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Research Article

Analysis of the river cruise network in Southeast Asia: A complex network approach

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Abstract

River cruise shipping is a tourism sectors which tends to have rapid growth. This study analyzes the structural properties and connectivity of the river cruise network and cruise ports by using complex network analysis. By analyzing 257 river cruise voyages operated by 5 cruise lines in Southeast Asia, this study shows that the network consists of 31 cruise ports, connected by 94 cruise routes. A small number of ports play a central role in connecting to other ports in the network. The network has a short average path length and a low clustering coefficient. Siem Reap, Koh Chen, Ho Chi Minh City, Halong Bay, and Thanh Pho Ninh Binh are hubs with high connectivity. Siem Reap also plays an intermediary role, and has high reachability with other ports in the network, with the highest betweenness and closeness centralities. The findings of this study are useful for cruise lines and cruise port authorities for improvement of their operations and service network.

1. Introduction

A cruise shipping service is a combination of transportation and tourism (Niavis & Tsiotas, 2018). It services cruise passengers onshore and onboard with many cruise facilities, including entertainment, accommodation, fitness, food and beverages, shopping facilities, and childcare (Sun et al., 2019). The total number of global cruise passengers rose from 17.8 million in 2009 to 29.7 million in 2019 (CLIA, 2021). North America is the largest source market, compared to others, accounting for more than half of the total market share, followed by Western Europe, Asia, Australasia, and South America. The top five destinations with the largest volume of cruise passengers are the Caribbean, the Bahamas, Bermuda, Asia, and China (CLIA, 2022). River cruising also increases the cruise business (CLIA, 2021), and it combines different transport modes, requiring a variety of logistical infrastructures over a wide geographical area (Hall, 2013). Cruise lines design

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their voyages based on specific factors and destinations that influence the structural properties and connectivity of the river cruise network (Kanrak & Nguyen, 2021).

Cruise lines provide cruise services in Southeast Asia mainly in the Mekong and Red Rivers (Cruisecritic, 2022). The Mekong is a transboundary river in East Asia and Southeast Asia. It is the world's twelfth-longest river and the third-longest in Asia, and its estimated length is 4,909 kilometers (Liu et al., 2009; MRC, 2010). China, Thailand, Laos, Cambodia, Myanmar, and Vietnam share the Mekong River Basin and water flows (MRC, 2010). The Mekong is also the most popular river for cruising in Southeast Asia (Bosnic & Gasic, 2019). Five cruise lines provide services on this river (Cruisecritic, 2022). The Red River has a 1,149-kilometer length that flows from Yunnan in Southwest China through northern Vietnam to the Gulf of Tonkin (Tikkanen, 2022). Most voyages serviced in the Red River are operated by Pandaw River Cruises (Cruisecritic, 2022). Many voyages consist of popular destinations in this region, such as Angkor in Cambodia (Baniya et al., 2021). There are also some voyages consisting of destinations in other locations (Indonesia and Papua New Guinea) that have no river cruising to attract more passengers and increase sales (Gustafson, 2001).

This study analyzes the river cruise network in Southeast Asia to investigate its topological properties and characteristics, and identifies the roles that river cruise ports play in the network using complex network analysis.

The rest of this paper is structured as follows. Section 2 represents a literature review of the river cruise market and relevant studies. Section 3 explains the research methodology and data. Section 4 presents network analysis results. The conclusions and implications for future research are presented in Section 5.

2. Literature review

2.1 River cruise market

In the past decade, the international river cruise market has had a high growth demand, with the number of river cruise passengers dramatically increasing. The number of river cruise passengers in the European region moved upwards, from 151,400 to 207,700 (CLIA, 2019). The number of river cruise passengers in non-European regions has grown rapidly, from 22,900 to 24,600 (CLIA, 2019). The global river cruise market value increased from USD 4,789.4 million in 2018 to USD 5,600.98 million in 2021, and was expected to reach USD 7,660 million in 2027 (Statista, 2022). Reasons for this fast increase include the characteristics of river cruising to provide tourists with the opportunity to investigate laid-back villages, riverside towns, and energetic cities, and their easy reachability– to go to unexplored areas that large cruise ships are unable to access.

Currently, the largest market size for river cruising is mainly found in Africa, Southeast Asia, the United States of America, and Europe. Around 90 % of global river cruise passengers are in the European region, where 64 % visit the Rhine, the Danube, and their tributaries (Tomej & Lund-Durlacher, 2020). Thus, Europe has the biggest cruise fleet, followed by the Nile and other African rivers (CCNR, 2020). Many popular locations favor the growth of river cruises containing Paris, Budapest, London, Amsterdam, Cairo, Luxor, New York, San Antonio, Ho Chi Minh City, Bangkok, and Singapore. In terms of the competitive landscape, American Queen Voyages, Avalon Waterways, Ama Waterways, American Cruise Lines, Uniworld River Cruises, and Viking River Cruises are the key players in the river cruise market (FMI, 2022).

River cruises can last from a few hours to many days. They may pass through inland waterways/river estuaries and lakes, or partially travel across the seacoast (Tomej & Lund-Durlacher, 2020). On average, the size of river cruise ships is 11 meters wide and 109 meters long, with a maximum capacity of 143 passengers (Grammerstorf, 2013).

River cruises are supported by land local destination assets. The basic principle of river cruises is the supply of offboard accommodation, along with an intermodal transport system to and from the destination (Guedes & Rebelo, 2021). River cruising is usually still placed in the luxury segment,

with rates ranging from USD 200 to USD 500 per person per night. The average age of river cruise passengers is still in the sixties (Tomej & Lund-Durlacher, 2020).

Although river cruising is growing in demand, it has been investigated to a limited scope (Tomej & Lund-Durlacher, 2020). The river cruise network structure is still under-researched, especially in Southeast Asia, which is a region with a high potential growth rate for river cruise shipping.

2.2 Studies on cruise shipping

Studies on cruise shipping cover topics related to cruise destinations (Paoli et al., 2017; Weaver & Lawton, 2017), analysis of itinerary routes (Lee & Ramdeen, 2013; Rodrigue & Notteboom, 2013), supply chain management (Zhou et al., 2022), cruise demand (Xie et al., 2021), productive efficiency (Chang et al., 2017), sustainability concerns (Simonsen et al., 2019; Paiano et al., 2020), and the significance and economic impact of cruising (Larsen et al., 2013; Chen et al., 2019). There have also been some studies that analyzed ocean cruise networks, such as Jeon et al. (2019), Tsiotas et al. (2018), Kanrak and Nguyen (2021, 2022) and Kanrak et al. (2022).

Studies on river cruise tourism have focused on a limited number of topics, such as the future of cruising and its typologies (Dowling & Weeden, 2017), development issues (Van Balen et al., 2014), European river historical depiction (Erfurt-Cooper, 2009) and cruiser behaviors (Erdeji & Dragin, 2017; Cooper et al., 2019). There is limited research on river cruise shipping, especially river cruise network analysis which displays geographical data and network and destination properties. In other words, studies on an analysis of river cruise networks remain under-researched.

Only Guedes and Rebelo (2021) analyzed the physical network of river cruise shipping as a relational system, using centrality and constraint measures. They found that logistical attributes, rather than attraction, have a great influence on most centrality and constraint metrics. River cruising's destination network has proven to be a multimodal transit network structure in a hub-and-spoke network framework. It exhibits several modules linked by connector hubs, which is consistent with a power-law distribution common to real-world networks. The literature shows a lack of research on network analysis of river cruises in Southeast Asia, whose market share is expected to grow rapidly in the forthcoming years.

3. Research methodology

This study aims to interpret the network structure and connectivity of river cruise shipping using complex network analysis to analyze network structural properties and ports. The study gives paramount importance to network visualization as a whole in Southeast Asia. A model is applied to build network studies based on nodes that are connected by edges or links (Ducruet & Notteboom, 2012; Ducruet & Zaidi, 2012; Tsiotas & Polyzos, 2015; Tsiotas et al., 2018; Mou et al., 2020; Kanrak & Nguyen, 2021, 2022; Kanrak et al., 2022). In this study, nodes are river cruise ports, and links are cruise shipping routes that connect between ports in direct ways.

An analysis is conducted both at the network and port levels. At the network level, the topological structure of the river cruise network in Southeast Asia is analyzed using network density, average path length, and average clustering coefficient. At the port level, degree, betweenness, and closeness centralities are used to identify the important key ports and their roles. The details of these measures are presented in **Table 1**.

Network density is used to analyze the connectivity of the river cruise network in Southeast Asia as a whole. The average path length is used to analyze the average shortest path of ports in the network, reflecting the network's efficiency. The average clustering coefficient is used to analyze intra-connectivity among ports. Degree centrality analyzes ports' connectivity levels, reflecting their hub roles. Betweenness centrality determines the intermediary role of ports with high accessibility between two ports. Closeness centrality analyzes the reachability of a port to other ports in the network.

Table 1 Measures for analyzing network and port properties.

	Measure	Description	Equation
Network level	Network density	The proportion of the number of links that a network has to the possible number of links	$\rho(G) = \frac{m(G)}{n(n-1)}$
	Average path length	The average number of connection steps along the shortest paths for all possible pairs of nodes	$L = \frac{1}{n(n-1)} \sum_{i \neq j}^{n} d_{ij}$
	Average clustering coefficient	The mean of the probability of a new pair of nodes to the third node in a network	$C = \frac{1}{n} \sum_{i=1}^{n} \frac{2E_i}{k_i(k_i-1)}$
Port level	Degree centrality	Sum of the number of links that a node has	$C_D = \sum_{j=1}^{n} a_{ij}$
	Betweenness centrality	Fraction of the shortest paths passing through a given node and the number of the shortest paths	$C_B = \sum_{s \neq i \neq t} \frac{\sigma_{st}(i)}{\sigma_{st}}$
	Closeness centrality	The inverse of the average shortest paths from a node to all other nodes in the network	$C_C(i) = \frac{n-1}{\sum_{j \neq i} d_{ij}}$

The measures in **Table 1** use the following notations:
$m(G)$ = number of links that a network has,
n = number of nodes,
d_{ij} = connection steps between nodes i and j,
E_i = number of existing links between the neighbor of node i,
k_i = number of links of node i,
a_{ij} = constant is one if a link connects ports i and j; zero if otherwise,
$\sigma_{st}(i)$ = number of the shortest paths passing through node i, and
σ_{st} = number of the shortest paths.

The network is built based on cruise ship movements and cruise ports. The first result is a river cruise network comprising direct links between river cruise ports. This can be analyzed by creating a graph of direct linkages based on a sequence of ports of call in each cruise itinerary or voyage, namely from ports 1 to port 2 and from port 2 to port 3. This study defines ports as any stops on itineraries by cruise ships, such as islands, beaches, tourist places, bays, terminals, and ports (Kanrak et al., 2022). The study uses the secondary data collected from the website of the Australian cruise agent (https://www.cruisecritic.com.au). The network data consists of 31 ports in 5 countries, and 257 voyages offered by 5 cruise lines with 9 cruise ships. Note that the data is based on the current plans of cruise lines to be serviced in 2023; any cancellations or schedule changes in the future are not considered or updated. Thus, an analysis is done for 2023. The R software is used to analyze the data of the study.

4. Empirical findings

Figure 1 illustrates the river cruise network in Southeast Asia, with 31 ports in Thailand, Vietnam, Laos, and Cambodia connected by 94 cruise routes (links). The network appears to have two clusters connected, indicating that cruise ships call at multiple ports in the same regions conveniently. This reflects the fact that cruise ports are connected to others within the same location,

but are rarely connected to other ports in other locations. The reason lies in their geographical limitation, as rivers do not mix.

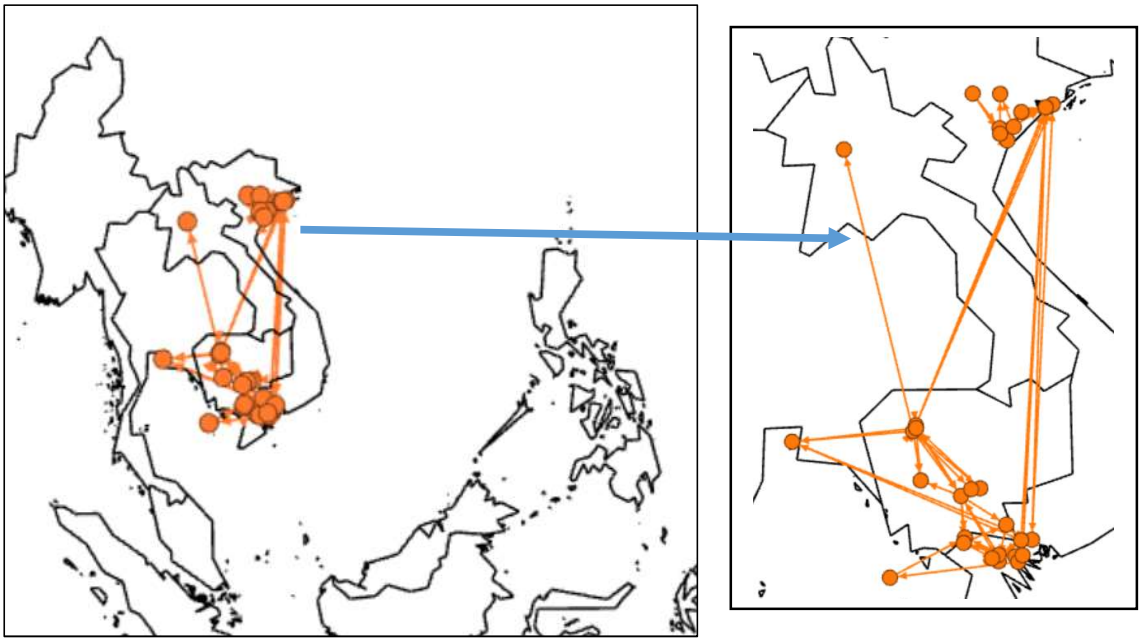

Figure 1 Graph of the river cruise network in Southeast Asia.

In 2023, there will be 257 cruise voyages serviced by 5 cruise lines. Scenic will service the largest number of voyages, accounting for 42.41 %, followed by Avalon Waterways, Croisi Europe, and Pandaw River Cruises, servicing 69, 56, and 22 voyages, respectively. Lindblad Expeditions will service only 1 voyage, as shown in Table 2. There are 98 voyages starting from Ho Chi Minh City, and 78 voyages starting from Siem Reap, which accounts for 68.09 % of the total voyages. Ho Chi Minh City and Siem Reap are also the most popular ending ports; the largest number of voyages end at these ports, with 89 and 72 voyages, respectively. This reflects that Ho Chi Minh City and Siem Reap are the most popular ports for embarking and disembarking for cruise shipping in Southeast Asia.

Table 2 Number of river voyages in Southeast Asia to be serviced in 2023.

Cruise line	Number of voyages	Share of total (%)
Avalon Waterways	69	26.85
Croisi Europe	56	21.80
Lindblad Expeditions	1	0.38
Pandaw River Cruises	22	8.56
Scenic	109	42.41

4.1 Network structural properties

The network has a density of 0.14194, reflecting that 14.19 % of possible connections between ports are covered by cruise shipping. This also implies that cruise lines are selective in setting itineraries and are efficient in serving a larger network with a small number of links (Kanrak &

Nguyen, 2021). A low network density also reflects that the river cruise network is a sparse network, indicating that not all ports can connect to each other.

The average path length reflects the network's efficiency in terms of convenience for cruise passengers reaching ports in the network. The network has an average path length of 2.5871, which is relatively small compared to the small number of ports that the network has. This indicates that cruise ships have a high ability to reach ports with short connection steps, reflecting that the network has high efficiency. The average number of ports per voyage is 9, confirming that the network is tight.

The clustering coefficient shows the intra-connectivity of ports, which is reflected by the probability of meeting connected neighbors of ports in the network. The network has an average clustering coefficient of 0.35849, which is relatively low. This implies that the probability of meeting linked neighbors around a port is 35.85 %, reflecting that the neighbors of a port have weak connectivity. In other words, there is a small number of connections among the neighbors of each port, indicating that the network has a small intra-connectivity among its ports.

4.2 Port properties

The properties of river cruise ports can be analyzed using three centrality measures: degree centrality, betweenness centrality, and closeness centrality.

The network has an average degree centrality of 4.26, indicating that each port can be connected to at least four other ports on average. **Table 3** shows the top five ports with the highest degree centrality values in the Southeast Asian River cruise network. Siem Reap and Koh Chen are ports with the highest degree centrality of 11, indicating that these two ports are connected to 11 other ports. Thus, they are the most important ports in the network, and are hubs controlling network connectivity, as they have the largest number of links. Ho Chi Minh City and Halong Bay rank second, with 9 degrees, followed by Thanh Pho Ninh Binh and Angkor Wat, with 7 and 6 degrees, respectively. Three ports rank fifth, with five degrees. This can confirm that Siem Reap, Koh Chen, Ho Chi Minh City, and Halong Bay are the most popular ports for cruise shipping in terms of their high connectivity. Therefore, they are defined as hubs for cruise shipping in this region.

Table 3 Top five ports with the highest values of degree centrality.

Rank	Port	Degree centrality
1	Siem Reap, Koh Chen	11
2	Ho Chi Minh City, Halong Bay	9
3	Thanh Pho Ninh Binh	7
4	Angkor Wat	6
5	Cai Be, Chau Doc, Gia Thanh	5

Figure 2 presents the cruise links (cruise services) distributed among all ports in the network. The network has a large number of ports (70.97 %) that have degree centrality values of less than five degrees. In other words, these ports have low connectivity. Among these, 22.5 % of ports have four degrees. It is worth noting that 45.16 % of ports have 2 - 3 degrees, while only one port has one degree. In contrast, a small number (less than 30 %) of ports have at least five connections. Thus, the network has a small number of ports as hubs, with a large number of connections controlling network connectivity.

In terms of the popular cruise routes, the routes with the largest number of sailings are the most popular links in the network. **Table 4** shows the five most popular river cruise routes in Southeast Asia. Kampong Cham-Koh Chen is the most popular route, with the largest number of 90 sailings, followed by Angkor Thorm-Koh Chen, Ho Chi Minh City-Cu Chi Tunnels, Siem Reap-Kampong Cham, and Khum Angkor Ban-Koh Chen, with 89, 59, 58, and 53 sailings, respectively.

This reflects that these routes are famous for cruise shipping, since they connect between ports with a large number of attractions. However, ten routes have the lowest number of sailings of one, indicating that these routes are not popular for cruise shipping.

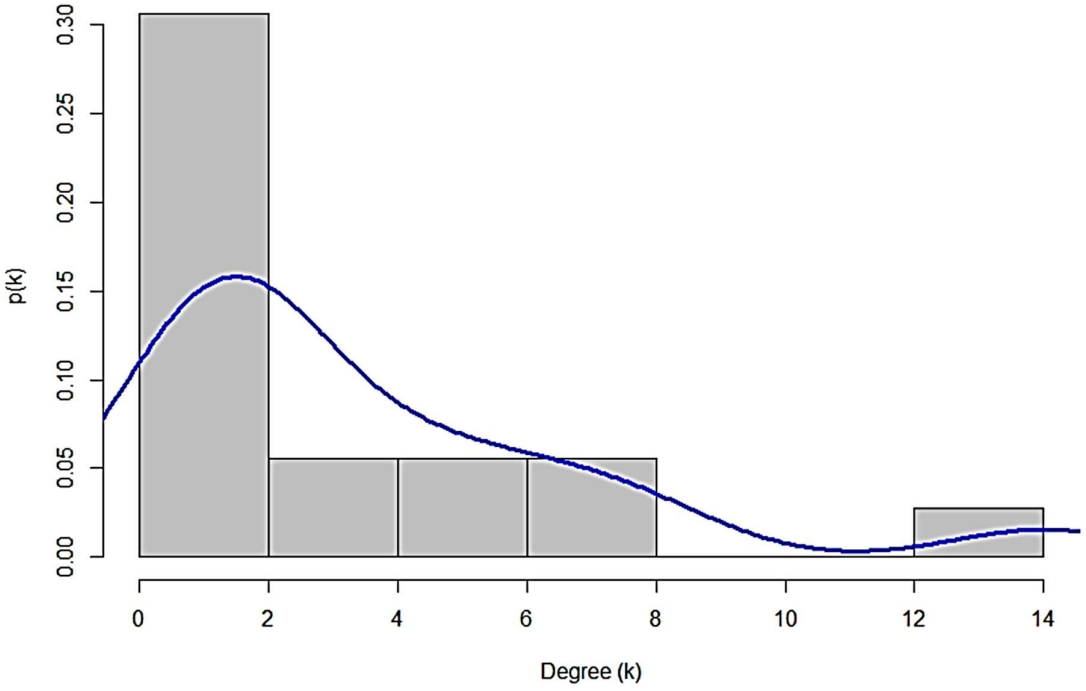

Figure 2 Degree distribution of river cruise ports.

Table 4 Most popular river cruise routes in Southeast Asia in 2023.

Rank	From	To	Sailing frequency/year
1	Kampong Cham	Koh Chen	90
2	Angkor Thorm	Koh Chen	89
3	Ho Chi Minh City	Cu Chi Tunnels	59
4	Siem Reap	Kampong Cham	58
5	Khum Angkor Ban	Koh Chen	53

In terms of betweenness centrality, the average betweenness centrality of river cruise ports in the network is 44.50. Siem Reap has the highest betweenness centrality, followed by Angkor Wat, Halong Bay, Ti Top Island, and Koh Chen. Siem Reap's betweenness centrality is 5.66 times higher than the average value, while Angkor Wat, Halong Bay, Ti Top Island, and Koh Chen are 4.74, 3.98, 3.08, and 3.01 times higher than the network's average, respectively. Therefore, these ports are centers of the network, as they have the shortest paths connecting ports. Thus, they play an intermediary role in the network. **Table 5** presents the betweenness of all ports in the network. The betweenness centrality of 16.13 % of ports is higher than 100, while that of 12.9 % of ports is between 51 - 100, and that of 25.81 % of ports is between 1 - 50. Interestingly, 45.16 % of ports do not play an intermediary role, because they have no shortest path between them to another port. Thus, they are peripheral ports in the network.

Table 5 Betweenness centrality of river cruise ports.

Betweenness centrality	Number of ports	Share of total (%)
0	14	45.16
1.00 - 20.00	3	9.68
21.00 - 40.00	4	12.90
41.00 - 60.00	3	9.68
61.00 - 80.00	1	3.23
81.00 - 100.00	1	3.23
> 100	5	16.13

In terms of closeness, the network has an average closeness centrality of 0.00235, reflecting the average reachability of a port. Siem Reap has the highest closeness centrality, followed by Angkor Wat, Ti Top Island, Laem Chabang, Luon Cave, and Kampong Cham. This indicates that these ports have the highest reachability in the network, since they have the shortest paths to reach other ports. Siem Reap's closeness centrality is 1.48 times higher than the average, and Angkor Wat, Ti Top Island, Laem Chabang, Luon Cave, and Kampong Cham have 1.45, 1.38, 1.35, 1.35, and 1.32, respectively. **Table 6** presents river cruise ports in Southeast Asia that have closeness centrality between 0.0000 and 0.00100, accounting for the lowest proportion of 3.23 %, which is the same proportion of ports with closeness centrality between 0.00101 and 0.00150. Ports with closeness centrality values from 0.00151 - 0.00200 account for 29.03 %. 19.35 % of ports have closeness centrality values of 0.00201 - 0.00250, which is similar to the number of ports with closeness centrality higher than 0.00300. The number of ports with closeness centrality values between 0.00251 and 0.00300 accounts for 25.81 %.

Table 6 Closeness centrality of river cruise ports.

Closeness centrality	Number of ports	Share of total (%)
0 - 0.00100	1	3.23
0.00101 - 0.00150	1	3.23
0.00151 - 0.00200	9	29.03
0.00201 - 0.00250	6	19.35
0.00251 - 0.00300	8	25.81
> 0.00300	6	19.35

To sum up, a complex network analysis of the river cruise network in Southeast Asia shows that the network has high efficiency. Its structural characteristic exhibits a small-world property. Siem Reap is the most important port, with the highest values of all measures. These address the objective of this study.

5. Conclusions

This study analyzed the structural properties of the river cruise network and cruise ports in Southeast Asia using complex network analysis. The results show that the network consists of 31 ports, connected by 94 links. It has a short average path length and a low average clustering coefficient. A small number of ports have high connectivity, and most ports have low connections. Cruise ports play different roles based on centrality measures. Siem Reap, Koh Chen, Ho Chi Minh City, Halong Bay, and Thanh Pho Ninh Binh are hubs of the network, with the highest values of degree centrality. Siem Reap, Angkor Wat, Halong Bay, Ti Top Island, and Koh Chen have the

highest betweenness centrality. Thus, they play an intermediary role in the network. Siem Reap, Angkor Wat, Ti Top Island, Laem Chabang, Luon Cave, and Kampong Cham are ports with high reachability, since they have the highest closeness centrality.

The findings of this study are useful for cruise lines and cruise port authorities. Cruise lines can use the findings to design their voyages by covering hub ports to increase network connectivity. Authorities can promote their ports with low connectivity as hubs by trying to connect high-degree ports. They may also increase the number of service links to other ports in the network. Authorities may also provide monetary promotions to attract more cruise ships and cruise passengers.

This study is subject to some limitations. First, this study analyzed the properties of the network and ports using several measures of complex network analysis, which only show a few properties. Future research could use more measures and statistics to analyze the network, such as rich-club coefficient, assortativity, modularity, strength centrality, and eigenvector centrality. Second, this study considered only the number of links to reflect the connectivity of the network and ports. Future research could consider other factors that might affect their connectivity, such as the attributes of ports and government policies. Third, this study analyzed the secondary data without considering primary data such as the opinions of port and cruise line managers on their network operations to support the findings. This could be carried out in future research to gain more insightful information. Fourth, this study only analyzed the overall structure and properties of the network. A comparison of the relationship between upstream ports and downstream ports, and how this affects the network growth and cruise ships' scheduling, could be considered in future works. Fifth, this study focuses only on an analysis of a river cruise network in one region. To increase the generalization of the study, future research could analyze the river cruise networks in diverse regions and compare the differences between them. Sixth, future research could use the measure of market concentration (e.g., Herfindahl-Hirschman Index), along with network analysis measures, to analyze cruise shipping, which could provide insight into details about cruise operations and markets.

References

Baniya, R., Dogru-Dastan, H., & Thapa, B. (2021). Visitors' experience at Angkor Wat, Cambodia: Evidence from sentiment and topic analysis. *Journal of Heritage Tourism, 16*(6), 632-645. https://doi.org/10.1080/1743873X.2020.1833892

Bosnic, I., & Gasic, I. (2019). River cruise industry: Trends and challenges. *Economic and Social Development: Book of Proceedings, 2019*, 32-41.

CCNR. (2020). *Annual Report - Inland Navigation in Europe Market Observation*. Central Commission For the Navigation of the Rhine.

Chang, Y. T., Lee, S., & Park, H. (2017). Efficiency analysis of major cruise lines. *Tourism Management, 58*, 78-88. https://doi.org/10.1016/j.tourman.2016.10.012

Chen, J. M., Petrick, J. F., Papathanassis, A., & Li, X. (2019). A meta-analysis of the direct economic impacts of cruise tourism on port communities. *Tourism Management Perspectives, 31*, 209-218. https://doi.org/10.1016/j.tmp.2019.05.005

CLIA. (2019). *Ocean & River cruise review 2018*. Retrieved from https://cruising.org/-/media/eu-resources/pdfs/CLIA-Cruise-Review-2018-Published-2019

CLIA. (2021). *State of the cruise industry outlook*. Retrieved from https://cruising.org/en/news-and-research/research/2019/december/state-of-the-cruise-industry-outlook-2020

CLIA. (2022). *State of the cruise industry outlook*. Retrieved from https://cruising.org/-/media/clia-media/research/2022/clia-state-of-the-cruise-industry-2022_updated.ashx

Cooper, D., Holmes, K., Pforr, C., & Shanka, T. (2019). Implications of generational change: European river cruises and the emerging Gen X market. *Journal of Vacation Marketing, 25*(4), 418-431. https://doi.org/10.1177/1356766718814088

Cruisecritic. (2022). *Cruisecritic*. Retrieved from https://www.cruisecritic.com.au

Dowling, R., & Weeden, C. (2017). *Cruise ship tourism*. CABI. https://doi.org/10.1079/9781780646084.0000

Ducruet, C., & Notteboom, T. (2012). The worldwide maritime network of container shipping: Spatial structure and regional dynamics. *Global Networks, 12*(3), 395-423. https://doi.org/10.1111/j.1471-0374.2011.00355.x

Ducruet, C., & Zaidi, F. (2012). Maritime constellations: A complex network approach to shipping and ports. *Maritime Policy & Management, 39*(2), 151-168. https://doi.org/10.1080/03088839.2011.650718

Erdeji, I., & Dragin, A. (2017). Is cruising along European rivers primarily intended for seniors and workers from Eastern Europe? *Geographica Pannonica, 21*(2), 115-123. https://doi.org/10.5937/GeoPan1702115E

Erfurt-Cooper, P. (2009). *European waterways as a source of leisure and recreation* (pp. 95-116). River Tourism, Wallingford, UK and Boston, MA: CABI. https://doi.org/10.1079/9781845934682.0095

FMI. (2022). *River cruises market*. Future market insights. Retrieved from https://www.futuremarketinsights.com/reports/river-cruises-industry-overview

Grammerstorf, H. H. (2013). *European river cruising: Greening measure and ecological aspects of river cruises*. Retrieved from http://ccr-zkr.org/files/documents/workshops/wrshp081013/6_HGrammerstorf_en.pdf

Guedes, A., & Rebelo, J. (2021). River cruise holiday packages: A network analysis combined with a geographic information system framework. *Tourism Management Perspectives, 37*, 100779. https://doi.org/10.1016/j.tmp.2020.100779

Gustafson, P. (2001). Roots and routes: Exploring the relationship between place attachment and mobility. *Environment and Behavior, 33*(5), 667-686. https://doi.org/10.1177/00139160121973188

Hall, C. M. (2013). *Policy learning and policy failure in sustainable tourism governance: From first-and second-order to third-order change?* (pp. 249-272). Tourism Governance, Routledge. https://doi.org/10.1080/09669582.2011.555555

Jeon, J. W., Duru, O., & Yeo, G. T. (2019). Cruise port centrality and spatial patterns of cruise shipping in the Asian market. *Maritime Policy & Management, 46*(3), 257-276. https://doi.org/10.1080/03088839.2019.1570370

Kanrak, M., & Nguyen, H. O. (2022). An analysis of connectivity, assortativity and cluster structure of the Asian-Australasian cruise shipping network. *Maritime Transport Research, 3*, 2022, 100048. https://doi.org/10.1016/j.martra.2021.100048

Kanrak, M., & Nguyen, H. O. (2022). Structure, characteristics and connectivity analysis of the asian-australasian cruise shipping network. *Maritime Policy & Management, 49*(6), 882-896. https://doi.org/10.1080/03088839.2021.1914876

Kanrak, M., Nguyen, H. O., & Du, Y. (2022). Analysis of the COVID-19 Pandemic's impact on the cruise shipping network in the Asian-Australasian region. *Journal of International Logistics and Trade, 20*(l), 1-17. https://doi.org/10.24006/jilt.2022.e1

Larsen, S., Wolff, K., Marnburg, E., & Øgaard, T. (2013). Belly full, purse closed: Cruise line passengers' expenditures. *Tourism Management Perspectives, 6*, 142-148. https://doi.org/10.1016/j.tmp.2013.02.002

Lee, S., & Ramdeen, C. (2013). Cruise ship itineraries and occupancy rates. *Tourism Management*, *34*, 236-237. https://doi.org/10.1016/j.tourman.2012.03.009

Liu, S., Lu, P., Liu, D., Jin, P., & Wang, W. (2009). Pinpointing the sources and measuring the lengths of the principal rivers of the world. *International Journal of Digital Earth, 2*(1), 80-87. https://doi.org/10.1080/17538940902746082

Mou, N., Sun, S., Yang, T., Wang, Z., Zheng, Y., Chen, J., & Zhang, L. (2020) Assessment of the resilience of a complex network for crude oil transportation on the Maritime Silk Road. *IEEE Access, 8*, 181311-181325. https://doi.org/10.1109/ACCESS.2020.3028214

MRC. (2010). *State of the Basin report*. Retrieved from https://www.mrcmekong.org/assets/Publications/basin-reports/MRC-SOB-report-2010full-report.pdf

Niavis, S., & Tsiotas, D. (2018). Decomposing the price of the cruise product into tourism and transport attributes: Evidence from the Mediterranean market. *Tourism Management, 67*, 98-110. https://doi.org/10.1016/j.tourman.2018.01.004

Paiano, A., Crovella, T., & Lagioia, G. (2020). Managing sustainable practices in cruise tourism: The assessment of carbon footprint and waste of water and beverage packaging. *Tourism Management, 77*, 104016. https://doi.org/10.1016/j.tourman.2019.104016

Paoli, C., Vassallo, P., Dapueto, G., Fanciulli, G., Massa, F., Venturini, S., & Povero, P. (2017). The economic revenues and the emergy costs of cruise tourism. *Journal of Cleaner Production, 166*, 1462-1478. https://doi.org/10.1016/j.jclepro.2017.08.130

Rodrigue, J. P., & Notteboom, T. (2013). The geography of cruises: Itineraries, not destinations. *Applied Geography, 38*, 31-42. https://doi.org/10.1016/j.apgeog.2012.11.011

Simonsen, M., Gössling, S., & Walnum, H. J. (2019). Cruise ship emissions in Norwegian waters: A geographical analysis. *Journal of Transport Geography, 78*, 87-97. https://doi.org/10.1016/j.jtrangeo.2019.05.014

Statista. (2022). *Projected size of the global river cruise ship market from 2018 to 2027*. Retrieved from https://www.statista.com/statistics/1119639/size-of-the-river-cruise-ship-market-worldwide

Sun, X., Xu, M., Lau, Y. Y., & Gauri, D. K. (2019). Cruisers' satisfaction with shore experience: An empirical study on a China-Japan itinerary. *Ocean & Coastal Management, 181*, 104867. https://doi.org/10.1016/j.ocecoaman.2019.104867

Tikkanen, A. (2022). *Gulf of Tonkin*. Retrieved from https://www.britannica.com/place/Gulf-of-Tonkin

Tomej, K., & Lund-Durlacher, D. (2020). Research note: River cruise characteristics from a destination management perspective. *Journal of Outdoor Recreation and Tourism, 30*, 100301. https://doi.org/10.1016/j.jort.2020.100301

Tsiotas, D., & Polyzos, S. (2015). Analyzing the maritime transportation system in Greece: A complex network approach. *Networks and Spatial Economics, 15*(4), 981-1010. https://doi.org/10.1007/s11067-014-9278-y

Tsiotas, D., Niavis, S., & Sdrolias, L. (2018). Operational and geographical dynamics of ports in the topology of cruise networks: The case of Mediterranean. *Journal of Transport Geography, 72*, 23-35. https://doi.org/10.1016/j.jtrangeo.2018.08.001

Van Balen, M., Dooms, M., & Haezendonck, E. (2014). River tourism development: The case of the port of Brussels. *Research in Transportation Business & Management, 13*, 71-79. https://doi.org/10.1016/j.rtbm.2014.10.014

Weaver, D. B., & Lawton, L. J. (2017). The cruise shorescape as contested tourism space: Evidence from the warm-water pleasure periphery. *Tourism Management Perspectives, 24*, 117-125. https://doi.org/10.1016/j.tmp.2017.08.003

Xie, G., Qian, Y., & Wang, S. (2021). Forecasting Chinese cruise tourism demand with big data: An optimized machine learning approach. *Tourism Management, 82*, 104208. https://doi.org/10.1016/j.tourman.2020.104208

Zhou, J., Chen, S. L., & Shi, W. (2022). The concept of the cruise supply chain and its characteristics: An empirical study of China's cruise industry. *Maritime Business Review, 7*(3), 196-221. https://doi.org/10.1016/j.tourman.2020.104208