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NETWORK INNOVATION TO ENHANCE SPATIAL POTENTIAL BORDER ECONOMIC CITY WITH A QUADRUPLE HELIX MODEL

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Abstract

This research aims to study the spatial potential of border economic cities, to create a network innovation mechanism to enhance the spatial potential of border economic cities with a Quadruple Helix model, to study the guidelines for driving the enhancement of the spatial potential of border economic cities with network innovation, and to critique the study results to study policy alternatives to set as policy proposals to enhance the spatial potential of border economic cities. The study emphasized participatory action research methods with Stakeholders developing at the Phu doo International Point of Entry, using various qualitative data collection methods, including document studies, in-depth interviews, workshops, and focus groups. The study found that the impact of the COVID-19 pandemic has resulted in a lack of stimulation for tourism and the local economy. Under the spatial potential leading to the creation of a mechanism to drive development with primary mechanisms and secondary mechanisms from the network innovation group under 4 driver issues: tourism, logistics system, research and education, and economy) 4 enablers issues: controlling the COVID-19 situation, medicine and referrals, international relations, and peace and order to create a guideline to drive the elevation of spatial potential to policy proposals to drive the development of the area into a new growth city. Developing a logistics transport system linking international border trade, creating agreements in various dimensions and developing international relations, developing a medical and referral system, and preparing for emerging disease situations.

Keywords: Network Innovation, Border Economy, Quadruple Helix Model

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Introduction

The influence of world changes in the era of globalization has resulted in each country's goals being an effort to keep up with changes and competition to develop the quality of life of the people and live well. Promoting economic growth is one factor that focuses on increasing the average national income per capita according to the set goals by using economic mechanisms under free competition as the main factor, which can make the country's economic development successful. Important economic indicators or signals include GDP, unemployment rate, inflation, consumer confidence, business confidence, and private investment, which affect income distribution, driving the economic system at the macro and micro levels to achieve balance.

Thailand is located in the Southeast Asian region and is the hub connecting South Asia, East Asia, and Southeast Asia. It shares borders with neighboring countries, including the Kingdom of Cambodia, the Lao People's Democratic Republic, the Union of Myanmar, and Malaysia. Along the borders of Thailand, there are many international contact points, including permanent border crossings, temporary border crossings, and relaxation points. Therefore, the border area is an important economic area for Thailand in trading with neighboring countries. Border trade is a trade that occurs in various forms, from exchanging or buying and selling goods used in daily life, agricultural products grown in the area, between villagers in adjacent border areas, developing into international trade to trading partners around the world and expanding from agricultural products to various industrial products.

After the COVID-19 pandemic, the global economy has collapsed. Each country is trying to adapt and find solutions to restore its economy to stimulate and return to developing and developing to keep up with the competition in terms of trade and investment to create GDP at a level that is nationally developed. Although the current situation of the COVID-19 pandemic has improved, people have been able to adjust their lifestyles to cope with the crisis. The impacts have caused Thailand to start rehabilitating its economy to recover once again. This research article uses a case study of the Phudoo Permanent Border Crossing in the Uttaradit Province

Phu Doo Permanent Border Checkpoint is a permanent checkpoint in Uttaradit Province, located in the lower northern region of Thailand. It can connect economic trade, and tourism in many dimensions, such as connecting the Lanna Kingdom (Chiang Mai) with the Lan Xang Kingdom (Luang Prabang), a distance of 695 km., connecting the World Heritage City of Luang Prabang with the World Heritage City of Sukhothai, Si Satchanalai, and Sakanglao, a distance of 550-650 km. and travel from the northern part of Thailand out of the Phu Doo Permanent Border Checkpoint into the Lao PDR. to visit Luang Prabang or to visit various cities in the Lao PDR such as Luang Prabang, Xayaburi, and Vientiane and can return to Thailand in the northeast, both entering at Ban Nakraseng Checkpoint (Tali District, Loei Province) - Kaen Thao City (Xayaburi Province, Lao PDR) or the Vientiane-Nong Khai checkpoint. As shown in Figure 1 (Panichakarn, 2020).



Figure 1 Northern Logistics Academic Network
Source: Panichakarn (2020)

In addition, Uttaradit Province is a border economic city with cultural capital, local products, and agricultural products that have been elevated to become a cultural tourism route and agricultural tourism route. It is also a logistics connection point, a trade gateway to various regions via rail and land transportation. It is a channel for connecting economic zones in national development in various ways and can generate income and develop areas along the border economic routes to generate income for communities, local areas, provinces, and the country from opportunities for national economic development. It can stimulate the economy in the area and distribute income to connect to the economic routes of the country.

In 2021, the COVID-19 pandemic in Southeast Asian countries has become more severe, affecting border trade as governments of each country have issued measures to control travel and border crossings to reduce and prevent the spread of the disease, resulting in economic activities in border areas slowing down or stopping. Although the current situation of the COVID-19 pandemic has eased and people have been able to adjust their lifestyles to cope with the crisis, the impact has caused Thailand to start rehabilitating its economy to recover once again. Uttaradit Province and relevant government and private sector agencies in Thailand and neighboring countries have negotiated to find a solution to this problem, including trying to adjust so that economic activities in the border areas can continue, but it still cannot stimulate the local economy to truly develop.

The author realizes that this problem is an urgent issue that the country must cooperate in finding ways to solve and develop. Therefore, he presents a research article obtained from the research study to present network innovations to enhance the spatial potential of border economic cities with a Quadruple Helix model with 4 research objectives: To study the spatial potential of border economic cities, to create a network innovation mechanism to enhance the spatial potential of border economic cities with a Quadruple Helix model, to study the guidelines for driving the enhancement of the spatial potential of border economic cities with network innovation, and to critique the study results to study policy alternatives to set as policy proposals to enhance the spatial potential of border economic cities.

Literature Review

Border trade refers to the form of trade among local people whose residences border neighboring countries. It involves the exchange of goods between each other, mostly goods that are necessary for daily life. The initial aim was to alleviate the suffering and shortages of people along the border through various border crossings, including permanent border crossings, special relaxation points, trade relaxation points, and temporary border crossings,

as well as natural channels that connect Thailand with neighboring countries (Myanmar, Lao PDR, Cambodia, and Malaysia). Later, when the infrastructure of borderless transportation and logistics was linked, online trade, etc., the context of border trade began to change to be more business-oriented (Department of Foreign Trade, 2020).

At present, Thailand has various types of border crossings with 4 neighboring countries, namely Myanmar, Lao PDR, Cambodia and Malaysia, totaling 47 places (excluding natural routes), of which 42 are permanent border crossings, 1 is a special relaxation point and 54 are other types of border crossings in 27 border provinces of Thailand. Most border and cross-border trade is conducted through permanent border crossings and special relaxation points, while most border trade at relaxation points is trade of people in border areas or border markets and transport of goods outside the routes approved by the Customs Department. It is often found that border trade is concentrated at main border crossings that are developed and have supporting facilities, resulting in congestion at border checkpoints. Therefore, the potential and readiness of border crossings, whether in terms of infrastructure, physical connectivity, transportation and logistics connectivity, CIQ (Customs Immigration Quarantine) personnel, as well as enabling regulations, etc., are all very important to support border trade and the competitiveness of Thai entrepreneurs doing business and investing with neighboring countries.

Border trade has become increasingly important in Thailand's economic development in recent years. In fact, border trade is a small-scale trade that is a form of intra-area trade between local people on the Thai side and neighboring countries. However, border trade is currently viewed from a wider perspective. From focusing on exporting and importing goods with countries with border connections, it has begun to link to trade with third countries. Part of this is due to the expansion of globalization, which has led to increased movement of capital, labor, goods, and resources between countries. In addition, important economic cooperation such as the Greater Mekong Subregion (GMS) is a collaboration between 6 countries: Thailand, Myanmar, Lao PDR, Cambodia, and southern China, which has received funding from the Asian Development Bank (ADB). This has led to the development of transportation routes and infrastructure on the North-South Economic Corridor (NSEC) and the East-West Economic Corridor (EWEC), which are important factors that facilitate international land transportation of goods and lead to the development of a more efficient logistics system.

Amidst the intense global trade competition, many countries have turned to trade protection policies and strict import measures. Non-Tariff Measures (NIMs) have been increasingly used, while Thai exports face increased competition from emerging economies. If Thai products cannot create differences that consumers want, Thailand's overseas market expansion will face more competitors and become more difficult. Under such circumstances, Thailand should focus on neighboring countries and neighboring countries in the region, which are regions with high economic growth and will be the mechanism for driving the global economy in the near future, such as Myanmar, which connects the world's two largest developing countries, China and India, by taking advantage of their location advantages, regional connectivity, free trade agreements, similarities in customs and cultures, and consumer behavior that trusts in the quality and likes Thai products, etc. (Piyanonthasin, 2017).

The "Quadruple Helix Model" is a conceptual framework that describes collaboration between different sectors of society to support innovation and development, which is an extension of the Triple Helix Model. The Triple Helix is a collaboration that emphasizes the integration of the private sector, government sector, and education sector. The goal is to transfer knowledge and technology from the education sector, which produces personnel and expertise, to the private sector. This collaboration can create impacts on the development of

the country's economic system, including policy formulation, regulation issuance, and budget management by the government sector. In countries that grow with innovation, such as the United States, the United Kingdom, Germany, and Japan, the private sector acts as the driving force of the country's economic system. Meanwhile, the education sector plays an important role in supporting knowledge, and the government sector helps support policies and infrastructure. Research and development investment in these countries mainly comes from the private sector (Etzkowitz & Leydesdorff, 2000). The Quadruple Helix concept promotes collaboration between the government, private sector, communities, society, universities, research institutes, and international networks to integrate knowledge and technology for development that is suitable for the country's context. This aligns with the BCG (Bio-Circular-Economy) concept, which aims to drive the creation of a new model for the country, requiring learning, change, and innovation. It represents a significant shift in developing the country's economy, society, and environment towards sustainable change. Applying the Quadruple Helix concept to real-world innovation is important for several reasons: - Citizen participation in the development of solutions makes approaches relevant to real life, leading to higher acceptance and adoption. - When citizens participate in defining and planning solutions, they can be more effective in addressing issues such as the environment or health. - Sharing ideas and resources across the four sectors helps develop strong networks that lead to the creation of high-quality innovations. - Citizen involvement creates a focus on sustainability, requiring collaboration from all sectors. The Quadruple Helix concept is crucial for creating interrelated innovations in today's society. Promoting public participation will lead to the development of technologies and innovations that better meet the needs of society and the environment, resulting in sustainable development in the long run. Full implementation of the Quadruple Helix requires creating understanding and awareness in all sectors, promoting true participation, and government support to create collaborative spaces for a better future for everyone (Afonso et al., 2012). Quadruple Helix builds on the Triple Helix concept by adding citizens as a key sector, emphasizing the importance of citizen participation in implementing innovations and technologies in everyday life. Citizen involvement ensures that innovations better address societal needs and issues.

Methodology

This study is a research and development (R&D) that emphasizes participatory action research (Participatory Action Research) to answer the four specified research objectives by using various qualitative research methods, including studying documents and related data (Documentary Research), in-depth interviews, workshops and focus groups with a Quadruple Helix model. The author designed the research as follows: The target group in the study of the creation of network innovation to enhance the potential of the border economic city area with the Quadruple Helix model at the Phu Doo permanent border crossing, Uttaradit Province, was selected by purposive sampling, divided according to the goals of the research objectives. As shown in figure 2.

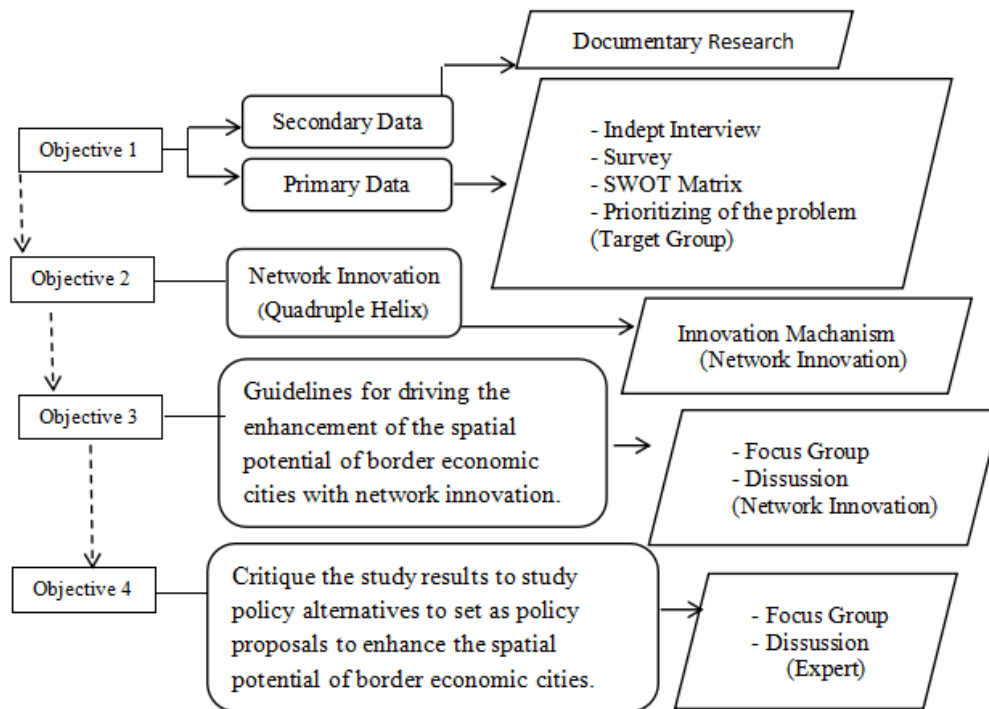


Figure 2 Research Process

Research Results

The results of the study according to the research objective 1 the spatial potential of the border economic city area at the Phu Doo permanent border checkpoint, Uttaradit Province is considered a strategic point for domestic and international trade gateways. There is a transportation route from the northern region to Vientiane and Luang Prabang, Lao PDR, which is the shortest distance. There are orders for consumer goods and animals from Thailand to transport goods via the high-speed rail connection point from Vientiane to China. China has invested in building a high-speed rail route connecting Laos to China and has ordered goods from Thailand via the Phudu permanent border checkpoint. Thailand has a plan to develop a project to expand the route to support economic expansion to support transportation to the Phu Doo border trade gate. Along the route of the border economic city area at the Phudu permanent border checkpoint, Uttaradit Province, it can connect trade and tourism. It can connect rail transportation by train from Sila At Railway Station to Chiang Mai, Bangkok, Klong Toey Port, Laem Chabang Port and Sattahip Port conveniently and quickly. Therefore, there are private businessmen in Thailand who have gone to do business in Laos. It can be a channel to expand the order of goods and hire workers in Thailand.

However, due to the distance between Uttaradit city and Phu Doo permanent border checkpoint, Uttaradit province is quite far from Phu Doo permanent border checkpoint, and the transportation route is a lane form and lacks a public transportation system that can provide services to the public. In terms of goods transportation and travel, there are not many continuous tourist check-in points, resulting in a small number of tourists, making travel difficult. There are also lack of facilities that are conducive to tourism, such as gas stations, internet signals, lighting, shops, distribution points, and promoting warehouses near Phu Doo permanent border checkpoint, so it is still not possible to upgrade the tourism economy in the area. In addition, there is an imbalance in tax collection, and the limitations of international cross-border laws do not allow for joint implementation between Thailand and Laos. The border communities have high hopes for the potential of the area to improve the border economy. However, various obstacles have hindered development and prevented it from aligning with the visions of Mee-Udon (2019). A case study of border communities at the

Phu Doo permanent border checkpoint, Tambon Muang Chet Ton, Amphoe Ban Khok, Uttaradit Province, revealed that despite the current underdevelopment of Phu Doo checkpoint and border trade, the villagers in the border communities are fairly well-off. They anticipate that the checkpoint will benefit their children in the future. The current well-being of the villagers is not directly attributed to the checkpoint or border trade, but rather to their agricultural activities, which have been impacted by recurring droughts, leading to increased debt. The villagers' present well-being necessitates adaptation to the prevailing circumstances. The establishment of a permanent checkpoint has raised the profile of Phu Doo, and the villagers take pride in the area being prioritized for development by the government and the province, which contributes to their well-being.

The results of the study according to the research objective 2 to create a network innovation mechanism to enhance the spatial potential of border economic cities with a Quadruple Helix model the research results found that. As shown in Figure 3, 4:

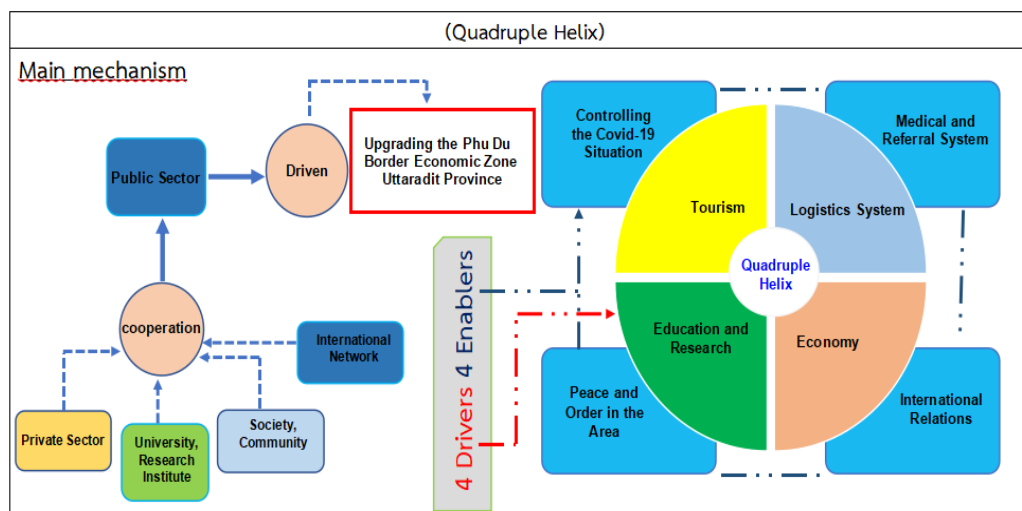


Figure 3 The primary mechanisms

From the figure 3, the primary mechanisms to enhance the spatial potential of border economic cities with the Quadruple Helix model with the network innovation group by synthesizing data under the spatial potential to create a mechanism according to the Quadruple Helix concept framework under the context of the area from the network innovation group to create 4 driver are tourism, logistics, economy, and research. At the same time, the 4 enablers issues are controlling the Covid-19 situation, medicine and referral systems, international relations, and peace and order in the area.

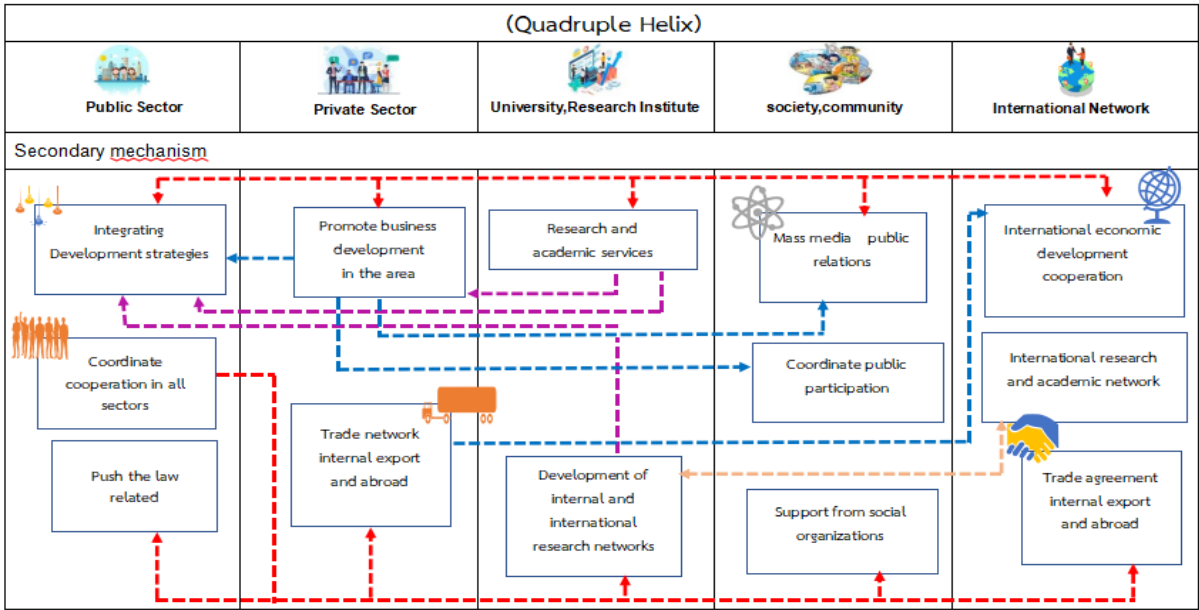


Figure 4 The secondary mechanism

From the figure 4, the secondary mechanism is the role of the network innovation group in developing the economic zone of the border economic city with the Quadruple Helix model cooperation, where each network partner can link their missions together under the same goal. This is because creating a systematic management mechanism will reduce planning errors and create a clear cooperation process consistent with the concept of Sirirurg Songsivilai (2018) The structure and mechanism for driving the national research and innovation strategy to drive the country's research and innovation strategy, effective management is crucial. This involves organizing the research and innovation system's structure and outlining clear roles, responsibilities, and management mechanisms. By ensuring that the structure and mechanisms are appropriately organized and involving all relevant sectors in the process, the country can create research and innovation within a reasonable timeframe.

The results of the study according to the research objective no.3, guidelines for driving the elevation of the spatial potential of border economic cities with network innovation. The conclusion from the study is to raise the spatial potential of border economic cities according to the concept of the Quadruple Helix model, 4 driver, 4 enablers. According to Table 1 as follows.

Table 1 4 Driver

4 Driver	
D1: Travel	Creating a Green Route Map to develop check-in points along the border economic zone
	Connecting travel infrastructure and utilities to support all tourist groups comprehensively
	Unlocking forest reserve areas to create tourism development benefits in the form of a green tourism economy
	Negotiation of the establishment of international forward-looking tourism cooperation towards tourism goals
D2: Economy	New Grotwh City
	Establishment of an international agreement on the establishment of a border trade market and the transportation of goods THA: LAO

	Analysis of spatial potential suitable for alternative agricultural career development and creative agriculture
	Expanding distribution centers to reach international exports
	Unlocking the agricultural land of the people to create benefits and jobs for the people in the area
D3: Logistics system	Developing the potential of highway routes and secondary routes connecting border economic zones
	Drive the development plan for rail transport to connect transport and distribute goods along the border economic zone to third countries.

Table 2 4 Enablers

4 Enablers	
E1: Covid-19 Situation control	Lessons learned from the Covid-19 pandemic situation to develop a plan for measures to control and monitor outbreaks of infectious diseases and emerging diseases.
	Empowering local administrative organizations in the area to assess the situation and create guidelines for prevention and control of areas in the community.
	Promoting the development of wisdom therapy to prevent and relieve initial symptoms of epidemics.
E2: International Relations	Coordinating activities to strengthen international relations by establishing a permanent network of representatives in the form of Intergovernmental Relation-IGR.
	Opening of the Thai-Laos border gate festival on various occasions.
	Personnel exchange in the form of border diplomacy to communicate and build relations between states.
E3: Medical and referral systems	Establishment of an international agreement on cooperation in promoting medical tourism and referrals
	Providing modern medical equipment to primary healthcare facilities to support urgent and emergency referral systems
E4: Peace and order in the area	Establishing international agreements to maintain peace and order
	Creating a community charter to promote peace and order in the area

Guideline to drive the elevation of spatial potential under 4 driver issues: tourism, logistics system, research and education, and economy) 4 enablers issues: controlling the COVID-19 situation, medicine and referrals, international relations, and peace This is because creating a development guideline for border economic zones that is in line with the context of the area will truly create benefits for people and the area, in line with the concept of Natthanaporn Ekanarachindawat to study approaches to development and management practices of Mukdahan Special Economic Zone (Tangpanitanon, 2020). It was found that the development project is in line with economic growth and the special economic zone to develop cultural tourism attractions to attract tourists to visit the province and create cooperation with the private sector to attract investment and create employment within the province.

Criticizing the study results to study policy alternatives to set policy proposals to enhance the potential of border economic cities in objective 4. The research results were criticized by experts in policy proposals for developing border economic areas using the connoisseurship

technique. The research results found that the research results were feasible for development according to Table 3 as follows.

Table 3 Criticized by experts

	Micro	Macro
D1: Travel	Creating a Green Route Map to develop check-in points along the border economic zone	Unlocking forest reserve areas to create tourism development benefits in the form of a green tourism economy
D2: Economy	New Growth City To create growth in the area to support development	Establishment of an international agreement on the establishment of a border trade market and the transportation of goods THA: LAO
D3: Logistics system	Organizing international public transport systems	Driving the development plan for rail transport to connect transport and distribute goods along the border economic zone to third countries
D4: Education and research	Research and development to drive the local economic development and educational management in the form of international exchange of educational personnel and academic administration	Comparative study of international public policies to develop a strategy for international economic development connectivity
E1: Covid-19 situation control	Lessons learned from the Covid-19 pandemic situation to develop a plan for measures to control and monitor epidemics and emerging diseases.	Establishment of international epidemic control, communication and surveillance agreements
E2: International Relations	Coordination of relations activities by establishing a permanent network representative group in the form of Intergovernmental Relation-IGR.	Establishing international agreements on trade, investment and international security
E3: Medical and referral systems	Providing modern medical equipment to remote primary healthcare facilities to support urgent and emergency referral systems	Establishment of an international agreement on cooperation in promoting medical tourism and referrals
E4: Peace and order in the area	Creating a community charter to promote peace and order in the area	Establishing international agreements to maintain peace and order

However, the approach to implementation should take into account the potential and readiness of the area, and the urgent practices that can be implemented so that people in the area will benefit soon should be implemented at the provincial level first. As for the practices that are beyond the potential for implementation at the provincial level, the research findings should be presented to those involved in driving the policy at the macro level. Consistent with the concept of Chainan & Cadchumsang (2017). said that in the context of regional

development, investment in economics, industry, trade, exchange, cross-border travel/movement, including border tourism are important processes and the foundation of "border economy". Therefore, it is considered extremely important to consider and study the issues related to these activities in the area.

Conclusions and Recommendations

The author conducted the research according to the research methodology process to obtain the results of the study in each objective to link the data to support the process in the next objective. Starting with the analysis of spatial potential to provide information to the target group in creating a network innovation mechanism to enhance the potential of the city's economic border area to develop with the Quadruple Helix model, which is the primary mechanism as a framework for drivers and enablers the elevation of spatial potential to be consistent with the context of the border economic city and the secondary mechanism to determine the role of network innovation cooperation in understanding the role of development according to the goals and missions of the network innovation organization to create a guideline for driving the approach to drive the elevation of the spatial potential of the border economic city with network innovation. The research results have been criticized by experts to adjust according to the experts' suggestions. They have been presented as policy proposals to provincial government agencies to be used as information to support the preparation of the provincial strategic plan. In addition, the suggestions beyond the potential of implementation at the provincial level have been presented by researchers to local politicians to be used as information for further development at the macro level.

The researchers presented the research results at the meeting of the Joint Public and Private Sector Committee to Solve Economic Problems at the provincial level to present the research results as policy recommendations to support the preparation of the Uttaradit Provincial Strategic Plan and the meeting of the Joint Public and Private Sector Committee to Solve Economic Problems, Lower Northern Provinces Group 1 to provide information to support economic development at the lower northern level and to present the research results to local politicians to use as information to drive the development of border economic zones in the area at the macro level.

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Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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