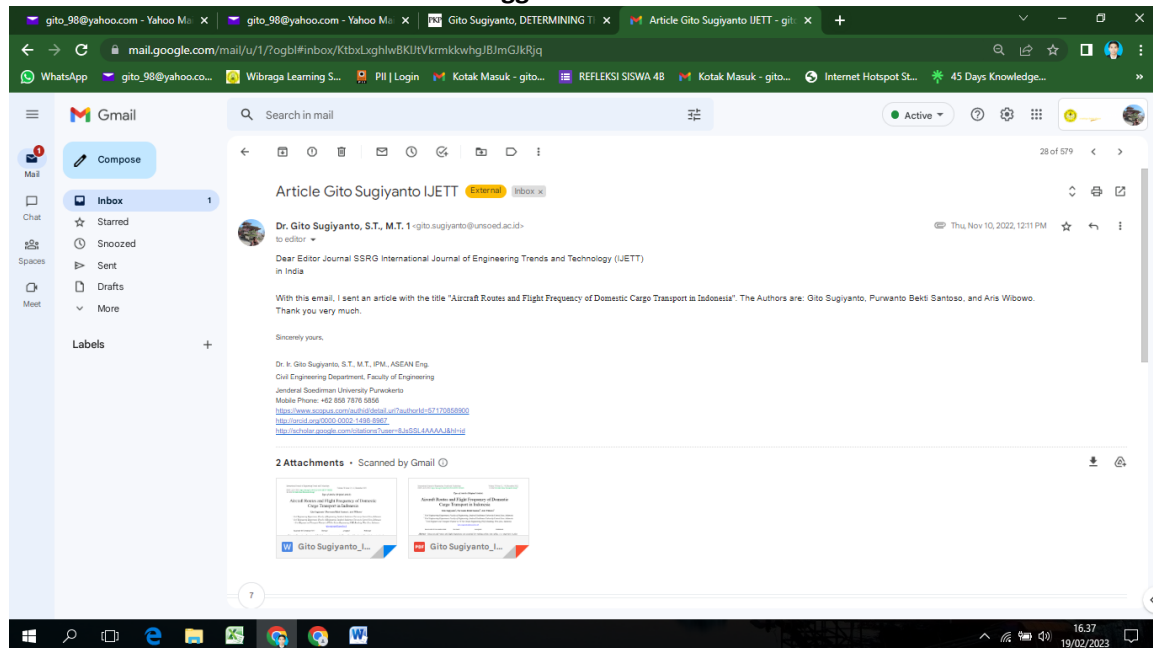
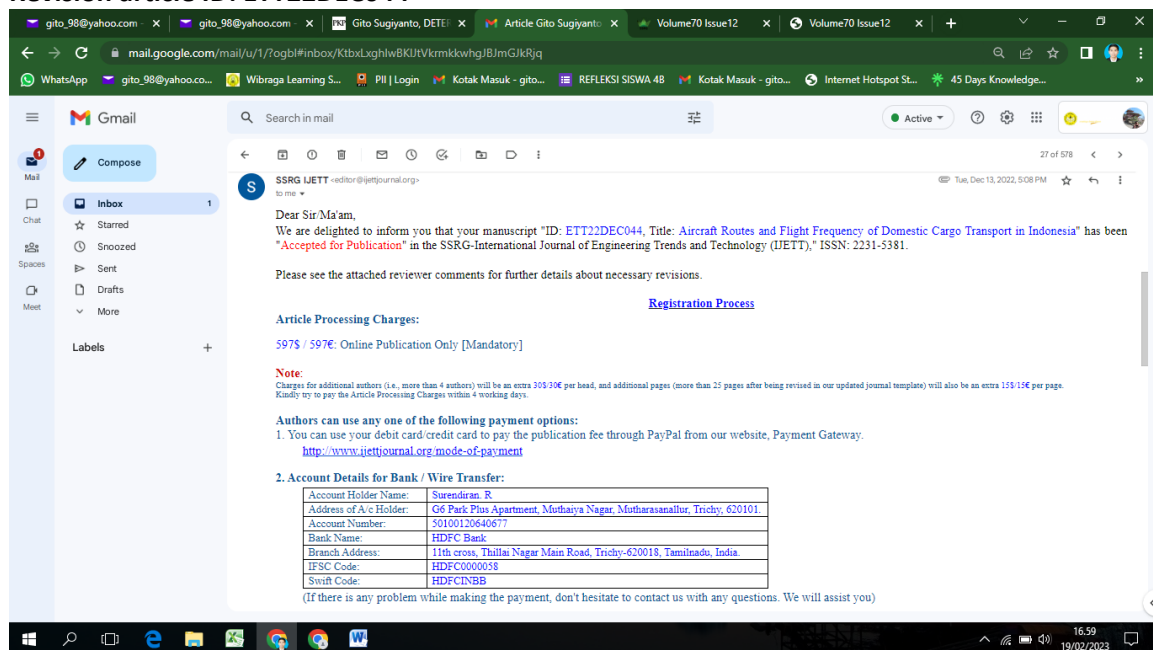


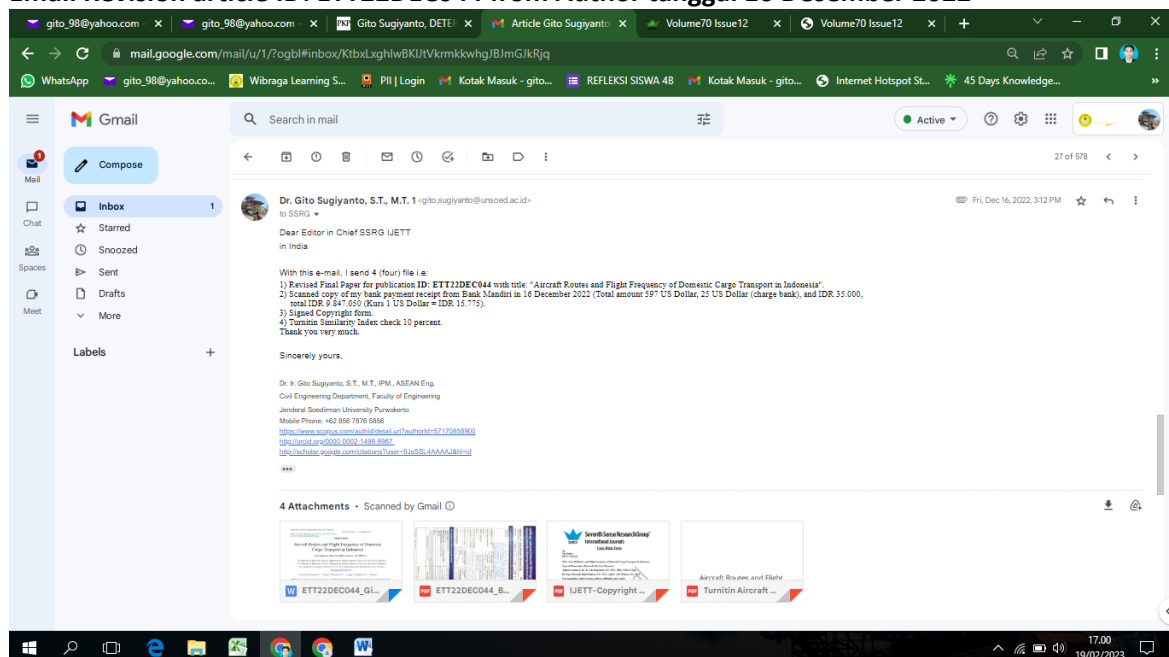
Bukti submit articleID: ETT22DEC044 tanggal 10 November 2022



Revision article ID: ETT22DEC044



Email Revision article ID: ETT22DEC044 from Author tanggal 16 Desember 2022





Dr. Gito Sugiyanto, S.T., M.T. 1 <gito.sugiyanto@unsoed.ac.id>

Article Gito Sugiyanto IJETT

10 messages

Dr. Gito Sugiyanto, S.T., M.T. 1 <gito.sugiyanto@unsoed.ac.id>
To: editor@ijettjournal.org

Thu, Nov 10, 2022 at 12:11 PM

Dear Editor Journal SSRG International Journal of Engineering Trends and Technology (IJETT)
in India

With this email, I sent an article with the title "Aircraft Routes and Flight Frequency of Domestic Cargo Transport in Indonesia". The Authors are: Gito Sugiyanto, Purwanto Bakti Santoso, and Aris Wibowo.
Thank you very much.

Sincerely yours,

Dr. Ir. Gito Sugiyanto, S.T., M.T., IPM., ASEAN Eng.
Civil Engineering Department, Faculty of Engineering
Jenderal Soedirman University Purwokerto
Mobile Phone: +62 858 7876 5856
<https://www.scopus.com/authid/detail.uri?authorId=57170858900>
<http://orcid.org/0000-0002-1498-8967>
<http://scholar.google.com/citations?user=8JsSSL4AAAAJ&hl=id>

2 attachments**Gito Sugiyanto_IJETT-Paper Format_Airline 10112022.doc**
667K**Gito Sugiyanto_IJETT-Paper Format_Airline 10112022.pdf**
1217K

SSRG IJETT <editor@ijettjournal.org>
To: "Dr. Gito Sugiyanto, S.T., M.T. 1" <gito.sugiyanto@unsoed.ac.id>

Thu, Nov 10, 2022 at 3:28 PM

Dear Author,

Your article has been received, and the id is **ETT22DEC044**.

We evaluate all manuscript submissions as expeditiously as possible and appreciate your patience throughout the double-blind peer-review process.

Thanking You and Best Regards,
Editorial Team-IJETT.

FOLLOW US:

[Quoted text hidden]

Dr. Gito Sugiyanto, S.T., M.T. 1 <gito.sugiyanto@unsoed.ac.id>
To: SSRG IJETT <editor@ijettjournal.org>

Sat, Nov 26, 2022 at 9:36 AM

Dear Editorial Team-IJETT

With this e-mail, I send a copyright form for the article ID ETT22DEC044.
Thank you very much.

Sincerely yours,

Dr. Ir. Gito Sugiyanto, S.T., M.T., IPM., ASEAN Eng.
Civil Engineering Department, Faculty of Engineering
Jenderal Soedirman University Purwokerto
Mobile Phone: +62 858 7876 5856
<https://www.scopus.com/authid/detail.uri?authorId=57170858900>
<http://orcid.org/0000-0002-1498-8967>
<http://scholar.google.com/citations?user=8JsSSL4AAAAJ&hl=id>

[Quoted text hidden]



Dr. Gito Sugiyanto, S.T., M.T. 1 <gito.sugiyanto@unsoed.ac.id>
To: SSRG IJETT <editor@ijettjournal.org>

Tue, Dec 6, 2022 at 8:50 AM

Dear Editor SSRG IJETT

I want to ask about the progress of the peer-review process article ETT22DEC044.

I want to ask because I will be monitoring and evaluating my research.

Thank you very much.

Sincerely yours,

Dr. Ir. Gito Sugiyanto, S.T., M.T., IPM., ASEAN Eng.
Civil Engineering Department, Faculty of Engineering
Jenderal Soedirman University Purwokerto
Mobile Phone: +62 858 7876 5856
<https://www.scopus.com/authid/detail.uri?authorId=57170858900>
<http://orcid.org/0000-0002-1498-8967>
<http://scholar.google.com/citations?user=8JsSSL4AAAAJ&hl=id>

On Thu, Nov 10, 2022 at 3:27 PM SSRG IJETT <editor@ijettjournal.org> wrote:

[Quoted text hidden]

SSRG IJETT <editor@ijettjournal.org>
To: "Dr. Gito Sugiyanto, S.T., M.T. 1" <gito.sugiyanto@unsoed.ac.id>

Tue, Dec 13, 2022 at 5:09 PM

Dear Sir/Ma'am,

We are delighted to inform you that your manuscript "ID: ETT22DEC044, Title: Aircraft Routes and Flight Frequency of Domestic Cargo Transport in Indonesia" has been "Accepted for Publication" in the SSRG-International Journal of Engineering Trends and Technology (IJETT)," ISSN: 2231-5381.

Please see the attached reviewer comments for further details about necessary revisions.

Registration Process

Article Processing Charges:

597\$ / 597€: Online Publication Only [Mandatory]

Note:

Charges for additional authors (i.e., more than 4 authors) will be an extra 30\$/30€ per head, and additional pages (more than 25 pages after being revised in our updated journal template) will also be an extra 15\$/15€ per page.

Kindly try to pay the Article Processing Charges within 4 working days.

Authors can use any one of the following payment options:

1. You can use your debit card/credit card to pay the publication fee through PayPal from our website, Payment Gateway.

<http://www.ijettjournal.org/mode-of-payment>

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Account Holder Name:	Surendiran. R
Address of A/c Holder:	G6 Park Plus Apartment, Muthaiya Nagar, Mutharasanallur, Trichy, 620101.
Account Number:	50100120640677
Bank Name:	HDFC Bank
Branch Address:	11th cross, Thillai Nagar Main Road, Trichy-620018, Tamilnadu, India.
IFSC Code:	HDFC00000058
Swift Code:	HDFCINBB

(If there is any problem while making the payment, don't hesitate to contact us with any questions. We will assist you)

Final Documents to reach us:

- 1) Revised Final Paper for publication as per our updated IJETT template.
(Link of our Paper Template and Copyright form: <https://ijettjournal.org/for-authors/downloads>)
- 2) Scanned copy of your bank payment receipt (write your name on top of the receipt); if done by online payment, send us the transaction id, date, account holder name, and account number.
- 3) Signed Copyright form for your article. You can either place a digital signature in the word file or take a printout, fill in the entries, and scan and send it to us.

Note: To avoid a last-minute rush, Submit the final paper, copyright form, and payment proof as soon as possible to get an early publication.

Thanks again for your association with SSRG-IJETT, and we hope to see more of your work in the future.

Best Regards,
Editorial Support Team
<http://ijettjournal.org/>

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 **ETT22DEC044.pdf**
161K

Dr. Gito Sugiyanto, S.T., M.T. 1 <gito.sugiyanto@unsoed.ac.id>
To: SSRG IJETT <editor@ijettjournal.org>

Fri, Dec 16, 2022 at 3:12 PM

Dear Editor in Chief SSRG IJETT
in India

With this e-mail, I send 4 (four) file i.e:

- 1) Revised Final Paper for publication **ID: ETT22DEC044** with title: "Aircraft Routes and Flight Frequency of Domestic Cargo Transport in Indonesia".
 - 2) Scanned copy of my bank payment receipt from Bank Mandiri in 16 December 2022 (Total amount 597 US Dollar, 25 US Dollar (charge bank), and IDR 35.000,
total IDR 9.847.050 (Kurs 1 US Dollar = IDR 15.775).
 - 3) Signed Copyright form.
 - 4) Turnitin Similarity Index check 10 percent.
- Thank you very much.

Sincerely yours,

Dr. Ir. Gito Sugiyanto, S.T., M.T., IPM., ASEAN Eng.
Civil Engineering Department, Faculty of Engineering
Jenderal Soedirman University Purwokerto
Mobile Phone: +62 858 7876 5856
<https://www.scopus.com/authid/detail.uri?authorId=57170858900>
<http://orcid.org/0000-0002-1498-8967>
<http://scholar.google.com/citations?user=8JsSSL4AAAAJ&hl=id>


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4 attachments

 **ETT22DEC044_Gito Sugiyanto_IJETT 15122022.doc**
691K

 **ETT22DEC044_Bank Payment Gito Sugiyanto.pdf**
525K

 **IJETT-Copyright Form_Airport.pdf**
534K

 **Turnitin Aircraft Routes and Flight Frequency of Domestic Cargo Transport in Indonesia 10.pdf**
2717K

SSRG IJETT <editor@ijettjournal.org>

Mon, Dec 19, 2022 at 10:53 PM

To: "Dr. Gito Sugiyanto, S.T., M.T. 1" <gito.sugiyanto@unsoed.ac.id>

Dear Sir/Ma'am,

Your payment has been cleared. The author's copyright form and revised manuscript have been received. Your manuscript is moved to publishing, and our production editor will keep you informed of your article's progress in the production process. You may also receive a galley proof of your manuscript for final review if we require more clarification. Meanwhile, send us figure-1 separately in a high-resolution format for final publication soon.

We're excited to move forward with your revised submission. Please feel free to email us with any questions.

Regards,

Production Team/SSRG-IJETT.

FOLLOW US:



[Quoted text hidden]

Dr. Gito Sugiyanto, S.T., M.T. 1 <gito.sugiyanto@unsoed.ac.id>

Tue, Dec 20, 2022 at 1:28 PM

To: SSRG IJETT <editor@ijettjournal.org>

Dear Production Team/SSRG-IJETT

With this e-mail, I send Figure 1 with a high resolution format.

Thank you very much.

Sincerely yours,

Dr. Ir. Gito Sugiyanto, S.T., M.T., IPM., ASEAN Eng.

Civil Engineering Department, Faculty of Engineering

Jenderal Soedirman University Purwokerto

Mobile Phone: +62 858 7876 5856

<https://www.scopus.com/authid/detail.uri?authorId=57170858900>

<http://orcid.org/0000-0002-1498-8967>

<http://scholar.google.com/citations?user=8JsSSL4AAAAJ&hl=id>

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2 attachments



Figure 1 Hub and Spoke Airport.bmp
3076K

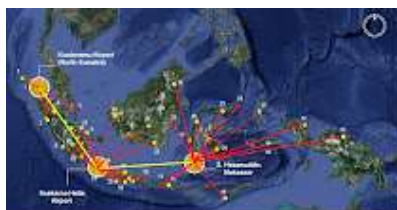


Figure 1 Hub and Spoke Airport_Gito Sugiyanto.bmp
1970K

SSRG IJETT <editor@ijettjournal.org>

Tue, Dec 20, 2022 at 1:36 PM

To: "Dr. Gito Sugiyanto, S.T., M.T. 1" <gito.sugiyanto@unsoed.ac.id>

Received, thank you.

FOLLOW US:



[Quoted text hidden]

SSRG IJETT <editor@ijettjournal.org>

Sun, Dec 25, 2022 at 1:24 PM

To: "Dr. Gito Sugiyanto, S.T., M.T. 1" <gito.sugiyanto@unsoed.ac.id>

Dear Sir/Ma'am,

Greetings from Seventh Sense Research Group[®] [SSRG] publishers!

We are happy to inform you that your article "ID: [ETT22DEC044](#), Title: [Aircraft Routes and Flight Frequency of Domestic Cargo Transport in Indonesia](#)" has been "Published" in Volume 70, Issue 12, of SSRG-International Journal of Engineering Trends and Technology (IJETT)", ISSN: 2231-5381.

Please find the link to find any corrections required: <https://ijettjournal.org/archive/ijett-v70i12p229>

The DOI will take some time to activate. Kindly upload your published SSRG-IJETT article to Google Scholar, ResearchGate, Orcid profile, Cornell university arXiv library, etc., to increase the paper's Impact factor and citation. Before uploading, read the instruction from our website <http://www.ijettjournal.org/arxiv>, then upload your article.

Thanks again for your association with SSRG-IJETT, and we hope to see more of your work in the future.

Best Regards,

Editorial Support Team.

<http://ijettjournal.org/>

FOLLOW US:



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International Journal of Engineering Trends and Technology IJETT

(Scopus Indexed, Scholarly Peer Reviewed Journal)

Reviewer Report Form

Manuscript Title	Aircraft Routes and Flight Frequency of Domestic Cargo Transport in Indonesia
Manuscript ID	ETT 22 DEC 044

Sl. No.	Evaluation criteria	Score (0-10)
1.	Topic Relevance	8
2.	Scholarly Quality	7
3.	Language Usage	8
4.	Use of Theory	8
5.	Novelty and Originality of the idea	7
6.	Technical Content and Correctness	8
7.	Critical Qualities	8
8.	Clarity of Conclusions	8
9.	Depth of Research	6
10.	References / Bibliography	8
	Total score (100)	76/100

RECOMMENDATION

The following are indicative score ranges:

ACCEPTED

ACCEPTED WITH MINOR REVISIONS

REJECTED

* Accept (without Revisions): 80-100

* Accept with minor revisions: 60-80

* Reject: Below 60

REVIEWER COMMENTS

(For **reviewer**: If your comments add up to a score of 80 or above and/ or you have no further comments or due to time constraints, it is sufficient to complete the above page alone)

If you have any detailed comments to make beyond the score on the previous page, please write them below.



International Journal of Engineering Trends and Technology IJETT

(Scopus Indexed, Scholarly Peer Reviewed Journal)

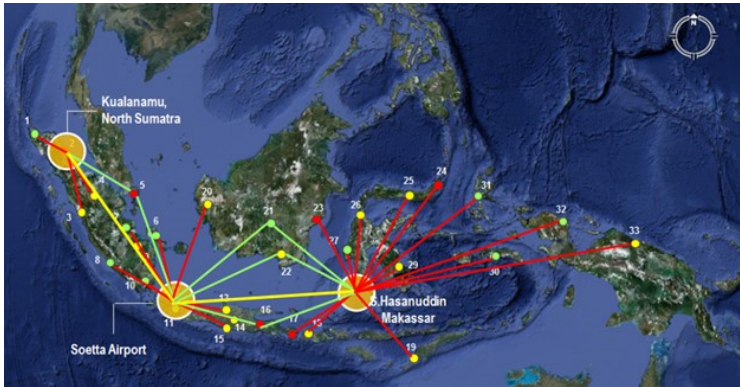
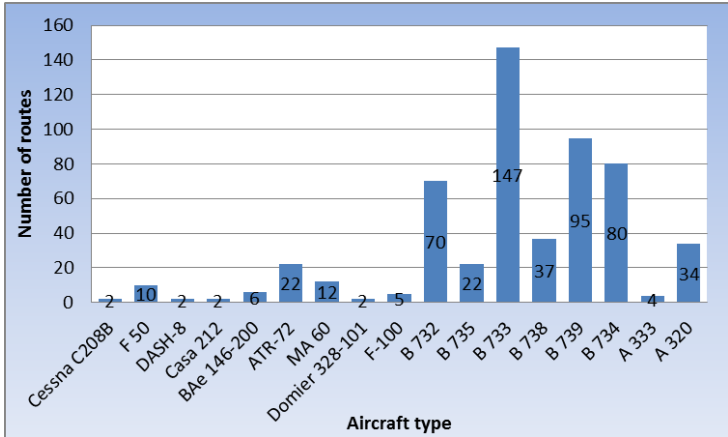
Reviewer Suggestions to Authors:

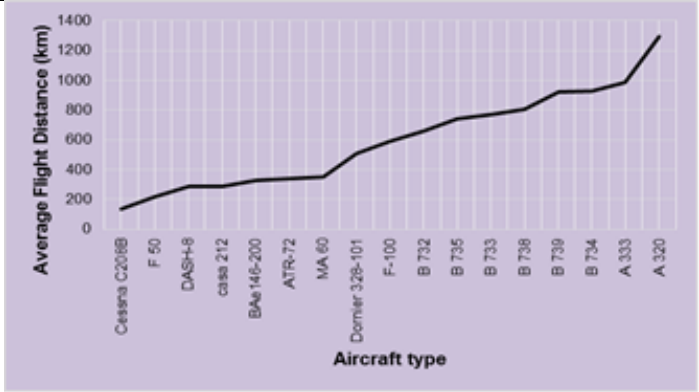
- The reviewer(s) have recommended for publication with minor revisions.
- Paper quality and idea was good to research filed. Kindly revise per following comments and revert us.
- 27% similarity with some internet sources and 24% with some publications identified (Plagiarism detection powered by [turnitin®](#)). Check plagiarism using some tool after revision. Maximum similarity with: http://www.arpnjournals.org/jeas/research_papers/rp_2020/jeas_0520_8218.pdf. Similarity index must be less than 8%.
- Tweak the introduction section by clearly mentioning the research gap and introduce the problem well.
- The novelty of the work must be clearly addressed and discussed. Compare your research with existing research findings.
- The review of the literature is not thorough so the reader is not given an adequate background about the topic.
- The analysis in the paper is minimal. Not enough of an advance or of enough impact for the journal.
- Authors must add few more chapter and present the research with detailed analysis with supportive data.
- Authors can use to present the experimental results and its corresponding analysis in detail supported by graphical and tabular data [in an editable format].
- Authors must use clear images for proper rendering of the final published paper and should not distort on zooming.
- Strictly prepare your paper in the form of our updated journal template available on the website. Kindly read the instructions and adhere to our journal template.
- Use equation editor plugin to type equations in MS Word.
- Include a detailed discussion on how and why you were able to achieve better results in comparison to state-of-the-art techniques or already reported in the literature.
- Perform Spell and grammar check. No word breaks at the end of lines.
- Kindly add previously published SSRG Journal articles (<http://www.internationaljournalsssrg.org/ssrg-journals.html>) as a reference in your paper to increase the citation of your paper and impact factor.

List Revision from Reviewer Paper Id ETT-22DEC-044

“Aircraft Routes and Flight Frequency of Domestic Cargo Transport in Indonesia”

No.	Suggestions from Reviewer	Revision from Author	Page
1.	The reviewer(s) have recommended for publication with minor revisions.	Thank you for this suggestion. The Authors revised the manuscript based on the comment from Reviewer.	1-9
2.	27% similarity with some internet sources and 24% with some publications identified (Plagiarism detection powered by turnitin®).	The Authors revised the manuscript. Total the similarity index is 10%. The similarity index with the www.arpnjournals.org is 4%. The result of the Plagiarism detection powered by turnitin® has result the total similarity index is 10%.	
3.	The authors should ask the help of native English speaking proof reader, because there are some typo and linguistic mistakes that should be fixed.	Thank you for this suggestion. The Authors ask the Native English speaking to proofread and check typo and linguistic mistakes.	1-9
4.	Tweak the introduction section by clearly mentioning the research gap and introduce the problem well	Thank you for this comment. In the introduction the Authors write: For an archipelagic country, air transportation plays an important role in transportation. The services of air freight are significant to supply chains of a globalized economy. Aircraft routes and flight frequencies are essential for making airline schedules. Key determinants of international air cargo flows include: population, air freight rate and dummy variables: regional economic bloc, long established colonial links, and open sky agreements [21]. The aim of this research is to analyse the aircraft routes and flight frequency of domestic cargo transport in Indonesia.	1-2
5.	The novelty of the work must be clearly addressed and	From Table 2, it can be seen that the number of routes needed to form a hub and spoke system of cargo transportation according to the Indonesia	4-5

	discussed. Compare your research with existing research findings	<p>National Logistics System or Sistem Logistik Nasional based on Presidential Regulation No. 26 of 2012 [1] scheme is 40 routes (2 way trip or round trip). The result of this study is similar to Yan et al. [37] that combine airport selection, fleet routing, and timetable setting to develop an integrated scheduling model [37]. The selection of the best air transport logistics distribution concept is one of the keys to success in reducing logistics and high economic costs [38]. The punctuality of air traffic is one of the most important criteria in selecting air services [34]. The parameters used to find the efficient and effective routes by calculating flight distance, flight time, and block fuel [39].</p>	
6.	Authors must use clear images for proper rendering of the final published paper and should not distort on zooming.	<p>Author revision the Figure 1: Hub and spoke airport network based on the National Logistics System.</p>  <p>Fig. 1 Hub and spoke airport network based on the National Logistics System</p>  <p>Fig. 2 Number of routes served by different types of aircraft.</p>	2-7

		 <p>Fig. 3 Relationship between Aircraft Type and Flight Mileage</p>	
7.	<p>The analysis in the paper is minimal. Not enough of an advance or of enough impact for the journal.</p>	<p>Thank you for this suggestion. The Authors add the analysis:</p> <p>Analysis of Flight Frequency Needs</p> <p>Flight frequency is determined by the type of cargo aircraft to be used. Different types of aircraft have different cargo capacities. Cargo transportation can use the same aircraft as passenger aircraft (“combi aircraft”) or with special cargo aircraft. are aircraft that can be used to carry either passengers as an airliner, or cargo as a freighter, and may have a partition in the aircraft cabin to allow both uses at the same time in a mixed passenger/freight combination [43]. Combi aircraft typically feature an oversized cargo door, as well as tracks on the cabin floor to allow the seats to be added or removed quickly. The luggage is the most vulnerable place where threat objects could be hidden inside [44]. To get the type of aircraft, it is necessary to also consider the types of aircraft that are commonly used in Indonesia with the consideration that there are quite a number of pilots or aircraft technicians who are ready to work for cargo transportation.</p> <p>Figure 2 shows the number of routes served by various types of aircraft. Based on the existing routes and the type of aircraft, it can be concluded that the most widely used aircraft type today is the B-737-300 type (there are 147 routes). Figure 3 shows the relationship between the type of aircraft and the average mileage on various domestic flight routes in Indonesia. The most widely used B-737-300 aircraft generally travel an average of 768 km. Meanwhile,</p>	5

		the Airbus A320 aircraft type is generally used for longer flights with an average flight distance of 1,297 km.																																																			
8.	Authors must add few more chapter and present the research with detailed analysis with supportive data.	<p>Thank you for this suggestion. The Authors add the detailed analysis about:</p> <p>Volume of Cargo Movement by Flight Route</p> <p>Flight routes based on the concept of hub and spoke above are presented in Table 3. The routes delivered are direct flight routes or point to point. As for determining the volume of movement on each of these routes, it can be calculated from the origin-destination matrix (O-D matrix) which has been modified in such a way that the entire contents of the cells are filled. With this approach, the volume of cargo per route can be traced according to the location of the transit airport (hub). The results of the calculation of the volume of cargo on each route on the implementation of hub and spoke concept are presented in Table 3 as follows.</p> <p>Table 3. Estimation of cargo volume per flight route on the implementation of hub and spoke.</p> <table><tr><th>Hub Airport</th><th>Flight Route (Round Trip)</th><th>Cargo Volume (kg)</th></tr><tr><td rowspan="15">Soekarno Hatta International Airport (CGK) Cengkareng</td><td>(1) Jakarta - Pangkal Pinang</td><td>10,953,514</td></tr><tr><td>(2) Jakarta - Jambi</td><td>7,839,043</td></tr><tr><td>(3) Jakarta - Bengkulu</td><td>4,169,709</td></tr><tr><td>(4) Jakarta - Palembang</td><td>14,487,719</td></tr><tr><td>(5) Jakarta - Lampung</td><td>2,220,708</td></tr><tr><td>(6) Jakarta - Bandung</td><td>984,742</td></tr><tr><td>(7) Jakarta - Semarang</td><td>11,812,651</td></tr><tr><td>(8) Jakarta - Surakarta/ Solo</td><td>3,713,475</td></tr><tr><td>(9) Jakarta - Yogyakarta</td><td>27,964,316</td></tr><tr><td>(10) Jakarta - Surabaya</td><td>61,641,931</td></tr><tr><td>(11) Jakarta - Pontianak</td><td>10,140,923</td></tr><tr><td>(12) Jakarta - Batam</td><td>36,694,985</td></tr><tr><td>(13) Jakarta - Palangkaraya</td><td>3,947,012</td></tr><tr><td>(14) Jakarta - Banjarmasin</td><td>9,035,662</td></tr><tr><td>(15) Jakarta - Makassar</td><td>163,780,168</td></tr><tr><td rowspan="5">Kualanamu International Airport (KNO) Deli Serdang</td><td>(1) Medan - Banda Aceh</td><td>9,565,893</td></tr><tr><td>(2) Medan - Batam</td><td>3,131,018</td></tr><tr><td>(3) Medan - Padang</td><td>18,009,487</td></tr><tr><td>(4) Medan - Pekanbaru</td><td>17,638,019</td></tr><tr><td>(5) Medan - Jakarta</td><td>79,605,768</td></tr><tr><td rowspan="2">Sultan Hasanuddin</td><td>(1) Makassar - Balikpapan</td><td>46,611,765</td></tr><tr><td>(2) Makassar -</td><td>2.234.313</td></tr></table>	Hub Airport	Flight Route (Round Trip)	Cargo Volume (kg)	Soekarno Hatta International Airport (CGK) Cengkareng	(1) Jakarta - Pangkal Pinang	10,953,514	(2) Jakarta - Jambi	7,839,043	(3) Jakarta - Bengkulu	4,169,709	(4) Jakarta - Palembang	14,487,719	(5) Jakarta - Lampung	2,220,708	(6) Jakarta - Bandung	984,742	(7) Jakarta - Semarang	11,812,651	(8) Jakarta - Surakarta/ Solo	3,713,475	(9) Jakarta - Yogyakarta	27,964,316	(10) Jakarta - Surabaya	61,641,931	(11) Jakarta - Pontianak	10,140,923	(12) Jakarta - Batam	36,694,985	(13) Jakarta - Palangkaraya	3,947,012	(14) Jakarta - Banjarmasin	9,035,662	(15) Jakarta - Makassar	163,780,168	Kualanamu International Airport (KNO) Deli Serdang	(1) Medan - Banda Aceh	9,565,893	(2) Medan - Batam	3,131,018	(3) Medan - Padang	18,009,487	(4) Medan - Pekanbaru	17,638,019	(5) Medan - Jakarta	79,605,768	Sultan Hasanuddin	(1) Makassar - Balikpapan	46,611,765	(2) Makassar -	2.234.313	5-6
Hub Airport	Flight Route (Round Trip)	Cargo Volume (kg)																																																			
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Original Article

Aircraft Routes and Flight Frequency of Domestic Cargo Transport in Indonesia

Gito Sugiyanto¹, Purwanto Bakti Santoso², Aris Wibowo³

^{1,2}Civil Engineering Department, Faculty of Engineering, Jenderal Soedirman University Central Java, Indonesia

³ Civil Engineer and Transport Planner in PT Nur Straits Engineering (NSE) Bandung, West Java, Indonesia

Corresponding Author : gito.sugiyanto@unsoed.ac.id

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Abstract - It is essential to plan aircraft routes and frequencies effectively to achieve a profitable timetable. The distance between two airports is an important geographical factor affecting air cargo transport demand. Analysis of cargo transportation routes is needed to support the Indonesian Logistics System. Flight routes were developed based on a hub and spoke airport network concepts. This research aims to analyze the aircraft routes and flight frequency of domestic cargo transport in Indonesia. Three airports that serve as hub airports in Indonesia are Soekarno-Hatta International Airport (CGK) in Cengkareng, Banten; Kualanamu International Airport (KNO) in Deli Serdang, North Sumatra, and Sultan Hasanuddin International Airport (UPG) in Makassar, South Sulawesi. The results show that the number of aircraft routes needed to the hub and spoke airport network for domestic cargo transportation with the Indonesian National Logistics System scheme is 40 routes. The flight routes analyzed are direct flight routes (point to point). As for long-distance routes, you can use this route pattern. The flight frequency is determined by the type of cargo aircraft, the aircraft's carrying capacity (maximum payloads), and the volume of cargo.

Keywords – Aircraft route, Air cargo, Flight frequency, Point to point.

1. Introduction

In the context of logistics management, transportation functions provide logistics service solutions, particularly in product movement and storage. Transport functions in the movement of products; transportation play a role in the movement of goods, both in the form of raw materials, components, work in process, and finished goods. Transport plays a role in storage products, mainly temporary storage from the location of origin of delivery or hinterland to the location aim. Based on the National Logistics System, several things can be done to facilitate the flow of goods through strengthening financial, transportation, information, and distribution networks. The transportation network in question is the integration between logistics links which serve to flow goods from the origin to the destination point [1].

For an archipelagic country, air transportation plays an important role in transportation. Air freight services are significant to supply chains of a globalized economy [2]. Although compared to ocean freight, air transport has just a relatively small share in tonnes, not less than 1/3 (one-third) of the values in international trade are conveyed by air [3]. Aircraft routes and flight frequencies are essential for making airline schedules [3] [4]. The provision of infrastructure that encourages national connectivity will reduce transport and

logistics costs, increase product competitiveness, and accelerate economic growth [5] [6].

Airlines evaluate their operating strategies according to the air freight movement analysis. Parameters that influence air cargo demand are macroeconomic and hinterland-derived factors, such as population, gross domestic product per capita, and distance [7] [8] [9]. In the other study by Arendal [10] for Europe's domestic market, the role of air cargo road transport must be anticipated. Some of the previously developed models are air cargo models were proposed based on the prediction of the origin-destination market [11] [12], air cargo schedule [13], fleet assignment and cargo routing [14], airport choice of freighter operators [15], truck handling operations at cargo terminal [16], and air cargo supply-demand interaction [17]. A systematic route typology was developed by Heinitz and Meincke [18]. Four stages in the systematization of air cargo route choice include demand segmentation, choice-set size determination, choice-set formation and qualification, and choice [18].

Furthermore, Abate studies the economic effects of air transport market liberalization [19]. There is a balance between the interests of consumers and the aviation and tourism industries. The strategy to lower passenger ticket prices and increase the total surplus is to form an air cargo alliance [20]. Key determinants of international air cargo



flows include air freight rate, population, and dummy variables, i.e., regional economic bloc, long-established colonial links, and open sky agreements [21]. This research aims to analyse the aircraft routes and flight frequency of domestic cargo transport in Indonesia.

2. Materials and Methods

2.1. Location of the Study

The study location in this research is in three airports that serve as hub airports in Indonesia Soekarno Hatta International Airport (CGK), Cengkareng in Tangerang Banten, Kualanamu International Airport (KNO) in Deli Serdang Regency North Sumatra, and Sultan Hasanuddin International Airport (UPG) in Makassar, Maros Regency, South Sulawesi, Indonesia.

2.2. Data Collection

Data required in this study includes the production data for domestic flights from 38 airports in Indonesia which are divided into 12 airports on the island of Sumatra, 8 airports on the island of Java, 5 airports on the island of Kalimantan, 6 airports on the island of Sulawesi, 3 airports on the island of Bali and Nusa Tenggara, and 4 airports on the island of Maluku and Papua. Flight traffic data consist of the number of passengers, baggage (kg), aircraft traffic movement, and cargo (kg). Data production of each airport is obtained from the Directorate General of Civil Aviation, Ministry of Transportation Republic of Indonesia, PT (Persero) Angkasa Pura I Indonesia, and PT (Persero) Angkasa Pura II Indonesia [22]. National airport arrangements in Indonesia based on the Ministry of Transportation Republic of Indonesia PM Number 39 of 2019 [23].

2.3. Analysis Approach

The analysis approach of this research, according to Bazargan, stated there are four stages of the flight planning management process:

- flight schedules,
- fleet assignment,
- aircraft route determinations, and
- crew scheduling [24].

3. Results and Discussion

3.1. Air Cargo Route Analysis: Hub and Spoke Concepts

Analysis of cargo transportation routes in Indonesia to support the National Logistics System or *Sistem Logistik Nasional* based on the Presidential Regulation Republic of Indonesia Number 26 of 2012 [1] requires justification and assumptions about what kind of hub and spoke system will be applied in the field. Based on the Indonesia National Logistics System, the number of hubs developed in 2011-2015 is 3 airports. Thus, the concept of the hub can be derived with a combination of 3 hub airports and 35 spoke airports and flight routes could be assumed as presented in Figure 1 as follows.

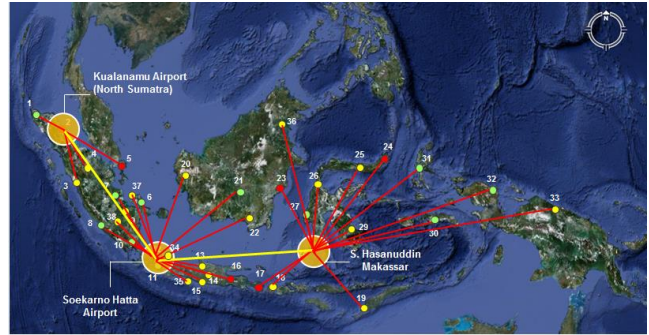


Fig. 1 Hub and spoke airport network based on the National Logistics System.

Soekarno Hatta International Airport (CGK) in Cengkareng, Banten, is a central hub in Indonesia because all of the spoke airports in all of the cities in Indonesia fly into Soekarno Hatta International Airport (SHIA). There are route flights from Soekarno Hatta International Airport in Cengkareng to all cities in Indonesia [25]. Sugiyanto *et al.* stated that the percentage of cargo volume at Soekarno Hatta International Airport in Cengkareng, Banten is 38.229% for domestic flights [26]. Based on Herfindahl-Hirschmann Index (HHI), Kualanamu International Airport (KNO) in Deli Serdang, North Sumatra, is a hub airport for a domestic flights in Sumatra Island, Indonesia [27].

According to Martin and Roman's study, two parameters influencing the hub location are airport location and competition [28]. The economic crisis has affected price behavior both in terms of the price level and dispersion, with a clear increase in price level and decrease in price dispersion [29]. Road infrastructure is one of the factors that must be considered in determining the airport's location, besides the accessibility factor [30] [31]. Low aircraft frequencies substantially negatively affect waiting costs and scheduling costs at hub airports [32]. The advantages of the application of hub and spoke in airport networks are decreased number of routes [33], increased demand (frequent flights), decreased costs [34], and externality costs [35] [36]. Three airports that serve as hub airports in Indonesia are Soekarno Hatta International Airport (CGK), Kualanamu International Airport (KNO), and Sultan Hasanuddin International Airport (UPG). Distribution and justification for the hub and spoke airport networks in Indonesia can be described in Table 1 as follows.

3.2. Flight Route Needs for Domestic

Flight routes based on the hub and spoke airport network concept is presented in Table 2. The routes delivered are direct flight routes (point to point) and 2-way trips. As for long-distance routes, you can use this route pattern. For example, in the case of flights from Padang to Gorontalo, the route that needs to be taken is Padang – Jakarta – Makassar – Gorontalo. This means that the routes that occur are Padang – Jakarta, Jakarta – Makassar, and Makassar – Gorontalo. For other intercity flight cases, refer to Table 2 as follows.

Table 1. Distribution and justification for the hub and spoke airport network in Indonesia.

Hub Airport (IATA Code)	Spoke Airport	
	Airport (Location)	IATA
Soekarno Hatta International Airport (CGK) Cengkareng, Banten	Depati Amir Airport (Pangkal Pinang, Kep. Bangka Belitung)	PGK
	Sultan Thaha Saifuddin Airport (Jambi)	DJB
	Fatmawati Soekarno Airport (Bengkulu)	BKS
	Sultan Mahmud Badaruddin II International Airport (Palembang, South Sumatra)	PLM
	Raden Inten II International Airport (Bandar Lampung, Lampung)	TKG
	Husein Sastranegara International Airport (Bandung, West Java)	BDG
	Ahmad Yani International Airport (Semarang, Central Java)	SRG
	Adi Sumarmo International Airport (Surakarta/ Solo, Central Java)	SOC
	Adi Sutjipto International Airport (Sleman, Special Region of Yogyakarta)	JOG
	Yogyakarta International Airport (Kulon Progo, Special Region of Yogyakarta)	YIA
	Juanda International Airport (Surabaya, East Java)	SUB
	Supadio International Airport (Pontianak, West Kalimantan)	PNK
	Raja Haji Fisabilillah International Airport (Tanjung Pinang, Kepulauan Riau)	TNJ
	Abdul Rachman Saleh Airport (Malang, East Java)	MNG
	¹⁾ Hang Nadim International Airport (Batam, Kepulauan Riau)	BTH
	²⁾ Tjilik Riwt Airport (Palangkaraya, Central Kalimantan)	PKY
	³⁾ Syamsudin Noor International Airport (Banjarmasin, South Kalimantan)	BDJ
	⁴⁾ Ngurah Rai International Airport (Badung, Denpasar, Bali)	DPS
Kualanamu International Airport (KNO), Deli Serdang, Medan, North Sumatra	Sultan Iskandar Muda International Airport (Banda Aceh, Nanggroe Aceh Darussalam)	BTJ
	Sultan Syarif Kasim II International Airport (Pekanbaru, Riau)	PKU
	Minangkabau International Airport (Padang, West Sumatra)	PDG
	Hang Nadim International Airport (Batam, Kep. Riau)	BTH
	Halim Perdanakusuma International Airport (East Jakarta, DKI Jakarta)	HLP
Sultan Hasanuddin International Airport (UPG) Makassar, South Sulawesi	Sultan Aji Muhammad Sulaiman Sepinggan International Airport (Balikpapan, East Kalimantan)	BPN
	Tjilik Riwt Airport (Palangkaraya, East Kalimantan)	PKY
	Juwata Airport (Tarakan, North Kalimantan)	TRK
	Syamsudin Noor International Airport (Banjarmasin, South Kalimantan)	BDJ
	Ngurah Rai International Airport (Denpasar, Bali)	DPS
	Zainuddin Abdul Madjid Lombok International Airport (Mataram, West Nusa Tenggara)	LOP
	Eltari International Airport (Kupang, East Nusa Tenggara)	KOE
	Sam Ratulangi International Airport (Manado, North Sulawesi)	MDC
	Djalaluddin Airport (Gorontalo)	GTO
	Mutiara SIS Al-Jufrie Airport (Palu, Central Sulawesi)	PLW
	Tampa Padang Airport (Mamuju, West Sulawesi)	MJU
	Haluoleo (Wolter Monginsidi) International Airport (Kendari, South East Sulawesi)	KDI
	Pattimura International Airport (Ambon, Maluku)	AMQ
	Sultan Babullah Airport (Ternate, North Maluku)	TTE
	Sentani Airport (Jayapura, Papua)	DJJ
	Rendani Airport (Manokwari, West Papua)	MKW
	Juanda International Airport (Surabaya, East Java)	SUB

¹⁻⁴⁾: Considering the 4 spoke airports that can make direct flights to 2 different hubs from Soekarno-Hatta International Airport (CGK) Cengkareng, Banten; Sultan Hasanuddin International Airport (UPG) Makassar, South Sulawesi and Kualanamu International Airport (KNO), Deli Serdang, Medan, North Sumatra, namely: Hang Nadim International Airport in Batam, Kep. Riau; Tjilik Riwt Airport in Palangkaraya, Central Kalimantan; Syamsuddin Noor International Airport in Banjarmasin, South Kalimantan, and Ngurah Rai International Airport in Denpasar, Bali.

From Table 2, it can be seen that the number of routes needed to form a hub and spoke system of cargo transportation according to the Indonesia National Logistics System or Sistem Logistik Nasional based on Presidential Regulation No. 26 of 2012 [1] scheme is 40 routes (2-way trip or round trip). There are 18 routes from Jakarta, 5 routes from Medan, and 17 routes from Makassar. The result of this

study is similar to Yan et al. [37], which combines fleet routing, airport selection, and timetable setting to develop an integrated scheduling model [37]. The selection of the best air transport logistics distribution concept is one of the keys to success in reducing logistics and high economic costs [38]. The punctuality of air traffic is one of the essential criteria in selecting air services [34].

Table 2. Identification of the flight route needs to support air cargo transportation for domestic flights in Indonesia.

Flight Route	Airport Network (Round Trip)	IATA Code
1. Jakarta - Pangkal Pinang	Soekarno Hatta International Airport - Depati Amir Airport	CGK - PGK
2. Jakarta - Jambi	Soekarno Hatta International Airport - Sultan Thaha Saifuddin Airport	CGK - DJB
3. Jakarta - Bengkulu	Soekarno Hatta International Airport - Fatmawati Soekarno Airport	CGK - BKS
4. Jakarta - Palembang	Soekarno Hatta International Airport - Sultan Mahmud Badaruddin II Inter. Airport	CGK - PLM
5. Jakarta - Lampung	Soekarno Hatta International Airport - Raden Inten II International Airport	CGK - TKG
6. Jakarta - Bandung	Soekarno Hatta International Airport - Husein Sastranegara International Airport	CGK - BDG
7. Jakarta - Semarang	Soekarno Hatta International Airport - Ahmad Yani International Airport	CGK - SRG
8. Jakarta - Surakarta	Soekarno Hatta International Airport - Adi Sumarmo International Airport	CGK - SOC
9. Jakarta - Yogyakarta	Halim Perdanakusuma International Airport - Adi Sutjipto International Airport	HLP - JOG
	Soekarno Hatta International Airport - Yogyakarta International Airport	CGK - YIA
10. Jakarta - Surabaya	Soekarno Hatta International Airport - Juanda International Airport	CGK - SUB
11. Jakarta - Pontianak	Soekarno Hatta International Airport - Supadio International Airport	CGK - PNK
12. Jakarta - Tanjung Pinang	Soekarno Hatta International Airport - Raja Haji Fisabilillah International Airport	CGK - TNJ
13. Jakarta - Malang	Soekarno Hatta International Airport - Abdul Rachman Saleh Airport	CGK - MNG
14. Jakarta - Makassar	Soekarno Hatta International Airport - Sultan Hasanuddin International Airport	CGK - UPG
15. Jakarta - Batam	¹⁾ Soekarno Hatta International Airport - Hang Nadim International Airport	CGK - BTH
16. Jakarta - Palangkaraya	²⁾ Soekarno Hatta International Airport - Tjilik Riwut Airport	CGK - PKY
17. Jakarta - Banjarmasin	³⁾ Soekarno Hatta International Airport - Syamsudin Noor International Airport	CGK - BDJ
18. Jakarta - Denpasar	⁴⁾ Soekarno Hatta International Airport - Ngurah Rai International Airport	CGK - DPS
19. Medan - Banda Aceh	Kualanamu International Airport - Sultan Iskandar Muda International Airport	KNO - BTJ
20. Medan - Pekanbaru	Kualanamu International Airport - Sultan Syarif Kasim II International Airport	KNO - PKU
21. Medan - Padang	Kualanamu International Airport - Minangkabau International Airport	KNO - PDG
22. Medan - Batam	Kualanamu International Airport - Hang Nadim International Airport	KNO - BTH
23. Medan - Jakarta	Kualanamu International Airport - Halim Perdanakusuma International Airport	KNO - HLP
	Kualanamu International Airport - Soekarno Hatta International Airport	KNO - CGK
24. Makassar - Balikpapan	Sultan Hasanuddin International Airport - Sultan Aji Muhammad Sulaiman Sepinggan International Airport	UPG - BPN
25. Makassar - Palangkaraya	Sultan Hasanuddin International Airport - Tjilik Riwut Airport	UPG - PKY
26. Makassar - Tarakan	Sultan Hasanuddin International Airport - Juwata Airport	UPG - TRK
27. Makassar - Banjarmasin	Sultan Hasanuddin International Airport - Syamsudin Noor International Airport	UPG - BDJ
28. Makassar - Denpasar	Sultan Hasanuddin International Airport - Ngurah Rai International Airport	UPG - DPS
29. Makassar - Mataram	Sultan Hasanuddin International Airport - Zainuddin Abdul Madjid Lombok International Airport	UPG - LOP
30. Makassar - Kupang	Sultan Hasanuddin International Airport - Eltari International Airport	UPG - KOE
31. Makassar - Manado	Sultan Hasanuddin International Airport - Sam Ratulangi International Airport	UPG - MDC
32. Makassar - Gorontalo	Sultan Hasanuddin International Airport - Djalaluddin Airport	UPG - GTO
33. Makassar - Palu	Sultan Hasanuddin International Airport - Mutiara SIS Al-Jufrie Airport	UPG - PLW
34. Makassar - Mamuju	Sultan Hasanuddin International Airport - Tampa Padang Airport	UPG - MJU
35. Makassar - Kendari	Sultan Hasanuddin International Airport - Haluoleo (Wolter Monginsidi) International Airport	UPG - KDI
36. Makassar - Ambon	Sultan Hasanuddin International Airport - Pattimura International Airport	UPG - AMQ
37. Makassar - Ternate	Sultan Hasanuddin International Airport - Sultan Babullah Airport	UPG - TTE
38. Makassar - Jayapura	Sultan Hasanuddin International Airport - Sentani Airport	UPG - DJJ
39. Makassar - Manokwari	Sultan Hasanuddin International Airport - Rendani Airport	UPG - MKW
40. Makassar - Surabaya	Sultan Hasanuddin International Airport - Juanda International Airport	UPG - SUB

The parameters used to find efficient and effective routes are by calculating flight distance, flight time, and block fuel. Block fuel is the total fuel required for the flight and is the sum of the taxi fuel, the trip fuel, the contingency fuel, the alternate fuel, the final reserve fuel, the additional fuel, and any extra fuel carried [39].

Air transport liberalization will benefit the aviation industry and consumers in the region, albeit not necessarily on an equal basis across or within groups [40]. Most air routes have high allocation and passenger transport efficiency while low freight transport efficiency [41]. The network's physical topology and the functional network with

traffic information correlate highly to a country's Gross Domestic Product (GDP) [42].

3.3. Volume of Cargo Movement by Flight Route

Flight routes based on the concept of hub and spoke above are presented in Table 3. The routes delivered are direct flight routes or point-to-point. As for determining the volume of movement on each of these routes, it can be calculated from the origin-destination matrix (O-D matrix), which has been modified to fill the entire contents of the cells. With this approach, the volume of cargo per route can be traced according to the location of the transit airport (hub). The results of the calculation of the volume of cargo on each route on the implementation of the hub and spoke concept are presented in Table 3 as follows.

Table 3. Estimation of cargo volume per flight route on the implementation of the hub and spoke.

Hub Airport	Flight Route (Round Trip)	Cargo Volume (kg)
Soekarno Hatta International Airport (CGK) Cengkareng	(1) Jakarta - Pangkal Pinang	10,953,514
	(2) Jakarta - Jambi	7,839,043
	(3) Jakarta - Bengkulu	4,169,709
	(4) Jakarta - Palembang	14,487,719
	(5) Jakarta - Lampung	2,220,708
	(6) Jakarta - Bandung	984,742
	(7) Jakarta - Semarang	11,812,651
	(8) Jakarta - Surakarta/ Solo	3,713,475
	(9) Jakarta - Yogyakarta	27,964,316
	(10) Jakarta - Surabaya	61,641,931
	(11) Jakarta - Pontianak	10,140,923
	(12) Jakarta - Batam	36,694,985
	(13) Jakarta - Palangkaraya	3,947,012
	(14) Jakarta - Banjarmasin	9,035,662
	(15) Jakarta - Makassar	163,780,168
Kualanamu International Airport (KNO) Deli Serdang	(1) Medan - Banda Aceh	9,565,893
	(2) Medan - Batam	3,131,018
	(3) Medan - Padang	18,009,487
	(4) Medan - Pekanbaru	17,638,019
	(5) Medan - Jakarta	79,605,768
Sultan Hasanuddin International Airport (UPG) Makassar	(1) Makassar - Balikpapan	46,611,765
	(2) Makassar - Palangkaraya	2,234,313
	(3) Makassar - Banjarmasin	11,203,851
	(4) Makassar - Surabaya	22,507,664
	(5) Makassar - Denpasar	125,766,545
	(6) Makassar - Mataram	12,473,297
	(7) Makassar - Kupang	23,359,566
	(8) Makassar - Palu	10,081,714
	(9) Makassar - Manado	12,141,161
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	(14) Makassar - Ternate	6,636,896
	(15) Makassar - Jayapura	83,692,447
	(16) Makassar - Manokwari	3,684,065

3.4. Analysis of Flight Frequency Needs

Flight frequency is determined by the type of cargo aircraft to be used. Different types of aircraft have various cargo capacities. Cargo transportation can use the same aircraft as passenger aircraft ("combi aircraft") or with particular cargo aircraft are aircraft that can be used to carry either passenger as an airliner or cargo as a freighter and may have a partition in the aircraft cabin to allow both uses at the same time in a mixed passenger/freight combination [43].

Combi aircraft typically feature an oversized cargo door and tracks on the cabin floor, allowing the seats to be added or removed quickly. The luggage is the most vulnerable place where threatening objects could be hidden inside [44]. To get the type of aircraft, it is necessary also to consider the types of aircraft commonly used in Indonesia. There are quite a few pilots or aircraft technicians ready to work for cargo transportation.

3.5. Consideration of Existing Aircraft Type

Cargo aircraft can basically use aircraft that are used for passenger transport. The aircraft type selection is generally based on the aircraft's efficiency and the distance of the route to be served. Currently, several types of aircraft are used by airlines in Indonesia to serve scheduled domestic flight routes.

Figure 2 shows the number of routes served by various types of aircraft. Based on the existing routes and the type of aircraft, it can be concluded that the most widely used aircraft type today is the B-737-300 type (there are 147 routes).

Figure 3 shows the relationship between the type of aircraft and the average mileage on various domestic flight routes in Indonesia. The most widely used B-737-300 aircraft generally travel an average of 768 km. Meanwhile, the Airbus A320 aircraft type is generally used for longer flights with an average flight distance of 1,297 km.

Determining the flight frequencies and aircraft types on individual routes of their air service networks is one of the most important problems airlines encounter [45] [46] [47]. One of the airport-airline choice models that can be used in an area with multiple airports is based on a nested Multinomial Logit (MNL) model to examine airport and airline competition [48]. These decisions will affect the cost and quality of airline passenger flight services [49].

Air transport not only contributes to the national economy directly in terms of employment and tax revenue but also plays important roles in regional development by providing essential inputs to other sectors such as trade, logistics [50], and tourism [51]. Aviation activities positively affect regional economies [52].

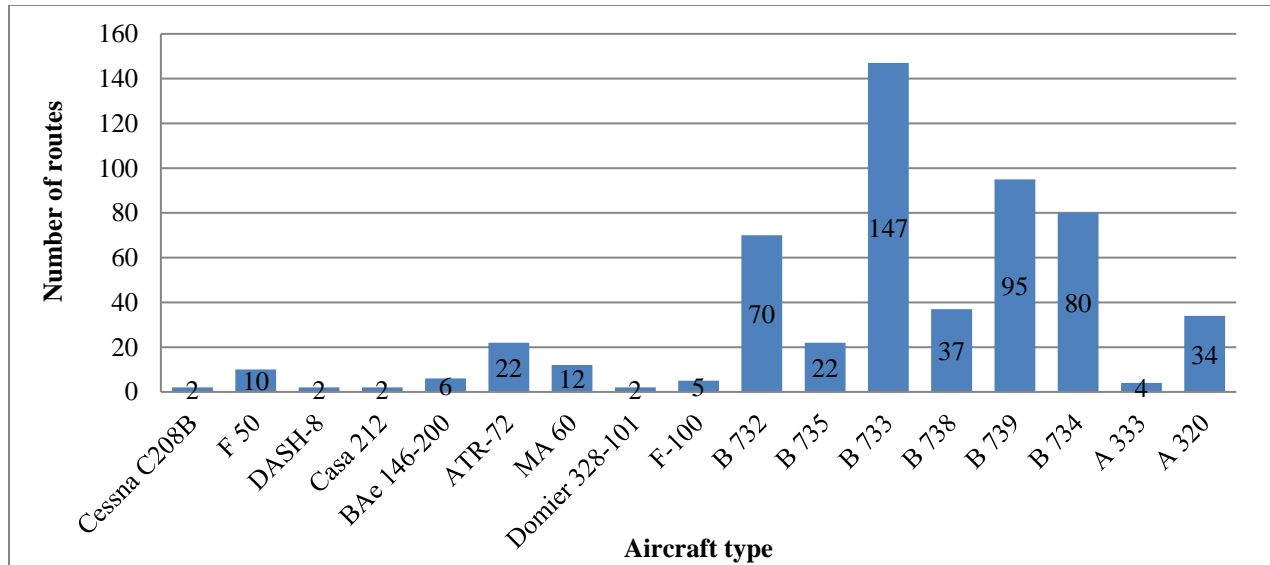


Fig. 2 Number of routes served by different types of aircraft.

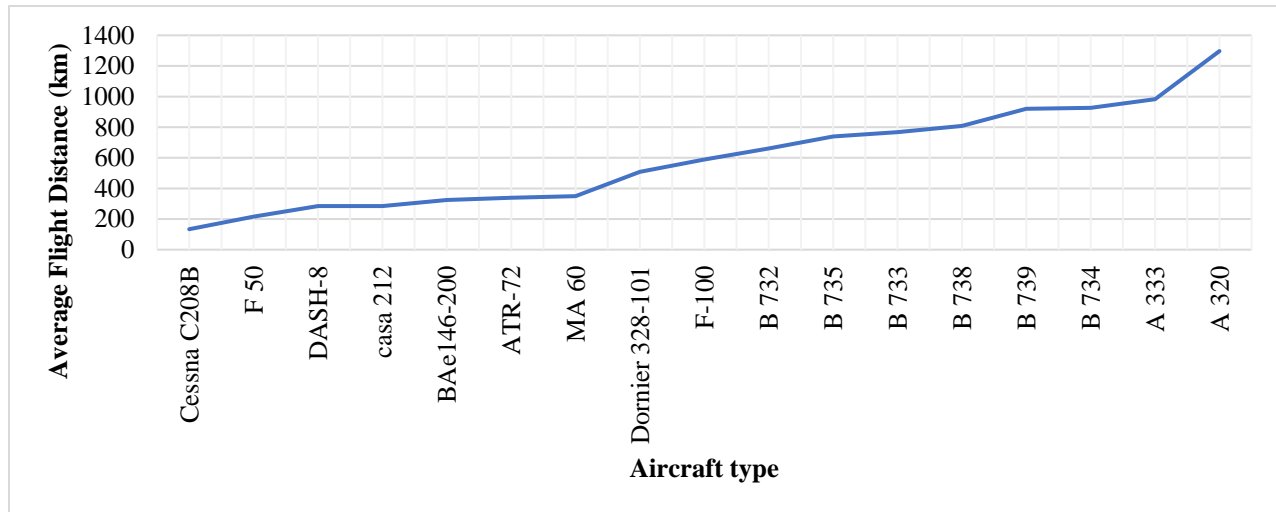


Fig. 3 Relationship between Aircraft Type and Flight Mileage.

4. Conclusions and Further Research

Three airports that serve as hub airports in Indonesia are Soekarno Hatta International Airport (CGK) in Cengkareng, Banten; Kualanamu International Airport (KNO) in Deli Serdang, North Sumatra, and Sultan Hasanuddin International Airport (UPG) in Makassar, South Sulawesi. The results show that the number of aircraft routes needed to the hub and spoke airport network for domestic cargo transportation with the scheme of the National Logistics System is 40 routes. The flight routes analyzed are direct flight routes or point-to-point concepts. The number of routes needed to form a hub and spoke airport network system of cargo transportation according to the National Logistics System scheme is 40 routes (round trip).

Further research is focused on determining the flight frequencies on an airline network with demand-supply

interactions between passenger demand and flight frequencies. This is done because the logistics transportation system in Indonesia uses combi aircraft (passengers and cargo).

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