DEFINING CHARACTERISTICS OF VIETNAM'S INLAND LOGISTICS NODE SYSTEM: INSIGHTS FROM A STATISTICAL ANALYSIS

XÁC ĐỊNH CÁC YẾU TỐ ĐẶC TRƯNG CỦA HỆ THỐNG NÚT LOGISTICS NỘI ĐỊA Ở VIỆT NAM THÔNG QUA PHÂN TÍCH THỐNG KÊ MÔ TẢ

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Abstract

This research aims to examine the system of inland logistics nodes in Vietnam in view of the relationship and integration between inland logistics nodes and main seaports, as well as the transport legs connecting those terminals. The inland logistics nodes defined in this study include dry ports, ICDs, logistics centers and rail/inland waterway terminals existing in the country. We first determined the major charateristics of inland logistics nodes based on the desk research of literature review. Then data of Vietnamese inland logistics nodes are collected from secondary sources and own calculations before a statistical descriptive analysis was carried out to provide insights of the inland node system. The discussion of the current status and development direction of Vietnamese inland logistics nodes are followed accordingly.

Keywords: *Inland terminal, Vietnam, statistics, dry port, ICD, logistics center*.

Tóm tắt

Nghiên cứu này nhằm đánh giá hệ thống các điểm nút logistics nội địa chính ở Việt Nam trong mỗi quan hệ và tích hợp giữa các điểm nút này với cảng biển và kết nối giao thông giữa các điểm nút này. Bài báo tập trung vào các ICD và trung tâm logistics của đất nước có kết nối với cảng biển. Đầu tiên chúng tôi xác định các yếu tố đặc trưng của các điểm nút logistics nội địa thông qua nghiên cứu cơ sở lý luận. Sau đó chúng tôi thu thập và tính toán các số liệu của các điểm nút logistics nội địa Việt Nam ứng với các yếu tố đặc trưng đó trước khi tiến hành phân tích mô tả để đưa ra những cái nhìn sâu về hệ thống này. Sau đó nghiên cứu thảo luận, nhận định về tình hình thực trạng về hệ thống các nút logistics nội địa ở Việt Nam.

Từ khóa: *Bến nội địa, Việt Nam, thống kê, cảng cạn, ICD, trung tâm logistics.*

1. Introduction

According to Roso et al. [1], the target of transportation system is the movement of cargoes from the original point to the destination through a network of nodes and links. Whereas the links might include a combination of various transportation modes such as waterway, motorway, railway and airway, the nodes are places for packaging, handling, storage or other value-added activities. As a result of containerization and improvement of technology, the volume of seaborne trade has risen significantly. Consequently, the role of transport nodes, i.e. seaports and inland terminals, are also changed to meet the requirement of higher integration level to hinterland. Similarly, the concept of port regionalization discusses the integration of gateway ports to inland nodes through corridors indicated to form local handling centers [2]. The appearance of inland ports is therefore considered as an indispensable consequence of containerization trend and the increase of integration between seaports and inland networks. In the supply chain, the inland logistics nodes might work as inland centers to enhance the movement of shipments or be exented to seaports to solve the limit of capacity, natural limits or problems arising from bigger business scale as congestion or environmental issues.

The reseaches of inland nodes have been increasing significantly in the past twenty years as a critical way to reduce the total logistics cost [3]. However, there is a wide diversity in the conceptualization and application of inland node set up in different countries [4]. Such diversification requires a close look and specific evaluation on each context. In Vietnam, inland node system are discussed in logistics reports of public and private organizations, but these are mere description of the existing network. There is a need of evaluating Vietnamese inland node system in a systemactic way using quantitative

approach. Our research objective aims to examining and identifying such system using a statistical descriptive approach. The sub research questions include (1) which characteristics should be used to define an inland node and (2) how the characteristics of Vietnam inland nodes are.

By reviewing and synthesizing the recent literature of inland nodes, we point out the main characteristics for identifying an inland node system. We then collect the data of such characteristics of inland node system in Vietnam, mainly from secondary sources. Afterward, current situation of Vietnam's inland logistics nodes will be statistically examined in order to reveal general characteristics of the system. The research outcome should interest stakeholders in the industry, such as central and local government, maritime parties, inland transport and logistics companies by providing the insight of the current system for their strategic decision.

The structure of the paper consists of five sections as follows. After the introduction, the paper reviews the theoretical backgrounds on inland logistics nodes, including their concept, classification and characteristics. We then explain the methodological approach and data collection. Afterward, a statistical descriptive analysis was carried out to provide insights of the inland node system. The discussion of the current status and development direction of Vietnamese inland logistics nodes are followed accordingly.

2. Literature review

2.1. Concepts of inland logistics nodes

There are diversified facilities are set up as inland logistics nodes, including inland container depots (ICDs), dry port, logistics centers, freight village and inland terminals. ICD or dry port is an inland intermodal terminal connected directly to seaports to offer services of leaving or picking containers as if in seaports to customers. The main functions of an ICD are cargo handling, empty container services and customs clearance. Logistics centers are defined as multimodal terminals where shipments are transferred between different transport modes to serve local, national or international markets [5]. Typical functions of logistics centers include transportation, cargo handling, storage, sorting and labeling. According to Langevin & Riopel [6], a logistics center is a node of logistics networks, playing an important role in the flow of shipment to provide logistics services such as distribution, cargo processing, storage and consolidation. They emphasized that the major difference between a logistics center and warehouse is in the volume of storage; in a logistics center, the volume of storage should be limited or even eliminated and the logistics center should have capabilities to serve the movement of shipments. The most popular and widely accepted definition of logistics center was provided by the European Association of Freight Villages and Logistics Center. Such center is defined as an identifined area within which all activities relating to the transport, logistics and distribution of goods, both for national and international transit, are carried out by various operators on a commercial basis [7]. Inland terminals may refer to facilities where cargo is received or dispatched on various modes of transport. They can be inland waterway terminal, railway station, airport or intermodal freight centers. Finally, the advance dry port concept refers to (1) large scale inland terminals with (2) dedicated and high capacity connection to seaports and (3) integrate with wide range of logistics activities [8].

2.2. Characteristics of inland logistics nodes

General characteristics of inland logistics nodes are well discussed in the literature of Nguyen and Notteboom [8], Roso and Lumsden [1], Notteboom et al. [4], Notteboom and Rodrigue [9] and UNESCAP [10]. First, an inland logistics node should be defined by its role in the domestic logistics system, i.e. satellite terminal or load centers or transloading center. Satellite terminals are ones located in the proximity of seaports and work as seaports' extensions. Load centers are situatated near the inland market, i.e. export or import base, to consolidate and deconsolidate the cargo flow. Transloading ones are in the middle between seaports and market to transload cargo between two transport systems (for example, rail to rail).

The second main characteristic of inland nodes is the scale or capacity. Larger scale inland nodes are likely to handle higher traffic from/to seaports [8]. Third, as large scale inland nodes are likely to connect to seaport, we should draw attention to the dominant seaport where the majority of cargo of such inland nodes come from/to. Also, the transport leg to seaports is the crucial factors that influences the inland logistics node's performance. According to [1] and [11], such transport leg should be dedicated for the fast, reliable and high capacity connection

between inland logistics nodes and seaports, preferred by rail or inland waterway. For example, in the US there exist a high speed and double stack train connecting inland nodes and seaports in East and West coasts [12]. In European, such connections are carried out by inland waterway to connect inland ports and seaports [9]. Such characteristics could be accessed by the distance to the nearest seaports, modes of connection, capacity and reliability of those transportation modes. Finally, we consider other factors such as geographical location, specific local issues, years of operation which might be used for the evaluation.

3. Methodology and analysis framework

The process employed to perform the research is as follow: firstly, research on theoretical background to point out important characteristics impacting effectiveness of the inland logistics system, secondly, collecting statistical data of those characteristics from both updated reports and interviews with experts working in seaports, ICDs and logistics enterprises and lastly, applying descriptive statistics methodology to analyze the given charateristics for comprehensive understanding on Vietnam inland logistics system.

As synthesized in the literature of inland nodes, the analysis framework for evaluating inland nodes in Vietnam including three main charactertistics, i.e. the role in the port-hinterland system, the size of inland nodes and the connection between inland nodes and seaports (Figure 1).The descriptive analysis of inland logistics nodes in Vietnam is performed based on secondary information and data.

As the data on inland logistics nodes are not abundantly available in Vietnam, they are collected from various sources, i.e. literature [11, 13-16], own calculation (using Google Earth and Google Map) and these inland logistics nodes' webpages. Among these, the area of inland logistics nodes is the actual geographical area in use calculated in hectares. The connecting transport mode is about whether an inland logistics node has rail or inland waterway (IWT) connectivity with any seaports other than road. The distance between inland logistics nodes and seaports is estimated by the shortest distance from these nodes to the dominant seaport by road using Google Map. In addition, the role of inland logistics nodes in the port-hinterland setting (i.e. satellite terminals, load centers and transmodal terminals) is obtained by analyzing each dry port's situation. The dataset of inland logistics nodes is also classified by their geographical location, i.e. North, Central and South, and the type of logistical nodes, i.e. ICD (Table 1), logistics center (Table 2) and collocation of these nodes.

4. Defining characteristics of Vietnam's inland logistics nodes

The inland node system of Vietnam includes ICDs, logistics centers, depot, inland transport terminal. In this study, we focus on examining the ICD system and logistics center sytem as in Vietnam as they are the significant scale facility with connection to seaports. Depot, rail terminals or inland waterway terminals are integrated into these ICDs and centers. We found that in Vietnam, there are two large scale inland nodes that are close to the advanced dry port concept as discussed later.

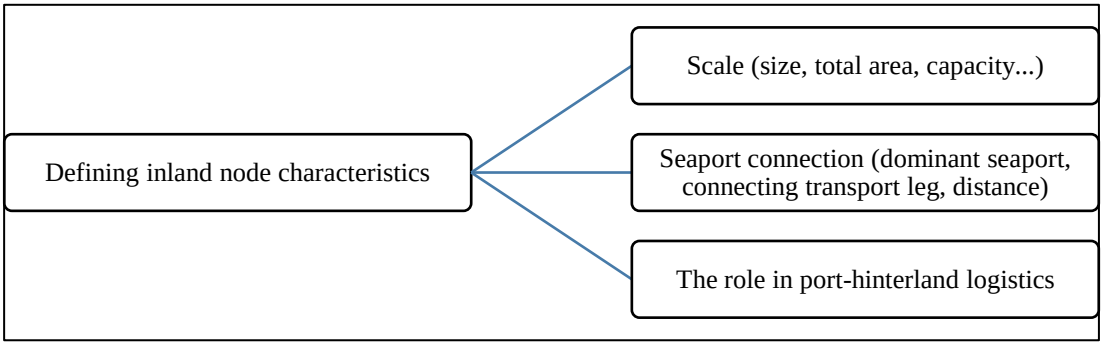

Figure 1. The main characteristics group of inland nodes

Table 1. The list of ICDs in Northern and Southern Vietnam

ICD name	Location (city/ province)	Area (hectares)	Connecting modes	Dominant seaport	Distan-ce to seaport (km)	Role
Northern Vietnam						
Gia Thuy	Hanoi	1	Road	Hai Phong	120	Load center
My Dinh	Hanoi	5.2	Road	Hai Phong	135	Load center
Tien Son	Bac Ninh	10	Road	Hai Phong	130	Load center
Hai Duong	Hai Duong	10	Road	Hai Phong	44	Load center
Thuy Van	Hanoi	2.1	Road	Hai Phong	120	Load center
Lao Cai	Lao Cai	4.5	Road & Rail	Hai Phong	418	Load center /trans modal
Hoa Xa	Nam Dinh	5.6	Road	Hai Phong	95	Load center
New Port Hai Phong	Hai Phong	29.5	Road	Hai Phong	12	satellite
Phuc Loc	Ninh Binh	34.5	Road	Hai Phong	142	Load center
Hai Linh	Phu Tho	13.5	Road & IWT	Hai Phong	188	Load center
Mong Cai	Quang Ninh	40	Road	Cai Lan/ Hai Phong	201	Trans-modal
Quang Binh Dinh Vu	Hai Phong	10	Road	Hai Phong	12	Load center
Southern Vietnam						
Phuoc Long	Ho Chi Minh	12	Road & IWT	Cat Lai/ Cai Mep	10.9	Satellite
Transimex	Ho Chi Minh	9.4	Road & IWT	Cat Lai/ Cai Mep	11.3	Satellite
Sotrans	Ho Chi Minh	10	Road & IWT	Cat Lai/ Cai Mep	10	Satellite
Tanamexco - Tay Nam	Ho Chi Minh	12.5	Road & IWT	Cat Lai/ Cai Mep	11.4	Satellite
ICD Phuc Long	Ho Chi Minh	10	Road & IWT	Cat Lai/ Cai Mep	12	Satellite
Tan Tao	Ho Chi Minh	6.4	Road	Cat Lai/ Cai Mep	30	Load center
Tan Cang - Long Binh	Dong Nai	105	Road	Cat Lai/ Cai Mep	31.9	Load center
Dong Nai	Dong Nai	18	Road	Cat Lai/ Cai Mep	34.2	Load center
Bien Hoa	Dong Nai	18	Road	Cat Lai/ Cai Mep	24.3	Load center
Tan Cang - Nhon Trach	Dong Nai	11.1	Road & IWT	Cat Lai/ Cai Mep	6.7	Satellite
Tan Cang - Song Than	Binh Duong	50	Road & Rail	Cat Lai/ Cai Mep	22.9	Load center
TBS Tan Van	Binh Duong	22	Road & IWT	Cat Lai/ Cai Mep	22.8	Load center

Source: Authors' compilation from ICDs' homepages and various Internet sources.

4.1. The ICD system

The ICD system in Vietnam is different between the North and the South, while in the Central there is currently no ICD. In the North of Vietnam, there are 11 ICDs, which could be classified into two groups. Group 1 includes old ICDs, built more than 10 years ago, consist of Gia Thuy ICD, My Dinh ICD, Tien Son ICD, Hai Duong ICD, Thuy Van ICD and My Dinh ICD. These are small ICDs with less than 10 hectares area each and low throughput capacity. Group 2 includes new ICDs which were built since 2015, i.e. Phuc Loc ICD, Mong Cai ICD, Hai Linh ICD and ICD New Port Hai Phong. These are larger ICDs with average area of more than 30 hectares. The total annual throughput of ICDs in the North is around 50,000 TEUs, which accounts for only 0.2% of the seaports' throughput.

In the North, most ICDs are inland load centers, serving industrial zones or consumption areas. The average distance to the main sea port of these terminals is 157 km, ranging from 44 km to 418 km. Among the others, only New Port Hai Phong ICD is the satellite terminal, located 12 kms away from the dominant seaport. Besides, there are two load center ICDs also functioning as transmodal terminals, i.e. Mong Cai and Lao Cai, to facilitate the movements of cargo between China and Vietnam. In terms of connectivity, most ICDs are unimodal with only road connection. Lao Cai ICD is the only one which connects to seaports through a railway system, but the capacity of the linking train is limited at around 20 containers per day [16]. Besides, Hai Linh ICD is the only terminal in the North having inland waterway access.

In contrast to Northern ICDs where road transport connecting to and from them is dominant, the ICDs in Southern Vietnam are more developed with the standout role of inland waterway connectivity. Seven out of 12 ICDs there are satellite terminals which are located around 10 kms from the dominant seaports. All of them have connection to seaports using the combination of road and inland waterway. These ICDs are small in scale with the area of around 10 hectares, functioning as extended gates of seaports. This is the result of the limited capacity issue that seaports in the South are facing. As these seaports have no space for expansion, empty containers are transported from/to seaports to such ICDs via inland waterway for storage and other services, such as container cleaning, repair or maintenance. ICDs as load centers in the South, in contrast, are located further in the hinterland, about 30 kms from the seaport. They are situated in the proximity of the economic zones in Binh Duong and Dong Nai provinces and Ho Chi Minh City. The size of such ICDs varies from 6.4 to hundreds of hectares. There exist two large load centers, i.e. Tan Cang Song Than and Tan Cang, functioning also as logistics centers. Most of inland load centers in the South are unimodal, connecting to seaports by road. TBS Tan Van ICD is the only inland node that has inland waterway connection with seaports.

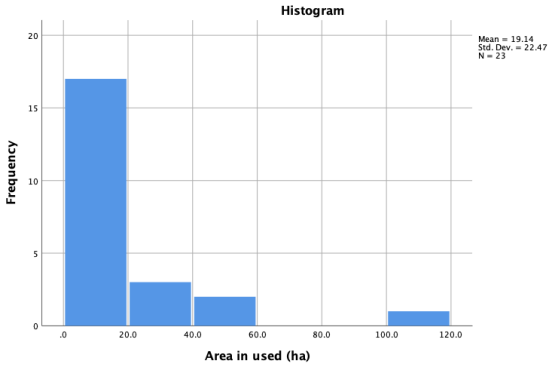

Figure 2. Scale of ICDs in Vietnam

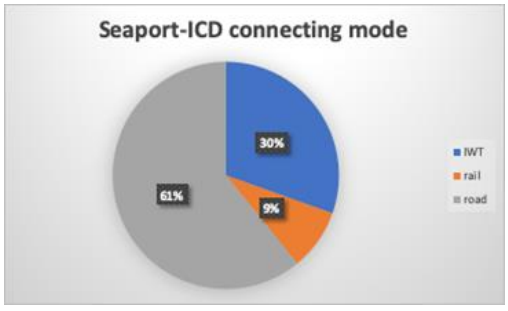

Figure 3. The modal split of inland nodes-seaports connection

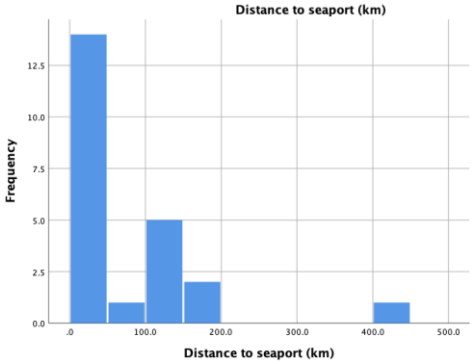

Figure 4. Distance to seaports

In terms of the role of ICDs in the chain between seaports and hinterland: from the Table 1, 66% of current ICDs play as Load center, whereas 26% and 9% of those are Satellite terminal and Transmodal, respectively. The scale distribution of Vietnam ICDs is presented in the Figure 2, showing that most of ICDs are quite small (less than 20 ha) and there are few large scale ICDs (larger than 100 ha). With regards of connectivity to seaports, the Figure 3 shows that the movement of shipment between ICDs and seaports over relies on road transport. The connection using inland waterway is significant while railway uses are very little. The figure 4 exlore the fact that the distance between seaports and ICDs is quite short as 61% of ICDs is less than 50 km far from the nearest seaports. Almost ICDs is less than 200 km far from seaports except only one case of Lao Cai ICD.

4.2. The system of logistics centers

In Vietnam, logistics centers are apparently all load centers. They are mostly concentrated in national economic centers in parallel with the development of production, distribution and big-scale consumer markets. They are performing various activities in distribution centers such as cargo receipt, storage, preparation and delivery serving customers' orders. Other services which are offered to customers include transportation, cross-docking, labeling, packing and packaging, order processing, shipping and receiving. Key features of major logistics centers in Vietnam are summarized in **Table 2**.

All these logistics centers are located closely to industrial zones and work as load center for such zones. However, their connection to seaports is mostly relied on road transport. The common size of these logistics centers is also small with many of those being smaller than 10 hectares or even one or two hectares. The biggest one is the Geodis Wilson Cat Lai Logistics Center which is located on a total area of 250 hectares. The range of services offered by Vietnamese logistics centers is also limited, especially value-added logistics services. In fact, many logistics centers play the role as ICDs with some extension of services. They mainly support business activities of companies, especially foreign companies rather than a specific industry or an economic region. These

Table 2. Major logistics centers in Northern and Southern Vietnam

Name	Location (city/ province)	Area (hectares)	Connecting mode	Dominant seaport	Distance to seaport (km)	Role
Northern Vietnam						
Green Dinh Vu	Hai Phong	7.6	Road	Hai Phong	1	Load center
Dam Co	Haiphong	1.1	Road	Haiphong	1	Load center
Cai Lan VOSA	Quang Ninh	2	Road	Cai Lan	1	Load center
Kim Thanh	Lao Cai	5.7	Road	Hai Phong	416	Load center
Tien Son	Bac Ninh	10	Road	Hai Phong	130	Load center
Central Vietnam						
Kerry Logistics	Da Nang	1	Road	Da Nang	14	Load center
Southern Vietnam						
ICD Tan Cang - Long Binh	Dong Nai	105	Road	Cat lai	30	Load center
ICD Tan Cang Song Than	Binh Duong	50	Road	Cat Lai	24	Load center
Gemadept (No1 & 2 DC)	Binh Duong	3	Road	Cat Lai	24	Load center
TBS Logistics Center	Binh Duong	13.5	Road	Cat Lai	23	Load center
Dam Co	Binh Duong	3.7	Road	Cat Lai	23	Load center
Transimex	Binh Duong	1.8	Road	Cat Lai	21	Load center
ITL	Binh Duong	5	Road	Cat Lai	17	Load center
Geodis Wilson	HCM	250	Road	Cat Lai	20	Load center
Schenker Gemadept	Binh Duong	1	Road	Cat lai	23	Load center
Uniliver Vietnam	Binh Duong	10	Road	Cat Lai	25	

Source: Authors' compilation from logistics centers' homepages and various Internet sources.

logistics centers are still not integrated to form an efficient logistics system for the country. They are currently controlled by companies providing services of logistics centers with very limited collaboration and coordination with general policies or economic plans of local provinces.

4.3. The emergence of advanced dry ports

According to inland node literature [1, 11], an advanced inland logistics node, called dry port, should be (i) an intermodal terminal with (ii) strong connection to seaports and (iii) integrated or collocated with logistics service area. In Vietnam, most inland logistics nodes are small-scaled and only have one or two parameters of those. However, there appears a few inland logistics nodes that integrate ICD and logistics center functions in the same location, for example, the cases of ICD Tan Cang Song Than and ICD Tan Cang Long Binh. They are both subsidiaries of Sai Gon New Port Corporation, the biggest container terminal operator in Vietnam. The company provides a wide range of services, including terminal operation, cargo handling, logistics and other maritime services. Both ICDs are located in the proximity of industrial zones to facilitate the movement of export/import cargo to/from seaports, with the priority of Tan Cang Cat Lai Port and other subsidiaries of the company. Apart from the ICD functions, i.e. terminal services, container services and customs clearance, Tan Cang Song Than and Tan Cang Long Binh have a vast area of warehouses to offer a wide range of logistics services, such as distribution and other value-added services, such as packaging or labelling. Specifically, Tan Cang Song Than ICD has 22 hectares of warehouse for distribution center, bonded warehouse, domestic warehouse and CFS and 10 hectares of container yard. Similarly, Tan Cang Long Binh ICD has 50 hectares of warehouses and 5.6-hectare area for container yard. However, both ICDs does not have multimodal connection to seaports as they rely on road connection to move cargo from/to the sea.

They are parts of Tan Cang Corporation's ecosystem including seaports, domestic transportation and shipping to offer door-to-door services to customers. However, compared with advanced integrated inland terminals in developed countries, number of issues in those Vietnam's terminals should be improved. The key relies on a specific transport infrastructure system connecting seaports to those ICDs. It is a prerequisite condition to enhance efficiency of logistics system. The connection should be performed by railway or inland waterway due to high capacity and reliability

5. Conclusion and discussion

This research aims to examine the system of inland logistics nodes in Vietnam with the inclusion of the relationship and integration between inland logistics nodes and main seaports. The study first determined the major charateristics of inland logistics nodes based on the desk research of literature review. Then data of Vietnamese inland logistics nodes are collected before a statistical descriptive analysis was carried out to provide insights of the inland node system.

We found that despite of the large number and long-developed history, the inland logistics nodes are under developed and lagging behind the full advance concept of dry ports with international importance. These nodes are small in scale and over reliance on road transport in connection with seaports. The distances between load centers and seaports are quite short which reduce their competitiveness with the direct transport by road between end customers and seaports. The role of Vietnamese inland logistics nodes therefore is insignificant in assisting and relieving seaports. That comes from a number of reasons as follows. The first reason is the separation of ICDs and logistics center development. In developed, system such inland terminals should be co-located with logistics sites to complement for each other and utilise the economies of scale. Second, the transport infrastructure of rail is insubstantial while inland waterway development is limited in the South. Third, there is a lack of macro planning in developing inland nodes in correspondance with seaports and economic zone developments. However, there is an emergence o a few large scale ICDs which integrate the logistics sites. These are the efforts of a mega player from private sector, which is promising to grow as the lead player in the logistics sector of domestic market.

This research outcome contributes to the literature of inland logistics nodes by examining a specific case study in Vietnam. This could be used as reference for further studies of Vietnam inland node system planning and development. Stakholders from the

industry, such as maritime parties, inland transport and logistics companies could also gain insights from the study for their strategic decisions.

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