# Mechanisms for Collaboration and Engagement in High-Value Agricultural and Food Business Groups, in Accordance with the Development Guidelines for New Economic Hubs within the Central-Western Economic Corridor

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## Abstract

This research aimed to: (1) examine the background information and current situation of high-value agricultural and food product clusters in the Central-Western Economic Corridor (CWEC); (2) design and prioritize potential clusters for development within the CWEC; (3) establish a stakeholder network cooperation mechanism; and (4) formulate policy recommendations for the CWEC, which encompasses four provinces: Kanchanaburi, Suphan Buri, Phra Nakhon Si Ayutthaya, and Nakhon Pathom. The study employed a qualitative methodology through participatory action research (PAR), grounded in a holistic development approach and the Quadruple Helix concept. A total of 75 key informants participated, including 33 representatives from government and state enterprises, 8 from the private sector and entrepreneurial ventures, 19 from academia and expert fields, and 15 from the community. Research instruments included secondary data sources, semi-structured interview guides, focus group discussions, and brainstorming sessions. Key informants were selected through purposive sampling based on direct institutional or community involvement in the CWEC development agenda; within each group, snowball referral was applied where access was limited. Data validity was ensured through methodological triangulation combining in-depth interviews, focus group discussions, documentary analysis and source triangulation across all four stakeholder groups. Qualitative content analysis followed systematic coding procedures, with inter-rater discrepancies resolved through structured discussion. Findings revealed that the CWEC possesses considerable potential for linking production bases to the ASEAN region, though challenges remain in infrastructure and policy integration. The evaluation of potential business clusters resulted in the following prioritization: (1) white shrimp and giant freshwater prawn, (2) tropical fruits, (3) rice, (4) tilapia and snakehead fish, and (5) beef cattle. Furthermore, the study developed the Public–Private–Academic–Community (PPA-C) Model, a contextualized Quadruple Helix cooperation mechanism for inclusive agro-food cluster governance in which communities serve as active co-producers rather than passive beneficiaries. Cluster potential was evaluated across four criteria: economic potential, market and export potential, sustainability and competitiveness, and readiness for development and impact; the five priority clusters (shrimp, tropical fruit, rice, freshwater fish, and beef cattle) yielded overall mean scores of 7.91, 7.81, 7.73, 7.60, and 6.60, respectively. Policy recommendations emphasize enhancing product value through technology, improving infrastructure, and expanding domestic and international markets. Short-, medium-, and long-term action plans are proposed to strengthen sustainable competitiveness.

**Keywords:** High-value agricultural, Cluster development, PPA-C Model, Quadruple Helix

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## Introduction

The National Strategy (2018–2037) and the 13th National Economic and Social Development Plan (2023–2027) delineate the trajectory for national advancement, emphasizing the equitable distribution of prosperity across regions, the reduction of inequality, and the enhancement of national competitiveness. This vision is particularly evident in Strategy 2, which highlights the importance of increasing productivity in both quantity and value. It incorporates diverse agricultural approaches, including local identity agriculture, safe agriculture, organic agriculture, processed agriculture, and smart agriculture (Office of the Prime Minister, 2018a). This initiative aligns with the 13th National Economic and Social Development Plan, which aspires for Thailand to become a leader in high-value agricultural and processed agricultural products (National Economic and Social Development Council, 2022).

Special Economic Zones (SEZs) are established under the principle of area-based development to consolidate regions for the simultaneous promotion and support of diverse developmental dimensions. This includes budget allocation, the construction of essential infrastructure, and the provision of investment and business incentives. The objectives are to distribute prosperity across regions, reduce income inequality, enhance the citizen's quality of life, and foster regional stability.

Nevertheless, the concentration of economic growth in major cities has generated disparities between urban and rural areas. In 2019, Bangkok accounted for 33.8% of the nation's GDP, while other regions contributed less than 10% (MoneyBuffalo, 2021). This imbalance prompted advocacy for the establishment of special economic corridors. Following the Cabinet resolution of September 20, 2022, the Special Economic Zone Policy Committee (SEZPC) designated four regional special economic corridors: the Northern Special Economic Corridor (NEC), the Northeastern Special Economic Corridor (NeEC), the Central-Western Special Economic Corridor (CWEC), and the Southern Special Economic Corridor (SEC). These corridors focus on five critical areas: infrastructure development, investment promotion, human resource development, economic advancement, and digital economic development alongside sustainable growth (Katchwattana, 2023).

The Central-Western Economic Corridor (CWEC) encompasses four provinces: Ayutthaya, Nakhon Pathom, Suphan Buri, and Kanchanaburi. Its objective is to evolve into a premier economic hub for agricultural industries, tourism, and high-tech sectors of international caliber, linking Bangkok, its surrounding areas, and the Eastern Economic Corridor (EEC) (Senate Secretariat, 2024). This region records a combined Gross Provincial Product (GPP) of approximately 1,036,630 million baht, accounting for 6.4% of the nation's GDP. The industrial sector serves as the primary economic driver (53.1%), followed by the service sector (38.0%) and agriculture (8.9%). In addition, the CWEC supports a workforce of around 2.3 million individuals, representing 5.8% of the total national workforce (National Statistical Office, 2024a, 2024b, 2024c, 2024d).

The exceptional potential of the CWEC lies in its capacity to link trade and transportation routes between the western and eastern coasts. The Kanchanaburi Border Economic Development Zone connects to the Dawei deep-sea port in Myanmar and features transportation infrastructure that links to the EEC, which subsequently extends to Cambodia and Vietnam. Furthermore, Thailand is positioned to engage with the China-Indochina Peninsula Economic Corridor (CIPEC) development plan through economic collaboration in the Greater Mekong Subregion (GMS), which emphasizes three development strategies: connectivity, enhancing competitiveness, and strengthening communities (Sukdanon, 2019).

The CWEC also represents a vital and diverse agricultural region of Thailand. The total area encompasses 18,478,827 rai, of which 7,543,770 rai is allocated for agricultural use. The region benefits from a relatively extensive irrigation system compared to other areas. Key agricultural products include crops (rice, sugarcane, cassava, orchids, and pomelo), fisheries (white shrimp, giant freshwater prawn, snakehead fish, and tilapia), and livestock (beef cattle, broiler chickens, and pigs). Products registered under Geographical Indication include Nakhon Chai Si pomelo (Nakhon Pathom Provincial Agricultural and Cooperative Office, 2023) and Suphan Buri water chestnut (Suphan Buri Provincial Agriculture and Cooperatives Office, 2023).

A study of agricultural export data indicates that in 2023, Thailand's exports of agricultural and processed agricultural products to FTA partner countries increased by 4 percent, reaching a value of US$19,563 million, which accounts for 73 percent of total exports. The most rapidly expanding market was China, with an 11 percent rise, followed by ASEAN with a 5 percent increase (Office of the Prime Minister, 2024b). However, the advancement of high-value agricultural and food products in the CWEC region continues to face several challenges, including inadequately interconnected logistics infrastructure, limited policy integration among relevant agencies, and entrepreneurs' difficulties in adapting to high-level value chains. Educational institutions play a pivotal role in addressing these issues by developing curricula, conducting research and development to foster innovation, and facilitating knowledge transfer (Science, Research and Innovation Promotion and Coordination Division, 2024).

Economic corridors are grounded in the New Economic Geography theory, which explains the concentration of economic activity through the principles of increasing returns and agglomeration economies. This concentration arises from the forward and backward linkages among businesses, labor, and markets, resulting in reduced transportation costs and enhanced knowledge transfer among entrepreneurs within the same region (Krugman, 1991). The development of economic corridors unfolds in four stages: Stage 1, the transport corridor, emphasizes the movement of goods and individuals; Stage 2, the logistics corridor, integrates transportation systems; Stage 3, the trade corridor, facilitates commerce and minimizes customs barriers; and Stage 4, the economic corridor, encompasses production activities, employment, and value creation along the route.

However, the shift from transport corridors to economic corridors frequently encounters the "tunnel effect," a phenomenon in which infrastructure is constructed but fails to deliver benefits to local communities due to insufficient economic connectivity. This issue is particularly prevalent in developing nations that prioritize investments in physical infrastructure while neglecting the development of local entrepreneurial capacities (Hope & Cox, 2015).

In Thailand, the CWEC encompasses the provinces of Ayutthaya, Nakhon Pathom, Suphan Buri, and Kanchanaburi, facilitating connections between agricultural production bases and the Southern Economic Corridor, extending to the Dawei Port in Myanmar. This region is a significant producer of rice, sugarcane, and a variety of fruits and vegetables (Office of the National Economic and Social Development Council, 2025). Research on regional development has identified land-use conflicts arising from urban expansion encroaching upon agricultural land, leading to the displacement of small-scale farmers while benefits accrue predominantly to large corporations (Glassman, 2018; Rigg et al., 2019). Consequently, the development of the CWEC must balance physical infrastructure (hard infrastructure) with social infrastructure (soft infrastructure) while integrating urban and rural supply chains (rural-urban linkages).

Prior research on agricultural cluster development in Southeast Asia demonstrates that geographic concentration alone is insufficient to generate competitive advantage; effective governance structures and institutional linkages are equally critical determinants of cluster performance (Altenburg & Meyer-Stamer, 1999; Sonobe & Otsuka, 2006). In the Thai context, studies of the EEC have focused predominantly on high-technology manufacturing (Wongpidavet, 2022), while research on agro-food corridor development remains limited in scope. Existing investigations tend to adopt either a sectoral lens—analysing individual value chains in isolation—or a policy-descriptive approach that documents government initiatives without empirically assessing stakeholder collaboration mechanisms (Poapongsakorn & Pantakua, 2020). Furthermore, the application of the Quadruple Helix framework to agricultural special economic zones in ASEAN is largely nascent, with most studies focusing on Triple Helix dynamics in urban innovation districts rather than rural-agricultural settings (Carayannis & Campbell, 2012).

Consequently, a significant research gap exists in understanding how multi-stakeholder cooperation mechanisms can be systematically designed and prioritized for high-value agro-food cluster development within emerging economic corridors in developing countries. This study addresses that gap by applying Participatory Action Research within a Quadruple Helix framework across four CWEC provinces, empirically prioritising five agricultural clusters, and proposing the PPA-C Model as an operationalised governance mechanism. The findings contribute both theoretical and practical knowledge to the fields of economic corridor development, agricultural cluster governance, and regional innovation systems.

A business cluster is a geographically concentrated assembly of interrelated enterprises within a specific region. It encompasses producers, suppliers, service providers, financial institutions, and ancillary organizations. Such clusters facilitate the sharing of resources, including skilled labor, infrastructure, and research institutions, as well as the dissemination of knowledge (knowledge spillover) among the participating businesses (Porter, 1998; Porter, 2000). The efficiency of a business cluster can be classified into two categories: passive collective efficiency, which arises from proximity—such as shared access to labor and materials—and active collective efficiency, which emerges from collaborative actions, such as pooling resources for raw material procurement, jointly developing products, and establishing quality standards. The latter form of efficiency is particularly vital in mitigating market imperfections encountered by individual enterprises (Schmitz, 1995).

Global value chain upgrading encompasses four dimensions. The first is process upgrading, which enhances production efficiency through technologies such as precision farming and automation. The second is product upgrading, focusing on the development of higher-value products, including health foods, functional foods, and organic products. The third is functional upgrading, which expands the role of enterprises from production to include design, branding, and marketing. The fourth is inter-sectoral upgrading, which involves applying knowledge and skills to new industries (Gereffi & Lee, 2016; Humphrey & Schmitz, 2002).

These four dimensions of enhancement correspond with Thailand's Bio-Circular-Green Economy (BCG) model, which seeks to transition from commodity production to high-value products through the application of biosciences, technology, and circular economy principles. The CWEC region is rich in agricultural raw materials; however, processing methods remain conventional. Most entrepreneurs operate as original equipment manufacturers (OEMs), possessing limited bargaining power and securing minimal revenue shares.

The Triple Helix model illustrates the collaboration among universities, industry, and government in promoting innovation. Each sector assumes an interconnected role: universities not only generate knowledge but also establish new enterprises; industry engages in research and training; and the government facilitates investment and formulates policy frameworks. The interplay among these three sectors fosters the dynamics of innovation (Etzkowitz & Leydesdorff, 2000).

The Quadruple Helix model incorporates civil society and media-based culture as a fourth component, recognizing that innovation must be socially accepted and responsive to the societal needs rather than being driven solely by government, the private sector, or academic institutions. This model aligns with the European Union's Smart Specialization Strategy (S3), which emphasizes the entrepreneurial discovery process and user-centric innovation.

Community engagement as co-creators enhances the social license to operate. Involving the community from the planning phase mitigates conflict, encourages innovation tailored to the local context, and shifts the community's role from beneficiaries to active participants in development (Miller et al., 2016; Nordberg, 2015). Within this framework, universities serve as regional anchor institutions, bridging national policies with local realities, leveraging academic expertise to address local challenges, and transforming local knowledge into standardized innovations.

Participatory Action Research (PAR) is based on the principle that research should drive social change rather than merely generate knowledge. Data contributors are regarded as co-researchers rather than subjects of study, actively engaging in the identification of issues, data collection, analysis, and decision-making processes. The PAR process comprises a dynamic four-step cycle that perpetually recurs: Step 1, Planning, involves defining the problem and potential solutions in collaboration with stakeholders; Step 2, Acting, entails implementing the plan; Step 3, Observing, focuses on collecting data on outcomes; and Step 4, Reflecting, analyzes the results to refine the plan for subsequent cycles. This iterative process promotes continuous learning and adaptation (Kemmis & McTaggart, 2005). PAR is particularly effective for addressing complex ("wicked") problems such as supply chain inequalities, resource conflicts, and climate change adaptation, which lack straightforward solutions and necessitate stakeholder engagement to identify viable resolutions (Kindon et al., 2007).

This process fosters an environment for the exchange of scientific knowledge and local wisdom. The amalgamation of these two forms of knowledge produces socially robust knowledge—validated and embraced by stakeholders—thereby increasing its likelihood of practical application compared to knowledge generated exclusively in laboratories or research offices.

The conceptual framework of this study integrates four complementary theoretical lenses that together explain the multi-dimensional dynamics of agro-food cluster development in the CWEC. First, Porter's Cluster Theory (1998, 2000) explains why geographic concentration of producers, processors, and supporting institutions in Nakhon Pathom and Suphan Buri generates collective efficiency and knowledge spillovers superior to isolated enterprises. Second, Schmitz's (1995) Global Value Chain (GVC) Upgrading framework (further elaborated by Gereffi & Lee, 2016) provides four upgrading pathways—process, product, functional, and inter-sectoral—through which CWEC clusters can transition from low-margin commodity supply to high-value food innovation. Third, Thailand's Bio-Circular-Green (BCG) Economy model operationalises the upgrading agenda by mandating bioscience-based value addition, circular resource utilisation, and environmental sustainability, aligning national industrial policy with cluster development goals. Fourth, the Quadruple Helix model (Etzkowitz & Leydesdorff, 2000; Nordberg, 2015) provides the governance architecture, positioning government, private sector, academia, and civil society as co-equal innovation actors. The present study synthesises these four frameworks into the PPA-C Model, which operationalises Quadruple Helix governance for the specific agro-food cluster context of the CWEC.

**Objectives**

1. To examine the background information and current situation of high-value agricultural and food product clusters in the Central-Western Economic Corridor.

2. To design and prioritize potential clusters for the development of the Central-Western Economic Corridor.

3. To develop a stakeholder network cooperation mechanism for the development of the Central-Western Economic Corridor.

4. To formulate policy recommendations for the development of the Central-Western Economic Corridor, with an emphasis on high-value agricultural and food products.

## Conceptual Framework

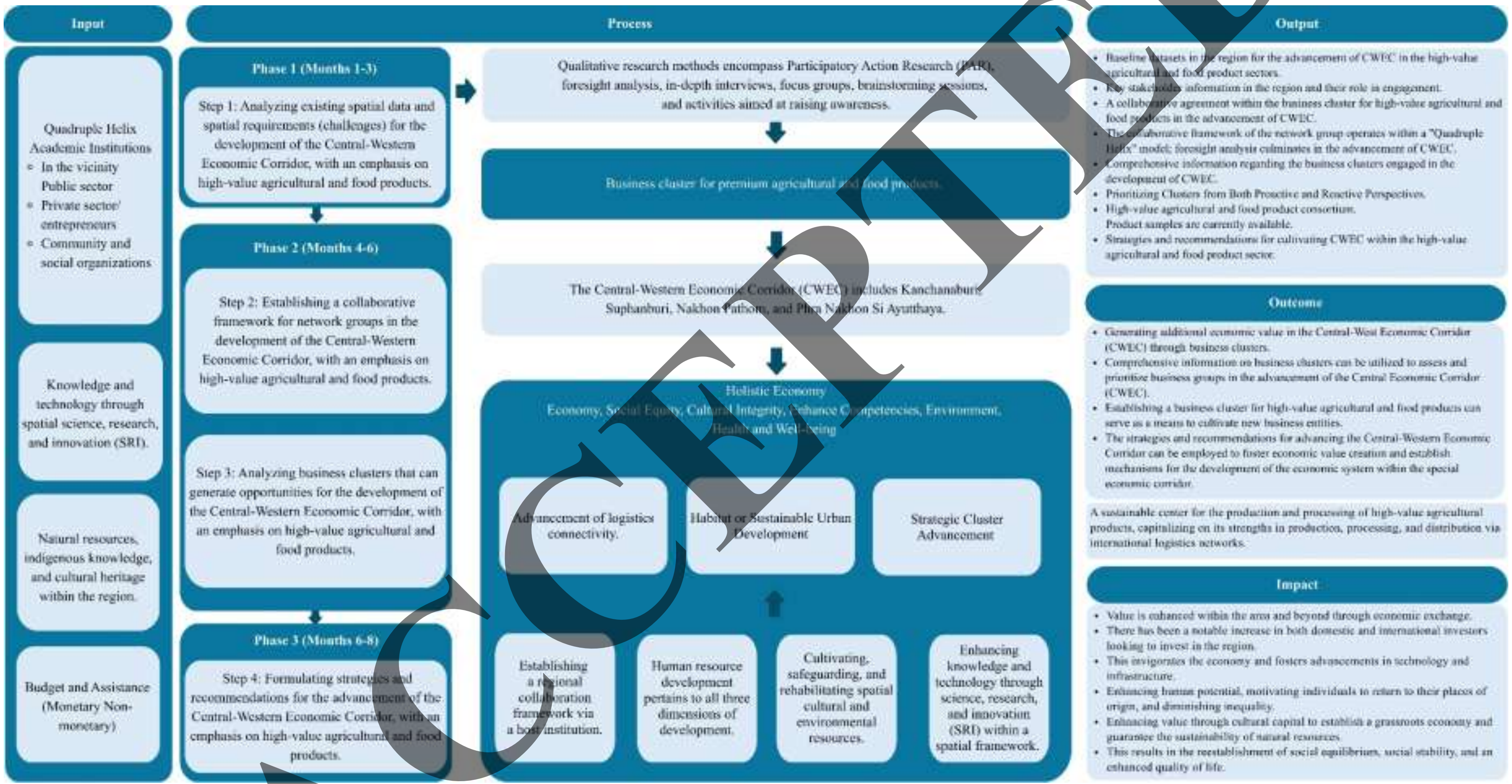


**Figure 1** Conceptual Framework

**Research Methodology**

1. **Research Methodology**

This study employed qualitative methods, specifically Participatory Action Research (PAR), emphasizing enhanced participation within a Quadruple Helix framework that integrates educational institutions, government, the private sector, and the community, all situated within the concept of a holistic economy.

Data quality was ensured through two forms of triangulation. First, methodological triangulation was applied by combining three data collection methods: semi-structured in-depth interviews, focus group discussions, and secondary documentary analysis, allowing convergent validation of findings across independent data sources. Second, source triangulation was achieved through systematic inclusion of all four Quadruple Helix stakeholder groups (government, private sector, academia, and community), ensuring that no single sector's perspective dominated the analysis. Where divergent views emerged across stakeholder groups, they were explicitly reported and analyzed rather than resolved by averaging (Lincoln & Guba, 1985). Internal consistency was further supported by member-checking: preliminary findings were presented at a validation workshop attended by 18 key informants drawn proportionally from all four groups, and participants' feedback was incorporated into the final analysis.

2. **Research Area and Scope**

The research focuses on the Central-Western Economic Corridor (CWEC) encompassing four provinces: Kanchanaburi, Suphan Buri, Phra Nakhon Si Ayutthaya, and Nakhon Pathom, with particular emphasis on the high-value agro-food industries.

3. **Principal Informants**

The primary informants comprised 75 stakeholders engaged in advancing the development strategy of the Central-Western Economic Corridor, categorized into four groups:

Group 1: Government and State Enterprise Sector, consisting of 33 personnel from local government agencies, including the Provincial Office, Provincial Agriculture and Cooperatives Office, Provincial Industry Office, Provincial Tourism and Sports Office, Provincial Public Works and Town Planning Office, Provincial Culture Office, Provincial Administrative Organization, and Sub-district Administrative Organizations.

Group 2: The Private Sector, consisting of entrepreneurs and representatives from the Provincial Chamber of Commerce, the Provincial Federation of Industries, the Provincial Tourism Industry Council, Thai SME Federation, the Young Smart Farmer Group, and Young Entrepreneur Chamber of Commerce, along with eight individual entrepreneurs.

Group 3: Academia, consisting of 19 scholars, specialists, and researchers with expertise in advancing CWEC's development strategy.

Group 4: Community and Society, comprising 15 representatives from community enterprises, agricultural producers, and local residents.

Key informants were selected through purposive sampling based on direct institutional or community involvement in the CWEC development agenda. Within each group, snowball referral was applied where access was limited. Data saturation was assessed iteratively until no new thematic categories emerged, confirming sufficiency of the final sample.

4. **Research Instruments**

Data collection employed four primary tools: (1) secondary data recording forms for gathering information from strategies at each level, including academic documents, research articles, research reports, and operational records from relevant agencies; (2) semi-structured interview forms for focus group discussions; (3) issue forms for brainstorming, critique, and discussion forums; and (4) public relations media for communication initiatives aimed at enhancing awareness.

5. **Research Steps**

The research was conducted in alignment with the objectives, through the following steps:

Step 1: Background Data and Current Situation Analysis – spatial data analysis, compilation of baseline data, stakeholder evaluation, and identification of critical gaps in the high-value agricultural and food product sector. Data were sourced from both primary and secondary channels through interviews, focus groups, and brainstorming sessions.

Step 2: Designing and Prioritizing Collaborative Business Groups – facilitated through group meetings and brainstorming sessions, supported by analysis of market size, stakeholders, and accessible technologies.

Step 3: Establishing A Collaboration Mechanism – encouraging participation from all stakeholders, including communities, private sector actors, investors, local government, and central government, through meetings, brainstorming sessions, and foresight analysis to formulate joint agreements and collaboration frameworks.

Step 4: Developing Policy Proposals – formulating policies, strategic plans, promotional initiatives, financial instruments, knowledge resources, and technologies that promote business growth, including lessons learned to serve as a model for other collaborative business entities.

6. **PAR Cycle Alignment**

The four research steps above correspond explicitly to the iterative PAR cycle of Plan–Act–Observe–Reflect (Kemmis & McTaggart, 2005), ensuring that knowledge production was co-created with stakeholders across multiple rounds rather than imposed by the research team. Step 1 (Background Data Analysis) constituted the Planning phase, in which the team and stakeholder representatives jointly diagnosed the current situation and established baseline data for each candidate cluster. Step 2 (Designing and Prioritising Clusters) constituted the Acting phase, translating the diagnosed challenges into a structured cluster-scoring exercise. Step 3 (Establishing a Collaboration Mechanism) constituted the Observation phase, collecting systematised data on feasibility and stakeholder commitment within the proposed PPA-C structure. Step 4 (Developing Policy Proposals) constituted the Reflection phase, synthesising all prior findings and refining them into the PPA-C Model governance framework through a stakeholder validation workshop.

**Data Analysis**

Data analysis proceeded in three stages. In Stage 1, all audio recordings were transcribed verbatim and returned to informants for member-checking; corrections were incorporated before analysis. In Stage 2, thematic content analysis was applied following the six-phase procedure of Braun & Clarke (2006): data familiarisation, initial code generation, theme searching, theme review, theme definition and naming, and report production. Each transcript was coded independently by two researchers, with discrepancies resolved through structured discussion. In Stage 3, where stakeholder views diverged across Quadruple Helix groups—particularly on resource allocation priorities—the divergences were treated as substantively meaningful data and reported transparently. The cluster-potential scoring exercise was conducted through focus group discussion and a structured FAO-based scoring questionnaire administered to the 19 academic informants. Final criteria weights were: economic potential (25%), market and export potential (30%), sustainability and competitiveness (25%), and readiness for development (20%).

**Results**

**Background information and current situation of high-value agricultural and food product clusters in the Central-Western Economic Corridor.**

An analysis of the Central-Western Economic Corridor (CWEC), which includes the provinces of Ayutthaya, Nakhon Pathom, Suphan Buri, and Kanchanaburi, reveals significant economic potential. The aggregate Gross Provincial Product (GPP) amounts to 1.04 trillion baht. The economic structure is primarily driven by the industrial sector (53.1%), followed by services (38.0%) and agriculture (8.9%). In terms of investment, total capital inflow in 2023 reached 53 billion baht. Demographic indicators further underscore the region's readiness for economic advancement, with a working-age population of 67.5%—surpassing the national average of 65.2%—and a dependency ratio of 0.48, which is below the national average. These figures highlight the preparedness of human resources for manufacturing and processing industries.

Regarding natural resources and spatial potential, the CWEC features a diverse and mutually supportive ecosystem. Kanchanaburi is distinguished by its forests and abundant water resources, including dams. Suphan Buri and Ayutthaya are lowland areas characterized by clay and loamy soils suitable for cultivation and rice farming. Nakhon Pathom, meanwhile, is an intensively farmed lowland region with a sophisticated irrigation system.

The agricultural and food production landscape is marked by a variety of economically significant products. Key crops include rice and sugarcane, alongside agricultural products with Geographical Indications such as Nakhon Pathom pomelo and Suphan Buri water chestnut. Livestock production encompasses broiler chickens, pigs, and cattle, while fisheries contribute white shrimp and giant freshwater prawn. These outputs align with Thailand's export trajectory, valued at over US$49 billion, with major markets in China, Japan, and the United States.

Based on stakeholder analysis within the Quadruple Helix Model, the roles in promoting regional development are classified into four primary sectors, as outlined below:

1. **Government Sector**

The government plays a pivotal role in facilitating infrastructure development. The Ministry of Transport emphasizes logistics connectivity through the M81 motorway and dual-track railways. The Ministry of Finance supports investment through tax measures and funding sources. The Ministries of Industry and Agriculture coordinate the establishment of industrial processing zones and water management systems to secure raw materials. Collaboration with the Tourism Authority of Thailand (TAT) and local authorities promotes tourism and public utilities. These initiatives are reinforced by infrastructure loans from the Asian Development Bank (ADB) and frameworks under the World Trade Organization (WTO).

2. **The Private Sector**

The private sector acts as a catalyst for economic growth. Financial institutions provide development loans, while agro-food enterprises such as CP and Betagro focus on high-value processing and export market expansion. Tourism entrepreneurs invest in sustainable enterprises, and foreign direct investment (FDI) facilitates the transfer of advanced production technologies, all within the regulatory framework of WTO free trade agreements.

3. **Community and Social Sector**

The community serves as the foundation of development, comprising farmer groups and community enterprises engaged in agricultural and food production as well as community-based tourism. Non-governmental organizations (NGOs), including the Green World Foundation and the Thai Life Foundation, provide support in areas of rights, sustainability, and grassroots economic strengthening.

4. **Academic Sector**

The Academic Sector contributes through knowledge creation and innovation. A network of higher education institutions plays a central role, including Suan Dusit University, which enhances standards in the food industry and high-value services; Kasetsart University, Kamphaeng Saen Campus, which conducts research in precision agriculture technology and artificial intelligence to improve productivity; Kanchanaburi Rajabhat University; Phra Nakhon Si

Ayutthaya Rajabhat University; Nakhon Pathom Rajabhat University; and Rajamangala University of Technology Suvarnabhumi, which focuses on tourism training and community vocational skills development.

**Prioritization of Potential Clusters for Developing the Central-Western Special Economic Corridor in High-Value Agricultural and Food Products**

A study and analysis of business clusters in the Central-Western Economic Corridor (CWEC), focusing on five primary high-value agricultural and food product categories, revealed that each category presents distinct contexts and challenges. Freshwater fish products represent economically significant aquatic species with high production volumes, predominantly located in Suphan Buri province; however, farmers face challenges related to feed costs and limited bargaining power. Tropical fruit products, including durian, mango, pomelo, and coconut, are high-value commodities with geographical indications (GI) in Kanchanaburi and Nakhon Pathom, yet they suffer from insufficient market data and quality control mechanisms. Rice products, cultivated extensively across the region, remain economically vital, but farmers lack incentives to adopt Good Agricultural Practices (GAP) standards and continue to face environmental challenges. Shrimp products, concentrated in Nakhon Pathom and Suphan Buri, are high-value export items that demonstrate strong growth potential due to global market demand. Beef products serve as a production base for fattened cattle intended for export, but the sector is currently experiencing a slowdown due to rising costs and illegal meat imports.

The evaluation of cluster potential was conducted using four primary criteria: economic potential, market and export potential, sustainability and competitiveness, and readiness for development and impact. Results indicate that the shrimp product cluster achieved the highest overall average score of 7.91, excelling in market and export potential (8.33) and economic potential (8.25). The tropical fruit product cluster followed closely with an average score of 7.81, demonstrating particular strengths in sustainability and competitiveness (7.91). The rice cluster ranked third with an average score of 7.73, earning the highest score in economic potential (8.55). The freshwater fish product cluster secured fourth place with an average score of 7.60, while the beef cluster ranked fifth place with an average score of 6.60.

The assessment clearly indicates that the shrimp industry cluster possesses the greatest readiness and potential to stimulate the regional economy (see Figure 2).


**Figure 2** Results of the business cluster potential evaluation

An analysis of the supply chain within the most promising shrimp cluster reveals a systematically interconnected framework. It begins upstream, with Suphan Buri and Nakhon Pathom serving as pivotal aquaculture bases, driven by community enterprises and shrimp farmer cooperatives. The midstream segment emphasizes processing and quality control in accordance with HACCP and GMP standards, with Nakhon Pathom functioning as the central hub for efficient processing plants and cold storage facilities. Downstream, the system extends through robust logistics networks, reaching wholesale, retail, and e-commerce channels to distribute products to domestic consumers and major export markets in Japan, China, and the United States.

Advancing the shrimp cluster towards sustainability requires a coordinated quadruple helix collaboration mechanism. This consists of: (1) the government sector, with the Department of Fisheries and the Ministry of Commerce establishing policies, product standards, and supporting infrastructure; (2) the private sector, with processing companies and logistics firms investing in production technology and cold chain systems; (3) civil society, including farmer groups and the Young Smart Farmer network, advocating environmentally sustainable production and participatory quality control; and (4) the education and research sector, with Suan Dusit University as the central entity driving food innovation and enhancing service standards, in partnership with local institutions such as Kasetsart University and Nakhon Pathom Rajabhat University, to cultivate human resources and technologies that sustainably strengthen the competitiveness of the Thai shrimp industry on the global stage.

The tropical fruit cluster encompasses four primary commodities grown across the CWEC: durian and coconut (Kanchanaburi and Nakhon Pathom), mango (Suphan Buri and Ayutthaya), and pomelo—with the Nakhon Chai Si pomelo holding Geographical Indication (GI) status. Total cultivated area exceeds 280,000 rai, with aggregate farmgate value estimated at 4.2 billion baht annually. The cluster ranked second in overall potential (mean score = 7.81), with its highest sub-score in sustainability and competitiveness (7.91). Supply chain analysis reveals a significant midstream gap. Upstream, smallholder farmers cultivate tropical fruits across fragmented landholdings with virtually no farmgate cold storage. Midstream, most produce is sold as fresh commodity without standardized quality grading, limiting access to premium and export tiers. Downstream, distribution relies heavily on traditional wholesale markets in Bangkok, and export channels for durian are dominated by a small number of licensed exporters, substantially reducing producer margins.

The rice cluster is the CWEC's most spatially extensive agricultural sector, with paddy rice cultivated across an estimated 3.2 million rai in Suphan Buri, Ayutthaya, and Kanchanaburi. The cluster ranked third in overall potential (mean score = 7.73) but achieved the highest sub-score in economic potential (8.55), reflecting its dominant role in the agricultural economy and the approximately 85,000 farm families dependent on rice income. Varieties produced include jasmine rice (Khao Hom Mali), Pathum Thani 1 fragrant rice, and conventional glutinous rice. Supply chain analysis identifies structural weaknesses at multiple points. Upstream, fewer than 15% of CWEC rice farmers hold GAP certification, and over-reliance on chemical inputs contributes to soil degradation. Midstream, approximately 80% of output is processed as white milled rice with minimal value addition. Downstream, export is conducted primarily through Bangkok-based exporters without a CWEC-specific marketing identity, despite community enterprise informants in Ayutthaya reporting that premium organic rice sold through direct channels achieves a farmgate price three times that of conventional rice.

The freshwater fish cluster is centred principally in Suphan Buri province, which accounts for an estimated 70% of total CWEC production. Key species include Nile tilapia (Oreochromis niloticus) and snakehead fish (Channa striata). The cluster ranked fourth in overall potential (mean score = 7.60), with a relatively balanced sub-score profile across all four criteria. Supply chain analysis reveals the following structure. Upstream, approximately 4,500 registered aquaculture households culture tilapia and snakehead fish in earthen ponds in Suphan Buri; feed costs constitute 60–65% of total production costs, and bargaining power vis-à-vis feed suppliers and intermediary buyers is severely limited. Midstream, approximately 15 registered processing plants supply tilapia fillets to domestic supermarket chains, while snakehead fish processing remains largely informal at household scale. Downstream, approximately 85% of production is absorbed domestically; the absence of ISO 22000 or HACCP certification at most processing facilities restricts access to premium export markets.

The beef cattle cluster serves as a production base for fattened cattle intended primarily for export markets. The cluster ranked fifth in overall potential (mean score = 6.60), reflecting current structural challenges including rising input costs, competition from illegal meat imports, and a broader sector slowdown. Supply chain analysis indicates that upstream production is dispersed across smallholder cattle farmers in Kanchanaburi and Suphan Buri, with limited access to quality feed and veterinary services. Midstream, slaughtering and processing capacity is insufficient for export-grade standards, and cold chain infrastructure connecting to export channels remains underdeveloped. Downstream, the domestic market absorbs the majority of output; access to ASEAN halal export markets—where demand is growing, particularly from China and the Middle East—remains constrained by the absence of halal-certified processing facilities.

Table 1 presents a comparative SWOT analysis of all five agro-food clusters, synthesising findings from stakeholder interviews, focus group discussions, and documentary data. This cross-cluster comparison provides the evidential basis for the prioritisation exercise reported above. Given that the shrimp cluster achieved the highest overall potential score and was identified as the priority cluster for immediate strategic development, the subsequent Quadruple Helix collaboration mechanism, policy recommendations, and implementation roadmap focus exclusively on the white shrimp and giant freshwater prawn cluster.

**Table 1** Comparative SWOT Analysis of Five Agro-Food Clusters in the CWEC

| Dimension | Shrimp (Score 7.91) | Tropical Fruit (Score 7.81) | Rice (Score 7.73) | Freshwater Fish (Score 7.60) | Beef Cattle (Score 6.60) |
|---|---|---|---|---|---|
| **S (Strengths)** | HACCP/GMP-ready processing infrastructure; established cold chain logistics | GI products (Nakhon Chai Si pomelo); highest sustainability and competitivenes | Highest economic potential sub-score (8.55); largest production area (3.2 M rai); | Strong local aquaculture base (~4,500 households); balanced cluster profile across all sub- | Established fattened-cattle production base; ASEAN halal market potential |

| Dimension | Shrimp (Score 7.91) | Tropical Fruit (Score 7.81) | Rice (Score 7.73) | Freshwater Fish (Score 7.60) | Beef Cattle (Score 6.60) |
|---|---|---|---|---|---|
| | network | s sub-score (7.91); strong natural resource base | diversified varieties | criteria | |
| **W (Weaknesses)** | EMS disease vulnerability; high energy production costs | Absent farmgate cold chain; fragmented smallholder landholdings (avg. 8–12 rai) | Below-15% GAP certification rate; minimal value-added processing; commodity price exposure | Feed cost dependency (60–65% of production cost); limited export-grade certification at processing plants | Rising input costs; competition from illegal meat imports; sector slowdown |
| **O (Opportunities)** | Growing global demand for ASC/BAP-certified shrimp; BCG circular economy (chitosan/astaxanthin) | Surging Chinese demand for durian; Japanese and South Korean demand for mango; GI expansion programme | RCEP premium rice markets (China, Japan); "CWEC Premium Jasmine" branding; organic certification premiums | High-value by-product extraction (collagen peptide, artisanal fish sauce); gastronomy tourism linkage | ASEAN halal beef market growth; fattened-cattle export potential to China and Middle East |
| **T (Threats)** | Competition from Vietnamese and Ecuadorian shrimp producers; stringent EU/US import standards | Quality inconsistency from broker-dependent export channels; post-harvest losses from cold chain gaps | Farmland conversion pressure from urban expansion; commodity price competition; soil degradation | Marine aquaculture competition; fishmeal price volatility; absence of ISO 22000/HACCP at most facilities | Illegal beef imports undercutting farm-gate prices; disease risks; consumer price sensitivity |

**Table 2** TOWS Matrix — Cross-Strategies for CWEC Agro-Food Cluster Development

| TOWS | O: Growing global demand for certified products; RCEP market access; GI expansion; BCG economy incentives | T: Import competition; stringent export standards; farmland conversion; disease and climate risks |
|---|---|---|
| **S: HACCP/GMP infrastructure; GI products; large production base; diverse cluster profiles** | SO Strategy: Leverage the shrimp cluster's HACCP/GMP-certified infrastructure and cold chain network to capture the ASC/BAP premium export market; simultaneously exploit GI status of tropical fruit (pomelo, durian) to access high-value Chinese and Japanese consumer segments | ST Strategy: Utilize the freshwater fish production base and by-product extraction capability (collagen peptide, artisanal fish sauce) to develop high-value product lines insulated from commodity price competition and import threats |
| **W: Low GAP certification; cold chain gaps; feed cost dependency; limited value-added processing** | WO Strategy: Deploy RCEP market access as a demand-pull incentive to drive GAP and organic certification uptake for rice and tropical fruit clusters; use CWEC Premium Jasmine branding to convert certification investment into farmgate price premiums | WT Strategy: Address feed cost dependency through collective input purchasing and locally sourced protein alternatives, reducing vulnerability to fishmeal price volatility and indirect competition from lower-cost marine aquaculture imports |

The TOWS strategies presented above are derived from the comparative SWOT findings across all five clusters and are intended to inform future policy design for the CWEC agro-food sector. Detailed operationalization of these strategies including stakeholder role assignment, foresight-based objectives, and phased implementation is developed in the following sections with specific reference to the shrimp cluster as the highest-priority case.

A synthesis of the roles of network partners and foresight into the shrimp industry in the CWEC indicates that fostering sustainability requires a quadruple helix collaboration mechanism with clearly delineated roles and responsibilities. The government sector is tasked with establishing standards and supporting infrastructure, with the Ministry of Agriculture and Cooperatives promoting smart agriculture, the Department of Fisheries supervising GAP/CoC standards, and the Ministry of Commerce enhancing international markets, complemented by BOI tax incentives to attract investment in biotechnology. The private sector plays a pivotal role in driving business, with financial institutions offering low-interest funding, processing companies investing in advanced production technologies (HACCP/GMP), and startups providing Internet of Things (IoT) and artificial intelligence (AI) solutions to farmers. Academic and research institutions are responsible for innovation and knowledge creation, with Suan Dusit University and its network of institutions collaboratively researching high-value product processing and developing technologies for extracting key substances from shrimp shells (e.g., chitosan, astaxanthin). Civil society and communities strengthen the industry from the grassroots level through the establishment of community enterprise groups to produce high-quality shrimp and connect it to gastronomy tourism.

For the decade-long development trajectory, eight strategic objectives have been established to enhance competitiveness. First, economic objectives target a minimum 15% increase in economic value through cost reductions via smart farming and added value from waste materials. Second, export objectives aim to boost export value by 15% by cultivating a high-quality product image and implementing a transparent traceability system. Third, growth objectives encourage the development of new products, such as ready-to-eat meals and high-value extracts, to meet global market demands. Fourth, standards objectives advocate for more than 50% of farms to secure international certifications (e.g., ASC, BAP) to mitigate trade barriers. Fifth, government support objectives focus on establishing an investment-friendly ecosystem that includes modern technology, funding sources, and regulatory frameworks. Sixth, environmental objectives emphasize green production through sustainable technologies such as Recirculating Aquaculture Systems (RAS) and renewable energy. Seventh, social objectives aim to enhance community quality of life through technological skills training and food tourism. Finally, entrepreneurship objectives seek to nurture a new generation of entrepreneurs adept at leveraging innovation and engaging with technology service enterprises. This initiative is designed to propel the sustainable growth of the Thai shrimp industry on the global stage.

**Policy recommendations for the development of the Central-Western Economic Corridor within the high-value agricultural and food business groups.**

To ensure the efficient and sustainable development of white shrimp and freshwater prawn products, a policy proposal has been formulated, outlining five key strategic areas. First, enhancing product value through processing and branding for the premium market. Second, leveraging technology and innovation, particularly AI and IoT, to reduce costs and improve production efficiency. Third, developing infrastructure such as temperature-controlled distribution centers (cold chain) and intelligent logistics systems. Fourth, expanding trade opportunities in both domestic and international markets through e-commerce platforms and business matching initiatives. Fifth, integrating quadrilateral cooperation to establish a robust collaborative mechanism.

These strategies are articulated in a 10-year roadmap divided into three phases: short-term phase (1–2 years) concentrates on foundational work, branding, and digital infrastructure development. The medium-term phase (3–6 years) focuses on enhancing production standards (GMP/HACCP), researching alternative feeds, and connecting to regional markets. The long-term (7–10 years) aims to establish a sustainable innovation ecosystem, implement a circular economy, and link with international economic corridors. The overarching objective is to increase economic value and exports by at least 15 percent and elevate farmers' income by 30 percent.


**Figure 3** Development roadmap for white shrimp and freshwater prawn products in the Central-Western Economic.

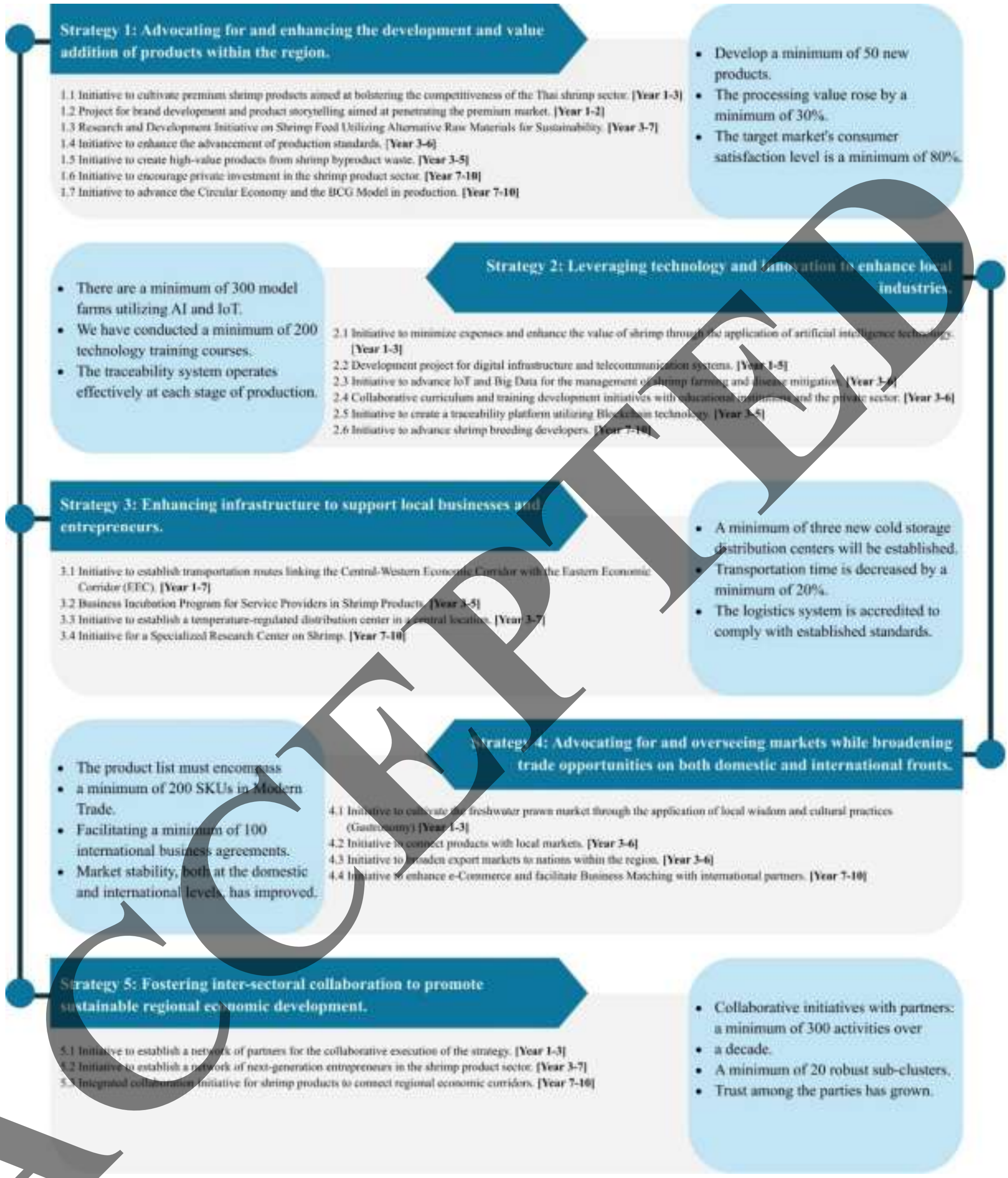


**Figure 4** Strategic Development plan for white shrimp and freshwater prawn products within the Central-Western Economic Corridor.

A pivotal mechanism for advancing the strategy is the establishment of a 'Service Provider' within the CWEC region. This entity will serve as a central hub, supporting entrepreneurs throughout the supply chain by providing services in research and development (R&D), standards testing, startup incubation, market linkages, and financing. Management will be guided by the PPA-C model (Public–Private–Academic–Community), ensuring inclusive and collaborative governance.

The development will be interconnected with other economic corridors: the NEC (Northern Region) for herbal raw materials, the NeEC (Northeastern Region) for agricultural crops, and the SEC (Southern Region) as a conduit to western markets. Through these linkages, the CWEC will operate as the national food processing and innovation center, integrating raw materials from across the country and connecting them to global markets.

## Discussion

The findings of this research can be analyzed in relation to the stated objectives, relevant theories, and pertinent literature as follows:

A comprehensive analysis of background information and current situation of high-value agricultural and food product clusters in the Central-Western Economic Corridor (CWEC) demonstrates that the CWEC possesses significant potential to function as a production and logistics hub connecting to ASEAN and China. This observation is consistent with Krugman's (1991) theory of New Economic Geography, which posits that the concentration of economic activity reduces transportation costs and fosters economies of scale. Nevertheless, the research identifies shortcomings in infrastructure and policy integration, highlighting the risk of the Tunnel Effect, as articulated by Hope and Cox (2015), which describes a scenario where transportation infrastructure may facilitate development without adequately benefiting local communities. Additionally, the study corroborates the findings of Glassman (2018) and Rigg et al. (2019), which emphasize the land-use conflict between urban expansion and agricultural zones within the Thai context. Consequently, the development of the CWEC must not solely prioritize physical infrastructure. It is imperative to enhance social infrastructure and supply chain connections between urban and rural areas to ensure equitable income distribution.

Cluster prioritization for the development of the CWEC, particularly in high-value agricultural and food products, identifies white shrimp and giant freshwater prawn clusters as possessing the greatest potential, outpacing rice and other crops. This phenomenon can be explained through Porter's (1998, 2000) Business Cluster theory, which posits that the concentration of producers, processors, and supporting industries in Nakhon Pathom and Suphan Buri generates a distinct competitive advantage over traditional agricultural products. Moreover, the research highlights opportunities for advancement in line with Gereffi & Lee's (2016) framework, particularly in product and process upgrading. Shrimp is more adept at adapting to the Bio-Circular-Green (BCG) economic model compared to other commodities. This study suggests that the economic development trajectory of the region should reallocate resources towards high-value-added clusters to circumvent the middle-income trap.

The development of collaborative mechanisms among network groups for advancing the CWEC in high-value agricultural and food products, particularly through the PPA-C Model, validates the significance of the Quadruple Helix model. This framework incorporates the contributions of civil society and communities into the development process, alongside government, private sector, and academic institutions. This conclusion is consistent with Nordberg's (2015) research, which asserts that modern innovation and regional development necessitate a social license to operate. Involving communities from the outset through participatory action research (PAR), as advocated by Kemmis & McTaggart (2005), facilitates the bridging of understanding gaps and renders policy proposals more pragmatically viable than top-down policy decisions. Additionally, the research emphasizes the role of educational institutions in the region as vital intermediaries, translating knowledge into practical applications.

The formulation of policy recommendations for developing the CWEC in high-value agricultural and food products presents short-, medium-, and long-term strategies. These emphasize the use of advanced technology (AI/IoT) and adherence to international standards (GAP/HACCP), aligned with the global context of food security and sustainable supply chains. The research indicates that future Thai SEC development policies should extend beyond traditional tax incentives, focusing instead on fostering an innovation ecosystem that promotes cluster growth. This encompasses investments in digital technology and research and development to elevate the CWEC from a supplier of inexpensive raw materials to a genuine regional hub for high-value food and innovation, consistent with national strategic objectives and the 13th National Economic and Social Development Plan.

The present findings extend and qualify more recent scholarship on agro-food cluster governance in developing economies. Poapongsakorn and Pantakua (2020) argue that Thai agricultural value chains remain structurally locked into low-margin commodity roles due to inadequate collective action institutions rather than inherent resource limitations a diagnosis consistent with this study's finding that institutional readiness, rather than natural resource endowments, is the primary differentiator between high- and low-ranked clusters. Wongpidavet (2022) observes that the EEC's governance architecture has struggled to generate backward linkages to local agricultural suppliers, a Tunnel Effect dynamic (Hope & Cox, 2015) that the PPA-C Model specifically addresses through its community co-production mandate. Furthermore, Barrientos et al. (2011) demonstrate that small-scale producers in Southeast Asian food value chains face the cumulative burden of multiple overlapping sustainability certification requirements, reinforcing this study's recommendation for a consolidated CWEC certification support infrastructure.

A comparison with the Eastern Economic Corridor (EEC), Thailand's most established special economic zone—illuminates the CWEC's distinctive strategic positioning. The EEC, established under the Special Economic Development Zone Act of 2018, has attracted over 1.97 trillion baht in investment concentrated in high-technology manufacturing sectors that rely on imported capital and knowledge (Eastern Economic Corridor Office, 2023). This investment profile generates substantial GDP contribution but limited rural income multipliers, as the EEC's production system maintains weak lateral linkages to surrounding agricultural communities, an empirical instance of the Tunnel Effect. The CWEC, by contrast, is built on an existing agricultural production base (7.54 million rai under cultivation) with established community enterprise networks and farmer cooperatives. The PPA-C Model is therefore suited to a fundamentally different development challenge: upgrading the governance and value-addition capacity of an existing agro-food system rather than attracting foreign capital to greenfield industrial zones. This suggests the CWEC should develop a complementary identity as Thailand's agro-food innovation corridor, integrated with the EEC through upstream-downstream supply chain linkages.

This research makes three distinct contributions to the existing body of knowledge. First, it develops and operationalizes the PPA-C Model as a domain-specific governance framework for agro-food cluster development within special economic corridors in developing countries, advancing the Quadruple Helix model by specifying role-differentiated responsibilities, foresight-based strategic objectives, and a phased implementation roadmap suited to Thailand's CWEC institutional context. Second, the study develops a multi-criteria cluster prioritisation methodology that integrates economic, market, sustainability, and readiness dimensions through a stakeholder-consensus focus group scoring process based on FAO evaluation criteria, a transparent, replicable decision tool for regional planners. Third, the application of PAR within an economic corridor governance context demonstrates the feasibility and added value of community co-production in policy design: community informants' participation in the scoring exercise and foresight workshops produced governance proposals that were more contextually grounded, as confirmed through member-checking—and generated the social license necessary for effective implementation (Miller et al., 2016).

Several limitations of this study warrant acknowledgement. First, the study was conducted within a single PAR cycle over 12 months; longitudinal research tracking actual implementation outcomes of the PPA-C Model would provide stronger evidence of its efficacy. Second, the private sector was represented by only 8 informants, reflecting genuine access constraints, as large agro-food corporations declined participation, which may underrepresent the private sector's strategic priorities. Third, the cluster-scoring exercise relies on expert elicitation, which is inherently subject to anchoring bias even with structured focus group procedures; alternative quantitative validation (e.g., econometric cluster locational quotient analysis) would strengthen the prioritisation's empirical basis. Finally, the PPA-C Model assumes a level of institutional capacity and inter-agency coordination that may not be uniformly available across all four CWEC provinces, and future research should investigate how institutional capacity constraints can be addressed within the proposed Service Provider framework.

**Suggestion**

1. **Recommendations for future research**

1.1 Examine the potential of emerging industries (New S-Curve) with significant growth prospects, including creative tourism, electric vehicles (EVs), and the digital content sector, to facilitate long-term strategic planning.

1.2 Conduct policy impact analyzes, particularly concerning organic farming policies and financial assistance for the agro-food sector.

1.3 Undertake environmental and social impact assessment (ESA) to guide natural resource management and mitigate conflicts with local communities.

1.4 Expand research into future food products, including functional foods and health-oriented foods, which represent significant global trends.

2. **Recommendations for implementing the research findings**

2.1 Establish the CWEC Agro-Food Service Provider as the Central Governance Hub. The research findings most directly support the creation of a single, accountable Service Provider entity, governed under the PPA-C Model, that consolidates R&D support, standards testing, startup incubation, market linkage services, and financing coordination for all five priority clusters. Its establishment should proceed in three phases: a preparatory phase (Years 1–2) focused on institutional formation; a cluster support phase (Years 3–6) providing direct services to the shrimp, tropical fruit, and rice clusters; and a regional hub phase (Years 7–10) connecting the CWEC to national and international agricultural innovation networks.

2.2 Accelerate Strategic Development of the Shrimp and Tropical Fruit Priority Clusters. Given their superior scores in market and export potential, the white shrimp/giant prawn and tropical fruit clusters should receive priority resource allocation in the short and medium terms. For the shrimp cluster: establish an RAS technology demonstration centre in Nakhon Pathom; support ASC/BAP certification for at least 30% of shrimp farms within three years; and develop a chitosan and astaxanthin by-product processing line consistent with BCG circular economy objectives. For the tropical fruit cluster: establish a four-node provincial cold chain network, launch a CWEC tropical fruit GI expansion programme, and develop functional ingredient product lines for export to China and Japan.

2.3 Develop Integrated Logistics and Cold Chain Infrastructure Connecting EEC, CWEC, and Dawei Port. Infrastructure investment should prioritize the logistics connectivity necessary to realise the CWEC's trans-regional role. The M81 motorway extension and dual-track railway connections should incorporate designated temperature-controlled freight facilities at key nodes in Nakhon Pathom, Suphan Buri, and Kanchanaburi. An intermodal cold chain hub at the Kanchanaburi border economic zone would enable direct refrigerated export to South Asian and Middle Eastern markets, diversifying the current dependence on EEC-routed export.

2.4 Implement a Consolidated Certification and Standards Support Programme. Research findings consistently identify certification gaps (GAP, HACCP, GMP, organic, GI) as primary barriers to market upgrading across all five clusters. The Service Provider should establish a consolidated CWEC Certification Support Programme offering: cost-sharing subsidies for individual farm/enterprise certification fees; group certification facilitation enabling 10–20 households to share a single certification audit; a pre-certification technical advisory service staffed by university extension officers; and a digital compliance tracking platform for real-time traceability verification.

2.5 Invest in Workforce Development and an Agricultural Innovation Talent Pipeline. Long-term competitiveness of the CWEC's agro-food clusters depends on a workforce equipped with skills in precision agriculture, food technology, supply chain management, and digital marketing. Short-term priorities include establishing a CWEC

Agricultural Innovation Training Centre jointly operated by Suan Dusit University and Kasetsart University Kamphaeng Saen Campus, offering modular industry-linked training in smart farming and food safety certification; and integrating CWEC cluster internship programmes into undergraduate curricula across regional universities. Medium-term priorities include curricula development for vocational programmes aligned with food processing and cold chain logistics occupations.

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