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Developing a structural equation model: Case study of Thai port developing

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Abstract

The Covid-19 pandemic substantially affects the global tourism industry. The cruise travel business has been one of the most important sources of national income. Therefore, the first need is to improve the cruise ports. This research aims to analyse and develop the structural model of the relationships, dimensions as well as indicators of the cruise port development. The survey research is used in data collection with 342 samples from the Thai tourism business association as well as from the cruise and yacht professionals' association. Three hypotheses drive the indicators to set a relationship among three dimensions that include the cruise tourism factor, the cruise ship characteristics, and the cruise port dimension. Structural equation modelling (SEM) was used to develop this model using the PLS method. The findings revealed that the development of the Thai cruise port model offers the relationship of three dimensions and sixty-nine indicators for improving Thai cruise ports. These results showed a path analysis and measurement model confirming the indicators among these dimensions. The results were also conceptualized into a guideline for how to implement a policy for the cruise port development to support the tourism industry and national economics.

Keywords: cruise port, cruise ship, cruise tourism

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1. Introduction

International travel is intended for various reasons including recreation, exploration, business, and discovery. Mass transportation is much more different from a century ago. Nowadays, technology and innovation have been enhanced to support our everyday lives. The incomes from the tourism business are equal to petroleum exports, automobile, or electronic industries. Consequently, tourism is a major source of income among developing countries [1]. International tourist arrivals (overnight visitors) grew around 4% from January to March 2019, compared to the same period of the previous year, and just 6% below the average growth compared to the past couple of years. Transportation takes the travellers from point to point and there were more functions for the itinerary [2]. The road trip is the most used mode of transportation, followed by rail, air, and maritime transportations in respective order. The tourism industry relies on the quality of transportation to serve travellers to their itineraries. According to the report from the Division of Economic Tourism and Sports, there were 39 million international travellers to Thailand in 2019. It cost around 1.9 billion baht as the country's national income [3]. The inbound - outbound travellers via Suvarnabhumi Airport total more than 100,000 persons, while more than 35,000 people per day travel through Phuket Airport. Maritime transportation means transport where goods (or people) are transported via sea routes. Laem Chabang Port has been promoted by the Government of Thailand to be the national main port, replacing the Bangkok Port where the freight containers were limited not to exceed 1.0 million TEU since 1996 [4].

A port is also specifically designed for a cargo operation. Because if a ship is unable to load and discharge the goods, there is no income gained. Therefore, both ship and port must operate together. Furthermore, a port must be designed appropriately for a specific type of cargo or cruise ship. Right now, there are three main Thai cruise ports–Bangkok, Laem Chabang, and Phuket [5]. The Government of Thailand has developed the strategy to promote cruise tourism for 2018 – 2027 to push Thailand as the centre of ASEAN cruise tourism, covering the development of infrastructure at the main ports, Bangkok Port and Laem Chabang Port, and supporting the anchoring points including Koh Samui Pier and the piers linking the islands of tourist destinations. The infrastructure development at the EEC project area will further improve Thailand's East Sea to be more convenient transportation and to connect with local tourist destinations as well as other neighbouring nations in the CLMVT region. The cruise industry was once especially driven by the private sector, even though it would have elevated the Thailand tourism economy and generated more employment. The exploration of factors associated with a cruise port improvement would result in the strategic plan for the development of the Thailand cruise ports.

2. Theoretical Framework

The cruise industry is of greater value with its continuous growth. As cruise tourism is delivered to every port of call and hinterland [6], when analysing the factors for cruise line port selections such as Phuket port, cruise passenger traffic 460,963 persons, an annual growth rate of 12%.

As McCalla [7] suggested, ships had specific ports for cargo,

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Table 1. Thai Cruise Port Dimension.

Thai Cruise Port dimensions
Cruise port (Cp)
Boarding Point (Cp 1) Drop off Point (Cp 2) Water width for Ship length < 250 m. (Cp 3) Water width for ship length 250 – 400 m. (Cp 4) Water width for ship length > 400 m. (Cp 5) Channel Depth > 10 m. (Cp 6) Channel Depth 10 – 15 m (Cp 7) Channel Depth 15 – 20 m.(Cp8)
Ship's Length < 175 m. (Cp 9) Ship's Length 175 - 250 m. (Cp 10) Ship's Length > 250 m. (Cp 11)
Port location from Public Transportation < 1 km. (Cp 12) Port location from Public Transportation 1 – 3 km. (Cp 13)
Port location from Public Transportation > 3 km. (Cp 14) Berth alongside 1 ship (Cp 15) Berth alongside 2 ships (Cp 16)
Berth alongside > 2 ships (Cp 17) Passenger waiting for area (Cp 18) Baggage Transportation System (Cp 19)
Tariff rate < 18,000 Baht/day (Cp 20) Tariff rate 18,000 – 27,000 Baht/day (Cp 21) Port Connection System (Cp 22)
Vehicle Connection System (Cp 23) Boat System Connecting (Cp 24) Weapon Inspection System (Cp 25)
Additional measures for new incidence diseases (Cp 26) Port security hierarchy (Cp 27) Operation process (Cp 28)
Supporting Point (Cp 29) Port link to Airport < 0.5 hrs (Cp 30) Port link to Airport 0.5 - 1.5 hrs (Cp 31) Port link to Airport > 1.5 hrs (Cp 32) Port link to Rail Transportation < 0.5 hrs (Cp 33) Port link to Rail Transportation 0.5 1.5 hrs (Cp 34)
Port link to Rail Transportation > 1.5 hrs (Cp 35) Port link to Road Public Transportation < 0.5 hrs (Cp 36)
Port link to Road Public Transportation 0.5 - 1.5 hrs (Cp 37) Port link to Road Public Transportation > 1.5 hrs (Cp 38)
Measures to Prevent Oil Pollution. (Cp 39) Measures to control pollution from toxic liquids in total volume (Cp 40)
Measures to prevent pollution from hazardous substances transported by sea in package form (Cp 41)
Measures to prevent pollution caused by ship sewage (Cp 42) Measures to control garbage in port (Cp 43)
Measures to prevent air pollution from ships (Cp 44) Measures to deal with dust problems (Cp 45)
Cruise tourism (Ct)
Contemporary & Premium (3 – 7 Night) (Ct 1) Upscale (+Superior dining etc.) (Ct 2) Luxury (12 Nights +) (Ct 3)
Expedition (high standard) (Ct 4) Port to historical attraction < 0.5 hrs (Ct 5) Port to historical attraction 0.5 - 2.0 hrs (Ct 6)
Port to historical attraction > 2.0 hrs (Ct 7) Port to Natural attraction < 0.5 hrs (Ct 8) Port to Natural attraction 0.5 - 2.0 hrs (Ct 9)
Port to Natural attraction > 2.0 hrs (Ct 10) Convenience, safety, public transportation (Ct 11) Tourism Safety (Ct 12)
Tour Capabilities (Ct 13) Port to Department Store/Duty free Shop < 0.5 hrs. (Ct 14)
Port to Department Store/Duty free Shop 0.52.0 hrs. (Ct 15) Port to Department Store/Duty free Shop > 2.0 hrs. (Ct 16)
Port to Hotel < 0.5 hrs. (Ct 17) Port to Hotel 0.52.0 hrs. (Ct 18) Port to Hotel > 2.0 hrs. (Ct 19)
Cruise ship characteristics (Cs)
Mega Ship (number of passengers 3,500 or more) (Cs 1) Large Ship (Number of passengers from 2,0003,500 (Cs 2)
Midsize Ship (Number of passengers from 700 to 2,000 passengers) (Cs 3)
Small Ship (Number of passengers ranging from less than 750) (Cs 4)
Expedition Ship (Number of passengers ranging from less than 100 to 300 passengers) (Cs 5)

though cruise ships had itineraries covering the entire world. There were three types of cruise portshome port, port of call, and hybrid port. A cruise port should be improved by both cruise lines as well as the government. Many factors were used for making decisions to create and execute acts. Factors associated with port development factors are modified by the port site and port situation. The cruise ports were chosen by cruise lines. [7] The first factor for deciding to be a cruise port was tourist attractions. The second was facilities to respond to tourists' needs. The Fuzzy-AHP method was used and four categoriesincluding, cruise terminal facility, natural environment of the hinterland, tourism attractions, and connectivity and agility at Singapore and Hong Kong cruise portswere analysed. Hong Kong had concentrated on the development of the modern cruise terminal with the prospect of Hong Kong being a major cruise hub. Thailand's GDP main mainly comes from the tourism industry. Cruise travellers almost always have high purchasing power and usually connect to the hinterland, making employment in the business sector [8]. They studied the factors for developing Thailand Cruise Port during the Covid-19 pandemic. The sampling was done by cruise port users, including ATTA: Association of Thai Travel Agents, Cruise Agents, and CAT: Cruise Ship Professional Association. The cruise port potential range was measured by port site, port situation, and ship characteristics. The potential range average was a result of users identifying the level of Thai cruise ports at a middle to almost good scale. Some factors revealed recommendations for the policymakers to adjust the strategy for promoting tourism. The results led to strategic planning for the development of Thai cruise ports for all parties.

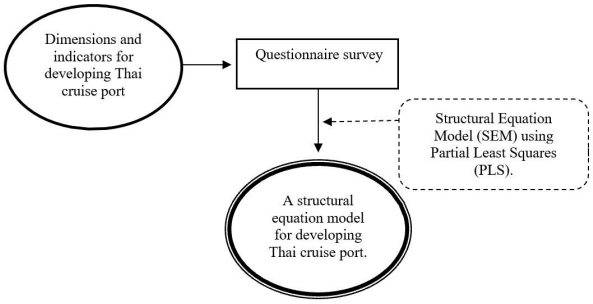

Figure 1: The methodological design

3. Methodology

This research methodology was designed as shown in Figure 1. The past research was used the data of factors for developing Thai cruise ports which were found in the previous article and reviewed literature. The framework was developed from documentary research using content analysis. This research used survey research that collected all data by selective sampling. The sampling method was non-probability sampling, in which the stakeholders in the processing of the Thai cruise port were selected using purposive sampling. A total of 342 samples consisted of 300 samples from the Thai Tourism Business Association and 42 samples from the cruise professionals/yacht professionals associations. A 5-scale rating questionnaire was

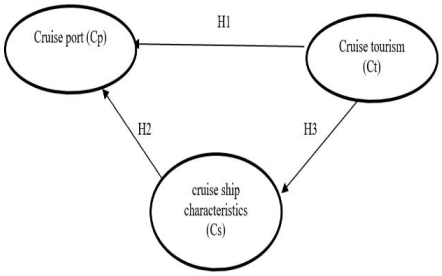

Figure 2: Framework for developing Thai cruise port

applied to collect data for finding the opinions of respondents on the current situation and the important factors for Thai cruise ports. Three main factors (69 sub-factors were demonstrated in Thai cruise port dimensions) of the questionnaire were presented, including the cruise port factor, cruise ship characteristics factor, and cruise tourism factor.

In this study, there were three hypotheses which drove the indicators to set the relationship among the dimensions as follows:

H1: The cruise port was positively influenced by the cruise tourism dimension.

H2: The cruise port was positively influenced by the cruise ship characteristics dimension.

H3: The cruise ship characteristics were positively influenced by the cruise tourism dimension.

Structural equation modelling was applied to develop the model using the PLS method. This resulted in the path model and measurement model for testing the cause and effect of the relationships among factors and presenting estimation measurements between dimensions and indicators [9]. The first result of this model was to offer a reliable valid measure of the dimensions and the relationship among factors to the path model. For the second result, the model fitted in the investigation of structural equation modelling proposed the path coefficients of the factors and indicators loading.

4. Findings

The structural model results for developing Thai cruise port were represented in Figure 3, while the average of R? presenting was 0.755, indicating this model was highly significant. The cross-loadings and the variability of factors were clarified by indicators that were shown that most factors and their indicators were above 0.7. The structural equations were shown as follows:

$Cp = 0.871\ Ct + 0.013Cs$; $R^2 = 0.779$,

$Cs = Ct$; $R^2 = 0.859$

Cp: Cruise port dimension, Ct: Cruise tourism dimension, Cs: cruise ship characteristics dimension

The results of hypothesis testing were presented in Table 2 showing the path coefficient, t-test, and p-value. These results showed that using PLS-SEM analysis in three hypothesis paths, two hypothesis paths were supported, while one hypothesis path remained unsubstantiated. Firstly, the direct path between cruise tourism (Ct) and cruise port (Cp) was significantly supported (p-value = 0.000). Secondly, the direct path between cruise ship characteristics (Cs) and cruise port (Cp) was significantly supported (p-value = 0.000). Thirdly, the direct path between cruise tourism (Ct) and cruise ship characteristics (Cs) was not significantly supported (p-value = 0.913). It meant that the cruise port (Cp) was positively influenced by cruise tourism (Ct) with a path coefficient of 0.871. The cruise port (Cp) was positively influenced by the cruise ship characteristics (Cs) with a path coefficient of 0.859. Another hypothesis path which was not supported was the cruise ship characteristics (Cs). It was positively influenced by cruise tourism (Ct) and found that the path coefficient was 0.013.

Table 2. Results of hypothesis testing.

Path	Path coefficient	t-test	p-value	Results
H1: Ct to Cp	0.871	7.771***	0.000	support
H2: Cs to Cp	0.859	32.206***	0.000	support
H3: Ct to Cs	0.013	0.109	0.913	non-support

p-value* < 0.1, p-value** < 0.05, p-value*** < 0.01

Table 3. Reliability and validity of Structural equation modelling.

Dimensions	CR	AVE	Cronbachs alpha
Cp	0.977	0.507	0.975
Ct	0.942	0.475	0.933
Cs	0.836	0.508	0.775
Average	0.9183	0.4966	0.8943

*GoF is 0.5152

The reliability and validity of structural equation modelling were presented by Composite Reliability (CR), Average Variance Extracted (AVE), and Cronbach's alpha, as shown in Table 3. These results were extracted to qualify the model measurement and Goodness of Fit (GoF) at 0.5152, indicating the data fitted the model at an acceptable level. The CR average was 0.9183 which was above 0.7 which represented an acceptable value. The AVE average was 0.4966 which had been calculated to be 0.5 for acceptance. The average of Cronbach's alpha was 0.8943, more than 0.7 which is widely accepted as the cut-point [9]. From these results, the factors were well validated as the indicators, and this model was fitted.

5. Results and Discussion

The cruise industry has the characteristic capabilities to relocate from region to region and respond to the tourism economy. A cruise port has multi-functions and is established by several factors. Thailand cruise ports are divided into three parts. Thai ports have been provided by the Government of Thailand with both the infrastructure and transportation systems. The relationships between the three factors, cruise tourism (Ct), cruise port (Cp) and good ship characteristics (Cs) were elucidated in detail below.

The first factor was cruise tourism (Ct). Thailand had various attractions supporting business travel. Both natural and historical attractions impressed travellers around the world. The Thai hospitality business sector also contributed to this factor enormously. Among the Ct factor, the associated indicators included port to a historical attraction for 0.5 2.0 $hrs_{(Ct6)}$, expedition (high standard) $_{(Ct4)}$, port to a natural attraction for 0.5 – 2.0 hrs $_{(Ct9)}$, upscale (+ superior dining etc.) $_{(Ct2)}$, luxury

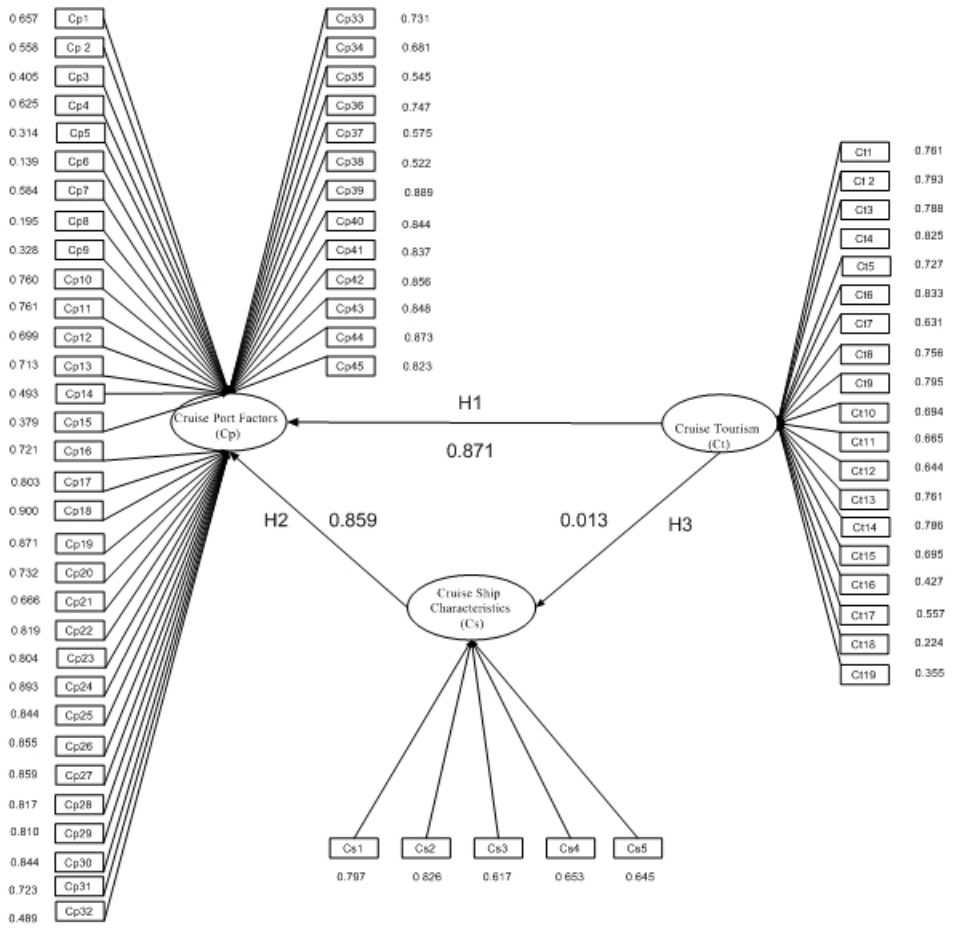

Figure 3: The Structural equation modelling for developing Thai cruise ports.

(12 nights +) $_{(Ct3)}$, port to a department store or a duty free shop $<$ 0.5 hrs $_{(Ct14)}$, tourism capabilities $_{(Ct13)}$, contemporary and premium (3 – 7 Night) $_{(Ct1)}$, and port to a natural attraction for $<$ 0.5 hrs $_{(Ct8)}$. The results also revealed that the time spent in a historical attraction for 0.5 – 2.0 hours was the proper period. Furthermore, the opportunity to support Thai cruise tourism was department stores and duty-free shops situated in the proximity of a port.

Secondly, for the cruise port (Cp), we had suggestions that ports should be subsidized by the Government. A port needed a substantial amount of budget to establish. Therefore, a Thai cruise port adapted from a port for cargo ships did not completely serve the cruise tourism objectives. The significant indicators supporting the development of a cruise port included the ship's length of 175 – 250 m $_{(Cp10)}$, the ship's length of $>$ 250 m $_{(Cp11)}$, the berth alongside 2 ships $_{(Cp16)}$, the berth alongside $>$ 2 ships $_{(Cp17)}$, the passenger waiting area $_{(Cp18)}$, the baggage transportation system $_{(Cp19)}$, the tariff rate $<$ 18,000 baht per day $_{(Cp20)}$, the port connection system $_{(Cp22)}$, the vehicle connection system $_{(Cp23)}$, the boat system connecting $_{(Cp24)}$, the weapon inspection system $_{(Cp25)}$, the additional measures for infectious diseases $_{(Cp26)}$, the port security hierarchy $_{(Cp27)}$, the operation process $_{(Cp28)}$, the supporting point $_{(Cp29)}$, the port link to an airport of $<$ 0.5 hrs $_{(Cp30)}$, the port link to an airport of 0.5 - 1.5 hrs $_{(Cp31)}$, the port link to an airport of rail transportation $<$ 0.5 hrs $_{(Cp33)}$, the port link to a road public transportation $<$ 0.5 hrs $_{(Cp36)}$, the measures to prevent oil pollution. $_{(Cp39)}$, the measures to control pollution from toxic liquids in total volume $_{(Cp40)}$, the measures to prevent pollution from hazardous substances transported by sea in package form $_{(Cp41)}$, the measures to prevent pollution caused by ship sewage $_{(Cp42)}$, the measures to control garbage in port $_{(Cp43)}$, the measures to prevent air pollution from ships $_{(Cp44)}$, and the measures to deal with dust problems $_{(Cp45)}$.

Thirdly, the cruise ship characteristics (Cs) were defined as the specific characteristics of a cruise ship suitable for a Thai port. A cruise ship is usually tailored by the objectives of the journey and purchasing power. Moreover, it is also related to the length of an itinerary period. The study demonstrated that the Thai cruise port should be adjusted for this purpose. In respective order, the supporting indicators included large ship $_{(Cs2)}$, mega-ship $_{(Cs1)}$, small ship $_{(Cs4)}$, expedition ship $_{(Cs5)}$, and midsize ship $_{(Cs3)}$. The relationship between cruise tourism and cruise port was as significant as port facilities for passengers. To promote cruise tourism, the authorities should provide the proper itineraries and support emergency plans during a trip. Moreover, the port tariffs and transportation fees should be fined corresponding to the port performance as well.

The main objective of cruise tourism is to provide itineraries suitable for a group of passengers' interests and purchasing power. We showed that it not only influenced the decision to choose ship types but also optimised budgets more efficiently.

The cruise ship characteristics and cruise pots should have supported each other. A port should be designed to match a ship type. Therefore, the port authorities should provide facilities to serve all ship sizes and respond to every condition. We demonstrated that the cruise ships have less effect on a cruise port. The parties concerned in cruise tourism would be to launch promotion campaigns and onshore itineraries to call cruise ships and passengers made more spending with activities.

This study aimed to reveal the opportunities for development for the policymakers to adjust and develop a cruise port. We presented the path models representing how the cruise tourism and cruise ship characteristics dimensions affected the cruise port dimensions. In conclusion, we suggested that the authorities should consider our supporting indicators to create cruise ports suitable for serving cruise tourism and the present-day cruise ship characteristics and promoting the sustainability of the tourism business.

6. Conclusion and Recommendations

Thai Cruise Tourism is a promisingly prominent part of the maritime tourism economy. It can drive business circles and promote more employment. This study developed the structural model of the cruise port development using the survey research called PLS-SEM. This model found that cruise tourism and cruise ship characteristics are the main factors guiding how to prepare a development plan for the Thai cruise ports. As a result of the fact that cruise tourism contributes to the cruise ship characteristics, the Thai Government should establish cruise ports with the potential to serve all cruise ship types. The authorities should concern and integrate all these associated indicators to formulate a strategic plan for raising the standard and quality.

Finally, both the government and the business owners must cooperate in creating and designing travel itineraries and providing the facilities to promote the cruise travel industry. Our upcoming future research will shed light on how to develop a sustainability plan for improving the cruise ports by incorporating the relating factors like environment and social factors into the economic factors.

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