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AIRPORT CLASSIFICATION BASED ON FREIGHT RATIO AND FEDERAL AVIATION ADMINISTRATION (CASE STUDY IN INDONESIA)

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ABSTRACT

There are seven airports in Indonesia with production of cargo very high i.e., Soekarno-Hatta International Airport, Sentani Airport, Sultan Hasanuddin International Airport, Kuala Namu International Airport, Hang Nadim International Airport, Juanda International Airport, and Sultan Aji Muhammad Sulaiman Sepinggan International Airport. The airfreight distribution in Indonesia spread unevenly. The solutions for freight shipments problem is evaluate the hub and spoke airport networks. The flight route in Indonesia has not been fully developed in accordance with the concept of hubs and spokes. The aim of this paper is to analysis the hub and spoke airport in Indonesia based on freight ratio and percentage of annual passenger boarding and cargo volume according to Federal Aviation Administration. The freight ratio value for domestic flight from thirty-four airports is 0.443 to 75.564 kg per passenger. Sentani Airport in Jayapura has the highest of freight ratio value and the category as a freight interest airport or cargo interest. The freight ratio value for international flight from nineteen airports is 0.182 to 48.306 kg per passenger. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan, East Kalimantan has the highest of freight ratio value and the category as a freight interest airport or cargo interest. Total of cargo production for domestic flight is 754,422,165 kg. The percentage of cargo production for domestic flight from thirty-four airports in Indonesia is 0.003% to 38.229%. Total of cargo production for international flight is 370,240,491 kg. The percentage of cargo production for international flight is 0.002% to 88.162%. Soekarno-Hatta International Airport has the highest of percentage of cargo production. The percentage of cargo volume in Soekarno-Hatta International Airport is 38.229% for domestic flight and 88.162% for international flight.

Keywords: freight ratio, hub airport, federal aviation administration, cargo volume.

INTRODUCTION

There are seven airports in Indonesia with production of cargo very high i.e.: Soekarno-Hatta Airport, Sentani Airport, Sultan Hasanuddin Airport, Kuala Namu Airport, Hang Nadim Airport, Juanda Airport, and Sultan Aji Muhammad Sulaiman Sepinggan Airport. Soekarno-Hatta International Airport (SHIA) is the busiest airport in Indonesia and the 18th rank of the busiest airport in the world in 2015 [1]. In 2015, Soekarno-Hatta International Airport serving 41,773,510 passengers and 288,410,185 kg of goods for domestic flights and 12,221,498 passengers and 326,411,673 kg of goods for international flights. In Sumatra island, Kuala Namu International Airport is the busiest airport that serving 6,374,897 passengers and 37,413,257 kg of goods for domestic flights and 1,629,894 passengers and 4,215,927 kg of goods for international flights. Sultan Hasanuddin International Airport is the busiest airport in Sulawesi island that serving 8,538,901 passengers and 53,473,971 kg of goods. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan is the busiest airport in Kalimantan island that serving 4,004,026 passengers and 27,753,782kg of goods. Sentani Airport in Jayapura is the busiest airport in Papua island that serving 1,728,549 passengers and 130,616,171 kg of goods [2].

The Master plan for Acceleration and Expansion of Indonesia's Economic Development or Master plan Percepatandan Perluasan Pembangunan Ekonomi Indonesia (MP3EI) year 2011-2025 targets are support the acceleration economic corridor of Java as the center of industry and national services, strengthen national connectivity for local and global, and increased efficiency in transportation cost and logistics distribution effectiveness of air transport [3]. The airfreight distribution in Indonesia spread unevenly. The flight route in Indonesia has not been fully developed in accordance with the concept of hub and spokes [4]. Insufficient number of infrastructures, transportation costs that lead to high economic costs, and limited network and capacity are the problems in logistics service [5]. One of the efforts that can be done to perform air transportation network is determine the hub and spoke airports.

The aim of this paper is to analysis of hub and spoke airport networks in Indonesia based on cargo volume and percentage of annual passenger boarding and cargo volume according to Federal Aviation Administration (FAA). Based on freight ratio value, airport can be classified in four types: full passenger airport, freight interest airport, freight specialist airport, and mixed passenger and freight airport. Fives airport classifications based on percentage of annual passenger boarding and cargo volume according to Federal Aviation Administration are large hub, medium hub, small hub, non-hub primary and non-primary commercial service [6].

LITERATURE

A) Hub and spoke network systems

A multi-objective model for the selection of a newly constructed hub and spoke system is proposed by Çiftçi and Sevkli [7] to maximize aircraft utilization and revenue whilst reducing the commercially infeasible network detour factor. The data includes unit passenger revenues and operating costs for the segments, distances between cities and hubs, expected load factors and flying times of segments.

Factors that affect the network structure of an airline are as follows: number of hubs, potential traffic at the hub cities, and location of the hub in order to minimize flying costs, good airport facilities, good weather facilities and strategy of competitors [8]. Discussions of airline competition analysis and network strategies in a hub and spoke system can be found in [9, 10, 11]. A location must have the four following features in order to be a hub i.e. traffic rights, short Minimum Connection Times (MCT), bi-directional connection and sufficient detour [12]. Traffic to regional air express and airfreight hubs is likely to respond in complex ways to fuel costs [13]. Air traffic punctuality is one of the most important criteria for choosing an air service [14].

Hub and spoke network systems have significant advantages for network carriers [15, Caves *et al*., 1984 in [7]. These include:

a) Consolidating passenger numbers and creating economies of density.
b) Decreasing the number of routes required to connect each pair of cities in a network.
c) Increasing the demand for frequent flights.
d) Consolidating the activities of personnel, maintenance, and operations.
e) Decreasing costs and increasing customer loyalty through airport domination.

B) Freight ratio

The number of hub flight is based on the number of spoke and inter-connected city [16]. Classification of airport as a hub or spoke can be classified based on Freight Ratio (FR). Freight ratioin kg per passenger is ratio between the number of cargo (kg) and the number of passenger boarding in the airport. The classification of airport based on freight ratio is follows:

a) Full passenger airport is airport with freight ratio (FR) value is very low.
b) Freight interest airport is airport with freight ratio (FR) value between 30-100 kg per passenger.
c) Freight specialist airport is airport with freight ratio (FR) value is more than 100 kg per passenger.
d) Mixed passenger and freight airport is airport with freight ratio (FR) value is 30 kg per passenger and the number of passenger boarding in the airport is high.

C) Federal aviation administration (FAA) classification of airport

The Federal Aviation Administration (FAA) has its own method for classifying whether an airport as a hub or non-hub. In Table-1 given the category of airports if used methods of grouping the FAA. In this method there are two criteria, the first criteria is airport classifications (commercial service and non-primary or except commercial service) and the second criteria is percentage of annual passenger boarding. Commercial service is publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service There are five categories of airport i.e. large hub airport, medium hub airport, small hub airport, non-hub primary airport, and non-primary commercial service airport [6].

Table-1. Classification of airport according to FAA[6].

Airport classifications		Hub type: Percentage of annual passenger boarding	Common name
Commercial service: Publicly owned airportsthat have at least 2,500passenger boardingseach calendar year andreceive scheduled passenger service	Primary: Have more than 10,000 passenger boardings each year	Large:1% or more	Large Hub
		Medium: at least 0.25%,but less than 1%	Medium Hub
		Small: at least 0.05%,but less than 0.25%	Small Hub
		Non-hub:More than 10,000,but less than 0.05%	Non-hub Primary
	Non-primary	Non-hub: at least 2,500and no more than 10,000	Non-primary Commercial Service
Non-primary (Except Commercial Service)		Not Applicable	

RESULT AND DISCUSSIONS

a. Hierarchy of airport

Hierarchy of airports in Indonesia as referred to Ministerial Decree of Transportation KM No. 11 (2010) in Article 9 (1) consists of hub airport and spoke airport. Hub airport is classified into three levels i.e.: primary hub, secondary hub and tertiary hub [17]. The hierarchy of thirty-four airports in Indonesia is shown in Table-2.

Table-2. Hierarchy of thirty-four airports in Indonesia.

No.	Airports, City	Hierarchy of airport
1.	Sultan IskandarMuda, Banda Aceh	Tertiary hub
2.	Kuala Namu, Medan	Primary hub
3.	Minangkabau, Padang	Secondary hub
4.	Sultan SyarifKasim II, Pekanbaru	Secondary hub
5.	Hang Nadim, Batam	Primary hub
6.	Depati Amir, Pangkal Pinang	Tertiary hub
7.	Sultan Thaha, Jambi	Tertiary hub
8.	FatmawatiSoekarno, Bengkulu	Tertiary hub
9.	Sultan Mahmud Badaruddin II, Palembang	Secondary hub
10.	RadinInten II (Branti), Lampung	Tertiary hub
11.	HuseinSastranegara, Bandung	Tertiary hub
12.	Soekarno-Hatta, Jakarta	Primary hub
13.	Ahmad Yani, Semarang	Secondary hub
14.	AdiSumarmo, Solo	Secondary hub
15.	AdiSutjipto, Yogyakarta	Secondary hub
16.	Juanda, Surabaya	Primary hub
17.	NgurahRai, Denpasar	Primary hub
18.	Selaparang, Mataram	Secondary hub
19.	Eltari, Kupang	Secondary hub
20.	Supadio, Pontianak	Secondary hub
21.	TjilikRiwut, Palangkaraya	Tertiary hub
22.	Syamsuddin Noor, Banjarmasin	Secondary hub
23.	Sultan Aji Muhammad Sulaiman (Sepinggan), Balikpapan	Primary hub
24.	Juwata, Tarakan	Tertiary hub
25.	Sam Ratulangi, Manado	Primary hub
26.	Djalaluddin, Gorontalo	Secondary hub
27.	Mutiara, Palu	Secondary hub
28.	Tampa Padang, Mamuju	Tertiary hub
29.	Sultan Hasanuddin, Makassar	Primary hub
30.	WolterMonginsidi, Kendari	Secondary hub
31.	Pattimura, Ambon	Tertiary hub
32.	Sultan Babullah, Ternate	Tertiary hub
33.	Sentani, Jayapura	Secondary hub
34.	Rendani, Manokwari	Tertiary hub

From Table-2, eight airports include primary hub i.e. Soekarno-Hatta International Airport Jakarta, Juanda International Airport Surabaya, Kuala Namu International Airport Medan, Hang Nadim International Airport Batam, NgurahRai International Airport Denpasar, Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport Balikpapan, Sultan Hasanuddin International Airport Makassar, and Sam Ratulangi International Airport Manado. There are 14 airports that include as secondary hub and 12 airports that include as tertiary hub [18]. Three secondary hub airports in Sumatra Islandare Minangkabau Airport in Padang, Sultan Syarif Kasim II Airport in Pekanbaru, and Sultan Mahmud Badaruddin II Airport in Palembang. Three secondary hub Airports in Java Island are Ahmad Yani Airport in Semarang, AdiSumarmo Airport in Solo, and AdiSutjipto Airport in Yogyakarta. Two secondary hub airports in Kalimantan Island are Supadio Airport in Pontianak and Syamsuddin Noor Airport in Banjarmasin. Three secondary hub airports in Sulawesi Island are Djalaluddin Airport in Gorontalo, Mutiara Airport in Palu, and Wolter Monginsidi Airport in Kendari. Sentani Airport is a secondary airport in Papua Island.

Flight route map of airport in Indonesia is shown in Figure-1. There are thirty-three provinces in this map and thirty-four airports. In Central Java Province, there are two airports, the first is Ahmad Yani in Semarang and the second is AdiSumarmo in Surakarta (Solo). The hierarchy of Ahmad Yani airport and AdiSumarmo airport are classified as a secondary hub airport. From Figure-1, Soekarno-Hatta International Airport is a central hub because all of the spoke cities in Indonesia fly into SHIA. There are route flights from SHIA to all cities in Indonesia. This result is in line with the findings of Sugiyanto *et al.*[18], based on Herfindahl-Hirschmann Index (HHI), the amount of domestic cargo hub is required for distribution logistics/cargo in Indonesia are two airports. Two airports with the largest cargo production, the first is Soekarno-Hatta International Airport in Jakarta and the second is Juanda International Airport in Surabaya [18].

Data required includes the production data of each airport, the number of passengers boarding (people), number of cargo production (kg) for domestic flights and international flights, these couple's flights from 34 airports for domestic flights and 19 airports for international routes pair. Data production of each of the airports is obtained from the Directorate General of Air Transportation, Ministry of Transportation Republic of Indonesia in 2016 [2]. This data was used to analyse the freight ratio value for domestic flight and international flight and airport classifications according to Federal Aviation Administration (FAA) method.

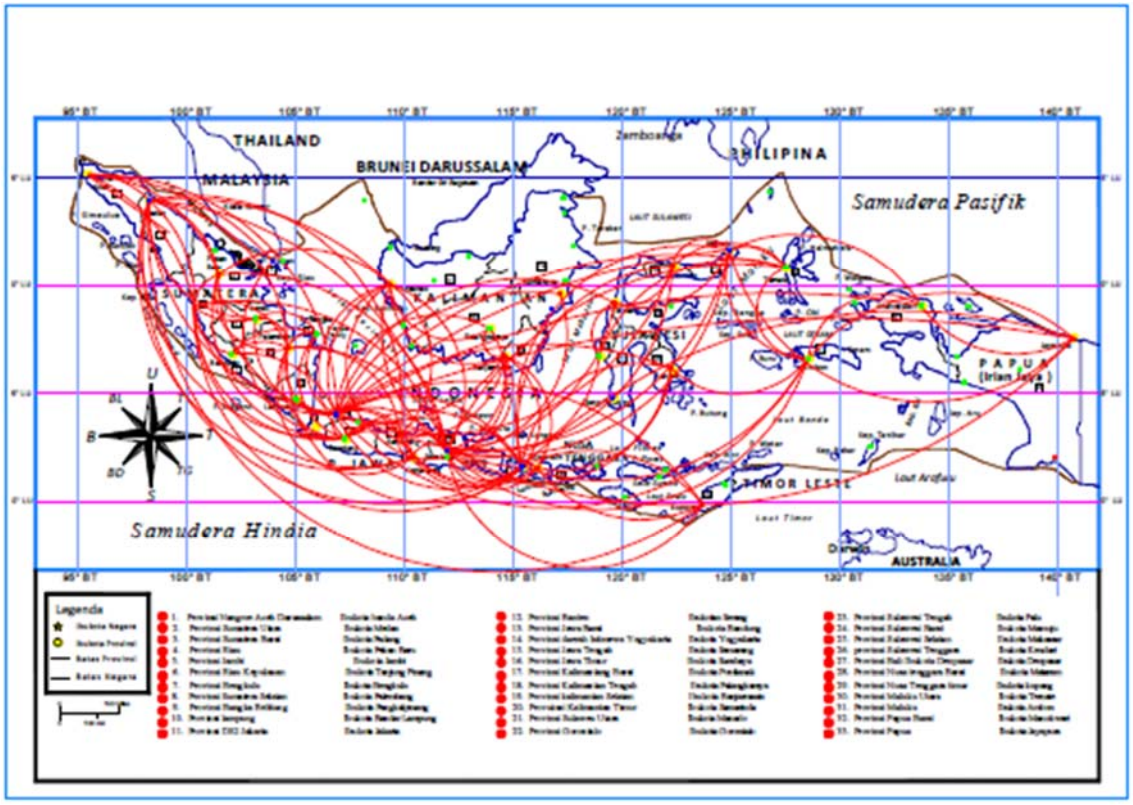

Figure-1. Flight route map of airport in Indonesia [5].

b. Freight ratio value for domestic flight

Freight ratio is ratio between the number of cargo (kg) and the number of passenger boarding in the airport.Freight ratio value for domestic flight from thirty-four airports in Indonesia is shown in Table-3. The highest value of cargo for domestic flight in Soekarno-Hatta International Airport is 288,410,185 kg. Number of passengers boarding from Soekarno-Hatta International Airport for domestic flight is 41,773,510 peoples. The freight ratio value for domestic flight in Soekarno-HattaInternational Airport is 6.904 kg/passenger. The freight ratio value for domestic flight from thirty-four airports in Indonesia is between 0.443 to 75.564 kg per passenger. Sentani Airport in Jayapura has the highest of freight ratio value (75.564 kg per passenger) for domestic flight and the category as a freight interest airport or cargo interest. Based on the freight ratio value for domestic flight, Supadio Airport in Pontianak, West Kalimantan and Tampa Padang Airport in Mamuju, West Sulawesi as a full passenger airport because the freight ratio (FR) value is very low.The freight ratio value in Tampa Padang Airport is 0.443 kg/passenger. There are thirty-one airport in Indonesia include in mixed passenger and freight airport category with the lowest freight ratio value is 1.959 kg per passenger in NgurahRai International Airport, Denpasarand the highest is 7.196 kg per passenger in Hang Nadim International Airport, Batam.

Table-3. Freight ratio value for domestic flight from thirty-four airports in Indonesia.

No.	**Airport**	**Number of passengers boarding** (people)	**Number of cargo** (kg)	**Freight ratio** (kg/passenger)	**Category**
1.	Sultan IskandarMuda	611,881	3,572,254	5.838	Mixed Passenger and Freight Airport
2.	Kuala Namu	6,374,897	37,413,257	5.869	Mixed Passenger and Freight Airport
3.	Minangkabau	2,937,780	9,372,979	3.190	Mixed Passenger and Freight Airport
4.	Sultan SyarifKasim II	2,504,666	9,308,292	3.716	Mixed Passenger and Freight Airport
5.	Hang Nadim	4,590,854	33,035,468	7.196	Mixed Passenger and Freight Airport
6.	Depati Amir	1,636,319	6,671,234	4.077	Mixed Passenger and Freight Airport

7.	Sultan Thaha	1,168,219	6,088,310	5.212	Mixed Passenger and Freight Airport
8.	FatmawatiSoekarno	590,982	2,034,146	3.442	Mixed Passenger and Freight Airport
9.	S.M. Badaruddin II	3,038,130	11,854,587	3.902	Mixed Passenger and Freight Airport
10.	RadinInten II (Branti)	1,419,342	4,437,830	3.127	Mixed Passenger and Freight Airport
11.	Husein Sastranegara	2,493,761	6,401,393	2.567	Mixed Passenger and Freight Airport
12.	Soekarno-Hatta	41,773,510	288,410,185	6.904	Mixed Passenger and Freight Airport
13.	Ahmad Yani	2,558,957	11,008,548	4.302	Mixed Passenger and Freight Airport
14.	Adi Sumarmo	610,039	2,841,117	4.657	Mixed Passenger and Freight Airport
15.	Adi Sutjipto	3,507,317	10,477,826	2.987	Mixed Passenger and Freight Airport
16.	Juanda	7,094,450	31,763,155	4.477	Mixed Passenger and Freight Airport
17.	NgurahRai	9,024,656	17,680,795	1.959	Mixed Passenger and Freight Airport
18.	Selaparang	1,632,235	6,536,373	4.005	Mixed Passenger and Freight Airport
19.	Eltari	624,416	2,241,050	3.589	Mixed Passenger and Freight Airport
20.	Supadio	2,639,562	2,495,401	0.945	Full Passenger Airport
21.	TjilikRiwut	642,330	3,587,391	5.585	Mixed Passenger and Freight Airport
22.	Syamsuddin Noor	1,647,229	11,533,966	7.002	Mixed Passenger and Freight Airport
23.	Sultan Aji Muhammad Sulaiman(Sepinggan)	3,966,206	25,926,867	6.537	Mixed Passenger and Freight Airport
24.	Juwata, Tarakan	983,893	6,888,095	7.001	Mixed Passenger and Freight Airport
25.	Sam Ratulangi	930,517	5,378,145	5.780	Mixed Passenger and Freight Airport
26.	Djalaluddin	381,082	2,295,757	6.024	Mixed Passenger and Freight Airport
27.	Mutiara	672,698	3,075,858	4.572	Mixed Passenger and Freight Airport
28.	Tampa Padang	48,494	21,488	0.443	Full Passenger Airport
29.	Sultan Hasanuddin	8,436,271	52,491,364	6.222	Mixed Passenger and Freight Airport
30.	WolterMonginsidi	662,468	3,123,571	4.715	Mixed Passenger and Freight Airport
31.	Pattimura	588,517	3,168,744	5.384	Mixed Passenger and Freight Airport
32.	Sultan Babullah	274,488	1,692,400	6.166	Mixed Passenger and Freight Airport
33.	Sentani	1,728,549	130,616,171	75.564	Freight Interest Airport or Cargo Interest
34.	Rendani	497,736	978,148	1.965	Mixed Passenger and Freight Airport

c. Freight ratio value for international flight

Freight ratio value for international flight from nineteenairports in Indonesia is shown in Table-4. The highest value of cargo for international flight in Soekarno-Hatta International Airport is 326,411,673 kg. Number of passengers boarding from Soekarno-Hatta International Airport for international flight is 12,221,498 peoples. The freight ratio value for international flight in Soekarno-HattaInternational Airport is 26.708 kg/passenger.The freight ratio value for international flight from nineteen airports in Indonesia is 0.182 to 48.306 kg per passenger. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan, East Kalimantan has the highest of freight ratio value (48.306 kg per passenger) for international flight and the category as a freight interest airport or cargo interest. Based on freight ratio value for international flight, Sultan IskandarMuda Airport in Banda Aceh and Supadio Airport in Pontianak, West Kalimantan as a full passenger airport because the freight ratio (FR) value is very low.The freight ratio value in Supadio Airport is 0.182 kg/passenger. There are six-teen airports in Indonesia include in mixed passenger and freight airport category with the freight ratio value 1.330 kg per passenger in Hussein Sastranegara International Airport, Bandung, West Java to 29.086 kg per passenger in Hang Nadim International Airport, Batam.

Table-4. Freight ratio value for international flight from nine-teen airports in Indonesia.

No.	Airport	Number of passengersboarding (people)	Number of cargo (kg)	Freight ratio (kg per passenger)	Category
1.	Sultan IskandarMuda	109,846	80,241	0.730	Full Passenger Airport
2.	Kuala Namu	1,629,894	4,215,927	2.587	Mixed Passenger and Freight Airport
3.	Minangkabau	89,455	784,875	8.774	Mixed Passenger and Freight Airport
4.	Sultan SyarifKasim II	447,858	1,179,191	2.633	Mixed Passenger and Freight Airport
5.	Hang Nadim	60,589	1,762,264	29.086	Mixed Passenger and Freight Airport
6.	S.M. Badaruddin II	108,872	236,881	2.176	Mixed Passenger and Freight Airport
7.	HuseinSastranegara	653,046	868,709	1.330	Mixed Passenger and Freight Airport
8.	Soekarno-Hatta	12,221,498	326,411,673	26.708	Mixed Passenger and Freight Airport
9.	Ahmad Yani	99,301	244,555	2.463	Mixed Passenger and Freight Airport
10.	AdiSumarmo	100,808	146,218	1.450	Mixed Passenger and Freight Airport
11.	AdiSutjipto	140,232	605,414	4.317	Mixed Passenger and Freight Airport
12.	Juanda	1,741,297	21,864,736	12.557	Mixed Passenger and Freight Airport
13.	NgurahRai	4,040,994	8,759,059	2.168	Mixed Passenger and Freight Airport
14.	Selaparang	5,992	93,489	15.602	Mixed Passenger and Freight Airport
15.	Supadio	48,332	8,774	0.182	Full Passenger Airport
16.	Sultan Aji Muhammad Sulaiman(Sepinggan)	37,820	1,826,915	48.306	Freight interest airport or Cargo Interest
17.	Juwata, Tarakan	4,601	12,801	2.782	Mixed Passenger and Freight Airport
18.	Sam Ratulangi	27,532	164,111	5.961	Mixed Passenger and Freight Airport
19.	Sultan Hasanuddin	102,630	982,607	9.574	Mixed Passenger and Freight Airport

d. FAA classification

Airport classifications according to FAA method based on percentage of annual passenger boarding and cargo volume [6]. The percentage value of cargo production in Indonesia for domestic flight from thirty-four airports and international flight from nineteen airports is shown in Table-5. Total of cargo production for domestic flight is 754,422,165 kg. The percentage of cargo production for domestic flight from thirty-four airports in Indonesia is 0.003% in Tampa Padang Airport, Mamuju to 38.229% in Soekarno-Hatta International Airport (SHIA). Soekarno-Hatta International Airport has the category as a large hub because SHIA have the commercial service (publicly owned airports that have at least 2,500 passenger boarding each calendar year and receive scheduled passenger service and have more than 10,000 passenger boarding each year. There are 41,773,510 passengers boarding from SHIA for domestic flight and 12,221,498 passengers for international flight. Based on the percentage of cargo production for domestic flight, 14 airports in large hub category (Kuala Namu Airport, Minangkabau Airport, Sultan SyarifKasim II Airport, Hang Nadim Airport, Sultan Mahmud Badaruddin II Airport, Soekarno-Hatta Airport, Ahmad Yani Airport, AdiSutjipto Airport, Juanda Airport, NgurahRai Airport, Syamsuddin Noor Airport, Sultan Aji Muhammad Sulaiman(Sepinggan) Airport, Sultan Hasanuddin Airport, and SentaniAirport). Seven-teen airports in medium hub category with the percentage of annual passenger boarding0.27% in FatmawatiSoekarno Airport to 0.913% in Juwata Airport. Two airports in small hub category (Sultan Babullah Airport and Rendani Airport) and one airport in non-hub primary category (Tampa Padang Airport).

Total of cargo production for international flight is 370,240,491 kg. The highest value of total of cargo production is in Soekarno-Hatta International Airport with the amount of 326,411,673 kg. The percentage of cargo production for international flight is 0.002% in Supadio Airport, Pontianak to 88.162% in Soekarno-Hatta Airport. Soekarno-Hatta International Airport has the highest of percentage of cargo production. The percentage of cargo volume in Soekarno-Hatta International Airport is 38.229% for domestic flight and 88.162% for international flight. For international flight, there are four airports with category in large hub (Kuala Namu International Airport, Soekarno-Hatta International Airport, Juanda International Airport, and NgurahRai International Airport). Four

airports in medium hub category with the percentage value of cargo production 0.265% to 0.493% (Sultan SyarifKasim II International Airport, Hang Nadim International Airport, Sultan Aji Muhammad Sulaiman(Sepinggan) International Airport and Sultan Hasanuddin International Airport). There are five airports in small hub category (Minangkabau International Airport, Sultan Mahmud Badaruddin II International Airport, HuseinSastranegara International Airport, Ahmad Yani International Airport, and AdiSutjipto International Airport). There are four airports with category in non-hub primary (Sultan Iskandar Muda International Airport, AdiSumarmo International Airport, Supadio International Airport and Sam Ratulangi International Airport) and two airports in non-primary commercial service category (Selaparang International Airport and Juwata International Airport).

Table-5. Category of thirty-four airports for domestic flight and nineteen airports for international flight according to FAA.

No.	Airport	Domestic flight			International flight		
		Cargo production (kg)	Percentage	Classification according to FAA	Cargo production (kg)	Percentage	Classification according to FAA
1.	Sultan IskandarMuda	3,572,254	0.474%	Medium Hub	80,241	0.022%	Non-hub primary
2.	Kuala Namu	37,413,257	4.959%	Large Hub	4,215,927	1.139%	Large Hub
3.	Minangkabau	9,372,979	1.242%	Large Hub	784,875	0.212%	Small Hub
4.	Sultan SyarifKasim II	9,308,292	1.234%	Large Hub	1,179,191	0.318%	Medium Hub
5.	Hang Nadim	33,035,468	4.379%	Large Hub	1,762,264	0.476%	Medium Hub
6.	Depati Amir	6,671,234	0.884%	Medium Hub	-	-	-
7.	Sultan Thaha	6,088,310	0.807%	Medium Hub	-	-	
8.	FatmawatiSoekarno	2,034,146	0.270%	Medium Hub	-	-	-
9.	S.M. Badaruddin II	11,854,587	1.571%	Large Hub	236,881	0.064%	Small Hub
10.	RadinInten II (Branti)	4,437,830	0.588%	Medium Hub	-	-	-
11.	Husein Sastranegara	6,401,393	0.849%	Medium Hub	868,709	0.235%	Small Hub
12.	Soekarno-Hatta	288,410,185	38.229%	Large Hub	326,411,673	88.162%	Large Hub
13.	Ahmad Yani	11,008,548	1.459%	Large Hub	244,555	0.066%	Small Hub
14.	Adi Sumarmo	2,841,117	0.377%	Medium Hub	138,269	0.037%	Non-hub primary
15.	Adi Sutjipto	10,477,826	1.389%	Large Hub	605,414	0.164%	Small Hub
16.	Juanda	31,763,155	4.210%	Large Hub	21,864,736	5.906%	Large Hub
17.	NgurahRai	17,680,795	2.344%	Large Hub	8,759,059	2.366%	Large Hub
18.	Selaparang	6,536,373	0.866%	Medium Hub	93,489	0.025%	Non-primary Commercial Service
19.	Eltari	2,241,050	0.297%	Medium Hub	-	-	-
20.	Supadio	2,495,401	0.331%	Medium Hub	8,774	0.002%	Non-hub primary
21.	TjilikRiwut	3,587,391	0.476%	Medium Hub	-	-	-
22.	Syamsuddin Noor	11,533,966	1.529%	Large Hub	-	-	-
23.	Sultan Aji Muhammad Sulaiman(Sepinggan)	25,926,867	3.437%	Large Hub	1,826,915	0.493%	Medium Hub
24.	Juwata	6,888,095	0.913%	Medium Hub	12,801	0.003%	Non-primary Commercial Service
25.	Sam Ratulangi	5,378,145	0.713%	Medium Hub	164,111	0.044%	Non-hub

No.	Airport	Domestic flight			International flight		
		Cargo production (kg)	Percentage	Classification according to FAA	Cargo production (kg)	Percentage	Classification according to FAA
							primary
26.	Djalaluddin	2,295,757	0.304%	Medium Hub	-	-	-
27.	Mutiara	3,075,858	0.408%	Medium Hub	-	-	-
28.	Tampa Padang	21,488	0.003%	Non-hub Primary	-	-	-
29.	Sultan Hasanuddin	52,491,364	6.958%	Large Hub	982,607	0.265%	Medium Hub
30.	WolterMonginsidi	3,123,571	0.414%	Medium Hub	-	-	-
31.	Pattimura	3,168,744	0.420%	Medium Hub	-	-	-
32.	Sultan Babullah	1,692,400	0.224%	Small Hub	-	-	-
33.	Sentani	130,616,171	17.313%	Large Hub	-	-	-
34.	Rendani	978,148	0.130%	Small Hub	-	-	-
	Total of cargo production (kg)	754,422,165		Total of cargo production (kg)	370,240,491		

CONCLUSIONS

The airfreight distribution in Indonesia spread unevenly. The solutions for freight shipments problem is evaluate the hub and spoke airport networks. The freight ratio value for domestic flight from thirty-four airports is 0.443 to 75.564 kg per passenger. Sentani Airport in Jayapura has the highest of freight ratio value and the category as a freight interest airport or cargo interest. The freight ratio value for international flight from nineteen airports is 0.182 to 48.306 kg per passenger. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan, East Kalimantan has the highest of freight ratio value and the category as a freight interest airport or cargo interest. Total of cargo production for domestic flight is 754,422,165 kg. The percentage of cargo production for domestic flight from thirty-four airports in Indonesia is 0.003% to 38.229%. Total of cargo production for international flight is 370,240,491 kg. The percentage of cargo production for international flight is 0.002% to 88.162%. Soekarno-Hatta International Airport has the highest value of percentage of cargo production. The percentage of cargo volume in Soekarno-Hatta International Airport is 38.229% for domestic flight and 88.162% for international flight.

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