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Analysis of the tourism network post the COVID-19 pandemic: Implications for revitalization

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A B S T R A C T

This study analyzes the tourism network and destinations after the COVID-19 pandemic using social network analysis (SNA). Analysis of 789 destinations in Thailand has found that the destinations are connected by 1,1175 tourism routes. The network is a sparse network with a low network density. It seems to have a scale-free property that reflects that most destinations have low connectivity and a small number of destinations have high connectivity. The network has a large average path length and low clustering coefficient. Different roles of destinations are identified based on degree, betweenness and closeness centrality. The findings draw implications for vitalizing the sector.

1. Introduction

The outbreak of the COVID-19 virus in December 2019 transformed the world in economic and social aspects to a level unprecedented in history. According to the World Health Organization (WHO, 2023), the number of infected people and deaths worldwide has declined significantly since the population has been vaccinated. However, the impact of the pandemic has persisted for many years and many sectors are still trying to revitalize. Tourism is one of the sectors most affected by the pandemic. The number of international tourists decreased by 22% in the first quarter of 2021 and was expected to decrease between 60 and 80% throughout the year (World Tourism Organization (UNWTO, 2020). This brought the revenue decreased by 1.2 trillion dollars. The social distancing policy forced accommodations to suspend operations or reduce their service capacity immediately. In addition, hotels and accommodations were considered initial focal points that transformed localized outbreaks into major epidemics and served as starting points for the global spread (Huang et al., 2020). This affects global travel, tourism and services. Countries around the world applied regulations to control the virus spread, which led to the tourism industry being impacted by other sectors. However, it was expected that the industry might return to the same level as pre-pandemic if people were fully vaccinated (Sankowski, 2021). The economy, businesses and the tourism industry might recover when borders reopen and travel restrictions are relaxed (Czerny et al., 2021; Liebig et al., 2021). The industry can recover quickly by increasing the number of trip bookings using new strategies driven by incentives or stimulus mechanisms (Ito et al., 2020). This leads to the demand for tourism increasing. The revitalization of the tourism sector depends on its capacity. Tourism companies' capacity supports the growth in demand growth which takes some time to recover (Sun et al., 2020). However, the recovery is still long because tourism companies have ceased their operations for many years, tourism destinations have been left abandoned and neglected without maintenance and care, some facilities have not been used, and workers have either left the industry or have not received training (Frame & Hemmings, 2020; Lucas et al., 2021). This leads to the tourism system (network) not yet recovered. Therefore, the sector needs to invest in repairing hotels and tourist

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destinations, recruiting and training employees, engaging international marketing and sales and even finding new locations (Kim et al., 2021, 2022), leading to the revitalization of the network.

Therefore, this study analyzes the tourism network after the COVID-19 pandemic using social network analysis (SNA). Network measures of SNA are used to analyze the properties of the network and tourism destinations to provide guidelines and implications for revitalizing the network. Analysis used the data of Thai tourism as a case study because Thailand ranks in the top 10 countries the most visited nations on the planet (Countrycassette, 2024). This enables tourism companies to manage their operations and services in the short, medium and long term. This paper is structured as follows. Section 2 presents a literature review on the tourism market and tourism network. Section 3 explains the research methodology, while Section 4 presents analysis results and discussion. Section 5 provides a conclusion implications and future research directions.

2. Literature review

2.1 Tourism market

International travel and tourism can be expanded by increasing disposable income, transportation infrastructure advancements and rising digital platforms. Before the pandemic, the number of tourist arrivals increased by 4% in 2019 (UNWTO, 2020). The market was hit by the pandemic, leading to the number of tourists travelling interracially significantly declining in 2020-2021. However, in 2022, more than 900 million tourists travelled internationally, an increase of more than 50% compared to 2021. 975 million tourists travelled internationally from January to September 2023, which increased by 38% in the same month of 2022 and reached close to 90% of the pre-pandemic levels (UNWTO, 2023). The preference of tourists shifted to experiential and sustainable tourism because they want to explore eco-friendly destinations and authentic cultural experiences (Grilli et al., 2021). The tourism market is one of the contributors to economic growth. In 2022, travel and tourism contributed to the global GDP amounted to 7.7 trillion U.S. dollars. It was expected to reach 9.5 trillion U.S. dollars, remaining 5% below pre-pandemic levels (WTTC, 2024). The market is the main revenue source of many countries, particularly those heavily reliant on tourism, such as Thailand, Spain and Mexico (Navarro-Drazich & Lorenzo, 2021). In addition, the tourism industry helps develop other sectors, such as entertainment, transportation and hospitality. The tourism market in Asia has significantly grown and is a key player in the tourism industry. Asia has diverse attractions, such as natural landscapes, historical sites, vibrant cities and cultural heritage (Shen & Chou, 2021). This makes destinations interesting for local and international tourists. From 2010 to 2019, the number of tourists travelling internationally in Asia and the Pacific increased continuously from 208 million to 306 million. This contributed to a million job creations (Shah et al., 2023). However, the number of tourists visiting the region decreased due to the pandemic in 2020-2022. In 2023, the Asian tourism market recovered 95% of pre-pandemic levels (UNWTO, 2023). China, Hong Kong, Malaysia, Thailand and Singapore are the most visited countries in Asia that are popular in tourism in terms of unique cultures, world-class hospitality and stunning landscapes (Vinicius Costa, 2022).

In 2020, the number of tourists visiting Asia decreased by 84% because of travel restrictions, safety concerns and border closures due to the pandemic due to the pandemic (UNWTO, 2021). The number of nights spent in Asia tourist lodging establishments decreased by 61% the same as in Europe. This results in the revenue of tourism companies decreasing by more than 50% because their customer base consists of international tourists (Shah et al., 2023). Governments and the tourism sector implement recovery plans and initiatives for reviving the tourism industry by promoting domestic tourism and implementing health and safety protocols. In addition, a sustainable tourism model is used to change travel preferences and boost the recovery of the market (Wilkinson & Coles, 2023). Tourism companies design their tourism packages in response to the changing landscape of the travel industry after the pandemic. Based on travel restrictions, the packages are designed by considering flexibility and adaptability, such as a flexible booking policy, reschedulable or refundable, as well as enhancing health and safety measures (Garrido-Moreno et al., 2021). Companies also offer domestic and local tourism packages, highlighting nearby tourism destinations to the limited mobility and travel preferences of tourists (Corbisiero & Monaco, 2021). The companies offer packages to support local communities and promote conservation initiatives and eco-friendly transportation and accommodations (Shebanina et al., 2023; Vijayabanu et al., 2023). The packages are designed to have reasonable prices, and local culture and activities as well as natural areas. This is because the companies want to offer packages with authentic experiences while reducing tourism destinations' negative impacts (Rasoolimanesh et al., 2021). These could help to revitalize the tourism industry after the pandemic.

2.3 Tourism Network

A tourism network is a form of relationships among tourism destinations, stakeholders, organizations or elements that have a link between them. Many studies apply network analysis approaches to tourism in different aspects. The largest group of studies analyze tourism destination networks to visualize the relationship among the stockholders of tourism destinations. They use clustering coefficient and density to identify the stockholders playing a central role. The studies also analyze assortativity, knowledge transferring between destinations, resilience, community structure and broker possibilities. Most of them obtain data from interviews, surveys and real-world relationships (Baggio, 2011, 2014; Baggio & Del Chiappa, 2014; Beritelli et al., 2015; da Fontoura Costa & Baggio, 2009; D'Agata et al., 2013; Del Chiappa & Presenza, 2013; Grama &

Baggio, 2013; Jørgensen, 2016; Lozano & Gutiérrez, 2018; Luthe et al., 2012; Luthe & Wyss, 2016; Scott et al., 2008, 2011; Tran et al., 2016; Valeri & Baggio, 2022; Wäsche, 2015; Wyss et al., 2015) However, some studies obtain information using links between the websites of the involved organizations (Baggio & Del Chiappa, 2014b; Kanrak et al., 2024; Piazzi et al., 2011; Ying et al., 2016). Another extensive topic studied in tourism is an analysis of itinerancy networks and mobility patterns. The studies consider weighted direct networks, their links showing the travel frequency of tourists visiting a destination, a link between destinations and tourist flows. (Asero et al., 2016; D'Agata et al., 2013b; Leung et al., 2012; Liu et al., 2012; Lozano & Gutiérrez, 2018; Seok et al., 2021; Shao et al., 2020). Some articles study the dynamics of tourism networks. The network analysis approach is used to analyze the dynamics of the networks corresponding to time series with yearly data. The evolution of links is analyzed using the natural or horizontal visibility algorithm (Baggio, 2014a; Baggio & Sainaghi, 2016; Chung et al., 2020; Guo et al., 2015; Sainaghi & Baggio, 2017). Stpartial patterns of tourism networks. Although many studies analyze tourism networks in multiple aspects, most analyze only overall network structural properties before the COVID-19 pandemic. Limited research is analyzed at the local and global levels to reflect the properties of both destinations and the network, especially after the pandemic for providing guidelines and implications for the sector's revitalization. This will be addressed in the present study.

3. Methodology

The tourism network in this study is considered as a binary network. Its nodes are connected by links in two directions. Let, $G(E, V)$ is the tourism network, where $E=\{e_i=1,2,3,\ldots m\}$, $m = |E|$ is the set of the tourism routes (edges or links) connecting between destinations, and $V=\{v_i = 1, 2, 3,\ldots, n\}$, $n = |V|$. The network is presented by an adjacency matrix $A_{n\times n}$ with $a_{ij} = 1$ when nodes i and j are connected by links, if $a_{ij} = 0$ is otherwise.

Six measures of SNA are used to analyze the tourism network and destinations after the pandemic as shown in Table 1. Density, average path length and average clustering coefficient are adopted to analyze the network, while degree centrality, betweenness centrality and closeness centrality are used to analyze destinations. The equations mentioned in the table use the following notations:

m = number of links,
n = number of nodes,
$d(i,j)$ = distance between nodes i and j,
k_i = degree (s) of node i,
a_{ij} = 1 if nodes i and j are connected by a link, 0 otherwise,
$\sigma_{s,t}(i)$ = number of the shortest paths from nodes s to t passing through node i, and
$\sigma_{s,t}$ = number of the shortest paths from nodes s to t.

Table 1
Statistical measures of SNA for analysis of the tourism network and destinations.

	Measure	Equation	Definition
Network	Density	$\rho(G) = \frac{2m(G)}{n(n-1)}$	Proportion of the total number of links that the network has and the possible number of links.
	Average path length	$L = \frac{1}{n(n-1)}\sum_{i\neq j}^{n} d(i,j)$	Average number of connection steps along the shortest paths for all possible pairs of nodes.
	Average clustering coefficient	$C = \frac{1}{n}\sum_{i=1}^{n} \frac{m_i}{k_i(k_i-1)/2}$	Average of the fractions of the number of pairs of a node's neighbors connected by links to the maximum possible links between them.
Destination	Degree centrality	$C_D(i) = \sum_{j=1}^{n} a_{ij}$	Number of links connect to a node.
	Betweenness centrality	$C_B(i) = \sum_{s\neq i\neq t} \frac{\sigma_{s,t}(i)}{\sigma_{s,t}}$	Sum of the number of the shortest paths passes a node.
	Closeness centrality	$C_C(i) = \frac{n-1}{\sum_{j\neq i} d(i,j)}$	Average of the shortest paths from a node to all others in the network.

Density is used to analyze the connectivity level of the network, average path length is used to analyze the efficiency connectivity of destinations, and average clustering coefficient is used to analyze the intra-connectivity among destinations. Degree centrality is used to analyze the connectivity of a destination to the defined importance and popularity of a destination.

Betweenness centrality is used to analyze the destination's accessibility to identify an intermediary destination. Closeness centrality is used to analyze the reachability of a destination to all others in the network.

This study uses the secondary data of tourism packages serviced in 2023 published on the websites of tourism agencies. The data consists of 268 service packages covering 789 destinations in Thailand. Note that any cancellations and changes in service packages are not considered. Data analysis is conducted using the R statistical software.

4. Results and discussion

4.1 Network properties

After the pandemic, tourism companies focus only on the main popular tourism destinations in different regions. This leads to the tourism network (system) in Thailand consisting of 789 destinations connected by 1,179 tourism routes (links), as shown in Fig. 1.

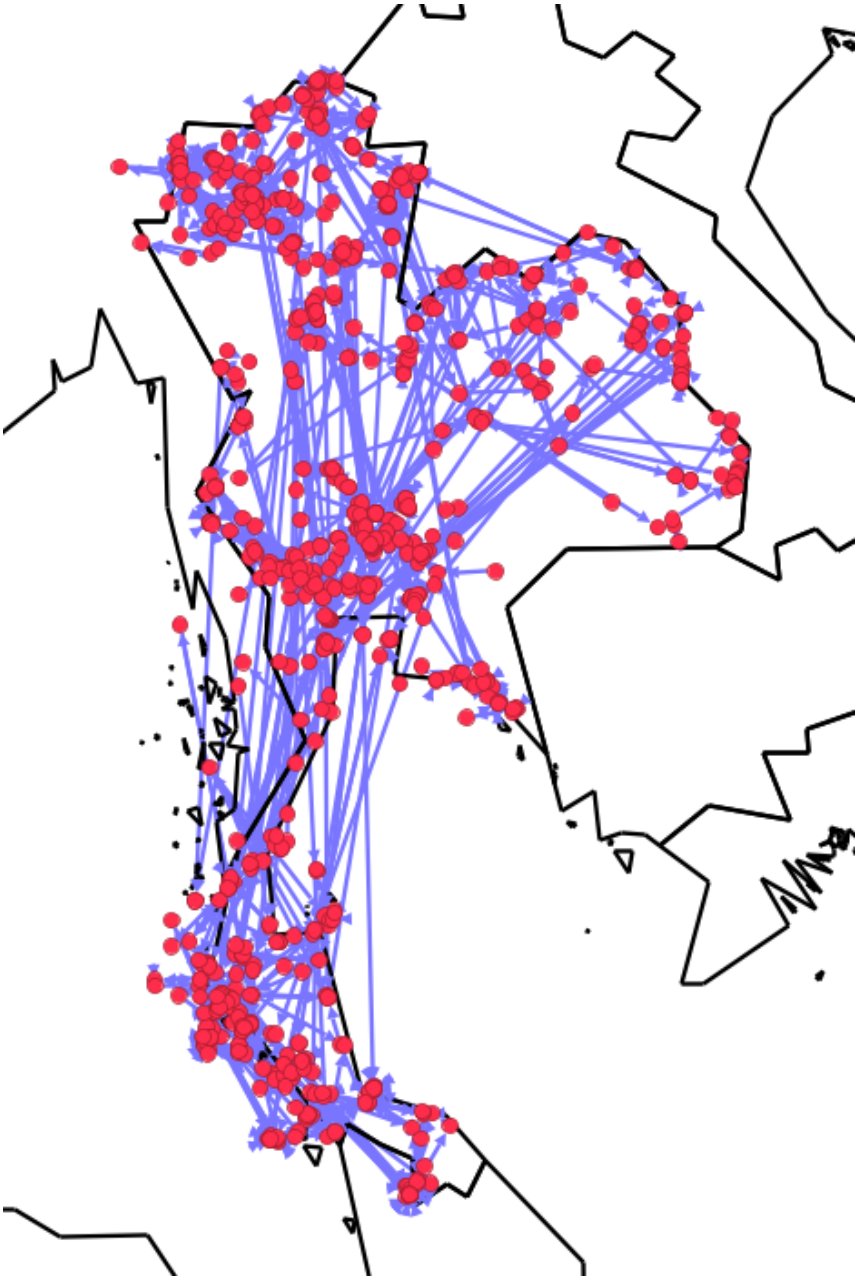

Fig. 1. Graph of the tourism network in 2023, with 789 destinations and 1,179 links
Source: Author

Destinations in the same regions tend to connect to each other because tourism companies want tourists to travel safely and visit multiple destinations in short periods. This leads companies to receive convenient services and reliability (Enoch, 1996). Among 1,179 links, 858 links build triangle relationships. A triangle relationship happens when three nodes share links with each other. Fig. 2 shows an example of a triangle relationship among three tourism destinations in the network. Windmill Field Khao Kho (WFKK), Weapon Museum (WEM) and Khao Kho Sacrifice Memorial (KKSM) share links with each other. This reflects the fact that they are usually included in the same trip (service package) because they are in the same location. This implies that companies design tourism service packages considering distance to minimize travelling costs between destinations.

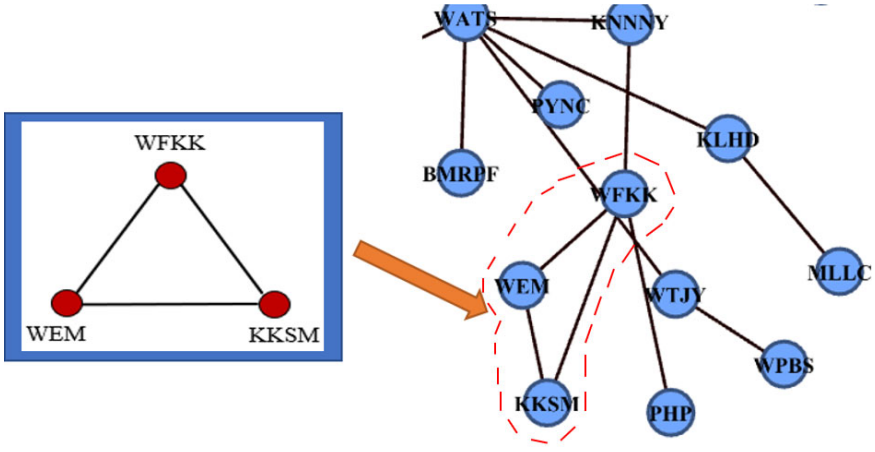

Fig. 2. A triangle relationship among the three tourism destinations
Source: Author

The density of links in the network found is quite low (0.00379), indicating that the percentage of tourism destinations have a low connection to others in the network. This always happens in real-world networks because of the locations' limitations that nodes cannot be connected to many others. Therefore, the network is a sparse network (Baggio, 2008). This is the same as tourism networks before the pandemic (Lozano & Gutiérrez, 2018; Tran et al., 2016). This implies that the tourism network is sparse before and after the pandemic. It is difficult to make it a complete network that a destination can connect to all others since it is subject to a location limitation. The network can only increase its connectivity by increasing links to other destinations in nearby locations. The sparseness of the network is also confirmed by a low clustering coefficient. The network has an average clustering coefficient of 0.19562. A small value of the clustering coefficient also reflects that the intra-connectivity among destinations in the same groups (subnetworks) is low. This implies that there is a lack of cooperation among the destinations for service tourists. This is because some destinations' locations are limited and difficult to access, leading to the connections among destinations being very low. The small values of density and average clustering coefficient can be concluded that the network after the pandemic has low efficiency.

The average path length shows the average number of connection steps (links) along the shortest path for all possible pairs of destinations in the network. The network has an average path length of 11.64008 relatively high, indicating that two destinations take at least 11 connections on average to connect to each other. This is because destinations are in the same locations that are designed to connect to each other, and rarely connect to others in different locations. Therefore, destinations take large connection steps to connect to destinations in other locations. These reflect the network has low connection efficiency.

4.2 Destination properties

The properties and the roles of tourism destinations are analyzed using degree, betweenness and closeness centrality.

Degree centrality

Table 1 shows 18 destinations with a high degree of centrality. Wat Rong Khun (WRK) has the highest degree centrality of 16 degrees, followed by Khao Lak (KHLAK) with 14 degrees, Wat Phra That Doi Suthep (WPTDS), Sutongpe Bridge (STOB) and Phuket Old Town (PHOT) with 12 degrees, Wat Phra That Khao Noi (WPTKN), Pak Bara Pier (PBP), Wat Maha That Wachiramongkol (WMTW) and Rajjaprabha Dam (RAD) with 12 degrees, Wat Pa Phu Kon (WPPK) and Wat Phra That Cho Hae (WPTCHA) with 11 degrees, and Wat Phet Samut Worawihan (WPSW), Kham Chanot Wang Nakhin (KCWN), Kaeng Khut Khu (KKK), Pra Mahatat Noppamethanedon (PMNO), Wat Phra That Chae Haeng (WPTCH), Wat Phra That Mae Yen (WPTMY) and Cape Phrom Thep (CPT) with 10 degrees, respectively. The degree centrality values of these destinations indicate the number of destinations connected to them. For example, WRK has 16 degrees, indicating that it is connected to 16 other destinations in the network.

The average degree centrality is 2.989, reflecting that each destination in the network can be connected to at least two other destinations. WRK has a 5.35 times higher chance of being connected to others than the average. KHLAK has 4.68 times, while WPTDS, STOB and PHOT are 4.34 times better than average. WPTKN, PBP, WMTW and RAD have 4.01 times, whilst WPPK and WPTCHA have 3.68 times. WPSW, KCWN, KKK, PMNO, WPTCH, WPTMYand CPT have a better connection of 3.35 times larger than average. These destinations are very important in the network as they have a larger number of connections than others. A large degree value also signifies that they are popular on the network.

Table 1
Top five tourism destinations with a high degree centrality

Rank	Destination	Degree centrality
1	WRK	16
2	KHLAK	14
3	WPTDS, STOB, PHOT,	13
4	WPTKN, PBP, WMTW, RAD	12
5	WPPK, WPTCHA	11
6	WPSW, KCWN, KKK, PMNO, WPTCH, WPTMY, CPT	10

Degree distributions disclose the links (tourism routes) that are distributed to destinations in the network. In Figure 3, the degree distribution of the tourism network is skewed with a large fraction (87.45%) of destinations having low connectivity of 1-5 links. In contrast, there is a small proportion (12.55%) of destinations having high connectivity of more than 5 links. This implies that the network has a scale-free property. Therefore, there are a small number of important destinations with a high degree to keep the network connected (Kanrak & Nguyen, 2022). Among these, destinations with two links have the largest proportion (32.45%), followed by destinations with one link (25.98%), destinations with three links (12.93%), destinations with four links (10.27%), destinations with five links (5.83%), destinations with six links (4.31%), destinations with seven links (2.41%), destinations with eight links (2.15%), destinations with nine links (1.39%), destinations with 10 links (0.89%), destinations with 12 links (0.51%), destinations with 13 links (0.38%), destinations with 14 links (0.13%) and destinations with 16 links (0.13%), respectively.

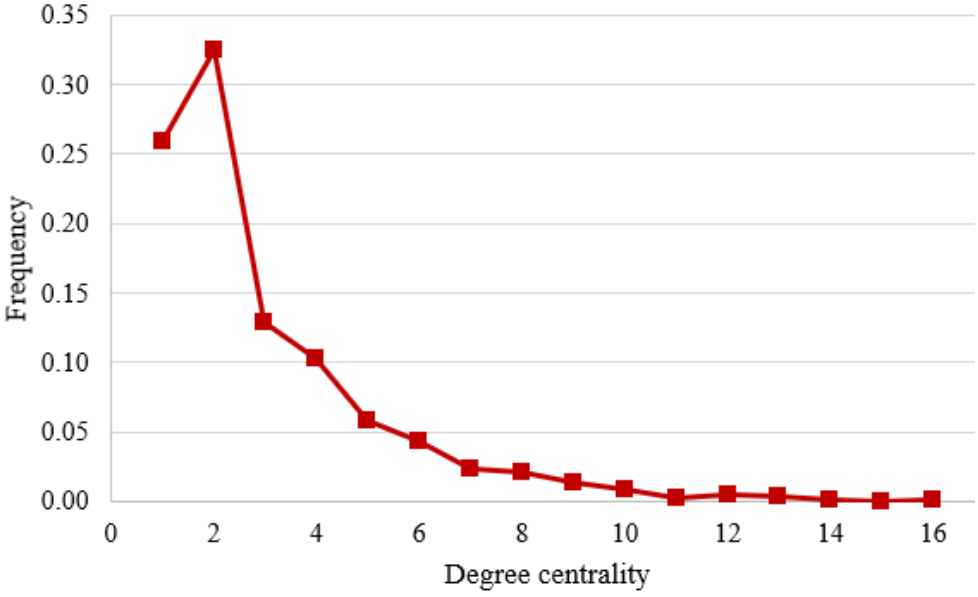

Fig. 3. Degree distribution of tourism destinations
Source: Author

Betweenness centrality

The betweenness centrality presents the potential of a destination that tourists would stop at this focal destination during the routes between pairs of other destinations (Shih, 2006). Destinations in the network studied have betweenness centrality scores ranging between 0-69,225.72. This causes the variability between destinations of 6687.83 (S.D.), exceeding the average betweenness centrality (2678.93) in the network. This reflects that considerable variation exists in the betweenness centrality of the network. Table 2 illustrates the 11 destinations with high betweenness scores higher than 30000, acting as highly important intermediates between other destinations' pairs. Thus, they have a strong need for traffic-related facilities and services (Shih, 2006). WPTCHA ranks first with the highest betweenness score, followed by WMTW, KHLAK, Kyaikhtiyo Pagoda (KYPA), Tiger Cave Temple (TCTE), Kaeo Komon Forest Park (KKFP), CPT, Nakuha Temple (NKHT), Wat Phra Si Rattana Mahathat Woramahawihan (WPSRMW), Dragon Spine Beach (DRSB) and WPPK, respectively.

Table 2
Top 11 destinations with high betweenness centrality scores

Rank	Destination	Betweenness
1	WPTCHA	69225.72
2	WMTW	54614.31
3	KHLAK	49504.68
4	KYPA	48353.57
5	TCTE	45494.77
6	KKFP	44989.61
7	CPT	43733.47
8	NKHT	39662.04
9	WPSRMW	35017.85
10	DRSB	34512.15
11	WPPK	30273.65

Fig. 4 presents that only 1.39% of destinations have a betweenness centrality larger than 30000, and one destination (0.39%) has a betweenness centrality of 25001-30000. Destinations with a betweenness centrality of 20001-25000 accounted for 1.26%. Destinations have lower betweenness centrality scores with 15001-20000 and 1001-15000 having similar proportions of 2.15% and 2.53%, respectively. Destinations with a betweenness centrality of 5001-10000 accounted for 6.08%. These indicate that destinations with a higher betweenness centrality play as highly crucial intermediates more than lower ones. Interestingly, more than 50% of destinations have a betweenness centrality of 1-5000, reflecting that they play a very less important intermediate role on the network. Therefore, they do not need many traffic-related facilities and services. The peripheral destinations of the network with a betweenness centrality of zero accounted for 33.09%, indicating that they are inaccessible in the network. Thus, these destinations do not want the need for the traffic for facility and service.

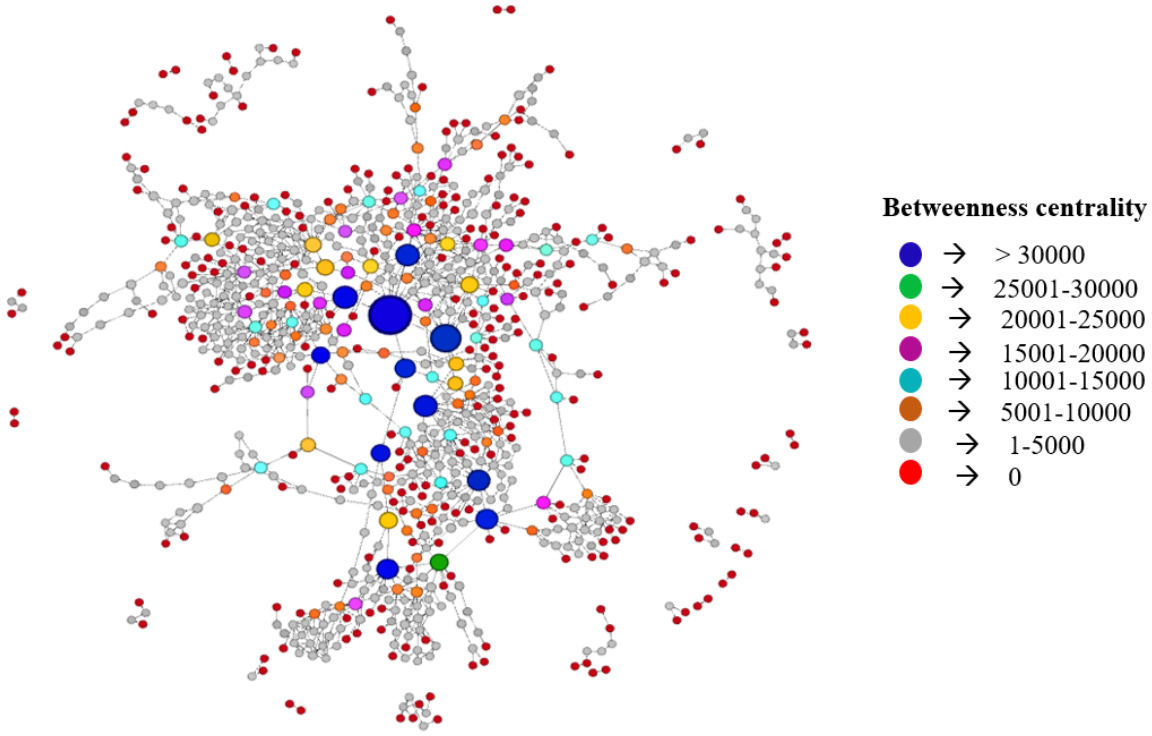

Fig. 4. Betweenness centrality scores of tourism distributions
Source: Author

Closeness centrality

The closeness centrality reflects the reachability of a destination. A destination with a high closeness centrality is more reachable by other destinations at shorter path lengths in the network. Table 3 presents that 26 destinations have a closeness centrality of 0.5 and above. Among these, 22 destinations have the highest closeness centrality of 1 (a maximum value) and the rest have a score of 0.5. Consequently, these destinations have high reachability to others. That is they can be reached by most other destinations by various tourism routes. These destinations are very popular and accessible and lots of themed tourism routes always include the destinations. This implies that they possess favored positions and structural advantages in the network (Liu et al., 2017). Interestingly, destinations with a high closeness centrality have a very low degree and betweenness centrality. Particularly, the destinations with a closeness centrality of 1 mostly have one degree, and all have a betweenness

centrality of zero. This phenomenon is different from other networks, such as maritime shipping networks in that their nodes have a high closeness degree and betweenness centrality (Kanrak, Lau, et al., 2023; Kanrak, Traiyarach, et al., 2023).

Table 3
Destinations with a high closeness centrality

Destination	Closeness	Degree	Betweenness
Samaesan Island (SAI)	1.00	1	0
Chomphuweg Temple (CHPT)	1.00	1	0
Wat Non Kum (WANKU)	1.00	1	0
Wang Nam Khieo (WANK)	1.00	1	0
Yang Luang Temple (YLT)	1.00	1	0
Hor Poo L Gon Museum (HPLGM)	1.00	1	0
Koh Lak Rad (KOLR)	1.00	1	0
Ko Rok Noi (KRNO)	1.00	3	0
Koh Hong (KOHONG)	1.00	1	0
Mama Jo Po Shrine (HEIS)	1.00	1	0
Arokya Roaring Bulging Court (ARBC)	1.00	1	0
Koh Sichang (KHOS)	1.00	1	0
Montree Tramote Museum (MTMU)	1.00	1	0
Wat Puttha Nimit (WPTTN)	1.00	1	0
Khao Yai Taing (KYTA)	1.00	1	0
Wat Pa Daet (WAPD)	1.00	1	0
Wat Si Rong Muang (WSRM)	1.00	1	0
Ko Matra (KOMAT)	1.00	1	0
Ko Ha (KPHA)	1.00	1	0
Nemo Fish Research Center (NEMO)	1.00	1	0
Ko Son (KOSO)	1.00	1	0
Doi Muse Market (DMSM)	1.00	1	0
Jesada Technik Museum (JSTM)	0.50	2	1
Ban Khok Sanga (BKSN)	0.50	2	1
Wat Phrai Pattana (WPPT)	0.50	2	1
Kui Buri National Park (KBNP)	0.50	2	1

In conclusion, destinations with a high degree and betweenness centrality are defined as hubs. WPTCHA, WMTW, KHLAK, CPT and WPPK are hubs of the network since they have high connectivity and accessibility. However, they cannot be reached by all other destinations because of their low reachability. 26 destinations have high reachability as they are in advantageous positions in the network, although they have low connectivity.

5. Conclusion and implications

This study analyzes the tourism network after the COVID-19 pandemic in order to provide implications and suggestions for the sector's revitalization. Analysis of 789 tourism destinations is conducted using a social network analysis approach. The results show that the destinations are connected by 1,1179 tourism links among these 858 links are triangle relationships among destinations. The network is a sparse network with a low potential connection among its destinations. It seems to have a scale-free property with a small number of destinations with high connectivity and most of them have a low connection. In addition, it has a large average path length and a low clustering coefficient.

Fewer destinations play important roles in the network based on their centrality measures. The important and popular destinations with a high connectivity are KHLAK, WPTDS, STOB, PHOT, WPTKN, PBP, WMTW and RAD, WPPK, WPTCHA, WPSW, KCWN, KKK, PMNO, WPTCH, WPTMY and CPT. Intermediate destinations with high accessibility are WPTCHA, WMTW, KHLAK, KYPA, TCTE, KKFP, CPT, NKHT, WPSRMW, DRSB and WPPK. 26 destinations have reachability to others are SAI, CHPT, WANKU, WANK, YLT, HPLGM, KOLR, KRNO, KOHONG, HEIS, ARBC, KHOS, MTMU, WPTTN, KYTA, WAPD, WSRM, KOMAT, KPHA, NEMO, KOSO, DMSM, JSTM, BKSN, WPPT and KBNP.

The study's findings provide implications for revitalizing the sector. A large number of destinations have low connectivity implies that they are visited by a small number of tourists. Tourism companies should take advantage of this issue by designing service packages to visit destinations. This strategy also helps the destinations have more connections to others in the network, leading to the network has high connectivity efficiency. A low intra-connectivity of the network can be increased by designing packages with low connectivity destinations in the same locations especially rural areas. This also assists the rural destinations to have more connections or even become more popular in the future and surrounding communities gain more income from tourists. This will lead to an increase in national income. In addition, it engages in sustainable development of rural and domestic tourism, which brings to the sustainable tourism network after the pandemic. This strategy can be conducted by the government's support to promote and develop these destinations to be known. The companies should design an attractive package with high-degree destinations that include WRK, KHLAK, WPTDS, STOB and PHOT. This could attract more tourists since these destinations are very popular in terms of both network and tourism perspectives. However, companies should consider designing a package with high-degree destinations in the same locations to avoid high transportation costs.

Some destinations have low connectivity since their locations are limited and difficult to access. The government should develop these destinations to be more accessible by providing some budgets to develop transport and accessibility. Another issue is communities' capacity. Communities around the destinations should increase their capacity to accommodate tourists who come to visit those places.

This study is subjected to some limitations. First, the present study focuses only on binary network analysis, but the weights (the frequency of travelling through links) of tourism routes are not considered. Future research should take into account weighted network analysis in tourism. Second, the study analyzes only the tourism network in one country. To be generalized, future research should compare analysis results between two countries. Third, the study reflects only the properties of the network and destinations from a network perspective. Future research should interview tourism companies or stakeholders in order to provide insight into analysis results.

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