FSTPT
Forum Studi Transportasi antar Perguruan Tinggi
Indonesian Inter-University Transportation Studies Forum

The 19th International Symposium of
Indonesian Inter-University
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Certificate of Appreciation

this certificate is awarded to:

Gito Sugiyanto

in recognition of valuable contribution as

Author

of **Hub and Spoke Airport Networks Based On Freight Ratio (Case Study in Kalimantan Island, Indonesia)**

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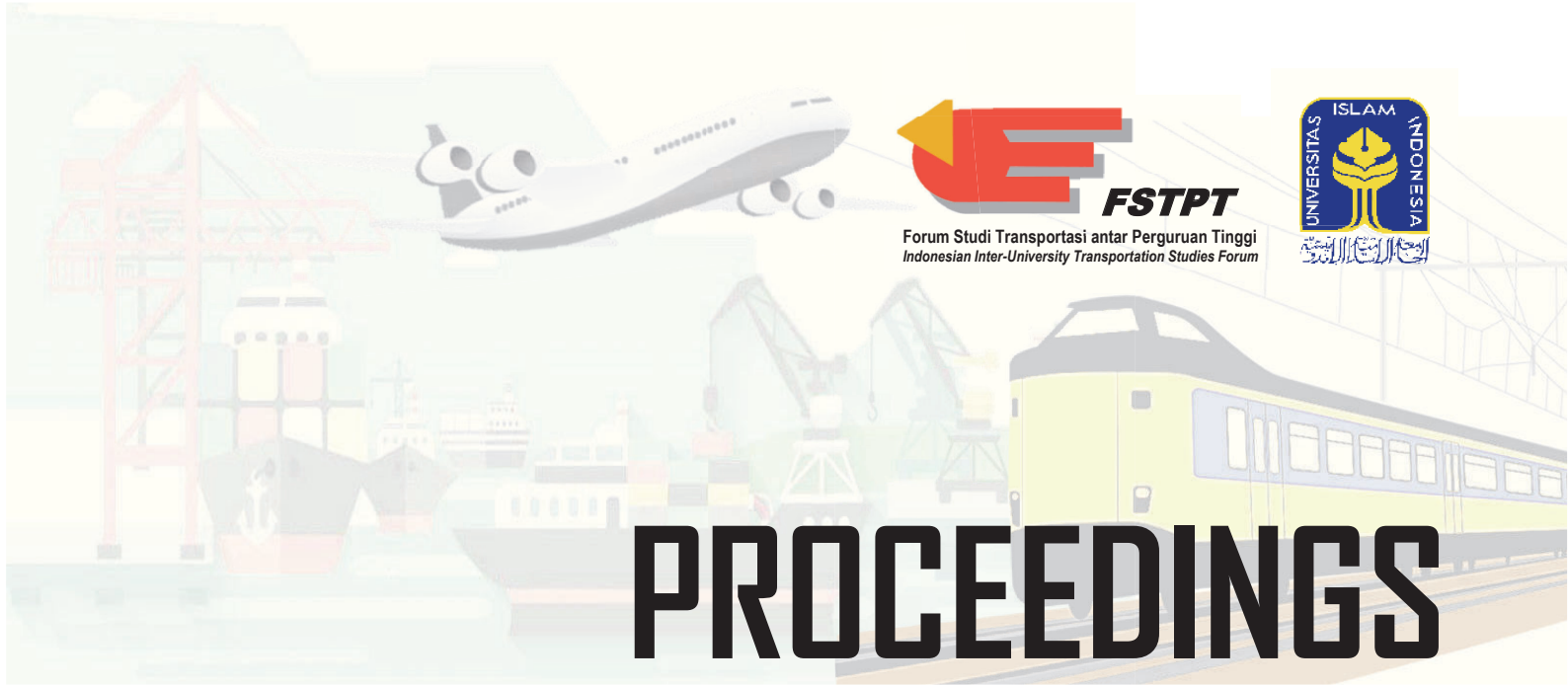

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PROCEEDINGS

The 19th International Symposium of FSTPT

"Connecting regions and improving mobility to foster nation's competitiveness and resilience"

Editors:
Berlian Kushari
Dwi Astuti Wahyu Wulan Pratiwi
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Board of Scientific Committee

Proceedings of the 19th International Symposium of FSTPT contains all papers presented dan discussed during the symposium. Each presented paper had undergone a blind peer review administered by FSTPT Board of Scientific Committee

FOREWORD

Forum Studi Transportasi antar Perguruan Tinggi (FSTPT), or the Indonesian inter-universities transportation studies forum is an organization whose members are universities or units of higer education institutions that focus their studies in the fields of transportation. Until October 2016, FSTPT has a total of 112 active member institutions from Indonesia and abroad. FSTPT, which was established at the end of 1998, has been running several routine activities, the biggest of which is the annual symposium. The symposium has always been an excellent platform for researchers, professors, students, and practitioners to share their research results, best practice experiences, thoughts, and ideas that contribute to improving the future of transportation sector, especially in Indonesia.

The International Symposium held at Islamic University of Indonesia (UII) at Yogyakarta was the 19th. As the chairwoman of FSTPT and on behalf of all FSTPT member institutions, I would like to thank and convey our utmost appreciation to UII, especially all organizing committee members at its Civil Engineering Department, that had conducted the symposium very successfully and effortlessly. Punctuality, effective use of an online system which handled all matters pertaining to paper submission, review process, registration of participants, payments, and attendance, as well as wholehearted hospitality marked the organization of the 19th FSTPT Symposium.

Lastly, I do hope that this proceedings book serve as a good repository where many discussions as well as knowledge transfers took place during the symposium are stored and maintained. It is now our responsibility to take them into further steps. Thank you.

Prof. Erika Buchari
2014 – 2016 Chair of FSTPT

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HUB AND SPOKE AIRPORT NETWORKS BASED ON FREIGHT RATIO (CASE STUDY IN KALIMANTAN ISLAND, INDONESIA)

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Abstract

Sultan Aji Muhammad Sulaiman International Airport, formerly named Sepinggan is the 6th busiest airport in Indonesia and the busiest airport in Kalimantan. The aim of this paper is to analysis of hub-and-spoke airport networks in Kalimantan Island based on freight ratio. The freight ratio analysis for domestic flight carried out for five airports and three for international flight. Freight ratio value for domestic flight is 0.945-7.002 kg/passenger. Syamsuddin Noor Airport has the highest of freight ratio value for domestic flight and the category as a mixed passenger and freight airport. Supadio Airport as a full passenger airport. Tjilik Riwut Airport, Sultan Aji Muhammad Sulaiman Airport and Juwata Airport include in mixed passenger and freight airport category. Freight ratio value for international flight is 0.182-48.306 kg/passenger. Sultan Aji Muhammad Sulaiman has the highest of freight ratio value and the category as a freight interest airport. Supadio as a full passenger airport and Juwata include in mixed passenger and freight airport.

Keywords: Hub and spoke, freight ratio, airport, Kalimantan Island

Abstrak

Bandar udara Internasional Sultan Aji Muhammad Sulaiman atau yang sebelumnya dikenal dengan nama Bandar udara Sepinggan merupakan bandara tersibuk urutan keenam di Indonesia dan merupakan bandara yang paling sibuk di Pulau Kalimantan. Tujuan paper ini adalah untuk menganalisis jaringan bandar udara hub-and-spoke di Pulau Kalimantan berdasarkan perbandingan antara jumlah barang dengan jumlah penumpang yang berangkat (freight ratio) dalam satuan kg per penumpang. Analisis freight ratio untuk penerbangan dalam negeri atau domestik dilakukan pada lima bandar udara sedangkan untuk penerbangan luar negeri atau internasional dilakukan di tiga bandara. Nilai freight ratio untuk penerbangan domestik sebesar 0,945-7,002 kg/penumpang. Bandar udara Syamsuddin Noor memiliki nilai freight ratio yang paling tinggi dan dikategorikan sebagai mixed passenger and freight airport. Bandar udara Supadio dikategorikan sebagai full passenger airport. Bandar udara Tjilik Riwut, Bandar udara Sultan Aji Muhammad Sulaiman dan Bandar udara Juwata dikategorikan sebagai mixed passenger and freight airport. Nilai freight ratio untuk penerbangan internasional sebesar 0,182-48,306 kg/penumpang. Bandar udara Sultan Aji Muhammad Sulaiman memiliki nilai freight ratio tertinggi dan dikategorikan sebagai freight interest airport. Bandara Supadio sebagai full passenger airport and Bandara Juwata dikategorikan sebagai mixed passenger and freight airport.

Kata kunci: Hub and spoke, freight ratio, bandar udara, Pulau Kalimantan

INTRODUCTION

Sultan Aji Muhammad Sulaiman International Airport, formerly named Sepinggan Airport is the 6th busiest airport in Indonesia and the busiest airport in Kalimantan that serving 4,004,026 passengers and 27,753,782 kilograms of goods (Ministry of Transportation, 2016). From October to December 2014 (in 5-15 million

passenger capacity category), Sultan Aji Muhammad Sulaiman Airport becomes the world's 16th best in Airport Service Quality or the best in Southeast Asia by Airport Council International survey among 79 airports with passenger capacity between 5-15 million a year (ACI, 2014). In 1995, the Indonesian government announced Sultan Aji Muhamad Sulaiman Airport as the fifth Indonesian hajj embarkation airport for Kalimantan region which also consist West Kalimantan, Central Kalimantan and South Kalimantan Province.

Hub and spoke network pattern has been introduced and developed in the aviation world in the United States since the early 1980s, triggered by the enforcement of the Airline Deregulation Act in the USA in 1978 (Dennis, 1994), which promoted considerable deployment of the hub and spoke network structures for the airports and airlines operations worldwide, and contributed also to the overall costs' reduction both for passenger and air cargo traffic (Wei and Yanji, 2006). The advantages of hub-and-spoke are consolidation of passengers, decreased number of routes, increase demand (frequent flights) and decrease costs. Traffic to regional air express and airfreight hubs is likely to respond in complex ways to fuel costs (O'Kelly, 2014). The carrier can save the fixed cost by forming the hub-spoke network (Morimoto, 2013). One of the efforts that can be done to perform air transportation network is determine the hub and spoke airports. Hub-and-spoke airport networks enable carriers to supply transport services to many combinations of origin and destination zones at high frequencies and low costs. The disadvantage for the traveller is of course that they have to make a detour via the hub airport implying an extra stop. For many combinations of origin and destination zone, travellers can choose between more than one main carrier and airport (Sugiyanto et al., 2015).

Hierarchy of airports in Indonesia as referred to KM No. 11 (2010) in Article 9 (1) consists of hub airport and spoke airport (KM No. 11, 2010). Hub airport is an airport that has a broad coverage of various service airport serving the passenger and/or cargo and influence the development of the national economy or the provinces. Spoke airport is airports that has service coverage and affect the development of the local economy, destination airport and supporting infrastructure service local activities.

The number of hub flight is based on the number of spoke and inter-connected city (Graham, 1998). Classification of airport as a hub or spoke can be classified based on Freight Ratio (FR). Freight ratio is ratio between the number of cargo (kg/passenger) and the number of passenger boarding in the airport. The aim of this paper is to analysis of hub-and-spoke airport networks in Kalimantan Island, Indonesia based on freight ratio. 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. The classification of airport based on freight ratio is follows:

1. Full passenger airport is airport with freight ratio value is very low.
2. Freight interest airport is airport with freight ratio value between 30-100 kg per passenger.
3. Freight specialist airport is airport with freight ratio value is more than 100 kg per passenger.
4. Mixed passenger and freight airport is airport with freight value is 30 kg per passenger and the number of passenger boarding in the airport is high.

RESULT AND DISCUSSION

Freight Ratio Value for Domestic Flight

The freight ratio analysis for domestic flight in Kalimantan Island carried out for five airports. The airport which is taken is the largest airport in each province. Five airports in Kalimantan Island i.e.: Supadio Airport in Pontianak, West Kalimantan; Tjilik Riwut Airport, Palangkaraya, Central Kalimantan; Syamsuddin Noor Airport, Banjarmasin, South Kalimantan; Sultan Aji Muhammad Sulaiman Sepinggan Airport, Balikpapan, East Kalimantan and Juwata Airport, Tarakan, North Kalimantan.

The freight ratio value for domestic flight from five airports in Kalimantan Island between 0.945 to 7.002 kg per passenger. Syamsuddin Noor Airport in Banjarmasin has the highest of freight ratio value (7.002 kg per passenger) and the category as a mixed passenger and freight airport because value is lower than 30 kg per passenger and the number of passenger boarding in the airport is high. Based on freight ratio value, Supadio Airport in Pontianak, West Kalimantan as a full passenger airport because the freight ratio value is very low (0.945 kg per passenger). Tjilik Riwut Airport, Sultan Aji Muhammad Sulaiman Sepinggan Airport and Juwata Airport include in mixed passenger and freight airport category. The freight ratio value for domestic flight from five airports in Kalimantan Island, Indonesia is shown in Table 1.

Table 1 Freight Ratio Value for Domestic Flight from Five Airports in Kalimantan Island

Airport, City	Number of passengers boarding (people)	Number of cargo (kg)	Freight ratio (kg per passenger)	Category
Supadio, Pontianak	2,639,562	2,495,401	0.945	Full Passenger Airport
Tjilik Riwut, Palangkaraya	642,330	3,587,391	5.585	Mixed Passenger and Freight Airport
Syamsuddin Noor, Banjarmasin	1,647,229	11,533,966	7.002	Mixed Passenger and Freight Airport
Sultan Aji Muhammad Sulaiman Sepinggan, Balikpapan	3,966,206	25,926,867	6.537	Mixed Passenger and Freight Airport
Juwata, Tarakan	983,893	6,888,095	7.001	Mixed Passenger and Freight Airport

Freight Ratio Value for International Flight

There are three airports in Kalimantan Island that serve international flight i.e.: Supadio Airport in Pontianak, West Kalimantan; Sultan Aji Muhammad Sulaiman Sepinggan Airport, Balikpapan, East Kalimantan and Juwata Airport, Tarakan, North Kalimantan. Freight ratio value for international flight from three airports in Kalimantan Island, Indonesia is shown in Table 2. From Table 2, the freight ratio value for international flight from three airports in Kalimantan Island between 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 and the category as a freight interest airport or cargo interest because freight ratio value between 30-100 kg per passenger. Supadio Airport in Pontianak, West Kalimantan as a full passenger airport category because the freight ratio value is very low 0.182 kg per passenger. Juwata Airport in Tarakan, North Kalimantan includes in mixed passenger and freight airport category with the freight ratio value 2.782 kg per passenger.

Table 2 Freight Ratio Value International Flight from Three Airports in Kalimantan Island

Airport, City	Number of passengers boarding (people)	Number of cargo (kg)	Freight ratio (kg per passenger)	Category
Supadio, Pontianak	48,332	8,774	0.182	Full Passenger Airport
Sultan Aji Muhammad Sulaiman Sepinggan, Balikpapan	37,820	1,826,915	48.306	Freight Interest Airport or Cargo Interest
Juwata, Tarakan	4,601	12,801	2.782	Mixed Passenger and Freight Airport

Hierarchy and Stages of Development

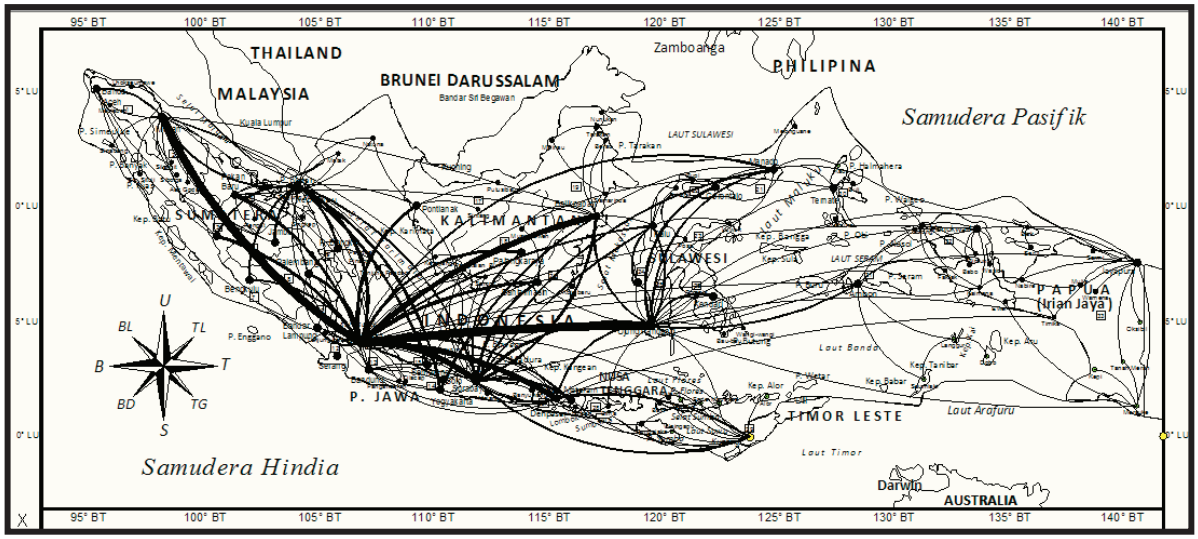
Based on KM No. 11 (2010), hierarchy and stages of development of five airports in Kalimantan Island Indonesia is shown in Table 3. Sultan Aji Muhammad Sulaiman Sepinggan Airport, Balikpapan is a primary hub, Supadio Airport and Syamsuddin Noor Airport is a secondary hub, Tjilik Riwut Airport and Juwata Airport is a tertiary hub.

Table 3 Hierarchy and Stages of Development from Five Airports in Kalimantan Island

Airport, City	Number of passengers boarding (people)	Number of cargo (kg)	Hierarchy	Stages of development
Supadio, Pontianak	2,687,894	2,504,175	Secondary hub	I-Stabilization of Secondary Airport
Tjilik Riwut, Palangkaraya	642,330	3,587,391	Tertiary hub	I-Stabilization of Tertiary Airport
Syamsuddin Noor, Banjarmasin	1,647,229	11,533,966	Secondary hub	I-Stabilization of Secondary Airport
Sultan Aji Muhammad Sulaiman Sepinggan, Balikpapan	4,004,026	27,753,782	Primary hub	I-Stabilization of Primary Airport
Juwata, Tarakan	988,494	6,900,896	Tertiary hub	IV- Development of Tertiary Airport

Desire line of airfreight cargo in Indonesia is shown in Figure-1 (Ministry of Transportation, 2012). From Figure 1, there are seven airports with the number of cargo

high i.e.: Soekarno-Hatta International Airport, Jakarta; Ngurah Rai Airport, Denpasar; Sultan Hasanuddin Airport, Makassar; Juanda Airport Surabaya; Kuala Namu Airport, Medan; Hang Nadim Airport, Batam and Sultan Aji Muhammad Sulaiman Sepinggan, Balikpapan.



Source: Ministry of Transportation, 2012.

Figure 1 Desire Line of airfreight cargo in Indonesia year 2011

CONCLUSIONS

The freight ratio value for domestic flight from five airports in Kalimantan Island between 0.945 to 7.002 kg per passenger. Syamsuddin Noor Airport, Banjarmasin has the highest of freight ratio value and the category as a mixed passenger and freight airport. Supadio Airport, Pontianak as a full passenger airport. Tjilik Riwut Airport, Sultan Aji Muhammad Sulaiman Sepinggan Airport and Juwata Airport include in mixed passenger and freight airport category. The freight ratio value for international flight from three airports in Kalimantan Island between 0.182 to 48.306 kg per passenger. Sultan Aji Muhammad Sulaiman Sepinggan International Airport in Balikpapan has the highest of freight ratio value and the category as a freight interest airport or cargo interest. Supadio Airport as a full passenger airport category and Juwata Airport, Tarakan include in mixed passenger and freight airport category.

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