EXPLORING THE CARGO POTENTIAL: A COMPREHENSIVE ANALYSIS OF KERTAJATI AIRPORT

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ABSTRACT
Kertajati Airport was constructed to cater the growing demand from West Java Province and its surrounding areas, aiming to address the limitations faced by the previous airport, Husein Sastranegara International Airport in Bandung. The intention was to relieve pressure from Soekarno-Hatta International Airport and accommodate passengers from the former airport. However, since its inauguration in 2018, the airport's activities have fallen short of initial expectations. In response to this challenge, the West Java Provincial Government has strategized to reposition Kertajati Airport as a dedicated cargo-centric facility, aiming to pivot its focus to a financial solution. This study encompasses an in-depth analysis of the cargo potential, considering the key commodities within West Java, strategies for cargo transfer from Soekarno-Hatta and Husein Sastranegara airports, estimated travel time and associated costs to Kertajati Airport, and the most efficient aircraft types for cargo transportation. The findings reveal that Kertajati Airport's catchment area encompasses 19 districts/cities (70%) within West Java and 3 districts/cities (9%) in Central Java. The demand forecasting analysis projects the volume for international and domestic cargo in 2028 originating from Soekarno-Hatta Airport, indicating a 13% transfer, are 62 tons and 56 tons, respectively. Concurrently, the anticipated demand volume for international and domestic cargo transfer from Husein Sastranegara Airport in 2023 are 4 tons and 30 tons, respectively. The concentration of cargo potential lies prominently in areas rich in key commodities, notably Bandung City, Bandung Barat District, Tasikmalaya District, Garut District, and Sumedang District. The results indicate that there is a potential to promote the Kertajati Airport into a cargo-centric facility. More deep research with more data will give more confidence to focus in developing this facility.

Keywords: airport; cargo demand; potential cargo centric; travel cost; travel time; kertajati

INTRODUCTION
The West Java Kertajati International Airport, situated in Kertajati District, Majalengka Regency, West Java, stands approximately 68 kilometers away from East Bandung. This airport initiative stemmed from the necessity to address the limitations faced by Husein Satranegara Airport, which could not keep up with the escalating air traffic demands in West Java Province. According to M. Pramintohadi Sukarno, the Director of Airports at the Ministry of Transportation, from 2016 to 2018, Husein Sastranegara Airport witnessed a 6% increase in passenger numbers, reaching 3.86 million passengers. Additionally, cargo traffic surged by 40% to 19.21 thousand tons, and aircraft movements experienced 11% growth, nearly 31,865 movements during this period.

The initial phase of Kertajati Airport's operation witnessed a concerning decline in passenger numbers. The West Java Central Statistics Agency (BPS) reported a stark contrast in passenger figures, noting a significant decrease from 243,756 passengers in the January-September 2019 period to a mere 42,400 passengers during the same timeframe in 2020, marking an 82% decline. According to the Head of the West Java Transportation Service, this dwindling interest among passengers in utilizing Kertajati Airport stems primarily from the challenging accessibility to the airport. The difficulty in reaching the airport has emerged as a critical deterrent, contributing to the declining load factor at Kertajati Airport. Many individuals from Bandung prefer Soekarno-Hatta Airport due to its accessibility despite the longer travel distance involved. This accessibility issue remains a primary factor impacting the reduced passenger traffic at Kertajati Airport.

According to BIJB Corporate Secretary Arief Budiman, the deficiency in passenger numbers can be attributed to insufficient access to the airport premises. The ongoing construction delays of the Cisumdawu Toll Road have significantly impacted access, dissuading individuals from choosing Kertajati Airport due to perceived inefficiencies in travel time and associated costs. The incomplete state of the toll road has created hurdles, discouraging potential passengers from opting for Kertajati Airport as a travel hub. The Government's plan to transform Kertajati Airport into a hub for aircraft maintenance and logistics activities aims to rejuvenate the airport amid the dwindling passenger numbers. The airport is poised to support cargo transport movements with a substantial cargo terminal area spanning 4,480 m2 and ample terminal space. As part of Angkasa Pura II's initiatives to enhance cargo management, a Cargo Village Area is slated for construction at both Kertajati Airport and Soekarno-Hatta Airport in 2023.

Angkasa Pura II President Director Muhammad Awaluddin emphasized the significance of this Cargo Village in elevating the competitiveness of Soekarno-Hatta Airport regionally and globally. The Cargo Village at Soekarno-Hatta Airport, equipped with cutting-edge technology, signifies a new era in air cargo services in Indonesia. In 2021, Soekarno-Hatta Airport in Tangerang, Banten, stood out as the primary cargo transportation hub, handling 702,787 tons, accounting for 81.78% of the total cargo volume across all 20 Angkasa Pura II airports. The decision to construct a Cargo Village at Kertajati Airport aligns with the strategic objective of developing the airport into a central hub for cargo services and aircraft maintenance, including repair and overhaul services. Awaluddin emphasized the importance of ensuring service reliability and facilities for cargo transportation while fostering collaboration with stakeholders to achieve these ambitious goals.

Analyzing the potential of the superior commodity sector is crucial for stimulating logistics activities. The plantation sector is one of Indonesia's primary contributors to foreign exchange due to its export of various plantation commodities. These commodities are considered superior and possess competitive advantages in the international market. West Java Province, among other regions in Indonesia, holds significant potential in contributing plantation products to the national economy. The national economy is primarily due to West Java's fertile land, which supports cultivating diverse types of plantation crops. Identifying and leveraging these strengths can play a pivotal role in driving the movement and growth of logistics activities in the region. Identifying the potential sectors of superiority within the region is pivotal in determining the cargo potential of Kertajati Airport. Understanding the types of commodities and sectors that thrive in West Java's fertile land and hold competitive advantages in international markets is crucial. Additionally, evaluating the feasibility and efficiency of transporting these commodities via aircraft cargo, considering factors like travel time and costs, is essential.

This comprehensive analysis allows for identifying high-value, high-demand goods that could significantly boost cargo movements at Kertajati Airport. By aligning the airport's offerings with the strengths of the region's commodities and ensuring efficient transportation logistics, Kertajati Airport can capitalize on these advantages to stimulate increased aircraft movements and cargo traffic.

METHOD

For this research, gathering secondary data is crucial. Here's a breakdown of the essential secondary data required:

1. Commodity Type: ruit, vegetable, ornamental plant, and poultry production in West Java Province.
2. Annual Cargo Volume: Historical data on annual cargo volumes handled at Soekarno-Hatta Airport and Husein Sastranegara Airport, explicitly focusing on the types and quantities of cargo.
3. Types of Aircraft in Operation: Details about the types of aircraft used for cargo transportation, their capacities, and their operational frequency in the region.
4. Distance Traveled and Travel Time: Data detailing the distances between the origin of the commodities to Kertajati Airport, Soekarno-Hatta Airport, and Husein Sastranegara Airport, along with estimated travel times via different modes of transport (aircraft) between these airports. This data is used to determine the catchment area for Kertajati Airport.
5. Cost Components: Information regarding the cost components associated with operating cargo transportation services, including fuel costs, maintenance expenses, labor costs, and other relevant operational expenses.

Gathering and analyzing this secondary data will provide a comprehensive understanding of the production potential, existing cargo volumes, transportation logistics, and associated costs. This data forms the foundation for assessing the feasibility and efficiency of utilizing Kertajati Airport as a cargo hub, enabling informed decision-making to maximize its potential in the logistics sector. Using travel time data for land transportation trips is a critical aspect of analyzing the accessibility of the airport. It serves as a variable for assessing the airport's catchment area, essentially outlining the regions within a feasible travel time to the airport. This data is sourced from the area of origin and often extracted using tools like Google Maps or similar mapping services.

The travel time information aids in calculating average speeds from various locations to the airport. Collecting and analyzing this data makes it possible to determine the areas accessible within specific timeframes, thereby indicating the potential reach of the airport for passengers or cargo transportation. This analysis helps understand the transportation infrastructure, identify possible constraints, and assess the overall accessibility for individuals or goods moving to and from the airport by land. Analyzing vehicle operational costs involve calculating the expenses incurred per kilometer of distance travelled and determining the value of vehicle time per hour. ’A formula by Tamin (2000) was used to calculate these costs and the time value of goods vehicles. This formula is likely designed to encompass various cost factors such as fuel, maintenance, depreciation, and possibly labor or opportunity costs associated with the time spent in transit.

The details of Tamin's formula may involve variables like fuel consumption rates, maintenance expenses, vehicle depreciation, and estimated time value, incorporating factors that contribute to the operational costs and the value of time for goods vehicles. This comprehensive calculation aids in understanding the overall expenses and time considerations associated with operating goods vehicles over certain distances, providing valuable insights into the logistics and transportation costs involved in cargo movement to and from the airport. The determination of potential cargo demand at Kertajati Airport involves multiple factors, including flight and cargo transfers from Soekarno-Hatta Airport and Husein Sastranegara Airport, as well as the demand arising from perishable goods (such as fruits, vegetables, and ornamental plants) and live animals (specifically poultry).

The Location Quotient (LQ) method was utilized to identify particular commodities within a region. This method evaluates the comparative advantage of certain commodities in a specific area. Understanding these comparative advantages enables the region to leverage and enhance these strengths, and increasing product competitiveness in both regional and global markets (as outlined by Mulyono and Munibah in 2016). The calculation of LQ involves an equation that assesses the concentration of a particular commodity in the local economy compared to its concentration in a broader reference economy. The formula for LQ is typically represented as:

$$\text{LQ}= \frac{Proportion\ of\ Local\ Economy\ in\ Specific\ Commodity}{Proportion\ of\ Reference\ Economy\ in\ Specific\ Commodity}$$

This equation provides a numerical value (LQ) that indicates whether a specific commodity is more concentrated or specialized in the local economy than the reference economy. A value greater than 1 signifies a comparative advantage in producing that commodity within the region. Utilizing the LQ method aids in identifying which commodities have a competitive edge in the area, thereby assisting in strategic planning and decision-making for cargo demand and supply, especially concerning perishable goods and live animals in this context.

$$LQ = \frac{pi/_{pt}}{Pi/_{Pt}}$$

(1)

Where:

LQ : Location Quotinent Index for commodity production at the district/city level
pi : Production value of crop "i" at the district/city level
pt : Total value of commodity production in the district/city plantation sector at the provincial level
Pi : Production value of crop "i" at the provincial level
Pt : Total value of commodity production in the plantation sector at the provincial level

LQ value > 1

So it is called a base sector, meaning that commodity "i" in a region has a comparative advantage with the amount of production that is capable of carrying out export activities in that sector or can be marketed to other regions.

LQ value = 1

So it is called the non-base sector, where commodity "i" in the region does not have advantages, its production is only sufficient to meet the needs of the region itself.

LQ value < 1

So it is called the non-based sector, where the "i" commodity in a region is unable to meet its own needs, so it needs supplies from outside the region.

Forecasting cargo demands is crucial for the strategic planning of Kertajati International Airport. The West Java Kertajati International Airport Master Plan outlines a 13% flight shift from Soekarno-Hatta Airport to Kertajati Airport (Siregar, 2016). This shift necessitates a comprehensive cargo forecasting analysis for both international and domestic cargo expected to be handled by Kertajati Airport in the upcoming planning year. Additionally, considering the impending completion of the Cisumdawu Toll Road project, Husein Sastranegara Airport is slated to revert to a military airport, redirecting all commercial flights to Kertajati Airport. This transition emphasizes the significance of conducting a cargo forecasting analysis, specifically from Husein Sastranegara Airport to Kertajati Airport. Understanding the projected cargo volumes originating from Husein Sastranegara Airport is crucial in preparing Kertajati Airport to accommodate and efficiently manage the expected increase in cargo traffic.

By conducting a thorough cargo forecasting analysis for both Soekarno-Hatta Airport and Husein Sastranegara Airport, Kertajati Airport can anticipate and strategize to handle the anticipated surge in cargo volumes, thereby optimizing its operational capacity and enhancing its position as a major transportation hub. Determining the optimal distance for aircraft operations at Kertajati Airport involves considering the aircraft's weight and its relationship with the distance traveled. This relationship often involves understanding the aircraft's maximum take-off weight (MTOW) and its performance capabilities concerning various distances. Aircraft performance in terms of flying distance is affected by factors like weight, fuel capacity, engine efficiency, and aerodynamics. Generally, heavier aircraft may have reduced range or operational efficiency compared to lighter ones due to increased fuel consumption and other performance considerations.

Calculating the weight of the aircraft and understanding its impact on the distance it can effectively travel involves assessing various factors:

1. Maximum Take-off Weight (MTOW): This is the maximum weight an aircraft can take off. It's crucial to determining the aircraft's operational capabilities, including the range it can cover.
2. Payload and Fuel Capacity: The weight of the payload (passengers, cargo, etc.) and the fuel capacity affect the aircraft's overall weight, influencing its operational range.
3. Aircraft Performance Charts: Aircraft manufacturers provide performance charts that detail the range at different weights, helping determine the relationship between weight and distance.
4. Efficiency Considerations: Heavier weights often increase fuel consumption, potentially reducing theaircraft's effective range.

By considering these factors and analyzing the aircraft's weight in relation to its maximum range capabilities, airlines and airport authorities can optimize operations and plan routes effectively, ensuring efficient utilization of the aircraft's capabilities within the context of Kertajati Airport's operational requirements. Assessing excess capacity in cargo compartments of aircraft is crucial for determining the maximum utilization based on both volume and weight considerations of the cargo that can be transported. Cargo transportation via aircraft relies heavily on factors such as payload capacity, available cargo space within the aircraft, door dimensions, and maximum floor load.

RESULT AND DISCUSSIONS

Airport Catchment Area Analysis Based on Travel Time

In this catchment area analysis, routes will be selected from each district/city in West Java and Central Java to Kertajati Airport by comparing several airports as a comparison with the shortest time. To find out the time and distance needed to travel using the Google Maps application, the shorter distance and time to the airport will be used as a goal for selecting airports from each district/city.

Calculation of Time Value of Goods Vehicles

The value of time is the amount of money a person is willing to spend to save one unit of travel. The value of time is usually proportional to per capita income, which is a constant comparison with the level of income. As an example of the calculation, the K factor value is taken from the correction of the district minimum wage (UMK) for Bandung and Majalengka. The following is the calculation of the K factor value.

UMK Jakarta = Rp 182.908,69
UMK Bandung = Rp. 81.494,34
UMK Majalengka = Rp 19.333,05
K Value Jakarta = 1

K Value Bandung $= \frac{\text{UMK Bandung} \times \text{K Value Jakarta}}{\text{UMK Jakarta}}$

$= \frac{\text{Rp.81.494,34} \times 1}{\text{Rp 182.908,69}}$

$= 0{,}45$

K Value Majalengka $= \frac{\text{UMK Majalengka} \times \text{K Value Jakarta}}{\text{UMK Jakarta}}$

$= \frac{\text{Rp 19.333,05} \times 1}{\text{Rp 182.908,69}}$

$= 0{,}11$

Average K Value $= \frac{0{,}45+0{,}11}{2}$

$= 0{,}28$

Next, an example of calculating the value of time in Class I can be seen as follows:

Class I = k × Basic Time Value
= 0,20 × Rp 78.740,69
= Rp 21.702,68
Minimum Time Value = Rp 38.450,73
Max { Rp 21.702,68 ; Rp 38.450,73 } = Rp 38.450,73

Calculation of Vehicle Operating Costs (VOC)

Vehicle operating costs are the total costs required to operate a vehicle under certain traffic and road conditions for one type of vehicle. This VOC component consists of fuel consumption, lubricating oil consumption, tire usage, maintenance, depreciation, capital interest, and insurance costs (Z. Tamin 2000). The following is an example of VOC calculation for a Class I vehicle at a speed of 60km/hour.

Table 1.
Components of Vehicle Operational Costs

Class	Components	Brand	Price (Rp.)	Unit
I (KR) Car	Vehicle	Daihatsu Gran Max Pu	200.000.700	Rp/Vehicle
	Fuel	Pertalite	10.000	Rp/Liter
	Lubricant	Fastron 10w-40	76.000	Rp/Liter
	Tire	accelera 175/60R13	390.000	Rp/Tire
	Maintenance Cost	Mechanic Wages	15.000	Rp/Hour

Fuel Consumption
Assumed :
Positive Slope Correction Factor (kk) = 0,4

Traffic Correction Factor (kl) = 0,185
Flatness Correction Factor (kr) = 0,085
Fuel Consumption = Basic Fuel Consumption × [1+(kk + kl + kr)] (2)

Basic Fuel Consumption and Fuel Class I (Pick-Up Car)

Basic Fuel Consumption $= 0{,}0284V^2 – 3{,}0644V + 141{,}68$ (3)

$= 0{,}0284(60)^2 – 3{,}0644(60) + 141{,}68$

= 60,06 liter/1000 km

Fuel Consumption = Basic Fuel Consumption×[1+(kk + kl + kr)]× Fuel Price (4)
= 60,06 × [1+(0,4 + 0,185 + 0,085)] × 10.000

= Rp1.102.935 /1000 km

Lubricant Consumption
Assumed :
Correction Factor = 1,5
Lubricant Consumption = Lubricant Consumption × Correction Factor × Lubricant Price (5)

Basic Lubricant Consumption and Lubricant Class I (Pick-Up Car)
Basic Lubricant Consumption = 0,0029 liter/km × 1000 km
= 2,9 liter/km
Lubricant Consumption = Lubricant Consumption × Correction Factor × Lubricant Price
= 2,9 × 1,5 × 76.000
= Rp330.600 /1000 km

Tire Consumption
Tire Consumption Class I
Basic Tire Consumption = 0,0008848 V – 0,0045333 (6)
= 0,0008848(60) – 0,0045333
= 0,048
Tire Consumption = Basic Tire Consumption × Number of Tires × Tire Prices
= 0,048 × 4 × Rp 390.000
= Rp75.745 / 1000 km

Maintenance Consumption (Spare Parts)
Maintenance Consumption Class I
Basic Maintenance Consumption = 0,0000064V + 0,0005567 (7)
= 0,0000064(60) + 0,0005567
= 0,0009407
Maintenance Consumption = Basic Maintenance Consumption x Vehicle Price
= 0,0009407 × Rp200.000.700

= Rp188.141 / 1000 km

Maintenance (Mechanic)
Maintenance Consumption Class I

Basic Mechanic Consumption = 0,00362V + 0,36267 (8)
= 0,00362(60) + 0,36267
= 0,5787

Mechanic Consumption = Basic Mechanic Consumption x Mechanic Price
= 0,5787 × Rp15.000
= Rp8.698 / 1000 km

Depreciation Expenses (Depreciation)
Depreciation Expenses Class I

Depreciation Expenses $= \frac{1}{((2{,}5 \text{ x } 60 \text{ km/hour}) + 125))} \times 0{,}5 \times \text{Vehicle Price}$ (9)
$= \frac{1}{((2{,}5 \text{ x } 60 \text{ km/hour}) + 125))} \times 0{,}5 \times \text{Rp}200.000.700$
= Rp363.638 /1000 km

Capital Interest
Capital Interest Class I

Capital Interest = 0,22% × Rp200.000.700
= Rp440.002 / 1000 km

Insurance fee
Insurance fee Class I

Insurance fee $= \frac{38}{(500(V))} \times \text{Vehicle Price}$ (10)
$= \frac{38}{(500(60))} \times \text{Rp}200.000.700$
= Rp253.334 / 1000 km

Total VOC(/1000km) = Rp1.102.935 + Rp330.600 + Rp75.745 + Rp188.141 + Rp8.698 + Rp363.638 + Rp440.002 + Rp253.334
Total VOC (Rp/km) = Rp. 2.663

Airport Catchment Recapitulation Based on VOT & VOC

After knowing the results of the VOT and VOC methods in the previous sub-chapter. Next, a recapitulation will be carried out for all regencies/cities in West Java and Central Java. The final results of all these calculations will determine the regional catchment of Kertajati Airport.

Table 2.
Example of calculating VOC (60 km/hour), VOT and West Java Catchment Area

Origin	Destination Airport	Vehicle Class	VOC (Rp/km)	VOT (Rp/hour/vehicle)	Total (Rp)	Airport Catchement
Bandung	Kertajati Airport	Class I	260.974	57,675	319.219	Kertajati Airport
	Soekarno-Hatta Airport		466.025	111.505	578.295	Kertajati Airport

Table 3.
Example of calculating VOC (60 km/hour), VOT and Central Java Catchment Area

Origin	Destination Airport	Vehicle Class	VOC (Rp/km)	VOT (Rp/hour/vehicle)	Total (Rp)	Airport Catchement
Tegal	Kertajati Airport	Class I	338.212	59.983	398.386	Kertajati Airport
	Jenderal Ahmad Yani Airport		415.442	79.154	494.597	Kertajati Airport
	YIA Airport		822.895	197.197	1.020.093	Kertajati Airport
	Adi Soemarmo Airport		671.099	111.647	782.747	Kertajati Airport

After carrying out the same calculations for each district/city in West Java and Central Java, the catchment area of Kertajati Airport can be seen in Figure 1.

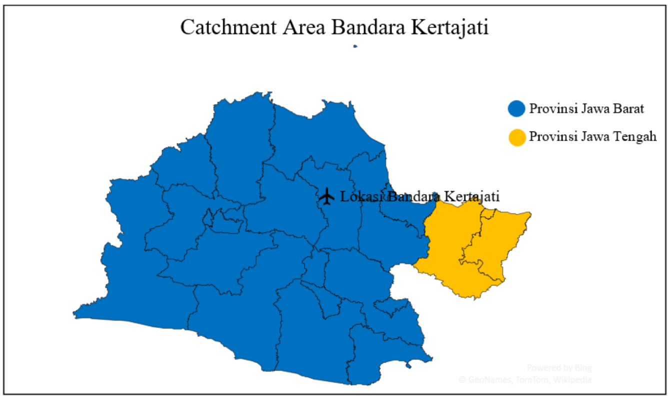

Figure 1. Kertajati Airport Catchment Area Map

Location Quotinent Analysis of Leading Commodities

Mangosteen is one of the export goods from West Java Province with HS code 08045030, which is a perishable goods category that can be transported by airplane. Because the origin of the mangosteen products is not known, an approach was taken using the Location Quotinent method to find out areas that have the potential to market the mangosteen.

Calculation of Production Variables from Mangosteen Fruit Commodities in 2017

pi = 32506 quintal
pt = 1316607 quintal
Pi = 421220 quintal
Pt = 20924992 quintal

Base/Non-Base Sector Analysis using the Location Quotient Method

$$LQ = \frac{pi/pt}{Pi/Pt}$$

$$LQ = \frac{32506\ ton/1316607\ ton}{421220\ ton/20924992\ ton}$$

LQ =1,2

After analyzing the LQ value for one year, the LQ value was recalculated to obtain the average LQ value for the 5 year period of 2017 to avoid biased values caused by seasonal factors.

Table 4.
LQ Value of Mangosteen Fruit Purwakarta Region 2017-2021

LQ Value of Mangosteen Fruit Purwakarta Region	
Year	LQ
2017	1,226
2018	1,137
2019	1,007
2020	1,158
2021	1,229

$\overline{\text{LQ}}$ Value $= \frac{\sum LQ}{n}$ (11)

$\overline{\text{LQ}} = \frac{1{,}226+1{,}137+1{,}007+1{,}158+1{,}229}{5}$

$\overline{\text{LQ}}$ =1,152

Analysis of Cargo Demand from Soekarno-Hatta Airport

Forecasting analysis was carried out to determine the cargo load that Kertajati Airport would receive from Soekarno-Hatta Airport, based on the West Java Kertajati International Airport Masterplan there would be a flight difference of 13% from Soekarno-Hatta Airport to Kertajati Airport (Siregar 2016). The data compared is international and domestic cargo data per year and then analyzed using linear regression.

Table 5.
Soekarno-Hatta Airport Annual Cargo Volume

Annual Cargo Volume (kg)		
Year	International Cargo	Domestic Cargo
2012	263.112.648	316.910.962
2013	325.634.926	319.663.022
2014	315.264.280	310.781.664
2015	326.411.673	287.917.374
2016	326.970.999	270.836.353
2017	367.870.959	276.570.981
2018	393.291.047	336.069.916
2019	341.332.240	229.340.708
2020	-	-
2021	325.535.915	282.570.659

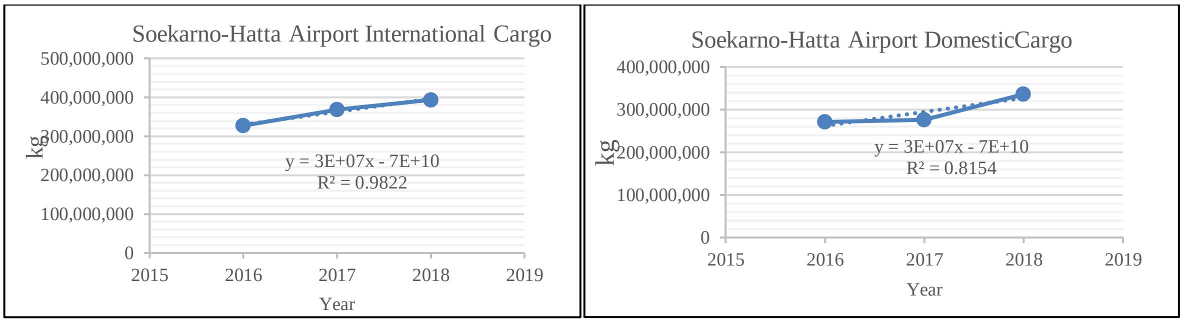

Figure 2. Linear Regression Graph for International and Domestic Cargo at Soekarno-Hatta Airport

In the linear regression analysis, the trendline was taken from 2016-2018, because this data shows a stable pattern compared to data from subsequent years. A comparison between actual and forecasting in 2021 showed a decrease of 66%. The results of this decrease were multiplied by the forecasting value for the following year, and the cargo shift can be seen in Table 6.

Table 6.
Forecasting International and Domestic Cargo Transfer Load Plans from Soekarno-Hatta Airport

Year	Soekarno-Hatta Airport Forecasting Results (kg)	Transition Percentage	Demand for Kertajati Airport Plans (kg)
2023	369.120.269	13%	47.985.635
2024	390.912.446	13%	50.818.618
2025	412.704.623	13%	53.651.601
2026	434.496.800	13%	56.484.584
2027	456.288.976	13%	59.317.567
2028	478.081.153	13%	62.150.550
Domestic Cargo			
2023	325.946.767	13%	42.373.080
2024	347.634.821	13%	45.192.527
2025	369.322.874	13%	48.011.974
2026	391.010.928	13%	50.831.421
2027	412.698.982	13%	53.650.868
2028	434.387.036	13%	56.470.315

Forecasting International and Domestic Cargo at Huseinsastranegara Airport

All flights will be diverted to Kertajati Airport. Therefore, it is necessary to carry out a cargo forecasting analysis from Husein Sastranegara Airport to Kertajati Airport to determine cargo demand in the planning year, which can be seen in Table 7.

Table 7.
Husein Sastranegara Airport Annual Cargo Volume

Annual Cargo Volume (kg)		
Year	International Cargo	Domestic Cargo
2014	702.559	5.152.099
2015	868.709	6.401.393
2016	1.030.499	8.786.520
2017	1.653.044	12.122.322
2018	2.305.238	16.905.075

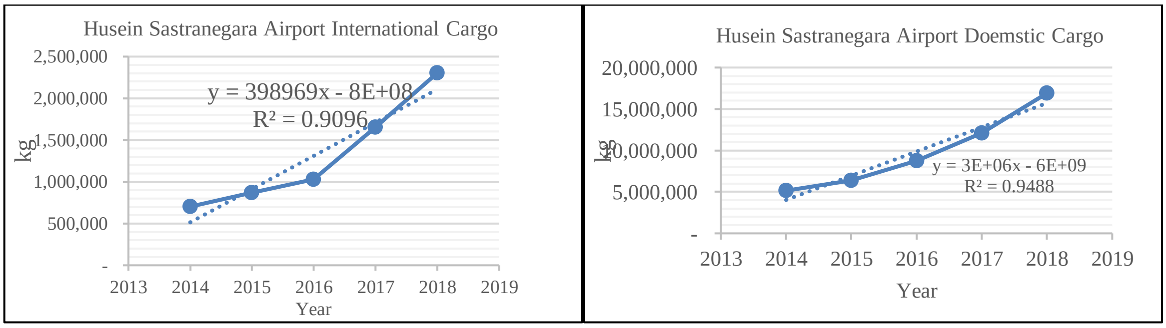

Figure 3. Linear Regression Graph for International and Domestic Cargo at Husein Sastranegara Airport

The y value is obtained from these results, then forecasting was carried out, and the following results are obtained.

Table 8.
Forecasting International and Domestic Cargo Transfer Load Plans from Husein Sastranegara Airport

International and Domestic Cargo Forecasting Results		
Year	International Cargo Volume (kg)	Domestic Cargo Volume (kg)
2019	2.508.917	18.641.546
2020	2.907.887	21.564.235
2021	3.306.856	24.486.923
2022	3.705.825	27.409.611
2023	4.104.794	30.332.299

Optimum Payload and Mileage Analysis

In determining the optimum travel distance for an aircraft, the factors taken into account were the payload being carried, the amount of fuel and the distance. The following calculations were carried out on payload, fuel, and range to find out the intersection of these 3 variables to obtain the optimum value. The following is an example of such calculation for the Boeing 777-300ER aircraft.

Boeing 777-300ER Aircraft Specifications
MTOW (Max Take-Off Weight) = 351535 kg
MDZFW(Max Design Zero Fuel Weight) = 237682 kg
OEW (Operating Empty Weight) = 167829 kg

MDZFW = Payload + OEW
Payload = MDZFW – OEW
= 237682 kg – 167829 kg
= 69853 kg

MTOW = OEW + Payload + Fuel
Fuel = MTOW – OEW – Payload
= 351535 kg –167829 kg – 69853 kg
= 104318 kg

After obtaining the values for each payload and fuel, a recapitulation was made in Table 4. 51 Recapitulation of Boeing 777-300ER Payload and Fuel Calculations and Figure 4. 23 to determine the optimum distance point for the Boeing 777-300ER aircraft.

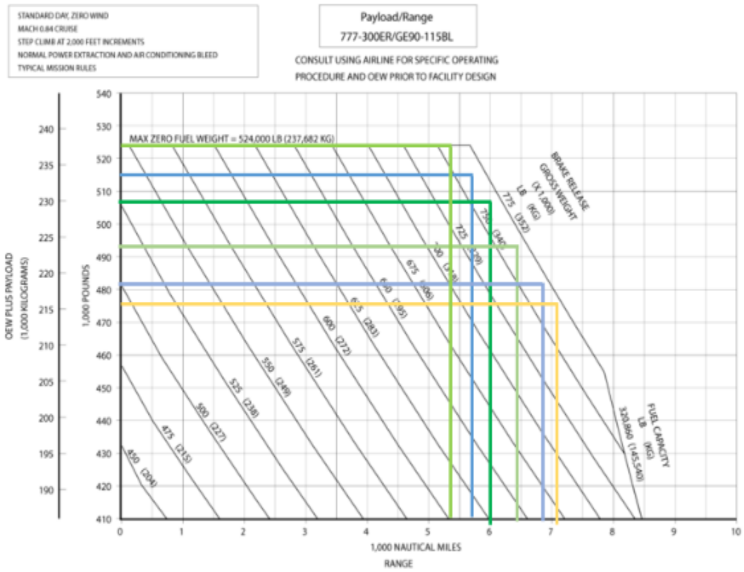

Figure 4. Boeing 777-300ER Payload and Range Curve

Table 9.
Recapitulation of Boeing 777-300ER Payload and Fuel Calculations

OEW + PLD	OEW	PAYLOAD	FUEL	MTOW	RANGE
237.682	167.829	69.853	104.318	342.000	5.400
234.000	167.829	66.171	108.000	342.000	5.700
230.000	167.829	62.171	112.000	342.000	6.000
224.000	167.829	56.171	118.000	342.000	6.400
218.000	167.829	50.171	124.000	342.000	6.900
217.000	167.829	49.171	125.000	342.000	7.010

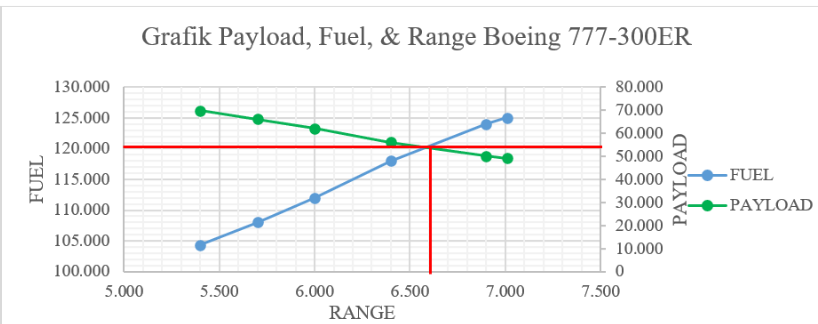

Figure 5. Graph of the relationship between payload and fuel and the range of the Boeing 777-300ER aircraft

From the results of this analysis, the following values were obtained:
Payload = 52,000 kg
Fuel = 120,000 kg
Range = 6690 nm = 12389.88 km

Aircraft Cargo Excess Capacity Analysis

This analysis was carried out to determine the optimization of passenger aircraft payload and cargo payload. This optimization is assumed to have an average seat load factor of 70% (Jasmine et al. 2020). By substituting the empty weight of the chair with the weight of the cargo that can be carried (excess capacity) at a price per kg based on the price set by FedEx Express. The following is an example of calculating the comparison of optimizing empty seats with cargo weight on planes serving this route. In the calculation example, the Jakarta-Singapore route is used, which uses 5 different types of aircraft, so these 5 types of aircraft will be analyzed.

Boeing 777-300ER Aircraft
PAX amount = 396
Route = Jakarta (CGK) – Singapura (SIN)
Distance = 548 nm
Cargo costs per kg = Rp233.200
Ticket Costs Per Person = Rp4.486.000
Permitted Payloads = 69853 kg

Load factor 70%
Load factor 70% = PAX amount × 70%
= 396 × 70%
= 277 seats

Weight Load factor
Weight Load factor 70% = Load factor 70% × Passenger Weight
= 277 kursi × 103 kg
= 28552 kg

Permitted Cargo Weight
Cargo Weight = Permitted Payloads – Load Factor 70%
= 69853 kg – 28552 kg
= 41301 kg

Revenue From Passengers
Revenue From Passengers = Load factor 70% × Ticket Price
= 277 seats × Rp4.486.000
= Rp1.243.519.200,00

Excess Capacity Revenue
Excess Capacity Revenue = Cargo Weight × Cargo Cost per Kg
= 41301 kg × Rp. 233.200
= Rp9.631.486.480

Total Revenue
Total Revenue = Revenue from Cargo + Revenue from Passengers

= Rp9.631.486.480+ Rp1.243.519.200,00
= Rp10.875.005.680

Based on the type of aircraft in operation, the aircraft with the greatest value is the Boeing 777-300ER aircraft with a cargo carrying capacity of 41,301 kg above other widebody aircraft, namely the B787, A350-900 and A330-300 series. Therefore, the B777-300ER aircraft can be said to be the most optimal for maximizing cargo transportation. Can be seen in Table 10 which is a recapitulation of the carrying capacity of each aircraft.

Table 10.
Recapitulation of Operating Aircraft Carrying Capacity

Aircraft Type	Max Payload (kg)	Actual MTOW (kg)	Cargo Capacity (kg)	Optimum Mileage (nm)
A320-200	18.500	78.000	5.522	2.685
A321-200	24.500	93.500	10.360	2.800
A330-300	45.000	242.000	22.950	5.370
A350-900	54.000	280.000	31.289	7.060
B737-800	21.319	79.016	8.053	2.440
B777-300ER	69.853	342.000	41.301	6.540
B787-800	47.627	226.000	22.497	5.600
B787-900	68.038	253.000	39.618	5.750

CONCLUSIONS

The analysis conducted for Kertajati Airport's cargo potential has yielded some comprehensive findings. Here's a breakdown of the key insights derived from the analysis: Catchment Area: The catchment area for Kertajati Airport spans 19 districts/cities in West Java (70%) and 3 districts/cities in Central Java (9%), determined through an analysis involving travel time, cost, and time value comparison with other airports. Superior Commodities: Using the Location Quotient method, ornamental plants emerge as the top commodity with the highest potential, followed by vegetables, fruit, and poultry. Ornamental plants concentrate mainly in Bandung City, while superior vegetables are in Bandung City and Tasikmalaya Regency. Superior fruit commodities are prominent in West Bandung Regency, and superior poultry commodities are found in Garut Regency, Sumedang Regency, and West Bandung Regency.

Cargo Demand Forecast: The forecasted cargo demand by 2028 includes an estimated 13% shift from Soekarno-Hatta Airport, resulting in an international cargo volume of 62,150,550 kg and domestic cargo of 56,470,315 kg. Additionally, the expected transition from Husein Sastranegara Airport in 2023 anticipates international cargo of 4,104,794 kg and domestic cargo of 30,332,299 kg. Aircraft Selection: Calculations based on Maximum Take-off Weight (MTOW) highlight the Boeing 777-300ER aircraft as the optimal choice due to its ability to cover optimum travel distances and accommodate a substantial cargo capacity of 41,301 kg, aligning well with the cargo demand projections and operational needs.
This analysis provides a comprehensive understanding of cargo potential, catchment areas, commodity strengths, and anticipated cargo demands which are crucial for strategic planning and infrastructure development at Kertajati Airport, emphasizing the importance of optimizing cargo handling and transportation capabilities.

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