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ORIGINAL ARTICLE

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Selecting a coastal cruise port of call location in mainland China using the AHP method

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Abstract

Increasing needs of mass tourism give the cruise industry opportunity to booming rapidly. The remarkable contribution of the cruise industry makes the port cities incorporate cruise tourism into development strategy. Whether a cruise port was included in the cruise lines' itineraries design will directly affect the profitability and survival of the port. As the contribution to cruise ports and hinterland cities, it is necessary to analyze the factors that affect the selection of cruise ports and design of itineraries. In contrast to ocean cruising, the coastal cruise market is rarely addressed in the academic literature. Particularly, there is a substantial gap regarding the changes taking place in the China coastal cruise market, and this paper seeks to address this issue. To respond to the need of cruise liners and passengers more accurately, this paper aims to identify the main issues affecting the coastal cruise port of call process exactly, reasonable and scientifically. And build a fruitful partnership relation between ports and cruise companies so that to provide valuable information for cruise lines and destinations to develop continuous attracting cruise tourism offerings as well as improve marketing communications, thereby make contribution to the port and regional economy. Valuable information for cruise lines and destinations to develop continuous attracting cruise tourism offerings as well as improve marketing communications, thereby make contribution to the cruise economy.

Keywords: Coastal cruise tourism, Cruise port selection, AHP (analytic hierarchy process), Cruise industry, Cruise port competitiveness comparison, Port management

Introduction

Cruise tourism is one of the fastest growing international tourism sectors, contributing enormous economic income. In our country, from the government to coastal port cities all treat cruise tourism with great enthusiasm and make great efforts to develop cruise. However, the cruise tourism market in china is not well developed, the ocean cruise market is almost monopolized by foreign cruise companies, the expected goals are not achieved yet. China's native cruise market development is still in the initial stage (Wang 2010) and faces dilemmas, Given the considerable economic impact of



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cruise industry and strong consumer interest in cruising, the develop of coastal cruise tourism would be a good choice for the native cruise ships operators.

In this rising market, both cruise lines and cruise destinations have to retain captured cruisers and attract new cruise wanna bes. Those cruise ports are under pressure to improve the quality of their services and maintain competitiveness policy support from the government. The growth has led to continuing investment in the further development of cruise industry. In order to meet the needs of passengers accurately and attract more cruise ships, it is important to identify the influential cruise ports selection factors, by which we can realize the competitive advantages and disadvantages of each coastal cruises ports. Thereby provide valuable information for cruise lines, ports and destinations to develop continuous preferable cruise tourism offerings.

According to the the currency of coastal cruise ports in China, this paper has established a scientific and feasible evaluation index system. we use the comprehensive competitiveness evaluation method based on the analytic hierarchy process (AHP) and finds the important factors of location choice of coastal cruise port. With regard to different criteria that involve quantitative and qualitative aspects, four criteria and sixteen sub-criteria are selected. Experts from cruise industry and universities responded to an interview, making contribution to the design of pairwise comparison matrices for the criteria and sub-criteria. Then the competitiveness evaluation index was built based on the analysis internal and external conditions, the qualitative description of the competitive factors was transformed into quantitative measurement by AHP. Based on the analysis of each coastal cruise port, this paper put forward some suggestions, thereby enables to improve management strategies as well as attract more cruise ships and visitors and make contribution to the cruise economy.

Literature review

The development of coastal cruise tourism

Coastal cruise tourism is one of the new trend and an important part of global maritime tourism (Kim and Kim 1996) that passengers cruise along the coastline and explore the world, enjoy the beauty of sea insightfully which is different from sea travel. This kind of tourism provides unique experience for the tourist (Trisutomo 2017) coastal cruise businesses are matured worldwide, such as the Norwegian channel, North America and Australia coast have formed well-developed coastal cruise tourism system. Domestically, things are different. Coastal cruise shipping is a kind of domestic passenger transport business that foreign vessels cannot operate without special permission, and the domestic vessels have priority. However, there are only few coastal cruise products alongside coastline, which indicates variety potential opportunities (Table 1).

The background of cruise industry in China (Fig. 1)

Compared with mature Europe market, the cruise industry in china is in its infancy with ever-growing and all-promising development. China has become the second largest cruise market world start from 2016. A total 4.9 million passengers went on ocean cruise in 2018(CCYIA, 2019), accounting for 17% a share of global cruise demand. Compared with last few years, it seems indicate a slight decline trend that cruise

Table 1 The major differences between coastal and ocean cruise tourism

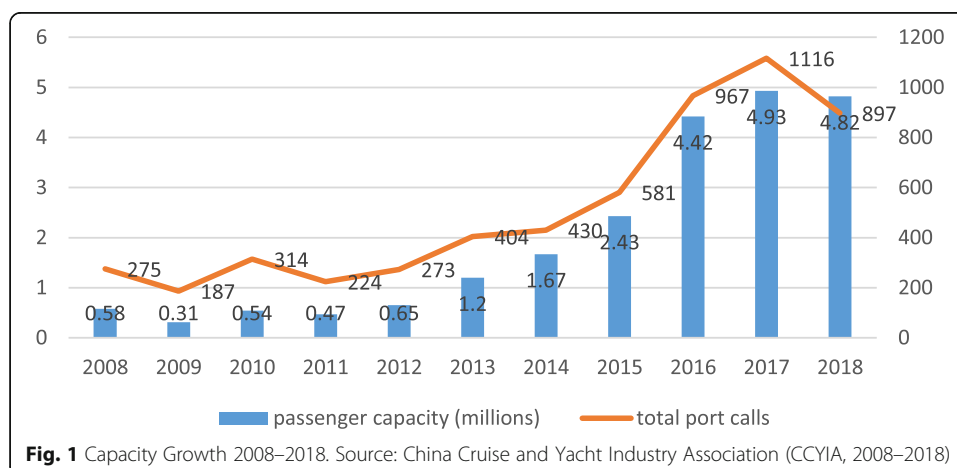
	Coastal cruise tourism	Ocean cruise tourism
Vessel flags	Domestic register	Open register; International ships registers
Cruise ship type	Mid-sized ships; Small ships	Large resort ships; Mid-sized ships
Cruise duration	Variety choices	4–6 days
Target source market	Both native and foreign	Native-based
Cruise destination	Domestic ports/islands	Foreign ports
Embark	ID card/passport	Passport
Cruise itinerary	Open/butterfly	Close

Source: authors

t?>industry will enter a new stage promises a vast potential. At present, China's ocean cruise tourism problems include: The richness and diversity of cruise line products are low, foreign cruise ships dominate the market mainly, and the development of local cruise ships is lagged behind (Yixuan 2017); The relationship between cruise ports is mainly one of competition and lack of cooperation, how to effectively unite ports is also a problem to be considered; At present, 80%–90% of the routes in the domestic cruise market are towards Japan and southeast Asia. those tedious and lack of Chinese characteristics itineraries cannot meet the growing consumer demand of tourists; The abundant coastline resources have not been fully developed and and efficiency of the port have not been utilized; The contradiction between diversification of tourism demand and low richness of cruise lines is prominent. There is a need to refresh the offerings and offer attractive and varied itineraries constantly that would appeal to the more and more sophisticated tastes change. The development of coastal cruise would be way to promote prosperous and sustainable future.

The development of coastal cruise in mainland China

Coastal cruise tourism is the combinations of leisure and sightseeing options, making exploration of natural and historic cities in coastline. China has the promote potential to develop maritime tourism, with the continental coastline extends for approximately 18,000 km, coastal water area of more than 4.7 million km², as well as pleasant climate and rich natural resources. These advantages generate the prospect development of



cruise industry (Sun et al. 2019) with the remarkable increasing demand of cruising tourism and the strong inducement of economic, China has intensively concentrated on the construction and development of cruise ports. A comprehensive cruise port system is forming along the China coastline (Sun et al. 2014). After field investigation to ports and careful consideration to current state of each port, the paper focus on 38 coastal cruise ports along the China coastline such as Shanghai port, Guangzhou port, Tianjin port, Nanjing port, Qingdao port and Shenzhen port, just to name but a few, showed in Fig. 2.



Fig. 2 The selected coastal cruise ports

The development of coastal cruise in our country still in infancy. At present, only Xisha cruise line is operated by “Dream of the South China sea” and “Changle princess” which operates in Sansha travel routes. With the support of government, the upgrading of port facilities and the completion of island tourism service facilities, the Xisha cruise tourism is becoming more and more popular. More than 70,000 passengers have been visited Xisha by cruises since 2013 (<https://www.msa.gov.cn/html/haishizhichuang/MTBD/20180117/3645FB21-A3B7-4C12-8336-8FBC60775962.html>) (Table 2).

Factors for coastal cruise port selections

In this section, we briefly reviewed the relevant academic and relate work to identify the major factors that influence the selection of coastal cruise ports. It needs all-round considerations when select ports and design itineraries, cruise product is more than transportation itself, it is a combination that includes ship as a destination and itineraries. The development of cruising activities involved the balance between socio-cultural, environment, economic, political and technical areas (Sanz-Blas et al. 2019). Manning (2006) discussed the major factors that influencing the ports selection process included the natural and cultural attractiveness of the ports, the constructions of ports infrastructure, connectivity to the adjacent destinations and the main source market, security, material supply, ports cost and the variety of itineraries for passengers to select. Lekakou et al. (2009) identified the dense port system available for arranging diversity

Table 2 Information about two domestic coastal cruises

Cruise	Dream of the South China sea	Chang le Princess
Operator	Sansha Nanhai Dream Cruises Co., Ltd.	Hainan Strait Shipping Co., Ltd.
Display		
parameters	<ul style="list-style-type: none"> Tonnage: 24572 GRT Length: 167.5 M Beam: 25.2 M Speed: 18.5 Kn Draft: 6.1M Passengers: 893 	<ul style="list-style-type: none"> Tonnage: 12336 GRT Length: 129.4 M Beam: 20.5 M Speed: 16.5 Kn Draft: 5.4 M Passengers: 537
Route		<ul style="list-style-type: none"> First day: Sanya- Xisha Second day: Xisha- Quanfu island, yagong island; Third day: Xisha- yinyu island Fourth day: Xisha- Sanya

Source: www.nanhaicruises.com; www.hnss.net.cn

of itineraries, powerful source markets and destinations along with port facilities should be taken into consideration when selecting cruise homeports or ports of call. Port competitiveness is not related only with port infrastructures, but also includes a series of derivative services to cruise ships and passengers. Moreover, the port management and political conditions and the regulatory framework also need attention. Finally, they identified the most significant factors included accessibility of the ports, flight density and reliability, tourist facilities, safety and security, urban tourism service and local transport systems, etc. Marti (1990) concluded the influencing factors included the physical conditions of the the ports and physical or cultural qualities of the port of region.

Bitiktaş and Akpınar (2016) summarized the itineraries are designed by cruise liners that are thought to attract and keep passengers' interest, the hinterland city amenities, cultural, historical and natural interest are some criteria of the select process, the programs are supposed to change actively according to social or political environment, and passenger's requirement especially. They concluded that itinerary system is the basic of cruise tourism which including visiting different destinations according to the determined schedule. All the sub systems of cruise port continue survive to achieve a special and united goal: passengers' and cruise liners' satisfaction.

Castillo-Manzano et al. (2014) justified the success reasons that the Mediterranean stands out the cruise market are: superior geographical advantage capable for easier navigation, a good climate makes it feasible to plan profitable programs, moreover the destinations also provide unique cultural-historical attractions range from towns, archaeological sites to precious civilizations. The attributes of the province (Number hotels per capita, population, islands), port and airport traffic (other port traffic, airport traffic), port authority features (depth of berth and channels, charges) are also the major issues that should be taken into account. Particularly, their study showed that ports have easy approach to hub airports and the hinterlands with a large population and unique tourism resources are the factors to attract cruises and tourists, and the traffic indications are the dominant factors.

Sun et al. (2019) pointed out that the location of cruise terminal is the most influential factors that affecting the selection process of cruise ports relatively. He established a comprehensive CRUISE framework based on the Porter's diamond framework, and extend the theory into Connectivity, Regional Competitiveness, Utilization, Infrastructure, Security, Environmental Management (CRUISE) framework and investigate locational characteristics of cruise terminals in Shanghai and Hong Kong.

Fogg (2001) found the ability for passenger handling (custom clearance, service), surrounding infrastructures such as hotel facilities, onshore tourism products matters the planning as well, he also mentioned the surrounding hotels should be paid more attention when select homeports rather than ports of call. Lasserre et al. (2019) took the Arctic regions cruise port as an example and identified a number of determinants that include the cruises operators that offer passengers with the opportunity to visit remote (the unknown and untouched) interests, the powerful maritime capabilities and mechanized ports and international airports with multiple international connections, the attractiveness of the ports of departure, the itinerary and route, seasonality and weather conditions, onshore public tourism infrastructure such as ports with passenger terminals, shops and museums, etc. other important factors contribute to the ports

competitiveness include the local leadership, political will, operator investment intensity in tourism-specific facilities, accessibility of visitors services and availability of events and the local liaison. Also the governance, policy, and regulations, infrastructure, accessibility, public transport, hotels also play key roles. The cruise operators may take the lack of maritime infrastructure as obstacle to organize their itineraries, Stewart illustrated that the development of maritime infrastructure could stimulate the interest of cruise liners. The construction of a deep water port as well as craft harbors may increase the attractiveness and promote the development of cruise tourism (Stewart and Dawson 2011).

Wang et al. (2014) revealed that cruise terminal facility (Berthing facilities, Fueling and water supply facilities, port charges, vessel services, and sea rescue systems), Natural environment of the hinterland (port climate, port security, and language ability of local residents), Tourism attractions (important historical places, culture and natural resources and diversity of onshore tourism programs), Connectivity and agility (connectivity and accessibility to port hinterland, freedom of customs, immigrations, and quarantine (CIQ), and accessibility to accommodation, entertainment) are the critical factors influencing ports selection. Beside the economic impacts, macroscopic factors such as norms, rules and policies are also critical, from the perspective of cruisers' satisfaction, a verity of literature was found that cruise ports characteristic, ports of call, and destination all have long-lasting effect (Sanz-Blas and Carvajal-Trujillo 2014).

These authors used different criteria sub-criteria to support the appropriate coastal cruise ports selection and we could have a preliminary summary, depth-interviews with experts were performed to ensure the appropriateness of those summarized factors. Finally, 4 major categories consist of 'source market', 'tourist attractions', 'port conditions' and 'policy support' that could encompass all criteria were initially proposed (Table 3).

Methodology

Factor analysis

Cruise liners keep constant attention not only on searching new ports of call but also to select ports of (dis)embarkation with cautious, as ports play a key role in the overall satisfaction of the cruise tourism. The ports selection process is extremely complicated and affected by several internal and external factors simultaneously.

Sufficient and payable passengers are the foundation and energy source of the development of the port, so the category "source market" is the primary factors should be taken into consideration when selecting a port of call. Itinerary along with on-board experience is at the heart of passenger expectations. The ability to access to places of touristic interest increasingly being important reasons to the cruise, the natural and cultural environment of the coastal cruise ports make a big different influence on the number of passengers and the type of cruises that can attract. The category "tourist attraction" is the core factors, compared with the international cruise tourism, it should be mentioned that some cities are not only play the role of source market but also the destination in the process of coastal cruise selection. Cruise ports are becoming more important with the growth of cruise industry as they connect the ship and tourist destinations, it is necessary that ports have the ability to cater for the arrival and departure of cruise ships and large passenger volumes. At the same time, the policy and

Table 3 Factors for coastal cruise port selection discussed in former papers

Authors	Source market	Tourist attractions	Port conditions	Policy support
Sanz-Blas et al. (2019)	economic	socio-cultural, environment	technical areas	political
Manning (2006)	the main source market	natural and cultural attractiveness	the constructions of ports infrastructure, connectivity to the adjacent destinations, security, material supply, ports cost and the variety of itineraries for passengers to select	
Lekakou et al. (2009)	powerful source markets	the dense destinations along with port facilities	port system available for arranging diversity of itineraries, port infrastructures, services to cruise ships and passengers	
Marti (1990)		physical or cultural qualities of the port of region	physical conditions of the ports	
Bitiktaş and Akpınar (2016)		cultural, historical and natural interest	hinterland city amenities	
Castillo-Manzano et al. (2014)	easy approach to hub airports and the hinterlands with a large population, unique tourism resources	unique cultural-historical attractions	geographical advantage, a good climate, the attributes of the province (Number hotels per capita, population, islands), port and airport traffic (other port traffic, airport traffic), port authority features (depth of berth and channels, charges)	
Sun et al. (2019)	Regional Competitiveness, Utilization, Security	Environmental	location of cruise terminal, Connectivity, Infrastructure	
Fogg (2001)	onshore tourism products	the ability for passenger handling	surrounding infrastructures such as hotel facilities	
Lasserre et al. (2019)	accessibility	the opportunity to visit remote interests, seasonality and weather conditions, onshore public tourism infrastructure, operator investment intensity in tourism-specific facilities	the powerful maritime capabilities, mechanized ports, international airports with multiple international connections, public transport, hotels	the local leadership, political will, the governance, policy, and regulations
Stewart and Dawson (2011)			maritime infrastructure construction of a deep	

Table 3 Factors for coastal cruise port selection discussed in former papers (*Continued*)

Authors	Source market	Tourist attractions	Port conditions	Policy support
Wang et al. (2014)		Natural environment of the hinterland, Tourism attractions (important historical places, culture and natural resources and diversity of onshore tourism programs)	water port, craft harbors cruise terminal facility (Berthing facilities, Fueling and water supply facilities, port charges, vessel services, and sea rescue systems), Connectivity and agility (connectivity and accessibility to port hinterland, accessibility to accommodation, entertainment) cruise ports characteristic, ports of call, and destination	freedom of customs, immigrations, and quarantine (CIQ)
Sanz-Bias and Carvajal-Trujillo (2014)				norms, rules and policies

Source: authors (2020)

regulation of the government and authority is important, the guiding and planning policies or incentive policy conditions for cruise tourism are the key factors for cruise lines.

To extract factors from the initial visions and obtain the underlying relationships associated with the factors more accurately, we invited experienced experts to incorporate the evaluation factors second time. Table 4 presents the composition of the experts, the responses of key players in the cruise industry chain such as cruise companies, cruise agents, cruise brokers, port authorities and researchers from universities and research institutions were included in the team to improve the accuracy and reliability.

Through previous studies, as well as depth-interview with experts, we summarized the relationship several select criteria for coastal cruise ports, presented in the Fig. 3. Although these four factors have different effects, they affect the competitiveness of cruise ports.

AHP is an effective solution when making decision that is inherent multi-criteria, and it is significant and successful applications in different fields. (Lo and Wen 2010) which has been used effectively when the samples are less than 50 key representatives to make a decision based criteria and sub-criteria (Whitmarsh and Palmieri 2009), tangible and intangible factors by developing a hierarchy of decision making in relation to pre-specified goal (Morgan 2017). The successful development of an AHP analysis involves three basic steps: (1) the development of a hierarchy; (2) executing data collection to establish pairwise comparison data on elements of the hierarchical structure; and (3) a synthesis of priorities to construct an overall priority rating (Saaty 1990).

Developing the AHP hierarchy

The first step is to develop AHP hierarchy involves a clear pre-specific goal and several criteria and sub-criteria. A hierarchy was established using multiple data sources including previous research and deep interview with experts.

Considering the above summary along with the suggestion from experts, four criteria and 16 sub-criteria are proposed to reflect the influential factors, some cross-check to remove duplicate factors and then integrate them which are presented in Table 5.

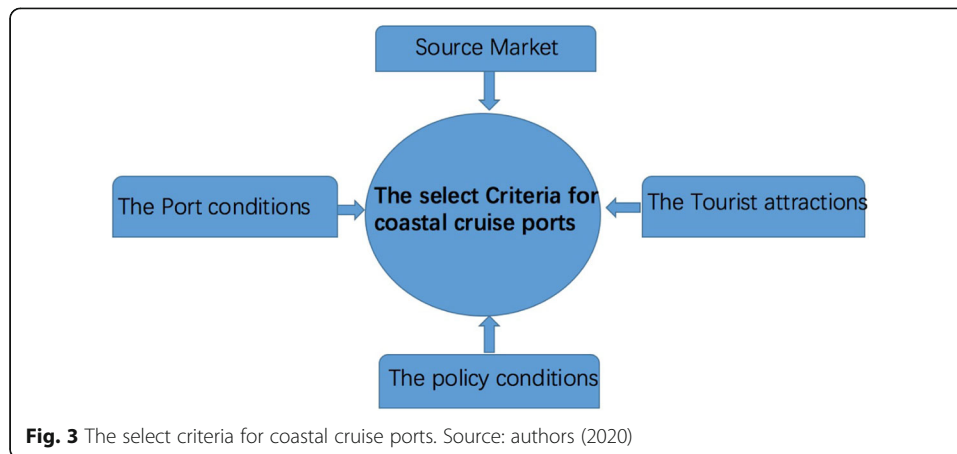
Data collection and establish pairwise comparison

A questionnaire was developed to examine and compare the relative importance and priorities of competency factors. Respondents explained the purpose of this paper and how to answer the questionnaires, thus make sure the criteria are clear and convey the same meaning to all of them. Then self-administered questionnaires were distributed to

Table 4 Composition of the pool of experts

Sector	Number of participants (<i>N</i> = 23)
Cruise companies	5
Cruise agents	4
Cruise brokers	4
Port authorities	4
Researchers	6

Source: authors (2020)



23 experts. They are expected to evaluate the relative importance of one objective relative to other, thus by a series of pairwise comparisons comprise the hierarchy of the criteria and the sub-criteria. Typically, a 9-point relative important scale is used to make the judgments where 9 represent the extreme importance of one factor over the other, and 1 mean the equally importance between the two objectives. Table 6 shows the fundamental scales of the AHP.

Statistical package for social sciences (SPSS) was used to analyze the descriptive statistics and expert choice for AHP questionnaires.

Pairwise comparison was synthesized for each level of the AHP hierarchical. And the number of them can use the formula: $[n(n-1)/2]$, where n is the number of individual criteria (Whitmarsh and Wattage 2006). For a certain criterion lever B_k , the factors below the criterion C_1, C_2, \dots, C_n , a judgment matrix with positive measurement results of $n \times n$ can be formed:

$$\begin{array}{ccccc}
 B_k & C_1 & C_2 & \cdots & C_n \\
 C_1 & C_{11} & C_{12} & \cdots & C_{1n} \\
 C_2 & C_{21} & C_{22} & \cdots & C_{2n} \\
 \vdots & \vdots & \vdots & \ddots & \vdots \\
 C_n & C_{n1} & C_{n2} & \cdots & C_{nn}
 \end{array}$$

It can be abbreviated as: $A = (a_{ij})_{n \times n}$, where the ratio of the importance of factor C_i to factor C_j in criterion B (Whitmarsh and Wattage 2006). Criteria factor loading with respect to the pre-specified goal was obtained, so as to each sub-criteria factor loading with respect to the goal and the criteria, respectively. The Consistency Index (CI) and Consistency Ratio (CR) were important to examined the validity of the results. The CR represents the how far the respondents' judgments are from perfect consistency (Tang 2014). The formula is as below:

$$\begin{aligned}
 CI &= \frac{\lambda_{\max} - n}{n - 1} \\
 CR &= \frac{CI}{RI}
 \end{aligned}$$

Where, λ_{\max} is the maximum characteristic root vector of the matrix, n is the number of factors, and RI is the mean random consistency index. For the judgment matrix of 1–9 scales, Table 7 shows the values of the RI (Whitmarsh and Wattage 2006) if the

Table 5 Hierarchy structure

Goal	Criteria	Sub-criteria	Description
A The Competitiveness Comparison of coastal cruises ports in mainland China	B1 Source market	C1 The city level	The administrative level of the port location(Municipality directly under the central government, deputy provincial cities, prefecture-level cities, county-level cities (districts and counties),etc.)
		C2 The population size	The population size of the hinterland area of the prefecture-level city where the port is located
		C3 The economic level	The economic development of cities, as well as the annual disposable income of residents.
		C4 The Tourism economy level	The domestic and foreign tourists and the tourism income of the source market.
		C5 The traffic conditions	The indicators of port cities accessibility include airport conditions (whether there is an airport within 50 km and the level of the airport) and high-speed rail station conditions (whether there is a high-speed rail station within 40 km).
	B2 The Tourist attractions	C6 The tourist attraction	The number of 5A and 4A scenic spots, world heritage sites and national tourist resorts within 100 km of the port cities;
		C7 The cultural resources	The cultural tourism resources of port cities include the conditions of intangible cultural heritage, local culture and folk customs, etc.
		C8 The Scarce resources	The scarce tourism resources of port cities include world heritage resources and local unique tourism resources.
		C9 The Ecological resources	The eco-tourism resources of port cities include national forest parks, eco-resorts and eco-tourism landscapes.
		C10 The Tourist service facilities	Supporting conditions of tourism services in port cities, including local transportation, tourism catering, tourism accommodation, etc.
	B3 The Port conditions	C11 The Terminal condition	Capable for cruise to berth and sail.
		C12 The infrastructure condition	Supporting facilities for port infrastructure and tourism services.
		C13 The distance between city and port	The distance between a port and the center of a city.
		C14 The Environmental landscape conditions	Port coastline and hinterland tourism environment and landscape conditions
	B4 policy support	C15 The guiding policy conditions	The guiding and planning policies for cruise tourism.
		C16 The incentive policy conditions	Cruise port city for cruise ship staying or as a home port incentives.

Source: authors (2020)

Table 6 The fundamental scales of AHP method

Intensity of importance on an absolute scale	Definition
1	Equal importance
3	Moderate importance of one over another
5	Strong importance
7	Very strong importance
9	Extreme importance
2,4,6,8	Intermediate values between the two adjacent
Reciprocals	Reciprocal values for inverse comparison

Source: Satty (1980)

CR is less than 0.1, which means the comparisons are acceptable, or the CR is greater than 0.1 indicates the inconsistent judgments. it's essential to make sure all of the expert's AHP judgments to be consistent, but the process was difficult. And the study distributed 3 times more questionnaires to obtain the samples meet the requirement.

Synthesis of priorities

The third step is to establish a synthesis of priorities to construct an overall priority rating.

Results

Results of AHP analysis

Based on the data from the questionnaire and AHP method, the weight of four criteria and 16 sub-criteria, the results are calculated and presented in Table 8 show that the criteria "source market" is considered most by cruise lines when select the coastal ports. The analysis results of evaluation weights for port selections were showed in Table 9.

Whether there is sufficient source market in the port city is the most important factors, and the second is the ability to offer a memorable and enjoyable experience ashore, Firstly, the radiation cities of the ports should have a rich of affluent customer base to support the constant operation. Secondly, Itineraries are well organized in such a way that enables visit the major attractions. Desirable scenic and cultural highlights are integral part of itinerary planning. Furthermore, the berthing wharf and dedicated facilities that satisfy both the cruise lines and passengers' needs. The importance of supporting infrastructure cannot be overemphasized. Suitable local service sector, such as hotel accommodation, excursions, shopping and sightseeing is also necessary to ensure passengers' enjoyable experience. The guiding and incentive policy conditions are key factors for cruise lines to select ports.

Tourists are the foundation and energy source of the development of the port, take Zhoushan port as an example, where has excellent tourism resources as well as supporting facilities and the comprehensive system of cruise ship. Zhoushan is

Table 7 Random Index values

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46

Source: Saaty (1995)

Table 8 The AHP results

Goal	Criteria	CR	Factor loading	Sub-criteria	CR	Factor loading (with respect to Goal)	Factor loading (with respect to Criteria)	
A The Competitiveness Comparison of coastal cruises ports in mainland China	B1 Source market	0.0894	0.5317	C1 The city level	0.0421	0.0351	0.0660	10
				C2 The population size		0.0654	0.1231	6
				C3 The economic level		0.2439	0.4588	1
				C4 The Tourism economy level		0.1076	0.2023	3
				C5 The traffic conditions		0.0796	0.1498	4
	B2 Tourist attractions		0.2954	C6 The tourist attraction	0.0117	0.0248	0.0840	12
				C7 The cultural resources		0.0686	0.2323	5
				C8 The Scarce resources		0.1102	0.3730	2
				C9 The Ecological resources		0.0633	0.2142	7
				C10 The Tourist service facilities		0.0285	0.0965	11
	B3 Port conditions		0.1242	C11 The Terminal condition	0.0590	0.0111	0.0895	16
				C12 The infrastructure condition		0.0609	0.4904	8
				C13 The distance between city and port		0.0242	0.1950	14
				C14 The Environmental landscape conditions		0.0280	0.2251	13
	B4 policy support		0.0488	C15 The guiding policy conditions	0	0.0122	0.2500	15
				C16 The incentive policy conditions		0.0366	0.7500	9

Source: authors (2020)

also one of the four pilot cities for the comprehensive reform of tourism in China, with the advantage of policy support. All these will provide good conditions for leisure activities of cruise passengers. However, only one cruise ship

Table 9 Summary of evaluation weights for port selections

NO	Port	Source market	Tourist attractions	Port conditions	policy support	score	NO	Port	Source market	Tourist attractions	Port conditions	policy support	score
1	Shanghai	52.364	27.008	13.230	4880	96.672	20	Taizhou	30.580	12.712	5.514	0	48.482
2	Guangzhou	49.274	23.042	11.906	4880	88.292	21	Ningde	15.405	22.070	6.468	0	43.700
3	Tianjin	49.578	22.436	11.422	3050	85.676	22	Weihai	19.716	13.952	9.966	0.610	43.596
4	Nanjing	48.762	26.090	10.604	0.610	85.418	23	Beihai	13.506	19.367	7.917	2.440	42.906
5	Qingdao	45.112	22.636	12.110	4880	83.928	24	Yangjiang	20.707	14.116	5.796	0	40.295
6	Shenzhen	47.240	20.431	11.868	4880	83.609	25	Lianyungang	19.125	7.460	9.686	4.270	39.893
7	Xiamen	31.519	25.204	13.230	4880	74.023	26	Zhuhai	15.598	14.897	9.562	0	39.409
8	Ningbo	46.212	18.121	9.170	0.610	73.546	27	Zhanjiang	19.186	10.665	7.188	2.684	39.399
9	Yantai	37.873	17.266	9.762	4.270	68.523	28	Dandong	17.672	17.665	3.948	0	39.204
10	Dalian	39.091	17.266	10.170	2.440	68.319	29	Haikou	13.627	13.409	7.082	4.270	38.064
11	Fuzhou	37.428	20.863	9.303	0.610	67.556	30	Shantou	19.103	12.216	6.018	0.244	37.257
12	Quanzhou	34.243	24.123	9.432	0	67.231	31	Fangchenggang	9.506	18.946	7.304	0	35.432
13	Wenzhou	32.573	18.142	6.162	4.270	60.823	32	Putian	16.201	11.931	6.766	0.244	34.737
14	Huizhou	31.863	20.915	5.516	0.244	58.214	33	Qinzhou	12.568	15.463	6.820	0	34.527
15	Sanya	15.520	27.704	9.910	4880	57.528	34	Pingtian	5.450	18.034	8.476	0.610	32.165
16	Yangzhou	23.258	25.272	9.470	0	57.433	35	Rizhao	12.855	11.979	7.884	0	32.151
17	Nantong	34.011	11.124	8.124	0	52.733	36	Shanwei	10.018	7.828	6.038	0	23.560
18	Qinhuangdao	18.302	25.008	9.634	0.244	52.621	37	Yingkou	13.786	5.339	4.322	0	23.204
19	Zhoushan	12.734	25.820	10.116	3.416	51.519	38	Danzhou	8.2305	5.904	4.864	0	18.755

called in Zhoushan port in 2018, and only 354 tourists. Unfortunately, things are seemed to getting worse in 2019. The awkward situation may be caused by the weak source market.

From the analysis results and situations of these coastal ports, there may be some valuable referential implications. For example, Shanghai port was found to rank highly with respect to all four criteria, which means that Shanghai port has the potential to be leading and core role in the development of coastal cruise. According to the results, Nanjing port ranking fifth in the Comprehensive system. Nanjing as the ancient capital of the six dynasties is famous for its cultural deposits, as well as natural environment and the diversity of tourism industries. Compare to other excellent ports, Nanjing port is falls short on the category of “policy support”. the situation is similar in Ningbo port. With the increasing attention from authorities, their ranks may change greatly. In Sanya, where is called the “Oriental Hawaii” owns pleasant climate, prominent port condition, and handful of tourist sites. However, Sanya is far away from the major powerful source markets, inadequate cruisers limit its ability to develop its cruise market potential.

Conclusions

The fast-growing cruise industry which has the significant influence and the promote potential draw tremendous enthusiasm. Considering the current embarrassed ocean cruise market, coastal cruises would be a good choice. Recently, cruise ports sprung up in China's coastline and many port cities incorporate cruise tourism into development strategy. Whether a cruise port was included in cruise lines' itineraries design will directly affect the profitability and survival of the port. it is necessary to analyze the factors that affect the selection of cruise ports and design of itineraries to meet the need of cruise liners and passengers more accurately,

This paper identifies the main factors motivating cruise liners to select specific ports by using AHP method. The results show that the sufficient source market is the most important factors, and the second is the ability to offer a memorable and enjoyable experience ashore, Furthermore, the berthing wharf and dedicated facilities that satisfy both the cruise lines and passengers' needs. Last but not least, the guiding and incentive policy conditions are key factors for cruise lines to select ports, these factors affect the competitiveness of cruise ports simultaneously.

To enhance core competitiveness and attract more cruises and more cruisers in the future, there are different improvements for different ports. The strong source market is the most important factors when select ports of call. The development of coastal cruise tourism is in initial stage, priority should be given to excellent choices. Yangtze river delta region could be an excellent pilot with sufficient hinterland, attractive tourism resources, complementary infrastructure as well as policy supporting. At the same time, pay attention to accelerate the popularization of cruise culture and keep the steady stream of customers. Just sightseeing can no longer meet the needs of tourists. Each port should combine their respective location, resources and other unique characteristics of the advantages in order to avoid

the homogenization of products caused by vicious competition. Take full use of local characteristic resources to create local attractions. During the integration of tourism resources, the most unique and attractive tourism attraction of the place should be mining deeply. In term of the infrastructure of the port, it is essential to form a unified standard, or experience that can be copied and promoted so as to provide standardized services to cruise and cruisers, achieve the goal of maximize satisfaction.

The port management departments should actively strive for favorable policies supporting to lure more cruises.

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Yuanyuan Zhu conceived of the study, and participated in its design and coordination and performed the statistical analysis and draft the manuscript. Juehao Cheng participated in the design of the study. All authors read and approved the final manuscript.

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Availability of data and materials

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Competing interests

The authors declare that they have no competing interests.

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References

- Bitiktaş F, Akpınar H (2016) A system approach for cruise port attractiveness: an evaluation of Turkish cruise ports
- Castillo-Manzano JI, Fageda X, Gonzalez-Laxe F (2014) An analysis of the determinants of cruise traffic: an empirical application to the Spanish port system. *Transp Res E Logist Transp Rev* 66:115–125
- Fogg JA (2001) Cruise ship port planning factors. Ph.D. Thesis, Florida International University, Miami
- Kim SG, Kim YJE (1996) Overview of coastal and marine tourism in Korea. *J Tour Stud* 7(2):46
- Lasserre F, Têtu P-L, Dawson J (2019) The evolution and relative competitiveness of global arctic cruise tourism destinations. <https://doi.org/10.4324/9781351037464-7>
- Lekakou MB, Pallis AA, Vaggelas GK (2009) Which homeport in Europe: the cruise industry's selection criteria. *TOURISMOS* 4(4):215e240
- Lo YF, Wen MH (2010) A fuzzy-AHP based technique for the decision of design feature selection in massively multiplayer online role-playing game development. *Expert Syst Appl* 37:8685e8693
- Manning, T. (2006). Managing cruise ship impacts: guidelines for current and potential destination communities. <http://www.tourism.org/content/projects/Managing%20Cruise%20Ship%20Impacts.pdf>
- Marti BE (1990) Geography and the cruise ship port selection process. *Marit Policy Manage* 17(3):157–164
- Morgan R (2017) An investigation of constraints upon fisheries diversification using the Analytic Hierarchy Process (AHP). *Marine Policy* 86:24–30
- Saaty TL (1980) The analytic hierarchy process. McGraw-Hill, New York
- Saaty TL (1990) How to make a decision: the analytic hierarchy process. *Eur J Oper Res* 48(1):9–26
- Saaty TL (1995) Decision-making for leaders: the analytical hierarchy process for decisions in a complex world. RWS Publications, Pittsburgh
- Sanz-Blas S, Buzova D, Schlesinger W (2019) The sustainability of cruise tourism onshore: the impact of crowding on visitors' satisfaction. *Sustainability* 11:1510
- Sanz-Blas S, Carvajal-Trujillo E (2014) Cruise passengers' experiences in a Mediterranean port of call—the case study of Valencia. *Ocean Coast Manag* 102:307–316
- Stewart EJ, Dawson J (2011) A matter of good fortune? The grounding of the clipper adventurer in the NWP, Arctic Canada. *Arctic* 64(2):263–267
- Sun X, Feng X, Gauri DK (2014) The cruise industry in China: exports, progress and challenges. *Int J Hosp Manag* 42:71–84
- Sun X, Yip TL, Lau Y-Y (2019) Location characteristics of cruise terminals in China: a lesson from Hong Kong and Shanghai. *Sustainability* 11:5056. <https://doi.org/10.3390/su11185056>
- Tang H-WW (2014) Constructing a competence model for international professionals in the MICE industry: an analytic hierarchy process approach. *J Hosp Leis Sport Tour Educ* 15:34–49
- Trisutomo S (2017) Visual assessment on coastal cruise tourism: a preliminary planning using importance performance analysis. *IOP Conf Ser Earth Environ Sci* 79:012014. <https://doi.org/10.1088/1755-1315/79/1/012014>
- Wang J (2010) The study on location choice of cruise home port. University of Finance and Economics, Tianjin

- Wang Y, Jung K, Yeo G, Chou C (2014) Selecting a cruise port of call location using the fuzzy-AHP method: a case study in East Asia. *Tour Manag* 42:262–270
- Whitmarsh D, Palmieri MG (2009) Social acceptability of marine aquaculture: the use of survey-based methods for eliciting public and stakeholder preferences. *Mar Policy* 33:452–457
- Whitmarsh D, Wattage P (2006) Public attitudes towards the environmental impact of salmon aquaculture in Scotland. *Eur Environ* 16:108–121
- Yixuan L (2017) Research on port selection and ship assignment of coastal cruise lines in China. Dalian Maritime University

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