Policy Comparison between Malaysia and Thailand:

Towards Sustainable Shrimp Industry

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ABSTRACT

The shrimp farming industry plays a vital role in the economies of both Malaysia and Thailand. In particular, Thailand has historically led shrimp production and exports. However, the industry's growth in Thailand and Malaysia has slowed, with emerging competitors like Vietnam and Indonesia gaining ground. This paper aims to compare the policy frameworks and regulatory measures implemented in Malaysia and Thailand to promote sustainable shrimp farming. It begins by examining the significance of sustainability in minimizing environmental impact while fulfilling global food demands. The study then explores the current status of shrimp farming in each country, evaluates relevant policies and institutional responses, and assesses each country's comparative advantage in export competitiveness. By analyzing these policies and sustainability practices, this paper identifies strengths, challenges and opportunities for improvement to support a more resilient and competitive shrimp farming sector in both nations.

Keywords: Shrimp industry, export competitiveness, sustainability, Thailand, Malaysia
JEL Classification: F1, Q17, Q18

Introduction

The sustainable shrimp farming industry is becoming increasingly important in meeting the global demand for seafood. Aquaculture, including shrimp farming, plays a crucial role in providing food to feed the growing human population. Most developed countries have set certain criteria to ensure that the shrimp entering their country meet the sustainability level that has been set (Duraiappah & Gandhi, 2000; Sivaraman et al., 2019). Various strict regulations are imposed on shrimp farmers to penetrate their country. From the use of antibiotics or chemicals as treatment to the environmental aspect such as clearing the mangroves to make way for shrimp farms.

There is currently some movement towards sustainable shrimp farming in Southeast Asia like Thailand and Vietnam, with some of the farms trying to follow or meet requirements set by EU countries and other developed countries if they want to export the products (Engle et al., 2020). Efforts are also underway to collaborate with government institutions, universities, research centres, associations, and private companies to ensure the success of sustainable shrimp farming practices by continuously improving management practices, adhering to regulatory standards, and adopting an ecosystemic approach. Sustainable shrimp farming has seen success with support from various stakeholders such as government institutions, universities, research centres, associations, and private companies. This success is attributed to the industry's focus on sustainability, continuous improvement in farming practices, and adherence to regulatory standards. Overall, the sustainable shrimp farming industry is gradually growing and has the potential to meet the demand for aquatic food.

The shrimp farming industry plays a crucial role in the ASEAN region's aquaculture sector, contributing significantly to employment, economy, and food security. However, countries in the ASEAN region face different situations related to their shrimp industry. For example, Thailand was a large exporter of shrimp products in world markets. However, Thailand suffered from many problems, such as high production costs and a shortage of land for shrimp farming. Particularly, Thailand has lost the market share in world markets since 2010 onwards. By contrast, Vietnam has become a key competitor of the Thai shrimp industry and has captured more market shares in world markets. This is because Vietnam has advantages in production costs of shrimp farming (Fathi et al., 2018). Focusing on Malaysia, the country is not a shrimp-exporting country, but there are some exports from the country. Malaysia is interested in retaining some of this export share and developing measures to achieve this goal. Moreover, Malaysia plans to do shrimp farming regarding sustainability. For example, Malaysia promotes shrimp farms to obtain sustainability certificates such as the Aquaculture Stewardship Council (ASC). However, it is not an easy task for Malaysia to create sustainable shrimp farms because the country still faces many problems related to the shrimp industry, such as labour shortages and White spot disease (WSD) (Kua et al., 2018).

To provide more details related to the challenges and problems of Thailand and Malaysia’s shrimp industries, these two countries face many obstacles. In terms of Thailand, the Thai shrimp industry faces diseases, rising production costs, labour shortages, and a lack of suitable land (Fathi et al., 2018). This has been the biggest challenge impacting Thailand's earnings

since 2012 (Rubel et al., 2019). WSD and early mortality syndrome (EMS) continue to pose a threat to the industry (Boonyawiwat et al., 2017). Focusing on Malaysia, the country also faced the WSD in 2011. The disease caused severe mortality in the shrimp industry and caused global losses of approximately $4 billion (Kua et al., 2018). Adding to the challenges was the cost of feed, which will certainly increase production costs. The ingredients used in shrimp feed formulations have increased significantly over the last decade, with fishmeal and fish oil having average prices of US$1496/ton and US$2348/ton, respectively (Villarreal, 2023). In addition, Malaysia's shrimp industry has long suffered from labour shortages. Most workers of the Malaysian shrimp industry relied on migrants from Bangladesh and Indonesia.

There have been initiatives to revitalize the local shrimp farming industry for both countries. The Thai government has introduced several regulations to support shrimp producers. The regulations also aim to improve sustainable practices and reposition Thai shrimp farming in the global market (Chulakasian et al., 2021). Thailand has already moved towards sustainable goals since the 2000s, with the regulations focusing on environmental protection. For example, water on farms must be regularly tested and treated before discharge to ensure minimal impact on the environment (Tookwinas et al., 2022). On the other hand, the shrimp farming industry in Malaysia is subject to several policies aimed at ensuring sustainability, and addressing various challenges such as disease management, environmental impacts, and production costs. Malaysia promotes shrimp farms to obtain sustainability certificates such as the Aquaculture Stewardship Council (ASC). Overall, the guidelines for shrimp farming in Malaysia and Thailand focus on improving sustainability, improving disease management and reducing environmental impact while achieving certifications, striving for and adopting advanced technologies to maintain and improve production levels. Both countries are also actively trying to follow the Sustainable Development Goals initiated by the United Nations (MGTC, 2023; Tookwinas et al., 2022). Therefore, initiatives have been introduced by bringing novel technologies into the sector to increase profitability, especially smart aquaculture such as the Internet of Things (IoT), Artificial Intelligence (AI), big data, and cloud systems to make shrimp farming sustainable (OECD, 2023). However, this innovative technique requires government support and cooperation from the business sector to be implemented among shrimp farmers as the initial cost of implementing smart aquaculture is high.

The purpose of this paper is to compare the shrimp farming policies and regulations in Malaysia and Thailand to assess their export competitiveness and the support mechanisms in place for sustainable shrimp farming. By examining these aspects, the study aims to identify best practices and potential areas for improvement in both countries. This comparison will highlight the effectiveness of different regulatory frameworks and their impact on improving shrimp production while ensuring environmental sustainability and economic viability in the global market.

The rest of the paper provides a comprehensive comparison of shrimp farming policies and regulations in Malaysia and Thailand, with a focus on their impact on export competitiveness and sustainability. The paper begins with an overview of the shrimp industry in ASEAN, followed by a detailed examination of shrimp aquaculture in both Malaysia and Thailand. It then explores the policies governing aquaculture in these two countries, highlighting regulatory

frameworks and institutional support mechanisms. Next, the analysis focuses on export competitiveness, using Malaysia and Thailand as comparative case studies. The paper concludes by discussing key findings and their implications for sustainable shrimp farming policy and practice.

An Overview of Shrimp Industries in Malaysia and Thailand

Shrimp production

Malaysia benefits from an extensive coastal area, a conducive climate, and a reliable supply of brackish water from the sea, all of which create optimal conditions for shrimp farming (Hashim, 2005; Wayne Witus & Wan Vun, 2016). Table 1 outlines the production metrics of the Malaysian white shrimp industry from 2010 to 2020, detailing the tonnes produced and retail values. Over this period, shrimp production experienced fluctuations, with the highest production recorded in 2010 at 69,084.10 tonnes and the lowest in 2017 at 35,648.04 tonnes. Retail values had the highest value in 2014 at USD 397,829.06 and the lowest in 2012 at USD 264,787.35. Despite a general decline in production and values from the early years, there was a notable stabilization and slight recovery in the latter part of the decade.

Table 1. Production of white shrimp in Malaysian, 2010-2020

Year	Production (Tonnes)	Retail Value USD ('000)
2010	69,084.10	310,763.53
2011	60,322.01	296,479.29
2012	48,991.81	264,787.35
2013	45,473.74	268,830.35
2014	57,181.15	397,829.06
2015	48,284.18	305,365.74
2016	37,592.81	239,258.35
2017	35,648.04	218,776.45
2018	36,007.25	230,873.20
2019	38,767.11	232,957.14
2020	35,148.65	207,617.03

Source: Department of Fisheries, Malaysia (2023)

Regarding Thailand, shrimp farms are usually located along the coastal areas in the south of Thailand. Table 2 shows production in tonnes and sales value in USD (thousands) for the years 2010 to 2020. During this period, production showed significant fluctuations, peaking at 611,437.49 tonnes in 2011 and falling to a low of 279,982 in 2014. Accordingly, the retail value in USD generally reflected these trends, with the highest value in 2012 at USD 2,457,640.88 and the lowest in 2015 at USD 1,320,905.63. Notably, despite fluctuations, retail value has seen a general upward trend from 2015, with a noticeable decline in 2020.

Table 2. Production of white shrimp in Thailand, 2010 - 2020

Year	Production (Tonnes)	Retail Value USD ('000)
2010	559,644.35	1,977,040.43
2011	611,437.49	2,443,556.77
2012	609,727.43	2,457,640.88
2013	325,395.00	1,827,876.38
2014	279,982.00	1,569,655.11
2015	294,780.00	1,320,905.63
2016	334,453.00	1,564,401.78
2017	359,898.00	1,855,801.08
2018	374,390.00	1,951,282.14
2019	396,792.00	2,034,029.68
2020	388,596.00	1,875,066.21

Source: Department of Statistics, Thailand (2023)

Shrimp consumption

Malaysians are known for their high fish consumption. Ahmad (2016) found that Malaysians consumed fish at least once a day, typically one and a half medium-sized fish per day. Due to its high market value, shrimp farming has become the first choice for aquaculture farmers in Malaysia (Lee, 2020) This preference for shrimp is driven by both domestic consumption and lucrative potential in local and international markets.

In Thailand, shrimp consumption is also deeply rooted in the local cuisine and culture. Thai people consume about 32.4 kg of seafood annually, with shrimp being a popular choice given its integration into traditional dishes (Lymer, 2008). Thai consumers often incorporate shrimp into their diet and use it in a variety of traditional dishes. This dual demand from both local consumers and international markets highlights the integral role that shrimp farming plays in Thailand's economic and cultural landscape.

Traded Shrimp and the contribution to the economy

Although the shrimp industry in Malaysia is not as large as in regional countries like Indonesia, Vietnam, and Thailand, it still significantly contributes to the country's economy. Malaysia also exports its aquaculture produce to foreign countries, with 7,480 metric tonnes exported in 2020.

The importance of shrimp farming in Thailand is highlighted by its significant contribution to the country's GDP, job creation, and rural livelihoods (Thongrak et al., 1997). The industry offers income opportunities to both small farmers and large trading companies, thereby contributing to poverty reduction and income distribution. Thailand's shrimp farming sector is closely integrated into global supply chains and exports both fresh and processed shrimp products to major markets worldwide. The industry plays a crucial role in generating foreign exchange earnings and improving Thailand's trade balance.

The shrimp export data from 2013 to 2022 reveals significant trends and differences between Thailand and Malaysia (Table 3). Malaysia's shrimp exports exhibited a steadier trend with less drastic changes. The highest export value for Malaysia was recorded in 2014, followed by a

decline and partial recovery in the subsequent years. The overall trend indicates that while Malaysia's exports were lower, they experienced fewer extreme variations. By contrast, Thailand's shrimp export values have shown considerable fluctuations, with a peak in 2017 at over USD 1.16 billion and a notable dip in 2015 and 2020. Despite these fluctuations, Thailand consistently maintained higher export values than Malaysia.

Comparing the two countries, Thailand's larger export volumes reflect its stronger presence in the global shrimp market, despite greater year-to-year fluctuations. Malaysia, with more stable but lower export numbers, suggests different market dynamics, possibly influenced by other economic or environmental factors. Both countries faced challenges that led to declines in certain years. However, Thailand's ability to return to high export levels in a few years suggests robust underlying industry strength.

Table 3. Export value of shrimp from Thailand and Malaysia (USD)

Year	Thailand	Malaysia
2013	1,020,413,517.00	353,031,803.00
2014	966,598,099.00	418,278,046.00
2015	785,506,105.00	256,532,667.00
2016	1,087,338,819.00	211,550,627.00
2017	1,162,581,587.00	234,455,343.20
2018	1,062,930,688.00	261,541,493.80
2019	995,450,386.00	316,749,340.80
2020	781,150,898.00	249,322,531.20
2021	892,806,054.00	304,272,944.40
2022	831,817,456.00	285,190,875.00

Source: UN Comtrade (2023)

Policies for Aquaculture in Malaysia and Thailand

An overview

Focusing on Malaysia, the Department of Fisheries Malaysia is responsible for the development of policies and regulations. The Department of Fisheries Malaysia is also responsible for maintaining the government's goal of increasing fish production as well as increasing income for industry players such as fishermen and aquaculture farmers. The Department of Fisheries Malaysia attempts to promote the use of technology by strengthening its research on modern technology such as the use of smart agriculture, IoT and Industry 4.0 to produce fish regarding the country's needs for food in affordable quantities, quality and price. In addition, the Department of Fisheries Malaysia collaborates with the Malaysian Ministry of Health to ensure consumer food safety. This cooperation consists of enforcing laws regarding the use of chemicals on farms. The Department of Fisheries Malaysia also works with the Malaysian Ministry of Natural Resources and Environmental Sustainability (NRES) to ensure long-term protection of the environment and biodiversity (Table 4).

In terms of Thailand, the country has its regulatory authority, namely the Department of Fisheries, which reports to the Ministry of Agriculture and Cooperatives. Likewise, shrimp farming in Thailand is subject to a complex regulatory framework developed by several

government organizations, notably the Department of Fisheries and the Department of Agriculture and Cooperatives. The Fisheries Act 1947 and its revisions are the main laws regulating aquaculture activities (Table 4).

To ensure the sustainability, safety, and quality of aquaculture practices, various certificates and schemes have been developed. These certificates and schemes range from ensuring good agricultural practices to certifying the quality of fish products. In Malaysia and Thailand, various certification schemes have been implemented to ensure the quality and sustainability of agricultural and aquaculture practices. In Malaysia, some of the certification schemes include Good Agricultural Practice, ASEAN Good Aquaculture Practices, Fish Quality Certificate, The Fisheries Biosecurity Certification Scheme, Halal certification, and Aquaculture Stewardship Council. These schemes focus on hygiene, prevention, risk reduction, reliability, consistency, traceability, customer and consumer relevance, transparency, and accountability. These certification systems aim to ensure that agricultural and aquaculture practices meet certain standards and guidelines set by regulatory authorities (Tookwinas et al., 2022). However, the requirement to keep up with the regulations of developing countries such as the European Union makes it challenging for Malaysia and Thailand to keep up.

Table 4. Regulations in Malaysia and Thailand

Parameters	Malaysia	Thailand
Permits and Licenses	• Licensing under the Fisheries Rules for implementation in the state ie for states that have gazetted the fisheries rules. • Broadcaster status: • Seven (7) States Finished Gazette ➢ W.P KL, Labuan,Johor,Melaka,Pulau Pinang,Terenganu,Kelantan and Negeri Sembilan • States that have passed the State Government Meeting (MMKN) ➢ Selangor • Four (4) states have not yet been gazetted: ➢ Pahang, Kedah, Perak and Perlis • Licensing involves premises that carry out aquaculture activities such as the breeding of fish seeds or the preservation of fish breeds through livestock enterprises as a whole or part of their life cycle • Aquaculture farmers only need to obtain the approval of Planning Permission (KM) from the State Land and Mines Office under the provisions of Section 19(1) of the Town and Country Planning Act 1976 (Act 172) to carry out these livestock activities. • DOF has provided Guidelines for Good Aquaculture Practices (Licensed Breeders) and the myGAP Certification Schemes	• Shrimp farmers in Thailand must obtain licenses and permits from the Department of Fisheries (DOF) to operate shrimp farms • DOF has provided guidelines for certificates Schemes
Environmental protection	• Emphasizes environmental protection through regulations enforced by the Department of Environment (DOE).	• Environmental protection measures are governed by various agencies,

Parameters	Malaysia	Thailand
	• Environmental impact assessments (EIAs) are required for shrimp farming projects to assess potential environmental risks and ensure mitigation measures are implemented. • Standard and Index of Marin Water Quality ACT – The Malaysian marine water quality standard is primarily used to protect the rich diversity of marine ecosystems in Malaysia, while the Malaysian Marine Water Quality Index represents the status of water quality in Malaysian marine waters. • This gazette can help the regulation of livestock farmers to ensure that the effluents from livestock ponds are compliant by requiring them to obtain a license to carry out livestock activities and then comply with the conditions set out in the license such as obtaining MyGAP certification	including the Department of Fisheries and the Royal Forest Department. • Regulations address issues such as mangrove preservation, coastal zone management, and water quality standards to minimize the environmental impact of shrimp farming.
Chemical usage	• Regulates the use of chemicals, antibiotics, and additives in shrimp farming to ensure food safety and minimize environmental contamination. • The Ministry of Health (MOH) oversees regulations related to chemical usage, including permissible levels and monitoring of residues in shrimp products.	• Regulations in place to monitor and control the use of chemicals and antibiotics in shrimp farming. • The Department of Fisheries implements inspection and certification programs to verify compliance with food safety standards and international regulations.
Land use policies	• ZIA (Zon Industri Akuakultur or Aquaculture Industrial Zone) are areas for aquaculture use • Shrimp farming operations are subject to land use planning considerations to prevent conflicts with other land uses and ensure sustainable development	• In Thailand, land use policies governing shrimp farming may include regulations on land conversion, leasing arrangements, and spatial planning. • The government promotes responsible land use practices to minimize land degradation and maintain ecosystem integrity
Certificates Scheme	• Malaysia Good Agricultural Practice (MyGAP) • ASEAN Good Aquaculture Practices • Fish Qualities Certificate • The Fisheries Biosecurity Certification Scheme • Halal • Aquaculture Stewardship Council	• Best Aquaculture Practice • Organic Thailand • Good Aquaculture Practices for Fish Farming • Code of Conduct (EU) • Good Agriculture Practice • Aquaculture Stewardship Council

Source: Department of Fisheries Malaysia (2022) and Department of Fisheries of Thailand (2024)

Industry support and development policy

Governmental support or aid to an industry is critical for its growth and development. Assistance to industry requires an in-depth study because if support is provided to an industry, it must take into consideration the government's financial resources and must originate from the source of national tax collection. In the case of Malaysia, National Agro-Food Policy 2.0 focuses on increasing the efficiency of the agri-food business along the entire value chain, making it more productive, competitive, and knowledge-intensive (MAFI, 2021).

The Malaysian Fisheries Ministry has also set targets to increase the production of fisheries products, with the specific aim of ensuring sufficient and safe national food supplies (MOA, 2011). Therefore, the aquaculture sector is identified as the main area that can increase the country's fish production, thereby contributing to economic growth. In addition, the Department of Fisheries Malaysia aims to improve services to encourage all existing aquaculture operators while attracting new private sector investors and entrepreneurs. The participation of new investors is expected to have a major impact on the use of new technologies, fish production, and the expansion of market space (Economic Planning Unit, 2020). Existing entrepreneurs can improve production productivity and entrepreneurial skills through this support service. Programs planned under these guidelines will be able to be distributed and implemented to target groups such as small, medium, and commercial entrepreneurs.

In addition, there is no specific aid to the shrimp industry in Malaysia, and it only covers the field of aquaculture. The most important and direct aid is SPEKS (EQUIPMENT/ LIVESTOCK INPUT AID). This assistance includes aspects of services, systems, infrastructure, technology, inputs and equipment. Programs Under Aquaculture Support Services such as Service advisors, External training, Study tours, Courses, seminars and workshops. Normally, government support for the shrimp industry was provided on a case-by-case basis. For example, if a disaster such as a flood or a sudden increase in inputs such as feed occurs, the state government or government agencies can provide support.

Besides, the Malaysian government launched myAgropreneur Fisheries (MyAP). MyAP is a fisheries entrepreneur development program led by the Department of Fisheries. It focuses on implementing entrepreneurial programs along the fisheries sector value chain, such as production, processing, marketing, and fisheries support industries, such as agritourism and recreational fishing. The Malaysian government also provided special funds through Agrobank Malaysia, known as the Agro-YES 2.0 programme. This programme provides company financing facilities through the Malaysian Family Agro-Food Financing Fund (DPAKM) programme, with a focus on the young entrepreneur sector. Crop production, fisheries, livestock, food industry products, marketing (retail or wholesale of agricultural products), agricultural support services and inputs, and agrotourism are among the enterprises mentioned under this programme. This programme intends to promote the intended agenda of empowering the country's food production to secure long-term food supply sustainability.

By contrast, the Thai government took proactive measures to restore their country's glory by creating the Thai marine shrimp farming restoration plan. This action plan targets the production of 400,000 tonnes of sea shrimp in 2023. This action plan was drawn up following a drastic decline in the harvest in the recent past. The factors causing this problem include the impact of diseases, increased operational costs, and the COVID-19 pandemic that hit the world in 2020. Therefore, the Ministry of Agriculture and Cooperatives has mandated the Department of Fisheries to prioritize the recovery of this industry from the production aspect to its supply chain. This recovery also emphasizes aspects of food safety, environmental protection and compliance with international standards.

The emphasis is on collaboration among various government and corporate agencies to address farmer issues. This collaboration was also developed to promote cutting-edge technology and research to benefit the marine prawn farming industry. This action plan also includes the sharing of successful farmers' expertise and experience with new industry players. The Department of Fisheries Thailand also developed a database or online system to track the recovery of this business by analyzing production data. In addition, the Department of Fisheries Thailand encourages farmers to adopt Pilot Aquaculture Product Purchasing Documents (APD).

Disease control is also given high priority, with ongoing research being conducted to eradicate diseases in the marine prawn farming business. The Thai government emphasizes the deployment of biosafety systems throughout the production chain to maintain safety and limit the risk of disease, which will result in breeder losses. The most important feature is that this action plan focuses on the use of alternative energy, which might indirectly reduce the consumption of electricity, increasing the cost to farmers. To address the issue of antibiotic use in the marine prawn farming business, priority should be given to the creation of microorganisms and probiotics.

The action plan also focuses on feed formula and feeding enhancement, farmer aggregation support to facilitate trade negotiations and access to financial sources, marketing and logistics advancement, and related law enforcement.

The Shrimp Board was established by the Ministry of Agriculture and Cooperatives to investigate and monitor the pricing stability of marine shrimp. Thailand will undoubtedly restore its sea shrimp production by its target, leveraging the experience and capacity of promising sea shrimp farmers, as well as the use of advanced technology, to produce shrimp products recognized by processors, exporters, cold storage entrepreneurs, and meet global demand.

In addition, the Thai government has launched two significant projects to encourage young people to participate in agriculture and aquaculture: Smart Farmers and Young Smart Farmers. The Smart Farmers program began in 2013, with the primary goal of incorporating data, networking, and other developing technology into agricultural production systems. The Department of Agricultural Extension (DOAE) introduced the Young Smart Farmer scheme a

year later, in 2014. The goal of this plan is to address the issue of low youth engagement in the agriculture and aquaculture industries.

Like Malaysia, the state-owned Bank for Agriculture and Agricultural Cooperatives (BAAC) has set a goal of creating 50,000 young clever farmers in five years, with a commitment to provide low-interest loans totaling 55 billion Bhat at lower rates than other commercial banks. These loans fall into three categories: bio-economy credit, circular economy credit, and green credit. Their goal was to empower young people to participate in agriculture and aquaculture.

Research and development

In terms of Malaysia, National Policy 41R was introduced in 2020. This policy will advance efforts to implement the 41R agenda through technological transformation for the socio-economic development of the people and the country (Unit Perancang Ekonomi, 2020). This policy is based on the country's comprehensive approach through public-private-public cooperation. The policy also addresses the challenges and optimizes the opportunities of the digital era related to economic, social, and environmental development. In line with the National Aquaculture Plan 2020-2030, the workplaces greater emphasis on the use of IoT in the agriculture and aquaculture industries. The application of the IoT and AI with the application of precision aquaculture principles. Smart Aquaculture is also necessary to prepare entrepreneurs for sustainable agricultural management in the future. To ensure the development of competitive national aquaculture, the application of mechanization and automation of modern technology must be emphasized and widely communicated to aquaculture operators.

The government through is collaboration with various agencies such as the Ministry of Science, Technology and Innovation (MOSTI) and the Ministry of Food Security and Agro-based Industry Malaysia has focused on smart agriculture to ensure the country's food security is always guaranteed (MAFI, 2021). Apart from that, government agencies such as and Fisheries Research Institute (FRI) actively conduct research to produce IoT innovations that can be used by farmers and breeders. The involvement of the private sector is also increasingly emerging with most of the IoT technologies brought in from abroad and some developed in the country.

Thailand, on the other hand, appears to be ahead of the curve when it comes to the deployment of IoT devices in shrimp farms (NSTDA, 2021). Most of these systems are created by local government entities, such as the National Electronics and Computer Technology Centre (NECTEC). The establishment of the Agricultural Technology and Innovation Centre (AIC) under the auspices of the Agricultural Technology Policy Steering Committee 4.0 promotes the usage of IoT or smart farming in the country.

Export Competitiveness of Thailand and Malaysia’s Shrimp Industries

Methodology

To analyze the export competitiveness of Thailand and Malaysia’s shrimp industries, the study uses the Revealed Comparative Advantage (RCA) index and content analysis. The RCA index is used to evaluate each country's comparative advantage in shrimp farming. This method

allows for identifying each country's strengths and weaknesses in the shrimp farming sector. By comparing the revealed benefits, insights are gained into the competitive position of Malaysia and Thailand in sustainable shrimp farming. By contrast, the content analysis is conducted to examine policies related to sustainable shrimp farming in both countries. This includes the systematic evaluation of documents such as government policies, regulations and industry guidelines. The content analysis identifies and compares key themes, priorities and strategies within the policy frameworks of Malaysia and Thailand. This approach enables a comprehensive understanding of the policy landscape surrounding sustainable shrimp farming in each country.

The concept of the RCA index is a valuable analytical tool for assessing different countries' competitiveness and trade patterns. It allows for determining a country's comparative advantage in particular products or industries, which in turn can guide policy decisions and influence trade strategies for a more sustainable shrimp industry. In this study, we use the Balassa index to assess the revealed comparative advantage (RCA) of the shrimp industry in Thailand and Malaysia for the years 2013 to 2022. According to Stellian (1976), The Balassa Index is a commonly used tool for measuring and analyzing the competitiveness of a country's export industry. The Balassa index is calculated by dividing the value of a country's exports of a particular product by the value of its total exports. The reason for this was to focus on a single and well-established index so that it could provide a more consistent analysis. However, it has limitations in that it assumes that factor endowments and technologies are uniform across countries, which may not always be true, and it may have an order of magnitude bias that potentially biases RCA values for larger economies (Stellian et al., 1976). Despite these limitations, the Balassa index remains a robust and widely accepted measure of comparative advantage.

The study extracts data from reputable sources such as the UN Comtrade and the World Bank database. Specifically, import/export data about shrimp (classified under HS code 0306) are extracted for Malaysia and Thailand, along with global data on shrimp trade. Additionally, GDP figures for both countries were included, alongside global GDP data. This comprehensive dataset allows for a thorough examination of the comparative advantage in shrimp farming, considering trade dynamics, economic indicators, and global trends, thereby enhancing the analysis's robustness in understanding Malaysia and Thailand's sustainability policies.

Results and Discussion

The analysis of the Balassa index for shrimp exports between Malaysia and Thailand shows clear trends over the period from 2013 to 2022. As shown in Table 5, Malaysia's comparative advantage in shrimp exports recorded a gradual decline, with the Balassa index declining by 1.28 in 2013 to 0.59 in 2022. This indicates a decreasing share of shrimp exports relative to Malaysia's total export portfolio. In contrast, Thailand maintained a relatively stable comparative advantage, with the Balassa index fluctuating between 2 and 3 over the years, although there was a slight decline after 2018. The COVID-19 crisis impacted the industry of both countries, as we can see that the decline started in 2020. It may take some time for the industry in both countries to recover to pre-COVID-19 levels. These fluctuations in

comparative advantage can be attributed to several factors, including shifts in global demand, competitive pressures, and domestic policies impacting the shrimp industry (Shinn et al., 2018).

Table 5. The Balassa index of the Thailand and Malaysia's shrimp export

Exporter	Period									
Thailand	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
BI (-1,0) & (0,∞)	3.70	2.98	2.54	3.19	2.97	2.82	2.77	2.25	2.15	2.11
Malaysia	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
BI (-1,0) & (0,∞)	1.28	1.25	0.89	0.70	0.65	0.70	0.85	0.71	0.65	0.58

A comparison of industry support and development policies in Malaysia and Thailand shows different approaches to government support, sector-specific targeting, and implementation of technology. Malaysia's National Agriculture and Food Policy 2.0 aims to increase the efficiency and productivity of the agri-food sector, focusing on the entire value chain from production to marketing. The Ministry of Agriculture and Food Security Malaysia has prioritized the aquaculture sector and provided support services such as training, infrastructure improvements, promoting the usage of smart aquaculture, and financing programs for young entrepreneurs (MAFI, 2021). In contrast, Thailand's targeted efforts under the Thai marine shrimp farming restoration plan aimed to revitalize the shrimp farming industry after significant setbacks due to disease, increased costs, and the COVID-19 pandemic (DOF, 2020). This plan focuses on restoring production levels to 400,000 tons by addressing critical issues such as disease control, operating costs, and market access. The Thai government has promoted collaboration between government agencies, the private sector, and farmers to implement advanced technologies and biosecurity systems. The establishment of the Shrimp Board to monitor price stability and structured efforts on sustainable practices and international compliance have contributed to the stabilization and growth of the industry. This comprehensive approach has likely helped maintain Thailand's stable comparative advantage.

In terms of technological advancement and research, both countries are interested in integrating IoT and AI into their aquaculture sector. Malaysia's National Policy 41R and National Aquaculture Plan 2020-2030 focus on technological change to achieve sustainable agricultural management. Working with agencies such as MOSTI underlines Malaysia's commitment to innovation and digitalization. However, broader sectoral improvements and youth engagement through programs such as myAgropreneur Fisheries may not be enough to meet the specific needs of the shrimp industry. On the other hand, Thailand's proactive use of IoT systems in shrimp farms, supported by local entities such as NECTEC and the Agricultural Technology and Innovation Center (AIC), reflects a more targeted approach. These efforts aim to modernize agricultural practices, improve productivity and ensure food security.

The observed trends in the Balassa index suggest that while Thailand and Malaysia have faced challenges, Thailand's more structured and targeted policies have better supported its shrimp industry. This highlights the importance of comprehensive, industry-specific strategies and technological integration for maintaining and improving comparative advantage. Future policy

interventions in Malaysia could benefit from a more targeted and sustainable approach to targeted support to the shrimp industry, learning from Thailand's successes.

Conclusion and Implications

The shrimp industry plays a significant role in the economies of Malaysia and Thailand. It offers employment opportunities, contributes to export earnings and secures the livelihoods of many small farmers. Both countries have implemented various policies and initiatives to promote the sustainability of the shrimp industry. These guidelines aim to address issues such as environmental degradation, overfishing and social well-being in the industry. Both Malaysia and Thailand recognize the importance of sustainable shrimp farming practices and have taken steps to address environmental, social and economic challenges in the industry. Based on the analysis of the RCA index of shrimp products of Malaysia and Thailand, the results suggested clear trends in their comparative advantages, from 2013 to 2022 Malaysia's comparative advantage in shrimp exports steadily declined, while Thailand's comparative advantage remained more stable.

These results have important policy implications for both countries. For Malaysia, the declining comparative advantage suggests that strategic policy interventions are needed to strengthen competitiveness in key sectors. Measures could focus on innovation, increasing productivity and investing in education and skills development to strengthen the workforce (Namira, 2024). In addition, diversifying the economy and reducing dependence on sectors where comparative advantage is weakening can help mitigate the impact of global market fluctuations. Strengthening trade agreements and opening up new markets could also provide opportunities for growth and stabilization. In contrast, Thailand's stable comparative advantage suggests that current policies may be effective in supporting its competitive sectors. However, to maintain and potentially improve this stability, Thailand could focus on maintaining favorable trade policies, continuing to invest in technological advances and ensuring a supportive regulatory environment for businesses (Sampantamit et al., 2020). In addition, policies targeting environmental sustainability and social inclusiveness could improve long-term economic resilience.

Limitations and Future Research

First, policy analysis in this paper captures a snapshot in time. The reality is that aquaculture policy landscapes, especially in dynamic sectors like shrimp farming, are continually evolving. Regulations, support schemes, and enforcement structures can shift in response to political, environmental, or economic pressures. What’s true today may not hold tomorrow, which is important to keep in mind when drawing conclusions based on current documents.

Second, while the Revealed Comparative Advantage (RCA) index provides a useful benchmark for evaluating trade competitiveness, it comes with a few caveats. It assumes a level playing field across countries in terms of resources and technology, which is rarely the case in practice. Larger economies may appear more competitive simply due to scale, and the index doesn’t capture softer but equally important dimensions such as environmental impact, product quality, or local consumption trends. In short, RCA offers a narrow, trade-focused view, which is only part of the bigger picture.

Third, this study relies heavily on content analysis of official policies and strategy documents. While useful for identifying national goals and priorities, these documents don’t always reflect

what's happening on the ground. Implementation can vary significantly between regions or even individual farms. A sustainability guideline might be followed closely in one area but overlooked in another due to a lack of resources or enforcement. Also, by working only with written sources, there's always a risk of missing informal practices or underreported challenges faced by farmers and local authorities. That said, these limitations don't negate the findings. They simply highlight areas where caution and further inquiry are needed. Looking ahead, there are several ways this research could be expanded. A natural next step would be to carry out fieldwork: visiting farms, speaking with producers, and listening to the people who live these policies every day. First-hand insights would help close the gap between policy on paper and reality in practice. Interviews with stakeholders could also reveal what's working, what's not, and why.

Environmental sustainability is another area ripe for deeper investigation. Future research could include direct assessments of shrimp farming's ecological footprint, looking at indicators like water quality, disease control, or mangrove preservation. This would help determine whether export gains are being achieved responsibly or at an environmental cost. It may also be useful to widen the geographic lens. Comparing Malaysia and Thailand to other major shrimp-producing countries in the region such as Indonesia, Vietnam, or India, would offer a broader perspective on policy effectiveness and market positioning. Similarly, comparing different regions within each country could reveal useful differences in how strategies are being applied or received. Finally, this type of work would benefit from a longer-term view. Tracking policy changes and competitiveness over time—year by year—would provide a clearer picture of which reforms are making a real difference. As the sector continues to grow and evolve, pairing economic data with environmental metrics and local feedback will give researchers and policymakers alike the tools they need to support more resilient and responsible shrimp aquaculture industries.

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