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LOGISTICS ACTIVITIES AND LOGISTICS PERFORMANCE OF THAI EXPORTERS EXPORTING CUT ORCHID FLOWERS TO VIETNAM

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ABSTRACT

The objectives of the study are to examine the logistics activities of Thai cut flower orchid exporters to Vietnam and evaluate their logistics performance across nine logistical operations in three dimensions: cost, time, and reliability. Identifying issues in improving the logistics efficiency of exporters is the key to gaining a competitive edge in exporting. Thai orchid exporters to Vietnam were interviewed in Bangkok, Nakhon Pathom, and Samut Sakhon provinces, Thailand's main orchid production regions, using semi-structured interviews with open-ended questions. Quantitative and logistics management data were collected using the Agricultural Logistics Performance Index (ALPI), which evaluated nine logistics activities in three dimensions. Qualitative data were obtained from conceptual framework inquiries.

Inductive analysis was used to study qualitative data, whereas percentages and averages were used to analyse quantitative data. According to the report, exporters performed six logistics tasks but ignored demand forecasting. Furthermore, site selection, warehousing and storage, and reverse logistics were absent. Exporter logistics performance averaged 94.98, with purchasing and procurement performing best at 98.05. Transportation, with an average performance of 90.84, needed the most optimisation. Exporters had the highest logistical reliability at 99.14, followed by cost and time.

Keywords: Export, cut orchid flowers, logistics activity, logistic performance, ALPI.

INTRODUCTION

Thailand has an ideal climate and water supply for orchid production. Farmers have excellent production skills and use generational expertise to develop orchid varieties. Orchid cultivation technology has improved, producing high-quality products. Thai orchids are known for their brilliant hues due to breeding and breed development. The variety of strong and unique breeds boosts their appeal. Experience in exportation and government assistance for agricultural networks benefit exporters. With a strong commitment to orchid cultivation and development, the government implements systematic agricultural product management and improves agricultural gross product through effective agriculture and cooperative management. These activities aim to stabilise farmers' incomes and agricultural pursuits (Office of Agricultural Economics, 2022).

The Office of Agricultural Economics reported that Thailand has a total orchid cultivation area of 17,981 rai, yielding a national production of 35,513 tons and involving 1,508 orchid farmer households. The primary orchid production hub is in the central region, attributed to its favourable climate, ample water resources, and superior transportation infrastructure. This region encompasses approximately 17,981 rai of land and contributes the highest production volume, accounting for approximately 35,308 tons, and involves 1,508 agricultural households. Conversely, there is limited information regarding orchid cultivation in the northern and southern regions, suggesting minimal or no activity in these areas (Office of Agricultural Economics, 2022).

In the central region, key provinces for orchid production include Nakhon Pathom Province (7,485 rai)[1], Samut Sakhon (4,479 rai), Bangkok (1,713 rai), Ratchaburi (1,356 rai), and Kanchanaburi (1,059 rai) (Office of Agricultural Economics, 2022).

The Ministry of Agriculture and Cooperatives acknowledged Thailand's capacity for orchid production and recognised an opportunity to bolster the country's income through promoting orchid cultivation. Consequently, in 2001, orchids were officially recognised as crucial economic crops, with the designation of product champion. This designation was accompanied by a policy aimed at accelerating production and addressing sustainable production challenges, with the overarching goal of establishing Thailand as a global hub for tropical orchid production. Additionally, efforts were made to stimulate domestic orchid production for both domestic sales and export purposes (Ritkarop, 2017). Thailand embarked on orchid exports to Western European markets, including the Federal Republic of Germany, the Netherlands, and Italy, as early as 1966. Over time, the market expanded to encompass Japan, Canada, the United States, and other countries. Subsequently, Thailand further extended its export reach to ASEAN markets such as Vietnam, Singapore, Malaysia, Indonesia, Brunei, Cambodia, and the Lao People's Democratic Republic (Nimngen, 2016).

The value of Thai orchid exports was at least USD 80 million from 2017 until 2020, when the COVID-19 outbreak occurred. As a result, the export volume decreased to USD 56.33 million with a negative export expansion rate of -34.15 per cent, marking the lowest figure in history (Department of International Trade Promotion, Ministry of Commerce, 2023). This decline was particularly notable in exports to key markets such as China, the United States, Japan, and Europe. Exporters were confronted with financial liquidity challenges due to decreased international orders, coupled with ongoing fixed costs and inventory expenses that did not generate income. Consequently, the volume of orchid production surpassed the demand for sales, further exacerbated by customers requesting deferred payments, exacerbating financial strain. Human resource management and wage concerns emerged as well, with increased employee unemployment resulting from decreased workloads due to diminished orders.

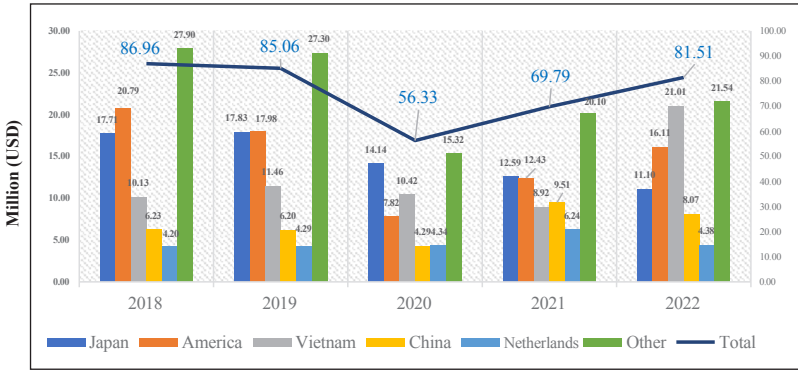
[1] The "rai" is the unit of measurement for land area in Thailand. The following conversions to hectares (ha) and acres apply: 1 rai = 0.16 ha, 1 ha = 6.25 rai, 1 rai = 0.395 acres and 1 acre = 2.53 rai.

Additionally, transportation was impacted by rising costs stemming from container shortages and port closures, leading to challenges in container reservation and increased storage expenses. Delays in product transportation and inspection processes, exacerbated by disease prevention measures necessitating screenings, extended transportation times from 4–5 days to 12–14 days, ultimately compromising the quality of orchid flowers upon reaching consumers (Lohawattanakul et al., 2022). Although the orchid industry in Thailand was affected, collaborative efforts between the government, private sector, and farmers were instrumental in seeking alternative markets within ASEAN countries, such as Vietnam and Myanmar, to bolster export values (Bureau of Agricultural Economic Research, 2021). This concerted effort is reflected in the increased value of orchid exports, which surged to USD 69.79 million (expanding by 23.87 %) as the epidemic situation began to improve in 2021. Furthermore, in 2022, as the epidemic subsided further, the total value of orchid exports increased to USD 81.51 million, with an expansion rate of 16.8 per cent (Department of International Trade Promotion, Ministry of Commerce, 2022).

The Department of International Trade Promotion's Orchid Situation Report for 2022 reveals that Thailand accounts for 55 per cent of the total orchid production and achieved an export value of USD 82.51 million in 2022. The primary export markets include Vietnam (USD 21.01 million), the United States (USD 16.11 million), Japan (USD 11.10 million), China (USD 8.07 million), the Netherlands (USD 4.38 million), and other countries (USD 21.54 million). According to the export value analysis, a shift in the order of export markets is observed, with Vietnam emerging as the top export destination (with a remarkable export expansion rate of 135.29 %), surpassing the Japanese market, which dropped to third place after the United States. This shift indicates Thailand's successful expansion into new Asian markets, particularly Vietnam, with a significant increase in export value (USD 12.09 million) while maintaining export values to the Japanese market (although slightly decreased by USD 1.49 million). A comparison of these changes highlights the positive impact of market expansion in Vietnam on the overall export value expansion. Further details are provided in Figure 1.

Figure 1

Value of Thailand Orchid Export to the Top Five Countries in 2018-2022



Source: The Department of International Trade Promotion (DITP) Thailand (2022).

Table 1

Value of World Orchid Trade in 2022

Exporters	Export Value (Million USD)	Percentage	Importers	Import Value (Million USD)	Percentage
Thai	74.9	37.6	Japan	58.1	29.2
Netherlands	57.5	28.9	United States	24.7	12.4
Taiwan	34.7	17.4	Vietnam	15	7.54
Malaysia	7.47	3.75	Italy	13.6	6.86
Vietnam	7.29	3.66	China	12.4	6.23
Others	17.14	8.69	Others	75.2	37.77
Total	199	100	Total	199	100

Notes: The figures for the value of Thai exports reported by the OEC differ from those reported by the Department of International Trade Promotion. Nevertheless, it is deemed to be necessary to include both sets of data to provide a comprehensive overview of the information.

Source: OEC World, Center for Collective Learning (2023).

The list of exporting countries and the world's primary orchid importers in 2022, with an estimated orchid trade value of USD 199 million, highlights significant trends in the global orchid market. Thailand emerges as the leading exporter in terms of value, while Japan leads as the top importer. Upon closer examination, Vietnam emerges as one of the top five exporters and importers of orchids

globally. Notably, Vietnam's import value exceeds its export value by USD 7.71 million. The WTO Center and Integration of the Vietnam Federation of Trade and Industry reports that currently, although Vietnam has the capability to cultivate Dendrobium orchids, there is a necessity to import rattan orchids from Thailand, which serves as Vietnam's largest market for importing rattan orchids (Thương, 2023).

Thai orchids stand out due to their superior beauty, larger size, brighter colours, and prolonged freshness compared to those grown in Ho Chi Minh City (Xô, 2005). Notably, Thai orchids possess larger and sturdier stems. These characteristics of Thai orchids perfectly align with the preferences of Vietnamese market consumers. The tradition of purchasing orchids during the Vietnamese New Year, which typically falls at the beginning of February, for house decoration and as gifts is quite popular. Potted orchids and cut orchids arranged as wreaths for various occasions, such as congratulating the opening of a new company and decorating for the Vietnamese New Year (Tết Nguyên Đán Celebration), are particularly sought after. Among these, the rattan orchid variety holds a prominent position in the market due to its exquisite flowers available in various colours, albeit at a relatively high price. Typically, the main purchasers of orchids are hotels, restaurants, companies, and individuals with middle to high incomes (Thanh Son, 2023). Vietnamese consumers boast high purchasing power, fueled by the rapid growth of Vietnam's economy and a population of approximately 90 million people, with high-income groups accounting for around 15 per cent of the total population. This growing purchasing power is a significant driver behind the increasing demand for consumer goods, including luxury items (WTO Center, n.d.; Integration of the Vietnam Federation of Trade and Industry, 2022). The expanding rate of orchid imports from Thailand since 2017 reflects this trend.

Thailand has the potential to produce high-quality orchids to meet the demands of the Vietnamese market as well as the global market, positioning itself as the leading exporter of orchids worldwide. However, the Thai orchid industry faces significant challenges and obstacles, including issues such as salinity due to drought, pest and disease problems, inconsistent production levels in response to market demand, agricultural labour shortages, reliance on foreign workers, escalating production factor costs, rising transportation expenses, market distortions and price fluctuations caused by Chinese

merchants' interventions, as well as a lack of marketing information and understanding of logistics and supply chain management. Addressing these challenges and obstacles requires concerted efforts in development, improvement, and finding solutions, drawing upon appropriate knowledge and cooperation among all stakeholders throughout the supply chain (Department of Agricultural Extension, Ministry of Agriculture and Cooperatives, 2022). Considering the economic potential of the Vietnamese market and Thailand's production capacity, it is imperative to study the management of logistics activities among entrepreneurs exporting cut flowers to the Vietnamese market to evaluate exporters' logistics performance, encompassing the cost, time, and reliability dimensions. Identifying logistics activities requiring improvement and development, prioritising enhancements to increase logistics performance, and creating an advantage in exports are paramount. Moreover, such improvements may facilitate market expansion into other Asian markets in the future.

METHODOLOGY

In-depth interviews were conducted to determine which logistics activities orchid exporters to Vietnam should prioritise for development and improvement. Structured interviews were used to collect data from a study sample comprising four entrepreneurs engaged in orchid export to Vietnam, selected purposively from a pool of 16 exporters registered with the Department of Business and Trade. These entrepreneurs operated in the central region across three provinces considered significant farming areas, including representatives from Bangkok, Nakhon Pathom Province, and Samut Sakhon. Interview questions were crafted by the researchers based on a review of the literature and theoretical concepts related to the Agricultural Logistics Performance Indicator (ALPI) were utilised to measure the performance of these activities across three dimensions: cost, time, and reliability, totalling 27 indicators. The data were analysed using descriptive statistics, namely percentages and averages.

Indicators for Evaluating Logistics Performance

The Ministry of Agriculture and Cooperatives assigned the Office of Agricultural Economics to prepare an action plan for the development

of agricultural logistics systems for 2020–2022. This plan serves as a framework for enhancing the country's agricultural logistics. The main objective is to increase the efficiency of agricultural logistics management throughout the supply chain and promote farmer institutions as the main mechanism for managing the logistics of linked agricultural products with entrepreneurs throughout the supply chain (Department of Agricultural Extension, Ministry of Agriculture and Cooperatives, 2022). During the preparation of the plan, the Office of the Vocational Education Commission evaluated the efficiency of logistics management (Agricultural Logistics Performance Index [ALPI]) for agricultural products according to logistics activities in the supply chain. This evaluation covered nine main activities in three important dimensions: cost, time, and reliability, totalling 27 indicators. These indicators serve as criteria to measure the performance of agribusiness units throughout the supply chain and present important issues and suggestions for developing logistics systems and agricultural product supply chains.

Thammasat University Research and Consulting Institute (2013) identified tools for developing indicators to assess and evaluate the performance of logistics management across nine logistics activities, including (i) customer service and support, (ii) purchasing and procurement, (iii) logistics communication and order processing, (iv) transportation, (v) facility site selection, warehousing and storage, (vi) demand forecasting and planning, (vii) inventory management, (viii) materials handling and packaging, and (ix) reverse logistics. These were utilised to evaluate the performance in three key areas: cost, time and reliability.

Cost Index

1. The Ratio of Transportation Cost Per Sale (ALPI1C) involves comparing the annual transportation costs with the company's annual sales. These transportation costs are:
    i. Transportation department in-house expenses, such as salary, labour, overtime, car fuel, etc., also include annual car depreciation, maintenance, and other transportation department expenses.
    ii. Company costs for outsourcing cargo transportation include transporting all goods to the factory. For imports, this encompasses transportation costs from the domestic

port or airport to the factory. For exports, it solely considers shipping expenses from production to the port or airport within the country.

2. The Ratio of Warehousing Cost Per Sale (ALPI2C) compares the annual warehouse management costs to the company's annual sales. The costs of warehouse management include:
   i. Expenses related to warehouse department employees, covering salaries, labour costs, overtime expenses, fuel costs, etc.
   ii. Fixed costs associated with warehouse management, such as annual warehouse insurance expenses and annual warehouse depreciation.
   iii. Expenses for utilising external warehouse services, including rental fees, etc.

3. The Ratio of Inventory Carrying Cost Per Sale (ALPI3C) is an indicator used to evaluate the opportunity cost associated with holding goods when stored in the company's warehouse. This includes expenses such as product insurance costs, depreciation of goods during storage, and other related costs.

4. The Customer Service Cost per Sale (ALPI4C) compares annual customer service costs to corporate sales. The marketing or sales department pays customer service workers salary, overtime, after-sales services, and other support activities. Advertising and other PR costs are excluded.

5. The Procurement Cost per Sale (ALPI5C) compares the annual procurement costs to the company's annual sales. The procurement costs include:
   i. Payments for purchasing department staff, overtime, fuel, etc.
   ii. Overheads for purchasing operations, including communication, etc.

6. The Ratio of Forecasting Cost per Sale (ALPI6C) compares customer demand forecasting costs to annual sales. This metric evaluates the cost-effectiveness of projecting consumer demand by comparing the annual cost of forecasting with the company's annual sales. The cost is calculated by multiplying

the average wage of customer demand forecasters by the time it takes them to forecast.

7. The Information Processing Cost per Sale (ALPI7C) compares annual capital expenditures for communication system installation to firm sales. These costs include:
   i. Annual investment in information system software for internal communication, including various applications or software.
   ii. Annual investment expenses for establishing computers, phones, printers, faxes, etc., in the organisation.

8. The Value Damage Cost per Sale (ALPI8C) is an indicator used to evaluate the value of damaged products from the completion of the production process for storage until just before shipping.

9. The Returned Goods Cost per Sale (ALPI9C) is an indicator used to evaluate the value of goods returned by customers due to product damage or failure to meet specified standards during production.

Time Index

1. The Average Order Cycle Time (ALPI1T) is an indicator used to evaluate the time taken to respond to orders from customers, from the moment the company confirms receipt of the order from customers to the delivery of products to customers.

2. The Average Delivery Cycle Time (ALPI2T) is an indicator used to evaluate the time it takes to deliver products to customers from the moment the products are loaded onto the vehicle for transport to the customer's location until the customers receive the product.

3. The Average Inventory Day (ALPI3T) is an indicator used to evaluate the average duration that the company reserves or stores finished goods in sufficient quantity to fulfil customer needs.

4. The Procurement Cycle Time (ALPI4T) is an indicator used to evaluate the duration of purchasing raw materials or products

from the moment the company receives confirmation of the order from the manufacturer until the manufacturer delivers the raw materials or products to the company.

5. The Forecasting Period (ALPI5T) is an indicator that reflects the time most used by companies to forecast customer needs. However, this may vary depending on the nature of each company's business.

6. The Order Processing Cycle Time (ALPI6T) is an indicator used to evaluate the average time taken for the marketing department to send orders to various departments within the organisation, beginning from the moment the marketing department receives order confirmation from the customer until the orders are dispatched to different departments within the organisation.

7. The Inventory Cycle Time (ALPI7T) is an indicator used to evaluate the average duration that finished goods remain in the warehouse, starting from the moment they are stored in the warehouse until they are withdrawn from the warehouse for shipment to customers.

8. The Material Handling and Packaging Cycle Time (ALPI8T) is an indicator used to evaluate the time from receiving raw materials into the production process, through production and product packaging until the finished goods are stored in the warehouse before being dispatched to customers.

9. The Cycle Time for Customer Returns (ALPI9T) is an indicator used to evaluate the average time taken to process product returns from customers, starting from the moment the customer notifies the company of the return until the company receives the returned product.

Reliability Index

1. The Transportation DIFOT Rate (ALPI1R) is an indicator used to evaluate the ability to deliver goods to customers in complete quantity and on time as agreed upon.

2. The Forecast Accuracy Rate (ALPI2R) is an indicator used to evaluate the accuracy of forecasting customer needs by comparing the actual order quantity with the forecasted product quantity.

3. The Rate of Returned Goods (ALPI3R) is an indicator used to evaluate the proportion of products returned by customers after they have been shipped, calculated based on the total number of products delivered.

4. The Supplier In-full and On-time Rate (ALPI4R) is an indicator used to evaluate the manufacturer's ability to fulfil the company's orders as agreed upon, ensuring that products are delivered in full quantity and on time. In this case, the manufacturer refers to the company's farmers.

5. The DIFOT CS and Support (ALPI5R) is an indicator used to evaluate the company's ability to deliver products to customers in full quantity and on time as agreed.

6. The Inventory Accuracy (ALPI6R) is an indicator used to evaluate the accuracy of inventory (raw materials, goods in process, and finished goods), indicating the variance between recorded inventory quantities and the actual count.

7. The Inventory Out-of-Stock Rate (ALPI7R) is an indicator used to evaluate the frequency or number of times the company fails to deliver products to customers due to insufficient finished goods, reflecting the company's ability to manage finished goods.

8. The Order Accuracy Rate (ALPI8R) is an indicator used to evaluate the accuracy of work orders from the sales or marketing department that are sent to other relevant departments within the organisation.

9. The Damage Rate (ALPI9R) is an indicator used to evaluate the rate of damage to finished products from the time of production and storage until the products are prepared for delivery, calculated based on the number of damaged products.

Table 2

27 indicators of the Agricultural Logistics Performance Index (ALPI).

Logistics Activity	Logistic Performance		
	Cost (Percentage: Sales)	Time (Day)	Reliability (Percentage Sales)
Customer Service and Support (ALPI1)	ALPI1C	ALPI1T	ALPI2R
Purchasing and Procurement (ALPI2)	ALPI2C	ALPI2T	ALPI2R
Logistics Communication and Order Processing (ALPI3)	ALPI3C	ALPI3T	ALPI3R
Transportation (ALPI4)	ALPI4C	ALPI4T	ALPI4R
Site Selection, Warehousing and Storage (ALPI5)	ALPI5C	ALPI5T	ALPI5R
Demand Forecasting (ALPI6)	ALPI6C	ALPI6T	ALPI6R
Inventory Management (ALPI7)	ALPI7C	ALPI7T	ALPI7R
Materials Handling and Packaging (ALPI8)	ALPI8C	ALPI8T	ALPI8R
Reverse Logistics (ALPI9)	ALPI9C	ALPI9T	ALPI9R

Source: Ministry of Agricultural and Cooperatives (2018).

The results of the logistics efficiency assessment obtained from all 27 indicators reveal the exporter's overall logistics costs for all activities, ascertain the overall delivery time for products, and determine the level of ability to deliver products on time.

RESULTS

Thai orchid exports involve several "players," starting with orchid production factor wholesalers who provide orchid growers with seedlings, fertilisers, nutrients, planting supplies, chemicals to control plant diseases and insects, packing, etc. The orchids are collected according to criteria and sold to local traders, cooperatives, and collectors, who also export (Prathumpong, 2017). Orchid buyers use varied transportation techniques. Small sellers in local markets buy orchids directly from farmers by driving to their plots and selling them to local and surrounding consumers or exporters who own packing and exporting companies. Some orchids go to Bangkok's principal markets, including Si Mum Mueang, Thai, Pak Khlong Talat, and Sanam Luang 2, while others are sold to local sellers. Most are exported by road or air to importing businesses, then dispersed to wholesalers, retailers, and consumers. The partnership of input suppliers, farmers, and exporters is crucial for adding value to exports. Quality materials from affordable input providers affect product quality and reduce production risks and expenses. Strong supplier relationships boost productivity and product quality by encouraging innovation and

process improvements. Farmers who produce high-quality raw materials adapt to market demands and diversify to boost export value. Adjustability to market changes and a wide product range boost export value. Shared information, technical support, collaborative plot management, and current technology implementation boost yield and quality, distinguishing products from the competition. Exporters link manufacturers to global markets. They must be skilled at finding new markets, building product recognition, implementing successful PR and marketing strategies, managing transportation and goods, and providing excellent customer and after-sales service. They are essential to Thailand's orchid export supply chain, enabling global exports.

Logistics Activities of Orchid Exporters to Vietnam

The results of this study on the logistics activities of four companies exporting cut flowers to Vietnam were obtained from semi-structured interviews. These interviews consisted of open-ended questions created based on performance indicators from the Agricultural Logistics Performance Index (ALPI), which examines the implementation of nine main logistics activities. The findings from the interviews are summarised as follows:

Customer service and support: Exporters have expanded their communication channels to enhance customer accessibility. This includes incorporating additional contact channels such as the LINE application, Facebook page, and email, with staff providing immediate customer information services during business hours.

Purchasing and procurement: Cut flower orchids that meet standardised quality criteria are primarily sourced from orchid plots that serve as regular suppliers to the company. The company is already acquainted with the orchids' quality and the production capacity of each plot. In certain situations where there is insufficient orchid supply to meet customer demands, the company may procure from alternate plots. The quantity and extent of purchase depend on the production capacity of the orchid plots that are capable of meeting the company's export demands. Additionally, the company procures materials and equipment such as cardboard boxes, food tubes, plastic bags, and other supplies on a monthly basis from established suppliers of production factors. Despite encountering COVID-related challenges,

the procurement process remains unaffected, with materials being domestically sourced and ordered according to the regular cycle.

Logistics communication and order processing: The order management process commences upon receipt of an order from the importer and continues until the orchids are delivered to the importer's representative, who establishes an orchid pickup point near the production site and the export company. The waiting period typically lasts 1–2 days. The exporter's order management procedure entails receiving an order from Vietnam, where orchids are ordered and bananas are received within approximately one day. Once orchids arrive from the plots, they undergo sequential processing steps, including quality selection, trimming flower inflorescence, and inserting nutrient tubes (which take approximately 3–6 hours). Subsequently, they are bundled and refrigerated in an air-conditioned room at 18°C to maintain coolness and prolong their shelf life (for at least 2 hours). Afterwards, they are packed in corrugated boxes and transported to the importer's pickup point, a process taking 1–3 hours.

Shipping management of exporters**:** Exporters handle some inbound transit (from planting plots to packaging plants), while farmers handle the rest. Outbound, corrugated boxes carry processed orchids to the importing agent. Some import agents offer pickups near production and export sites. Some companies pick up products, while others need exporters to deliver them to the import agency at the airport or receiving point. 4-wheel, 6-wheel, and 8-wheel trailers with or without refrigeration are utilised to keep temperatures below 15°C. Road or air shipment of orchids to Vietnam depends on importer needs. Land transport usually goes from Nakhon Phanom (Thailand) via Kammouane (Laos) to Ha Tinh (Vietnam) or from Ubon Ratchathani to Champasak-Pakse-Koh Tum- Da Nang. Due to no nationwide closures, orchid shipments to Vietnam are possible. Exporters must take epidemic prevention precautions at every stage, including transportation, which may delay shipping.

Site selection, warehousing, and storage: Due to the nature of the products, where immediate shipping is required upon packaging completion, the business does not maintain a warehouse. Additionally, there has been no factory expansion for packing purposes. Hence, this activity has not been undertaken.

Demand forecasting: Without forecasting tools, exporters with solid relationships predict export volumes based on experience and information exchange. Due to farmers' seasonal production cycles, order volumes, and importers' orchid usage, overall orders are expected to match those of the preceding month. The case study's export company predicted purchases based on orchid festivities, including New Year, Vietnamese New Year, National Women's Day, and others. Exporters use information from numerous sources to predict international consumers' spending tendencies during pandemics, with an emphasis on the domestic market.

Inventory management: Exporters maintain inventory of cut orchid bouquets in the processing phase, awaiting further processing steps (sizing, insertion into tubes, blackening, cold room soaking for 2 hours, and packing into boxes) before transportation. This inventory has a holding period of approximately 6–8 hours. To address epidemic-related challenges, exporters coordinate with farmers to delay cutting bunches to mitigate inventory issues in case of order reductions. Given the nature of orchids, they can remain on the tree for approximately 7 days.

Materials handling and packaging: Loading and unloading are carried out using human labour and non-motorised labour-saving machines like carts. Packaging is tailored for export, with sub-packaging for retail sales involving packing bouquets in plastic bags, with 12 bouquets per bag, and then placing them in large packaging, typically corrugated cardboard boxes, suitable for wholesale and transportation. During COVID-19, some exporters have reduced the size of their boxes to fit on passenger seats on aeroplanes.

Reverse logistics: The process involves returning orchids from Vietnam to Thailand, but since the orchids spoil during transit, this method is not used. The costs of returning the goods to their origin and the change in ownership each time they change hands make reverse logistics impracticable. Thus, reverse logistics would be complicated and time-consuming and likely result in ruined and unusable products, outweighing the cost of transit.

The findings of this study reveal that the sampled exporters engage in six specific logistics activities: customer service and support, purchasing and procurement, logistics communication and order processing, transportation, inventory management, and materials handling and packaging. Regarding collaboration with other stakeholders in the

supply chain, it was observed that exporters only cooperate with farmers in purchasing activities and inbound transportation, with information on price trends and pricing shared among exporters.

Logistics Performance of Thai Cut Flower Orchid Exporters to Vietnam

This section involves compiling data from interviews and accounting reports of the sample exporters, followed by analysing the results through the evaluation of Agricultural Logistics Performance Indicators (ALPI). These indicators are calculated based on the agricultural logistics activities of cut flower orchid exporters to Vietnam, covering nine main activities across three dimensions: cost, time, and reliability. The ALPI serves as a criterion for measuring the performance of agricultural business units (Office of Agricultural Economics, 2020).

Based on the findings from the initial phase of the study, it is evident that exporters engage in specific logistics activities, allowing for the assessment of six activities while others remain unperformed. These include planning or forecasting customer needs, factory location selection, warehouse management, and reverse logistics. Consequently, there are 18 indicators that require evaluation, as shown in the Table 3:

Table 3

Summary of 18 Agricultural Logistics Performance Indicators (ALPI) Among Cut Flower Orchid Exporters

Logistics Activity	Logistic Performance		
	Cost (Percentage: Sales)	Time (Day)	Reliability (Percentage)
Customer Service and Support (ALPI1)	ALPI1C	ALPI1T	ALPI2R
Purchasing and Procurement (ALPI2)	ALPI2C	ALPI2T	ALPI2R
Logistics Communication and Order Processing (ALPI3)	ALPI3C	ALPI3T	ALPI3R
Transportation (ALPI4)	ALPI4C	ALPI4T	ALPI4R
Inventory Management (ALPI7)	ALPI7C	ALPI7T	ALPI7R
Materials Handling and Packaging (ALPI8)	ALPI8C	ALPI8T	ALPI8R

Cost Performance of Exporters

The overall logistics costs of orchid exporters amount to approximately 13.10 per cent per sale, with transportation costs representing the

largest proportion at 11.23 per cent per sale. The sample exporters exhibited varying transportation costs. Upon closer examination, it was observed that Business D incurred the highest transportation costs within the group, approximately 17.63 per cent, whereas Business A had the lowest transportation costs at approximately 6.85 per cent. The author attributed this discrepancy to several factors. Firstly, the geographical location of Business D was farther from the airport compared to Business A. Additionally, Business D lacked sufficient in-house delivery vehicles and thus relied on contracted transportation services for some orders, resulting in less control over transportation costs compared to Business A. Conversely, inventory management costs accounted for the smallest proportion at 0.0003 per cent, and this remained consistent across all sample groups. This uniformity is attributed to similar management styles across the businesses, where raw materials are received, processed, packaged, and transported promptly, resulting in minimal inventory management costs.

Table 4

Percentage of Costs to Sales for Thai Cut Orchid Exporters to Vietnam

Logistics Activity	Cost (Percentage: Sales)					
	Firm A	Firm B	Firm C	Firm D	x-bar	S.D.
(ALPI1C)	0.3980	0.7697	0.3842	1.9569	0.8772	0.74
(ALPI2C)	0.3575	0.8768	0.6956	1.6935	0.9058	0.57
(ALPI3C)	0.0140	0.0279	0.0177	0.0439	0.0259	0.01
(ALPI4C)	6.8500	10.2735	10.1686	17.6272	11.2298	4.55
(ALPI7C)	0.0003	0.0003	0.0003	0.0002	0.0003	0.00
(ALPI8C)	0.0600	0.0600	0.0600	0.0600	0.0600	0.00
Percentage logistics costs to sales	7.6798	12.0081	11.3263	21.3816	13.0990	

Time Performance of Exporters

The overall delivery time for exporters is 5.94 days. When considering the activity that takes the longest to complete, Customer Service and Support (ALPI1T) required 2.75 days, and the sample businesses exhibited variations in the time taken to complete activities, although not significantly. Upon closer examination, it was discovered that Business D required 4 days, while Business B and C only took 2 days. The author investigated the reasons for this disparity and found that Business D took longer than other businesses due to the absence of its

own planting plots. As a result, it procured all orchids from farmers, necessitating at least one day to collect orchids after placing the order. Furthermore, if the order was placed in the afternoon, the waiting time was further prolonged, leading to delays in order fulfilment compared to other businesses. On the other hand, the activity that requires the least time is Transportation (ALPI4T), with transportation time averaging approximately 0.07 days (equivalent to 1 hour 48 minutes). There is no discernible difference in transit time among the four businesses as they were all situated in Bangkok, Nakhon Pathom, and Samut Sakhon provinces, which are approximately 1.30 to 2 hours away from the airport.

Table 5

Delivery Time of Thai Cut Flower Orchid Exporters to Vietnam

Logistics Activity	Time (Day)					
	Firm A	Firm B	Firm C	Firm D	x-bar	S.D.
(ALPI1T)	3.0000	2.0000	2.0000	4.0000	2.7500	0.96
(ALPI2T)	1.0000	1.0000	1.0000	1.0000	1.0000	0.00
(ALPI3T)	0.0833	0.1250	0.0833	0.0833	0.0938	0.02
(ALPI4T)	0.1042	0.0625	0.0625	0.0833	0.0781	0.02
(ALPI7T)	2.1471	1.3965	1.7892	1.2882	1.6553	0.39
(ALPI8T)	0.3333	0.3750	0.4167	0.3333	0.3646	0.04
Delivery time	6.6679	4.9590	5.3517	6.7882	5.9417	

Notes: LPI8T is an indicator used to estimate the delivery time for products to customers from the moment the products are loaded onto the vehicle and transported to the customer's location until the customer receives the product. For exporting abroad, only the time required to transport goods from the factory to the port or airport in the country is counted (Logistics Bureau, Department of Primary Industries and Mines, 2017).

Exporter's Reliability Performance

The overall reliability of exporters' logistics operations is approximately 99.35 per cent. When considering the most reliable activities, Customer Service and Support (ALPI1R) and Transportation (ALPI4R) each scored 100 per cent reliability, with no differences observed within the groups. The activity that showed less reliability compared to others was Purchasing and Procurement (ALPI 2R), which measures the ability of producers (farmers who send orchids to the company)

to respond to company orders as agreed upon, ensuring products are delivered in full quantity and on time. There were variations in reliability within the exporter group. The author investigated these differences and found that reliability ranged between 95.05 and 97.02 per cent. The business with the lowest reliability in the group was Business D, primarily due to its lack of planting plots. The efficiency of acquiring crucial raw materials (orchids) in terms of quantity and timeliness depends on the capabilities of the business's farmers.

Table 6

Percentage of Reliability of Exporters' Logistics Activities

Logistics Activity	Reliability (Percentage)					
	Firm A	Firm B	Firm C	Firm D	x-bar	S.D.
(ALPI1R)	100.0000	100.0000	100.0000	100.0000	100.0000	0.00
(ALPI2R)	96.0400	94.0500	97.0200	93.1000	95.0525	1.79
(ALPI3R)	99.9074	99.9306	99.9242	100.0000	99.9406	0.04
(ALPI4R)	100.0000	100.0000	100.0000	100.0000	100.0000	0.00
(ALPI7R)*	0.0926 (99.9070)	0.0694 (99.9310)	0.0758 (99.9240)	0.1389 (99.8620)	99.9058	0.03
(ALPI8R)*	0.0567 (99.9070)	0.0500 (99.9310)	0.0900 (99.9240)	0.0300 (99.8620)	99.9433	0.02
Percentage of Reliability	99.2996	98.9769	99.4630	99.6403	99.3450	

Notes: 1. *The reliability percentage values for ALPI7R and ALPI8R differ from those of other indicators. Therefore, they must be adjusted to the same base as other indicators before calculating the total reliability percentage value for each business.

2. Inventory Management (ALPI7R) uses the Inventory Out of Stock Rate (IOS) to determine how often the organisation fails to fulfil customer orders due to insufficient finished products. This reflects the company's management of finished products.

Materials Handling and Packaging (ALPI8R) monitors the damage rate of completed products (DR) from manufacture to delivery. It depends on the level of damage.

The results of the cost efficiency evaluation indicate that transportation costs constitute the largest component, while the most time-consuming activity is Customer Service and Support. In terms of reliability, Customer Service and Support, as well as Transportation, emerge as the most dependable activities.

Table 7

Logistics Performance of Thai Cut Flower Orchid Exporters to Vietnam

Logistics Activity	Logistic Performance		
	Cost (Percentage: Sales)	Time (Day)	Reliability (Percentage)
Customer Service and Support (ALPI1)	0.8772	2.7500	100.0000
Purchasing and Procurement (ALPI2)	0.9058	1.0000	95.0525
Logistics Communication and Order Processing (ALPI3)	0.0259	0.0938	99.9406
Transportation (ALPI4)	11.2298	0.0781	100.0000
Inventory Management (ALPI7)	0.0003	1.6553	99.9058
Materials Handling and Packaging (ALPI8)	0.0600	0.3646	99.9433
	13.0990	5.9417	99.3450

Logistics performance review across all three dimensions discovered variances in units and numerical values for each aspect:

1. Cost as a sales percentage. Lower values indicate lower costs and greater efficiency. Higher values indicate higher expenses and lesser efficiency.

2. Time is measured in days. Lower numbers indicate shorter duration and higher efficiency. Longer duration means lower efficiency.

3. Percentages measure reliability. Lower percentages indicate lower reliability and efficiency. Higher percentages imply reliability and efficiency.

To effectively summarise the level of logistics efficiency, it is essential to incorporate a comparative measurement, known as benchmarking, of logistics efficiency within the agricultural product supply chain. This benchmarking process mirrors the ranking of industrial logistics performance indicators, such as the Logistics Performance Index (LPI), outlined in the World Bank's Connecting to Compete 2023 report. The International LPI, featured in this report, evaluates satisfaction through surveys of international logistics experts, including freight forwarders, express carriers, and logistics service providers (LSPs). These experts assess logistics performance across six key areas: customs procedures, transportation infrastructure and information technology, international transportation preparation, competency of logistics service providers (both governmental and private), service punctuality, and product tracking and inspection systems. Each area is rated on a scale of 1 to 5. Thailand's overall score in this assessment

was 4.3, ranking it 34th out of 139 countries worldwide. These ranking results serve as valuable guidelines for informing the subsequent phases of logistics system development, as outlined by the Logistics System Development Strategy Division in 2023.

Thailand has not announced criteria or rankings for the Composite Index of Agricultural Logistics Management Efficiency (Agricultural Logistics Performance Index [ALPI]). The Ministry of Agriculture and Cooperatives' Preparation of the Master Plan for the Development of Logistics and Agricultural Supply Chains 2017-2021 utilises the ALPI indicator as a study tool. Thailand's agricultural logistics development is assessed using ALPI (Ministry of Agriculture and Cooperatives, 2017).

Additionally, the Office of Agricultural Economics, Ministry of Agriculture and Cooperatives (2021), is studying agricultural logistics costs. This project employs a database management system to store and analyse questionnaire data for agricultural logistics performance indicators (ALPI). The review encompasses agricultural logistics activities in supply chains for white rice, oil palm, jasmine rice, and pineapple factories. The sample includes 345 participants from the Farmers Institute (agricultural cooperatives, farmer groups, and community enterprises) and agricultural product collectors. The dimensions of logistics efficiency (cost, time, and reliability) are provided as averages without summarising, comparing, or ranking. Thus, to obtain the average logistics efficiency of exporters, the evaluation findings for all three aspects must be adjusted to percentage values.

Table 8

Percentages and Averages of Logistics Efficiency of Thai Cut Flower Orchid Exporters to Vietnam

Logistics Activity	Percentage of Logistic Performance			Average
	Cost	Time	Reliability	
Customer Service and Support (ALPI1)	99.12	79.17	100.00	92.76
Purchasing and Procurement (ALPI2)	99.09	100.00	95.05	98.05
Logistics Communication and Order Processing (ALPI3)	99.97	91.67	99.94	97.19
Transportation (ALPI4)	88.77	83.75	100.00	90.84
Inventory Management (ALPI7)	100.00	81.06	99.91	93.66
Materials Handling and Packaging (ALPI8)	99.94	92.22	99.94	97.37
Average	97.82	87.98	99.14	94.98

Table 8 shows that exporters have an overall efficiency of 94.98. Upon examining each activity, it becomes evident that Purchasing and Procurement is the most efficient, while Transportation is the least efficient. When considering dimensions, exporters exhibit the highest reliability in logistics efficiency, followed by cost, while time is the least efficient.

CONCLUSION

The logistics activities of Thai cut orchid exporters to Vietnam encompass six concrete activities out of a total of nine, with Reverse Logistics being the one not in operation. Throughout the study year (2022), the exporter refrained from expanding its business or facilities, thus omitting facilities site selection, warehousing and storage activities. Moreover, demand forecasting activities were scarcely carried out, hindering efficiency evaluation.

The overall logistics performance assessment of exporters yielded an average efficiency rating of 94.98. Notably, purchasing and procurement activities exhibited the highest efficiency, primarily due to timely execution. Conversely, transportation activities emerged as the least efficient, attributed to time and transportation cost inefficiencies.

Several suggestions have been proposed to enhance logistics efficiency among orchid exporters. These include planning transportation and delivery to mitigate delays and unnecessary costs, as well as fostering partnerships within the transportation service industry to bolster cost control and expense reduction efforts. Nonetheless, it is imperative to acknowledge that this study emanates from a sample of Thai cut flower orchid exporters targeting the Vietnamese market. Given its high export potential and presence in a market with robust purchasing power, these findings underscore the pivotal role of enhancing transportation efficiency to attain sustainable competitive advantage.

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