices and lessons learned from existing eco-industrial towns worldwide, the paper presents a conceptual framework tailored to the Thai context. The proposed institutional structural framework comprises several key elements. First, it emphasizes the establishment of a dedicated regulatory and policy framework that incentivizes sustainable practices and sets clear environmental and social performance standards. Second, it promotes the formation of partnerships among various stakeholders, including government agencies, industries, local communities, and non-governmental organizations, to foster collaboration and knowledge exchange. Furthermore, the framework highlights the importance of capacity building and knowledge dissemination to enhance understanding and implementation of eco-industrial principles. It suggests the establishment of training programs, research institutes, and platforms for sharing best practices and technological innovations. Additionally, the involvement of financial institutions and mechanisms to facilitate access to capital for eco-industrial projects is underscored.

Keywords: Eco-industrial Towns, Institutional Framework, Sustainable Development, Thailand, Environmental Stewardship, Social Well-being

การพัฒนากรอบโครงสร้างสถาบันสำหรับการส่งเสริมเมืองอุตสาหกรรมเชิงนิเวศในบริบทของประเทศไทย

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บทคัดย่อ

บทความนี้ศึกษาการพัฒนากรอบโครงสร้างสถาบันสำหรับการส่งเสริมเมืองอุตสาหกรรมเชิงนิเวศในบริบทของประเทศไทย โดยที่เมืองอุตสาหกรรมเชิงนิเวศ คือ โมเดลการพัฒนาแบบยั่งยืนที่มุ่งบูรณาการกิจกรรมเชิงอุตสาหกรรมกับภาวะการให้บริการดูแลสิ่งแวดล้อมและสุขภาวะทางสังคม งานวิจัยนี้ศึกษาความท้าทายเฉพาะและโอกาสในประเทศไทย ประกอบกับเสนอแนะกรอบในการอำนวยความสะดวกการจัดตั้งและดำเนินการให้เกิดผลสำเร็จของเมืองอุตสาหกรรมเชิงนิเวศ งานวิจัย พบว่า มีความต้องการด้านรูปแบบองค์รวมที่สามารถสมดุลการเจริญเติบโตทางเศรษฐกิจ การป้องกันสิ่งแวดล้อม และการมีส่วนร่วมของชุมชน โดยการใช้แนวทางปฏิบัติที่ดีที่สุดระดับสากล และบทเรียนจากเมืองอุตสาหกรรมสิ่งแวดล้อมที่มีอยู่ทั่วโลก ทั้งนี้ บทความจะนำเสนอกรอบแนวคิดเฉพาะในบริบทของประเทศไทย กรอบโครงสร้างสถาบันที่นำเสนอนั้นมีองค์ประกอบสำคัญหลาย

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องค์ประกอบหนึ่ง คือ เน้นการจัดให้มีกรอบเชิงนโยบายและกำกับดูแลที่เฉพาะเจาะจง อันจะเป็นการผลักดันวิธีปฏิบัติที่ยั่งยืนและกำหนดมาตรฐานศักยภาพด้านสังคมและสิ่งแวดล้อมที่ชัดเจน สอง คือ การส่งเสริมการสร้างพันธมิตรในกลุ่มผู้มีส่วนได้ส่วนเสีย รวมทั้งหน่วยงานรัฐบาล ชุมชนท้องถิ่น และองค์กรอิสระ ทั้งนี้ เพื่อสนับสนุนความร่วมมือและการแลกเปลี่ยนความรู้ นอกจากนี้ กรอบดังกล่าวยังให้ความสำคัญกับการสร้างความสามารถและการกระจายองค์ความรู้ ให้เกิดความเข้าใจและการดำเนินงานด้านหลักการของเมืองอุตสาหกรรมเชิงนิเวศเพิ่มมากขึ้น งานวิจัยยังเสนอให้จัดทำโปรแกรมการอบรม สร้างสถาบันวิจัยและช่องทางอื่น ๆ เพื่อแลกเปลี่ยนวิธีปฏิบัติที่ดีที่สุดและนวัตกรรมทางเทคโนโลยี อย่างไรก็ตาม สถาบันการเงินและกลไกเพื่ออำนวยความสะดวกในการเข้าถึงต้นทุนสำหรับโครงการอุตสาหกรรมเชิงนิเวศนั้น พบว่า ยังอยู่ในระดับต่ำกว่าเกณฑ์

คำสำคัญ: เมืองอุตสาหกรรมเชิงนิเวศ กรอบเชิงสถาบัน การพัฒนาที่ยั่งยืน ประเทศไทย ภาวะการให้บริการดูแลสิ่งแวดล้อม สุขภาวะทางสังคม

Introduction

Institutional Structural Frameworks (ISFs) can usually be divided into two levels: tall structure and wide structure. The process will be delayed due to the scrutiny of several committees, as is the case with the ISF regarding the driving of Thailand's Eco-Industrial Towns (EIT). After cabinet approval, It must be reviewed by the National Industrial Development Board (NIDB) before the policy can be passed on to EIT Development Steering Committee, EIT Development Integration Subcommittee, EIT Development Specialist Committee, Provincial EIT Development Committee, Provincial EIT Development Committee, Local Eco-Industry Mobility Working Group, and Eco Industry Network Working Group. The hallmark of a narrow high IFS is that administration committees are closely aligned with policymakers. In addition, the work that is academically produced is of high quality because it is under the control of specialized experts such as the Board of Experts in Urban Development, Eco-Industrial Committee, etc. However, the limitation of a narrow high ISF is that it has a long working period due to the range of controls. (Span of Control) that is quite wide compared to the wide-ranging low ISF. There are also several limitations associated with a narrow high ISF. For insatnce, there is a relatively high cost of holding each meeting. There is an over-management level. The distance between policymaker level (cabinet) and worker level (local EISWG and eco-industry network working group) is quite prominent. Another weakness is that workers are more likely to be eliminated from freedom of expression.

The authoritarian nature of the administration may bring about the problem of neglecting the true resonance of the people, including local stakeholders. On the other hand, a broad, low-ranging ISF can reduce administrative costs by a smaller number of meetings. Workers are highly independent to work, because policymakers or cabinets have so many policymakers, there is little control over them. However, the limitations of the broad ISF are short. It is necessary for policymakers to have an understanding of the problems that drive the right EIT, and be aware that policy fulfillment controls may not be possible thoroughly due to the excessive number of policy responders. Weighing between the hallmarks of a narrow high-rise ISF, subtracted by the limitations mentioned earlier, it is important as well as allowing other committees involved in driving EIT with a variety of dimensions. It is another channel that, in addition to saving government

budgets and costs, contributes significantly to the integration between government organizations to fight the sustainable development goals effectively.

The Methodology

The objective of this study is to describe how an ISF shapes the policy implementation of Thailand's Resource Efficiency concepts and Clean Production (RECP) (Berkel, 2016; UNIDO, 2016, 2017, 2021). It applies a qualitative approach via focus group to acquire how roles and responsibilities of a variety of policy actors (i.e., the prime minister, the cabinet, the policy boards, the local governments) determine the results of RECP. This study conducted 17 focus groups during November 11, 2021, and December 9, 2021 with the total of 467 participants mainly the representatives from the related boards, the senior bureaucrats from Ministry of Industry, the local governments, academics and research institutes, and factory management sections. The questions for open discussion include institutional mechanisms, resource efficiency, industrial-urban symbiosis, the BCG model, EIT, corporate social responsibility (CSR), and concerns over the disadvantaged participating in the sustainability scheme. After that, this study used constant comparative technique to analyze qualitative data from focus group. The coders identified the main themes including expected results of RECP policy and key characteristics of its implementation.

Policy Proposals and Measures Associated with ISF to Drive EIT

The EIT is an initiative to promote and gear the economic development and environmental sustainability of industrial estates. The EIT award is granted to an industrial estate which focuses on and actively promotes organization governance, human rights, labor practices, environment, community involvement and development (WHA Corporation, 2021). Meanwhile, The BCG economic model is a part of Thailand's post-COVID sustainable development strategy which centers on integrating knowledge, technology, and innovation to promote resource wealth, cultural diversity, and naturing the country's spirit (NSTDA, 2023). Specifically, the BCG economic model urges the entrepreneurs to apply the concepts of bioeconomy, circular economy, as well as green economy when designing and offering high value products and services to their customers. As a result, production following the BCG economic model is eco-friendly and requires less resource input, while conserving natural and biological resources.

Proposed Policies/Measures

ISFs that are framed in a high, narrow manner undermine the development of EIT as a consequence of its tall-narrow structure, which is still a lack of players to become key locomotives in driving the policy. The working group has therefore drawn up proposals to improve the ISF in three different ways, which can be described as below:

1) ISF Proposal Type 1

The first proposal the panel has analyzed is to maintain the same tall-narrow structure (Figure 1), but added the "*new players*" part to ensure sustainability towards driving EIT, such as the "National Reform Commission (NRC)" representatives should be filled. It is part of an ISF such as the NIDB, which consists of: The Prime Minister is a chairman of the Board of Directors. The Deputy Prime Minister is a vice chairman of the Board of Directors. Minister of Finance, Minister of Foreign Affairs, Minister of Higher Education, Science, Research and Innovation, Minister of Agriculture and Cooperatives, Minister of Digital Economy and Society, Minister of Natural Resources and Environment, Minister of Energy, Minister of Commerce, Minister of Interior, Minister of Labour, Minister of Education, Minister of Health, Minister of Industry, Secretary-General of the Board of Investment, Secretary-General of the National Economic and Social Development, Council Director of Budget Office, Secretary-General of the Eastern Special Development Zone, Policy Committee Director, Office of Small and Medium Enterprises Promotion, Chairman of the National Farmers' Council, Chairman of the Chamber of Commerce of Thailand, Chairman of the Industry Authority of Thailand, Chairman of the Thai Bankers Association, and no more than three qualified persons appointed by the Prime Minister as directors. It is known that the NRC has been appointed accordingly. The National Planning and Reform Act B.E. 2560 (2017), or National Reform Act, is responsible for developing plans to reform the countries in various areas set out in the 2017 Constitution and the National Reform Act, as well as doing other tasks as assigned by the National Strategy Committee (NSC). NSC requires the preparation of reform plans and procedures in the following areas: 1) Politics, 2) Public Administration, 3) Law, 4) Justice, 5) Education, 6) Economics, 7) Natural Resources and Environment, 8) Public Health, 9) Journalism Information Technology 10) Social, 11) Energy, 12) Culture, Sports, Labor and Human Resource Development, and 13) the Prevention and Suppression of Corruption and Misconduct.

The working groups (i.e. the National Economic Reform Commission, Natural Resources and Environment and Public Health, and the NRC) propose the establishment of a "National Industrial Reform Commission (NIRC)". To be responsible for framing the the Eco-Industrial Urban Development (EIUD) policy for the country. In order for the Local EISWG and the Eco-Industry Network Working Group (EINWG) to work with the Local Quality of Life Development Policy Committee in accordance with Sections 11 (6) and (8) of the Public Order Act B.E. 2534 (1991), the Prime Minister, with the approval of the Cabinet, has designated a committee called the "Area Quality of Life Development Policy Committee (AQLDPC)". The permanent secretary of the Interior Ministry is a chairman of the board of directors. The Permanent Secretary of The Ministry of Public Health is a vice chairman of the Board of Directors.

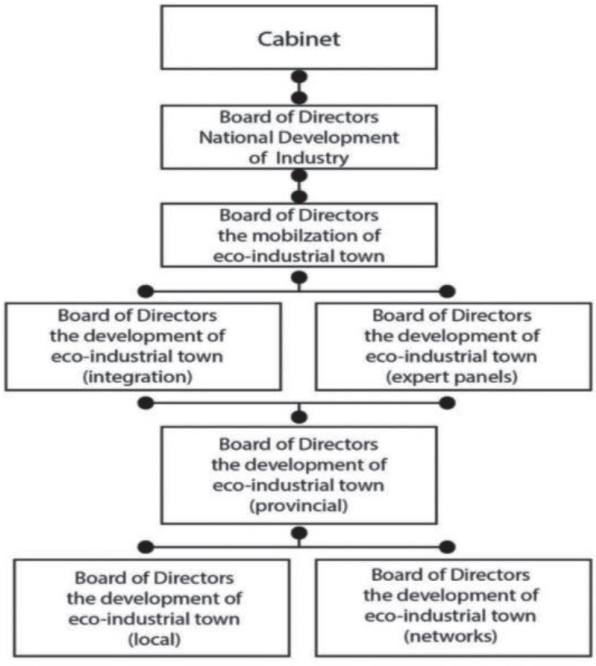

Figure 1: The Tall-Narrow Structure- Type 1

There are directors whose positions are: Permanent Secretary, Ministry of Social Development and Human Security Permanent Secretary, Ministry of Education, Director-General of the Department of Government Director-General of the Department of Community Development, Director-General of the CDC, Director-General of the Department of Health

Service Support, Director-General of the Department of Local Government, Director-General of the Department of Health Permanent, Secretary of Bangkok, Secretary-General of the National Health Board, Secretary-General of the National Health Security Agency, and the Fund Manager of Health Promotion Support Fund. The essence of the "AQLDPC" is to drive districts in provinces to achieve their goals based on the concepts of "Wellbeing/Quality of Life" and "People of the same district do not abandon each other/Thai people care about each other". At the heart of the "AQLDPC", it is to drive policy in the form of a centralized process to the board. EIT indicators should be integrated as part of the indicators of the well-being of people in the districts. In order to resolve the complicated ISF of high-narrow structure (Figure 1), the "Prime Minister's Performance Delivery Unit " or "PMDU", which is a special unit in the Office of the Secretary-General of the Prime Minister can be used to support the government's work in strategic and integrated missions. The emphasis is on solving problems for civilians who have failed to follow normal bureaucracy or have delays, which can cause damage to the wider public, are responsible by increasing integrated work between agencies in all sectors and having a duty to report on the progress of EIT to the Prime Minister directly.

2) ISF Proposal Type 2

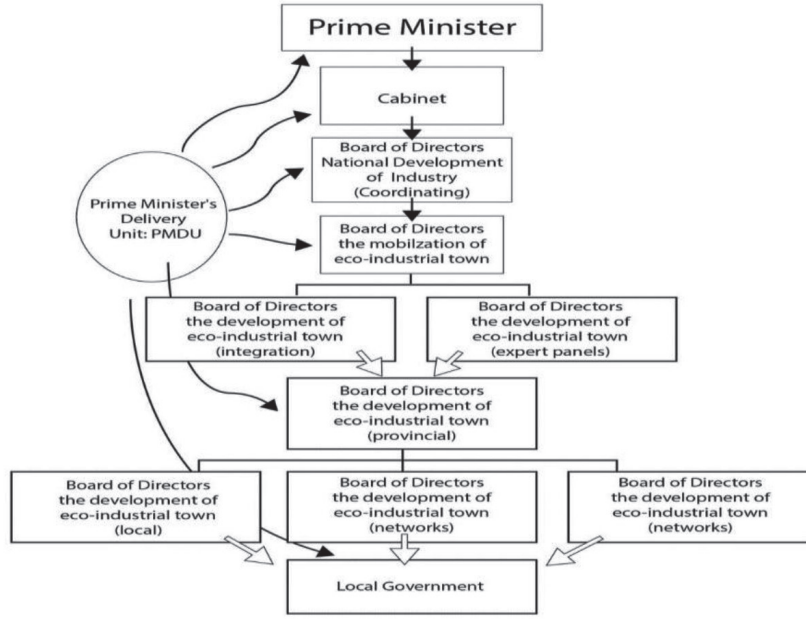

Figure 2: The Tall-Wide Structure - Type 2

The solution to the problem of ISF with a tall-narrow structure, the eco-industrial urban mobility or tall-wide structure (Figure 2), which not lie in increasing the number of players to become more complicated than ever. But it reduces the number of players to only the necessary amount, such as the dissolution of the EIUD Steering Committee. The EIUD Integration Subcommittee and the EIUD Specialist Committee are left with only the NIDB and the Provincial EIUD Board. Likewise, the local EISWG and the EINWG should be dissolved, leaving only the Subdistrict Administrative Organization (SAO) directly responsible.

3) ISF Proposal Type 3

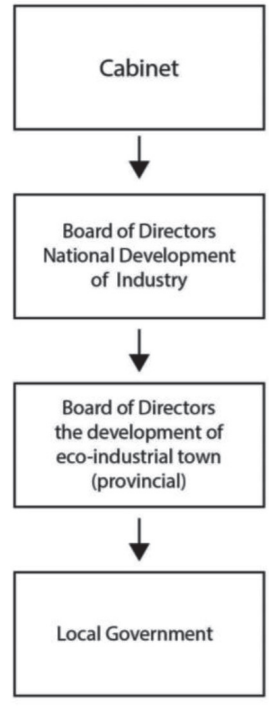

Figure 3: The Short-Narrow structures – Type 3

The Short-Narrow structure is the transfer of authority to drive EIT at the local level of the Eco-Industry Steering Working Group (EISWG) and the Eco-Industry Network Working Group (EINWG) to the supervision of municipalities, district administrations and provincial administrations instead, to modify the duties of the EIUD Steering Committee. The EIUD Committee and the Provincial EIUD Committee are in the form of consultants

instead to minimize the number of redundant and unnecessary meetings as possible. By using the "Quadruple Helix" concept, the BCG economic model was designed for moving forward together. According to Seesung, 2021, the BCG economic model can be considered as joining forces in the public-private/community/society-university/research institutes-international networks to "transform comparative advantage" in Thailand's biodiversity and multiculturalism into competitive advantage, transforming more efficient production systems by using these ideas. By reducing inequality and building a strong and environmentally friendly community, one can lead to sustainable development. The BCG economic model can be applied to drive the country with innovation with the assistance of Ministry of Higher Education, Science, Research and Innovation (MHESI), which can also be involved in driving EIT. MHESI, which merges higher education and research and development agencies, has been established by the Ministry of Science and Technology with the Office of the Higher Education Commission, the Office of the National Research Council and the Office of Research Support Fund. Therefore, the workforce of MHESI is to develop high skills in line with the development of the country, including supervision and innovation development. For the drive of innovation by private companies, it can be done through the Science and Technology Park, where the company is located. Startups of universities, both central and local, are administrators. For example, Chiang Mai University has launched four Deep Tech Startups (November Innovation Co., Ltd., Innovation in Research and Development of Implant Devices; Smile Migraine Co., Ltd. is an AI platform for migraine patients; LogixAid Co., Ltd. produces GoGo Board, a series of learning robots for youth; Inno-edge company. Gogo Co., Ltd., who designed a pain assessment platform in the elderly, dementia), entered "Angkaew Holding Co., Ltd." and has launched Venture Capital Fundraising, underpinning startups using advanced technology to create business value of over 3.2 billion baht. In addition, Chulalongkorn University has cultivated 50 "Deep Tech Startups" companies worth over 1.67 billion baht by bringing research and innovation from faculty members to help revive the Thai economy from the COVID-19 crisis. Increase competitiveness with internationals. This is an example of aparty from the higher education sector for driving an EIT in the future (Figure 4).

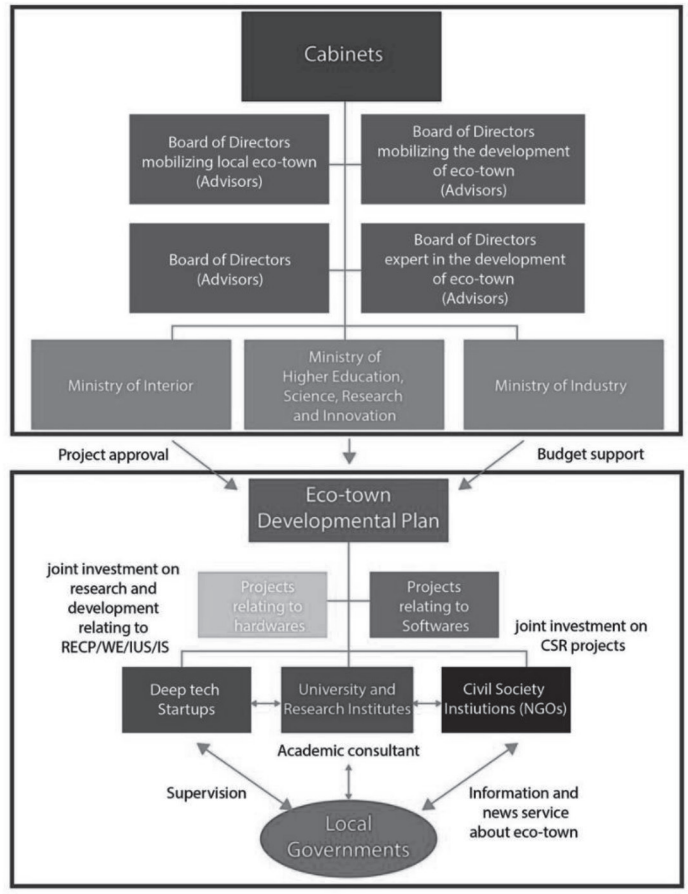

Figure 4: The Mixed Model Structure

Policy connection with 20-year national strategy and action plan to drive Thailand's development with the BCG economic model

The second ISF proposal is in line with the 20-year national strategy and thailand's development drive action plan with the BCG economic model as follows:

1) The 20-year national strategy for rebalancing and developing a public sector management system whose main goal is to make the public sector smaller and adaptable to changing conditions. Meet the needs of the people quickly and easily. Transparently, section 4.3 clearly states that the government should be smaller, appropriate for the mission, encourage people and all sectors to participate in the development of the country, and establish the relationship between the central government administration and SAO. It also has the right level of critical mission transfer and decentralization to strengthen

communities and localities. Dissolution of EIUD steering committee, the EIUD integration subcommittee and the EIUD committee remain only the NIDB in line with the concept of the 20-year National Strategy on balancing and developing the government management system title 4.3.

2) The 20-year national strategy for rebalancing and developing the public sector management system, title 4.3.3, clearly outlines the concept of promoting decentralization and supporting the role of local communities to make local governments high-performance agencies. It is based on good governance principles, in line with the concept of requiring a smaller ISF and in relation to the practical sector. In addition, the 20-year national strategy outlines mechanisms for properly collecting taxes and local income to be used in activities for responding to problem solving and developing eco-industrial areas in conjunction with local communities.

Expected results from policy proposals and measures related to ISF

Since the first ISF Proposal is tied to the structure in the traditional tall structure manner, where all government agencies, including the private sector, are already familiar with, what is added is that the new players, which are the "National Reform Commission on Industry". In case of any problems or obstacles, there is a PMDU to report directly to the Prime Minister to have a command down to deal with such issues. The second ISF proposal is characterized by structural simplifying, leaving only the agencies or committees necessary for real mobility. As a consequence, the number of meetings will be significantly reduced. Hence, the procedure for obtaining board approval has a comparatively shorter processing period. This institutional structure can attract more financial support from foreign investors than traditional institutional structures, as the second ISF proposal is based on a 20-year national strategic plan for rebalancing and developing a public sector management system, reducing workload and reducing operational redundancies from government agencies. For that reason, negative echoes or resistances from ministry officials who are associated with driving EIT are likely to be less than the the first ISF proposal. The third ISF proposal is characterized by a combination of high-profile, wide and short structural frameworks, compromising the concept of public administration in both the top-down approach, which focuses on centralized power (Sabatier, 1986) and the bottom-up approach, which highlights primarily on the needs and contributions of

civil society (Imperial, 2021), the influx of opportunities for creativity from research institutions and universities to help stimulate innovation linked to RECP/WE/IUS/IS by the private sector in the form of a company. Start Up Deep Tech is the main organization for driving a new business model, which will bring sustainable development of EIT.

Trade-off analysis of policy proposals and measures related to the new ISF compared to traditional policies and measures

The hallmark of the type-1 proposal is that the mistakes of presenting the policy will be minimized, as they have been carefully considerated by a series of departmental panels. Tall structures can inevitably affect decision delays. Due to a comparatively large amount of task forces, it is almost impossible for PMDU to attend all the meetings for approving the projects and launching new policies. The trade-off for minimizing any mistakes associated with project's approval or creating new policies is to loss of opportunities for foreign investment, as well as the response to emergency cases such as cybercrime, which need to be responsed as immediately as possible. On the contrary, the advantage of the type-2 proposal has the relatively shorter period of decision making in comparison with the structural framework under the type-1 proposal, which is filled with several committees. However, the declining number of board members inevitably undermines the level of careful consideration associated with the proposed project, which can subsequently lead to the hidden taps in decision making. For such reasons, it is worth bearing in mind that the ease of consideration had to be compensated by the risk that the project proposal may have neglected and overlooked deficiencies, negatively affecting the development of EIT in the broad picture, as well as in technical or cultural dimensions, political landscapes, and social conflict situations that are specific to each area. The strength of the third offer is that it combines the advantages of both the first and second form. MHESI has been urged to become the main host by using universities and research institutes as think tanks to drive EIT and provide opportunities for the SAO to create some new ideas. It has more powers to manage and open channels for civil society to be a part of EIT. What may happen in the future if the third ISF is applied is that there will be a noticeable disparity between SAOs with visionary leaders. The level of leadership (i.e. active leadership vs. reflective leadership) can make a big difference in term of fund raising campaigns to drive EIT (Castelli, 2016; Nawaz and Khan, 2016).

Overview risk analysis of policy proposals and measures related to ISFs

In this study, the SWOT analysis, including strengths, weaknesses, opportunities, and threats, was used to analyze risks regarding ISFs in three different forms as already proposed above. The following details are written as below:

Table 1: SWOT Analysis on the Tall-Wide Structure ISF Proposal - Type 1

Strengths	**Weaknesses**
- open to each agency to express their opinions fully - carefully moderated. The chances of mistakes are therefore minimized	- takes longer for each policy to crystallize - makes the decision slow - the lost of opportunity to collect foreign investors who may decide to change investment countries - too many government agencies involved - The migration of bureaucratic positions is therefore difficult to reject and directly affects the continuity of eco-industrial urbanization inevitably.
Opportunities	**Threats**
- integrated, with a national strategy as the primary goal and linking development at all levels - all issues, every mission in all areas are in line with the concept of the 20-year national strategy for rebalancing and developing the management system title 4.2.1, which focuses on adopting the national strategy as a driving mechanism for national development and the use of the PMDU for driving EIT	- cyber threats are now one of the main problems of large organizations and agencies, especially those and organizations associated with the industry that are vulnerable to be attacked by hackers. - lacks the agility to interact, the necessary emergency situation requires immediacy to make decisions - slow and lacking agility to counter threats that need to be dealt with instantly.

Table 2: SWOT Analysis on the Short-Narrow Structure ISF Proposal – type 2

Strengths The fact that the ISF is relatively short leads to the faster and more agile management than the ISF in type-1 and type-3.	**Weaknesses** When the duration of consideration decreases, the number of committee members to carefully discuss the problems/issues were automatically decreased as a result of reduced consideration time. Hence, the risk of mistakes from decision-making has also increased.
Opportunities Speed is one of the main factors that plays an important part in determining whether EIT will succeed or fail. In a real world situation with full of competition, It is not only Thailand that needs to attract investors from overseas. There are many other countries in Southeast Asia, South America, Africa, and Central Asia that also need financial support for promoting the industry. The second structure can create the best opportunities to welcome new investors because they are more agile in management than those type-1 and type-3.	**Threats** There are several issues that need to be carefully considered such as local culture, ethnic groups and gender inequality. These issues require a wide range of prudence and various perspectives from a committee with different expertises. Shortening the procedure can create new, more serious and complex problems.

Table 3: SWOT Analysis on the mixed model structure ISF Proposal – Type 3

Strengths	**Weaknesses**
Type 3 can attract private investors who are willing to inject capital into the new project. This influx of funds can provide financial support for existing operations and also enable the initiation of new projects. With increased investment, there is a higher likelihood of funding being available for projects related to industrial symbiosis, which involves collaborative efforts between different industries to optimize resource utilization. Furthermore, type-3 can bring in private sector expertise and management practices. Private companies often have a strong focus on efficiency, innovation, and profitability. Their expertise can lead to better financial management and strategic decision-making, allowing for the identification and pursuit of new projects that promote industrial symbiosis. It's important to note that type-3 can introduce competition and market forces into previously state-controlled industries. This competitive environment can foster innovation and drive companies to explore new projects that align with industrial symbiosis principles. The need to differentiate themselves in the market and gain a competitive advantage can lead to increased investment in symbiotic initiatives, further supporting financial and environmental objectives.	Because it is a new type of administration, which is focused on localization led by SAO. Universities, research institutes and Start Up companies are at the core of the drive, potentially causing resistance from public servants who continue to centrally uphold top-down public administration. However, the problem will be resolved in order as each stakeholder becomes accustomed to the management of a new EIT.

Table 3: SWOT Analysis on the mixed model structure ISF Proposal – Type 3 (cont.)

Opportunities	**Threats**
Mixed structure patterns provide opportunities for the younger generation. In particular, university professors, researchers, as well as start-up owners, who have the power to drive and are in the process of building themselves, have shown their full potential, with research topics related to RECP/WE/IUS/IS being able to use as thesis topics for postgraduate and PhD students as well as creating human resources for the country at the same time.	The Russia-Ukraine war and the spread of the Covid-19 pandemic pose significant risks to global economic decline. Here are some key factors contributing to these risks: Trade Disruptions: The Russia-Ukraine conflict and the pandemic can disrupt global trade flows. Geopolitical Uncertainty: The Russia-Ukraine conflict has geopolitical implications that can create uncertainty and instability in the global economy. Energy Supply Disruptions: Russia is a major energy exporter, and any escalation of the conflict could disrupt energy supplies, particularly natural gas, to Europe. Investor Sentiment and Confidence: Both the Russia-Ukraine conflict and the pandemic can impact investor sentiment and confidence. Uncertainty and geopolitical tensions can lead to capital flight from affected regions, limiting investment opportunities and economic growth. Financial System Vulnerability: The combined impact of the Russia-Ukraine conflict and the pandemic can strain the global financial system. Bank exposures to affected regions or industries could result in loan defaults and financial instability. Furthermore, the economic decline resulting from these events may lead to increased government debt levels, further straining the financial system and increasing the risk of economic recession.

Conclusion

In conclusion, the development of an ISF for promoting industrial symbiosis and utilizing the concepts of RECP in Thailand is a crucial step towards sustainable industrial growth and environmental stewardship. By embracing these principles, Thailand can effectively address the challenges of resource scarcity, pollution, and waste management while fostering economic development. Implementing an ISF requires collaborative efforts from various stakeholders, including government agencies, industry associations, academic institutions, and environmental organizations. These entities must work together to establish policies, regulations, and incentives that encourage the adoption of RECP practices. One key element of the ISF is the establishment of a national platform or network for industrial symbiosis. This platform would serve as a hub for connecting industries, facilitating the exchange of resources, byproducts, and waste materials. By fostering collaboration and synergy among businesses, the platform can promote resource efficiency, reduce waste generation, and create opportunities for cost savings and innovation. Furthermore, the ISF should prioritize the development of capacity-building programs and technical assistance to support industries in adopting resource-efficient and clean production techniques. This may involve providing training, knowledge sharing, and technical guidance to businesses, particularly small and medium-sized enterprises (SMEs), which constitute a significant portion of Thailand's industrial sector. The ISF should also include monitoring and evaluation mechanisms to assess the progress and effectiveness of the initiatives implemented. Regular monitoring of resource consumption, waste generation, and pollution levels will help identify areas for improvement and guide policy adjustments. By developing an ISF for promoting industrial symbiosis and resource efficiency, Thailand can position itself as a regional leader in sustainable industrial practices. This will not only enhance the country's environmental performance but also contribute to its economic competitiveness and attractiveness for foreign investment. In conclusion, embracing the concepts of industrial symbiosis, RECP through a well-designed ISF will enable Thailand to create a more sustainable and resilient industrial sector, fostering a greener future for the nation and its people.

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