











### 3.5 Scope of research

- Specification of minimum and maximum time of waiting for transfer at the intermediate airport between 1 and 24 hours.
- The scheduled flights during October, 2017 were considered in this study.

## 4. Result and discussion

### 4.1 Airport connectivity

The connectivity unit (CNU) that computes via NetScan model represents the connection efficiency of the airport. According to Figure 4, the medium airport with the highest connectivity unit is Phitsanulok airport (PHS) which is located in the northern region in Thailand, there are 3 airlines operate and at least 8 flights a day with 59.58 CNU per week. Phitsanulok airport has the highest number of CNU, mean passengers in PHS have many flights to select, and many choices for passengers can increase customer satisfaction. The airport with the lowest connectivity unit level is Nakhon Phanom airport (KOP) which is 29.74 CNU per week, there are 2 airlines operate in Nakhon Phanom airport with 4 flights per day. The medium airports in Thailand, which are Sakon Nakhon airport (SNO), Nakhon Phanom airport (KOP), Nannakhon airport (NNT), Phitsanulok airport (PHS) and Trang airport (TST) are serving the service from their origin to Don Muang Airport (DMK) only. There is no indirect route from the medium airports, because the flight distance is not long as the international flight and it's not attractive for passengers to choose an indirect connection to their destination.

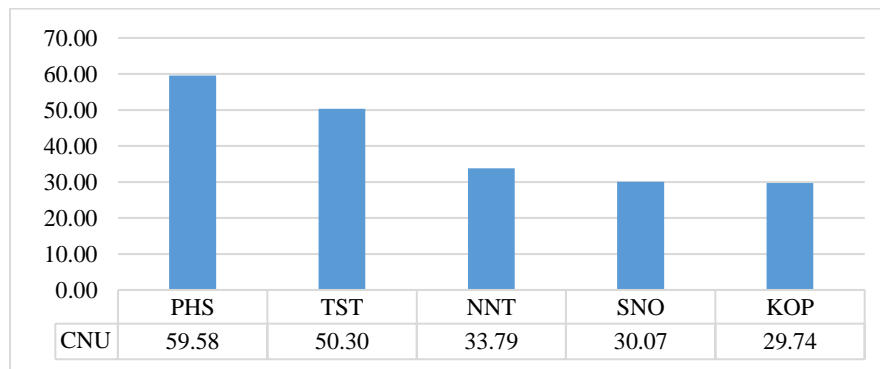


Figure 4: The connectivity unit of medium airports of Thailand  
Source: Researcher

The number of passenger in TST higher than PHS, but PHS has connectivity unit more than TRT. Because the airport connectivity in direct connection dimension depends on the frequency of flights and number of flights. Phitsanulok airport (PHS) has 9 flights per week, Trang airport has 7 flights per week, and both of PHS and TST operated by low cost carrier in Thailand, which are Nok air, Air Asia and Thai lion air.

Although TST has lower connectivity unit than PHS, but overall capacity seat of TST is more than PHS. The airlines operates the different types of aircraft, Trang airport has 7 flight per week, there were 3 flights that use Airbus A320-216 aircraft type and 4 flights that use Boeing 737-800 to serve passengers. In the other hand, Phitsanulok airport has 9 flights per week, it contain with 3 flights that use A320-216 aircraft type, 3 flights that use Boeing 737-800 aircraft type and 3 flights that use Bombardier Dash 8 Q400 which is smaller aircraft than Airbus A320-216 and Boeing 737-800.

Air connectivity is the ability to serve the passenger to connect to another airports, high number of connectivity unit represent that airport has various flights to passengers. Passengers might have satisfaction for more choices of the flight to fly. But the high number of connectivity unit cannot define that airport can accommodates passenger more than another airport.

### 4.2 Airline networks

The connectivity unit (CNU) can define the airline network at the airports. According to table 3, there are 3 low cost carriers in medium airports market, which are Nok air, Air Asia and Thai lion air. Nok air operates 14 flights per week, which is the highest number of flight in 1 week. So Nok Air earns 94.07 CNU/week, which is the highest CNU level in the medium sized market.

Table 3. The connectivity unit of each airline

Airline	Total CNU	Number of flights
Nok Air	97.03	14
Air Asia	81.98	11
Thai Lion Air	24.46	4

## 5. Concluding remark

The objective of this study is to evaluate the airport connectivity of medium airports in Thailand, which are Sakon Nakhon airport (SNO), Nakhon Phanom airport (KOP), Nannakhon airport (NNT), Phitsanulok airport (PHS) and Trang airport (TST). The destination of medium airports is Don Muang Airport only, because the medium airports are operating only domestic flights and the flight distance is not too long, therefore the indirect connection is not necessary. The direct connection which is flown directly from origin to destination is attractive for passengers than a flight with transfer at intermediate airport. Because the medium airports operate only direct connection, thus the value of quality index of every connection from medium airports to Don Muang Airport is closer to 1, it represents the routes are attractive for passengers.

The connectivity unit can measuring the attractiveness of the airport and can define the competitive position of airline networks. The future study might select the airport which has many destination into account. The airport and airline can apply the airport connectivity concept to plan the strategy to improve the airline networks.

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## References

- Airports of Thailand Public Co.,Ltd. (2017, 10 25). *Annual Report / Sustainability Report*. Retrieved from Annual Report / Sustainability Report: <http://airportthai.co.th/main/en/752-annual-report-sustainability-report>
- Burghouwt, G., & Veldhuis, J. (2006). The Competitive Position of Hub Airports in the Transatlantic Market. *Journal of Air Transportation*, 106-130.
- Department of Airports. (2017, 10 25). *Air Transport Statistics*. Retrieved from Air Transport Statistics: <https://www.airports.go.th/en/content/262.html>
- Federal Aviation Administration. (2017, 10 25). *Airport Categories*. Retrieved from Airport Categories: [https://www.faa.gov/airports/planning\\_capacity/passenger\\_allcargo\\_stats/categories/](https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/)
- Jantachalobon, N., & Vanichkobchinda, P. (2012). An Analysis of Airfreight Transshipment Connectivity at Suvarnabhumi International Airport. *European Journal of Business and Management*, 141-147.
- Jantachalobon, N., Vanichkobchinda, P., & Suthikarnnarunai, N. (2014). Airline Network Analysis of ASEAN International Airport Region. *The Open Transportation Journal*, 19-25.
- Kamtaeja, S., Sopadang, A., & Chao, P. (2014). Evaluation of air connectivity of Chiang Mai airport. *The 6th International Conference on Logistics and Transport*, (pp. 80-86). Kuala Lumpur, Malaysia.
- Kim, J. Y. (2007). *An Analysis of Airfreight Transshipment Connectivity at Incheon International Airport*. Korea: A Thesis submitted to Inha University.
- Matsumoto, H., Burghouwt, G., Wit, J. D., & Veldhuis, J. (2009). Air Network Performance and Hub Competitive Position: Evaluation Of Primary Airports In East And Southeast Asia. *Journal of Air Transport Management*, 384-400.
- Matsumoto, H., Burghouwt, G., Wit, J., & Veldhuis, J. (2008). Network performance, hub connectivity potential, and competitive position of primary airports in Asia/Pacific region. *Pacific Economic Review*, 639-650.

- Nugraha, P. (11-20). Analysing Indonesian Air Connectivity Period of 2006 - 2016. *Journal of the Civil Engineering Forum, Vol. 3 No.1* , 2017.
- Paleari, S., Redondi, R., & Malighetti, P. (2008). A comparative study of airport connectivity in China, Europe and US: Which network provides the best service to passengers? *Transportation Research Part E*, 198-210.
- Reynolds- Feighan, A., & Maclay, P. (2006). Accessibility and attractiveness of European Airport: a simple small community perspective. *Journal of Air Transport Management*, 12, 313- 323.
- Sopadang, A., & Suwanwong, T. (2016). Airport Connectivity Evaluation: The Study of Thailand. *International Conference on Industrial Engineering and Operations Management* (pp. 188-195). Detroit, Michigan, USA: IEOM Society International.
- Veldhuis, J. (1997). The competitive position of airline networks. *Journal of Air Transport Management*, 181-188.

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