Air Cargo Capacity on Cargo Terminal Development Plan at Soekarno-Hatta International Airport

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ABSTRACT

The purpose of this study was to find out the capacity of cargo volume, the needs of cargo warehouse space and utilization in 2023. The writer used quantitative analysis method with linier regression analysis method and a simple least squares method to calculate and forecast the cargo capacity at the amount needs. The calculation of the amount of cargo volume has been projected from the counting of 2010 to 2023, where the amount of desired cargo volume which was approximately 1,500,000 tons can be achieved around the year 2022 to 2023, while the amount of cargo volume at this time in 2013, reaching about 741,000 tons. In 2014 a new warehouse or domestic and international cargo terminal should be built to expand the space of the warehouse so that the old cargo terminal at IA terminal can be replaced.

Keywords*: air cargo capacity, the cargo warehouse space, warehouse utilization.*

Introduction

Soekarno-Hatta airport plays an important role in the development process of the State of Indonesia because it is the main entrance connecting Indonesia with other countries and other regions within Indonesia.

In accordance with the 2008 Soekarno-Hatta airport Master Plan (The decree of Minister No. KM 48, 2008), the cargo terminal is planned to be built in the cargo area of Soekarno-Hatta airport as a mean of supporting commercial activities as well as to improve service to the airport service users. During 2011 the number of cargo activities at Soekarno-Hatta airport reached about 634,324 tons, while the forecast shows that 5 years later, in 2016 the total number of cargo activity is going to reach 1 million tons and it is expected optimistically by PT. Angkasa Pura II and assisted by LAPI_ITB forecast that it will reach 1.5 million tons in 2022 or 2023 (PT Angkasa Pura, 2012 and directorate of air transport, 2009). To accommodate the cargo activities, PT Angkasa Pura II (Persero) needs careful planning studies professionally in order to continue the implementation that is design planning as well as the tender documents for the auction of the physical construction.

It takes additional reference materials such as a comparative study to other similar facilities that already exist and can be used as a viable model as an example of

airport buildings and facilities complete with modern cargo terminal, effectively and efficiently.

The review of literature in this study includes theories relating to the theory of statistical analysis from Kadir (2010), J. Supranto (2008) about regression and correlation, a simple least squares method, air cargo (IATA 2004, IATA AHM 810, 2008, IATA 2009, IATA SGHA section 5, 2013, ICAO Annex Np. 10,14,16,18, 1999) such as: service and cargo handling systems, outbound cargo handling, inbound cargo handling, Cargo Terminal Management, knowledge of some basic facilities at the cargo terminal (international import and entrance zone / inbound domestic and international export and out zone/ outbound domestic as well as import lines: red, green, and yellow).

Logistics is a strategic management process of the removal and storage of goods, spare parts and finished goods from suppliers, among the company's facilities and to customers (Bowersox, 2002)

According to IATA and ICAO (IATA 2004, IATA AHM 810, 2008, IATA 2009, IATA SGHA section 5, 2013, ICAO Annex Np. 10,14,16,18, 1999), cargo is any goods sent by aircraft but post or other property under international postal convention agreements and baggage carried by passengers.

According to the decree of the Minister of Transportation. No Km.14 1989 on the control of passengers, luggage and cargo transported by civil aircraft cargo is aircraft goods that is equipped with the Air Cargo Letter (SMU) including luggage sent through cargo shipment procedures.

From the definition above-mentioned definition of cargo essentially has the same meaning and can be inferred that the cargo is goods or items transported by the conveyance to be sent from the place of origin to the destination and equipped with appropriate documents and sent through the delivery procedures.

According to Suharto and Eko Probo (2010), "Cargo is defined simply as all goods that are sent by air (aircraft), sea (ships), or land (container truck) that is usually for trade, both between regions/ cities in the country and between countries (international) known as export-import.

There are three main parties associated with the shipment of cargo, namely the shipper and or the receiver (consignee); the carrier; and the ground handling and or warehouse operator. Shipper can be an individual, business entity, performed directly without intermediaries, or through freight forwarding services known as freight forwarders or freight forwarders ship or aircraft.

Export

Suharto and Eko Probo (2010) states, exported goods are goods that have been loaded or to be loaded on a carrier to be removed from the customs area. The goods exported must pass the documents examination. In order to encourage export, a physical examination often carried out as minimum as possible, so the investigation only conducted on the documents.

Based on the definition above, the writer can conclude that export is a trade activity of a company to remove the goods from the customs territory, sold or traded in the customs territory of the other country.

Research Method

Regression and Correlation Theory and a Simple Least Squares Method

Regression and Correlation Analysis (Kadir, 2010)

Regression analysis is an analytical technique that is typical for the correlation study. Correlation analysis is an analysis that seeks to see whether there is a

connection or not between two or more variables, measure the strength of relationship, making predictions based on the strength of that relationship.

This technique is useful to study the variables that have a relationship based on the theory previously constructed so that the direction of linkage is expected to be found.

Regression and Correlation Analysis

Functional relation : Y = f(X)
Regression analysis :
Y = f(X) …… Y = a + b(X)

Y = dependent variable
a = constants when the independent variable (X) = 0
X = independent variable
For example: Y = 10 + 0.5 X

Source: J. Supranto (2008)

Simple Least Square Method

Method of simple Least Squares:

An estimate of the value of a and b of the equation Y = a + bX based on the observation data resulting of the smallest (minimum) squared errors sum. Least Square method is a method that generates forecast data with the smallest error of squares forecasting.

Simple Least Square Method

FORECASTING, Linier Regression,
Equation: Y = a+bX
To get the regression equation above use 2 ways:
1. two normal equations:
$\sum Y = an + b\sum X$
$\sum XY = a \sum Y + b \sum X^2$
2. direct counting

$$a = \frac{(\sum X^2)(\sum Y) - (\sum X)(\sum XY)}{n(\sum X^2) - (\sum X)^2}$$

$$b = \frac{n(\sum XY) - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$

Estimatation value: Y' = a +bX

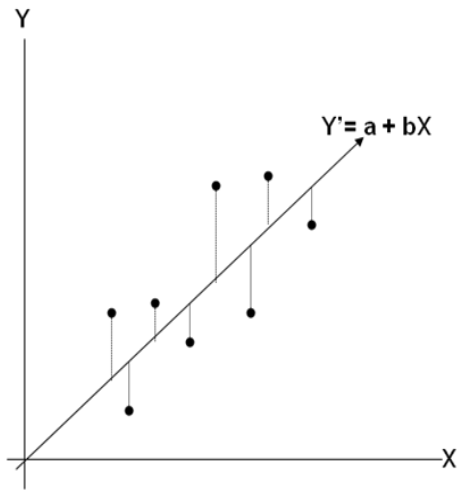

Figure 1 Forecasting, Linier Regression

Source: J. Supranto (2008)

Data Analysis Method

Multiple calculations such as a least square method and Linier regression forecasting are used to calculate the air cargo capacity. All necessary data compiled in Microsoft Excel file where each data has label and value that indicates purpose and conditions of the data. Then the data will be invoked by using the program.

Data and needs necessary for the counting:

1. Relatively equal service capacity within a maximum of 10 years or up to 2023, as efforts to improve the standards cargo terminal service at Soekarno-Hatta airport.
2. The amount of cargo needed: outgoing cargo, export, incoming, import, import rush, the amount of import cargo at the green, yellow, and red line to count the condition of cargo traffic, dwelling time, the amount of aircraft, the amount of

ton/ aircraft, the amount of aircraft/ day, the amount of cargo ton/ day.

3. The aircraft movement for domestic, international, outgoing, incoming, import, and export category.
4. The average calculation of the amount of the air cargo capacity (ton/ aircraft)
5. The calculation of the needed of warehouse's space and capacity
6. The calculation of air cargo capacity in the 2010 up to 2023 period
7. The calculation of air cargo warehouse utilization year 2023

Data Analysis Program

Once the data is collected and analyzed, the next step is to make the program analysis. Data analysis was carried out through the following three approaches:

a) Approach method with several annual departure counting (KAK PT. Angkasa Pura II, PT. Perentjana Djaja, 2012), only as a basic comparison calculation.

b) The calculation of capacity forecasting or the amount of cargo using Regression and Correlation Analysis Theory and Simple Least Square Method (j. Supranto, 2008)

c) The calculation for the forecasting of warehouse space and cargo terminal needed, using Microsoft excel file.

Data Collection Technical

Among the necessary data are data on the number of cargo, data needed to solve the calculation problem of air cargo. The data obtained through interviews with PT. Angkasa Pura II (Cargo General Manager, operator and staff at building 528, cargo area) and PT. Jasa Angkasa Semesta manager, regarding to the activity in the calculation of the amount of air cargo at existing cargo terminal at Terminal IA

Data considered and taken into account:

1) The number of air cargo data at Soekarno-Hatta aiport, since 2001 to 2013 and the data of the biggest amount of air cargo in the world in 2012/2013, as a comparison (Airport Council International, 2013).
2) The number of cargo forecasted by LAPI-ITB, in form of traffic ton, dwelling time, the number of aircraft, number of tons / aircraft, number of aircraft / day and the number of tons / day (LAPI-ITB, 2012).
3) Data on the percentage of the green line, yellow line and red line on the import cargo (PT Services Space Universe, 2012).
4) The total aircraft movements in 2011 (LAPI-ITB, 2012).
5) The cargo warehouse space and the existing cargo terminal will be planned at Soekarno Hatta Airport Cargo Terminal (PT Angkasa Pura II, 2013).
6) The traffic Movement of cargo flight and aircraft type with a large haulage capacity (tonnage minimum amount), specialized cargo aircraft schedules, th enumber of departure of the aircraft (LAPI-ITB, 2012).
7) The increasing trend of cargo terminal use (LAPI-ITB, 2012).
8) Percentage composition of cargo goods, bulk goods and packed goods (PT Jasa Angkasa Semesta, 2012).
9) Facilities of freight forwarder cargo agent activities in receiving the delivery of goods to customers and cargo reception facilities before the departure entering the area of the terminal cargo (restricted area).
10) Cargo acceptance process facilities (acceptance of cargo), temporary storage

of general cargo items and special cargo of cool storage, dangerous goods storage, etc.

All the data found will be used as consideration to construct the amount of calculation or the air cargo capacity.

Findings and Discussion

Logistic Industry Background

1) Airport is part of logistic business which is needed by manufacturing industry and has physical supply (inbound) and physical distribution (outbound) activities.
2) Airport needs to pay attention to shipper needs of air cargo shipment services.
3) The Shipper position in air cargo system as a demand generator and Shipper has criteria in choosing air cargo service providers.

From the research / planning LAPI ITB (2012) forecast data regarding the realization of Soekarno-Hatta airport cargo traffic in 2011 consisting of outgoing 176,152 tons, export 180,800 tons, incoming 28,265, import 178,121 tones, and import rush 70,987 tons

In this case, the writer collect the field data that import cargo is divided and explained in detail to become (percentage based on the existing data):

1) Green line 70% = 70% x 178,121 ton = 124,684 ton
2) Yellow line 20% = 20% x 178,121 ton = 35,624 ton
3) Red line 10% = 10% x 178,121 ton = 17,812 ton

Then the writer found the important thing in the operation of cargo warehouse is a long time to be / stay (dwelling time) in the warehouse, (PT Jasa Angkasa Semesta, 2012), namely:

1. For outgoing cargo (fit to domestic inter-island airplane) is averaged over the 0.5 day
2. For Export cargo is on average for 0.5 day
3. For incoming cargo (loading of the airplane inter-island) is the average over the 0.5 day
4. To import cargo green line during the 0.5 day
5. For import cargo yellow line during the 4 day
6. For import cargo red line during the 10 day
7. For import cargo rush for 1 day.

Green line means the process of obtaining documents PIB (Import Declaration) was smooth. It means there is no problem on the documents, freight, duty payments, and no importer status in the special notes (black list).

Yellow line means there are problems on documents and payment of customs duties.

The red line is usually due to suspected document does not correspond with the state of the cargo. The importer also has a bad record for example smuggling, document manipulation, etc.

The number of aircraft movements at Soekarno Hatta Airport in 2011 regarding to monthly data for the domestic and international as in the table above obtained from the study LAPI ITB (2012)

The detail of the cargo aircraft movement was processed by the writer as followed (50% is based on the observation at existing cargo terminal):

1) Outgoing = 504,382 x 50% = 252,191 airplane
2) Incoming = 582,382 x 50% = 252,191 airplane
3) Import = 107,548 x 50% = 53,774

airplane

4) Export = 107,548 x 50% = 53,774 airplane

The table above shows that cargo traffic must enter the warehouse on average per day. Then there is data which is observed and processed by the author on dwelling time (length of stay) in a warehouse in units of days for each type of cargo categories: outgoing, incoming, green line import, yellow line imports, red line imports, and the import rush.

Sample of the counting of cargo outgoing per day:

There is cargo traffic in as much as 14,819.0 m2 in m2. Here the dwelling time is 0.5 days. The calculations in 1 day just need space = 14,819.0 / 2 = 7,409.5 m2 for 1 tier stacking height. If high stacking shelf life is 2 tier, then the area of warehouse space required = 7,409.5 / 2 = 3,704.7 m2.

The next is an example calculation for import cargo red lines per day:

There is cargo traffic in as much as 1,498.5 m2 in m2. Here the dwelling time is 10 days. Calculations within 1 day need space = 1,498.5 x 10 = 14,984.6 m2 for 1 tier stacking height. If high stacking shelf life is 2 tier, then the area of warehouse space required = 14,984.6 / 2 = 7,492.3 m2.

Calculation of warehouse space needed per day in the table above for all categories of cargo (outgoing, incoming, green line imports, yellow line imports, red line imports, and the import rush) based on the amount in the above table is = 27,196.0 m2.

Counting sample:

Warehouse utilization estimation in 2015:

1) The existing warehouse space is 49,956 m2 (PT. Angkasa Pura II).
2) The estimation of warehouse utilization needed for average 2 tier stack is 37,152 m2
3) The warehouse utilization estimation in 2015 is 37,152/49,956 x 100% = 75% (over utilized)

Warehouse utilization estimation in 2023:

1) The existing warehouse space is 49,956 m2
2) The estimation of warehouse utilization needed for average 2 tier stack is 69,331
3) The warehouse utilization estimation in 2015 is 69,331/49,956 x 100% = 139%, so that the warehouse will be lack of space.

Conclusion

After the analysis and discussion of the calculation of the amount of new air cargo capacity, then a conclusion can be drawn as a basis to begin planning an air cargo terminal construction both domestically and internationally.

The space of Cargo warehouse needed in 2010 – 2023

The needs of warehouse space since 2010 with 49,956 m2 (PT. Angkasa Pura II, 2013) are expected to rise in the year 2023 with an area of 115,552 m2. Warehouse area increased by 132%. The space needs of 115,552 m2 is actually the minimum requirement when compared with the calculations of planning consultant for international and domestic cargo terminal at Soekarno-Hatta airport, so it takes 174,400 m2 terminal space, which can accommodate cargo space activities of international exports and imports as well as domestic outbound and inbound cargo space.

The capacity of the amount of Cargo Volume by 2023

The amount of cargo volume (tons):

Seen from the results of the study, the amount of air cargo is projected to reach approximately 741.394 million tones in 2013 and is forecast or projected to reach 1.5 million tons in 2023. Forecasting results are consistent with the calculation in annual cargo departure (Data PT. Planners Djaja) , only when compared with the projection of the LAPI-ITB and PT. Angkasa Pura II, achieving the amount of 1,500,000 tons of cargo has actually been achieved by four international airports, airport in Asia, namely Tao Yuan in Taiwan and in Europe, namely Heathrow in the UK, U.S. and Chicago O'Hare at Schipol in the Netherlands in 2012 or 11 years before a new projection which Indonesia can achieve.

Requirement number of air cargo since 2010 with a capacity of 586,736,000 tones are expected to rise in 2023 to reach a capacity of 1.617,099 billion tons. Air cargo capacity increased by 176%.

Air Cargo Warehouse Utilization in 2023

The utilization of warehouse in Soekarno-Hatta Airport in 2014 is 64%, which includes in the level of over utilized. Meanwhile the utilization prediction in 2015 will be 75%. The warehouse utilization forecast in 2019 will be 139%. This condition will be over utilized, will be over flow. In 2014 a new warehouse or cargo terminal should be built to expand the space of the warehouse. The forecast of warehouse space is needed with 60% utilization level.

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Appendices

Air Cargo Growth
Cargo Flight Traffic Movement

Table 1 The Movement of The Busiest Cargo Traffic in The World, 2012

Rank	Airport	Total Cargo (Metric Tones)
1	Hong kong International Airport	4,062,261
2	Memphis International Airport, USA	3,916,535
3	Shanghai Pudong International Airport, China	2,939,57
4	Incheon International Airport, Korea Selatan	2,456,724
5	Ted Stevens Anchorage International Airport, Alaska, USA	2,449,551
6	Dubai International Airport, UAE	2,267,365
7	Louisville International Airport, USA	2,187,766
8	Paris-Charles de Gaulle Airport, Paris	2,150,950
9	Frankfurt Airport, Jerman	2,066,173
10	Narita International Airport, Jepang	2,006,173
11	Miami International Airport, USA	1,929,889
12	Singapore Changi Airport	1,898,850
13	Beijing Capital International Airport, China	1,787,027
14	Los Angeles International Airport, USA	1,688,351
15	Taiwan Taoyuan International Airport, Taiwan	1,577,728
16	London Heathrow Airport, Inggris	1,556,203
17	O'Hare International Airport, Chicago, USA	1,512,186
18	Amsterdam Airport Schipol, Belanda	1,511,824
19	Suvarnabhumi Airport, Thailand	1,345,487
20	John F. Kennedy International Airport, New York, USA	1,283,663
	Soekarno-Hatta International Airport, Cengkareng	685,772

Source : World's busiest airports by Cargo Traffic (ACI, 2013)

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The Analysis of Warehouse Cargo Space Needs

Table 2 The Amount of Cargo Traffic

		Cargo traffic	Dwelling time	The amount	The amount ton/	aircraft/	The amount
		ton	Adjusted (day)	aircraft	aircraft	day	ton/day
Outgoing		176,152	0.50	252,191.0	0.698	700.5	489.3
Export		180,800	0.50	53,774.0	3.362	149.4	502.2
Incoming		28,265	0.50	252,191.0	0.112	700.5	78.5
Import		178,121		53,774.0	3.312	149.4	494.8
	Green line	124,684	0.50	10,570.0	11.796	29.4	346.3
	yellow line	35,624	4.00	3,020.0	11.796	8.4	99.0
	red line	17,812	10.00	5,377.4	3.312	14.9	49.5
Import rush		70,987	1.00	6,017.8	11.796	16.7	197.2
		634,324		636,915.2		1,769.2	2,256.8

Source: LAPI-ITB, PT. Angkasa Pura II, PT. Jasa Angkasa Semesta (2012) and processed by the writer (based on least square method and linier regression forecasting calculation)

Table 3 Cargo Dwelling Time at Soekarno Hatta Cargo Terminal Warehouse

	Dwelling time adjusted (day)
Outgoing	0.50
Export	0.50
Incoming	0.50
Import	
- green line	0.50
- yellow line	4.00
- red line	10.00
Import rush	1.00

Source: PT. Jasa Angkasa Semesta (2012) and processed by the writer

Table 4 The Movement of Cargo Aircraft at Soekarno Hatta Airport in 2011

Cargo aircraft movement in 2011						
	domestic	**inter national**	**outgoing**	**incoming**	**import**	**export**
Jan	40,407	8,517				
Feb.	37,610	8,176				
Mar	41,635	9,028				
Apr	40,203	8,807				
May	42,729	9,220				
Jun	42,425	8,968				
Jul	41,628	9,036				
Augs	42,574	9,337				
Sep	42,760	8,846				
Okt	43,459	9,269				
Nov	43,137	9,145				
Des	45,815	9,199				
Total	504,382	107,548	252,191	252,191	53,774	53,774

Source: PT. Angkasa Pura II, LAPI ITB (2012) and processed by the writer

Table 5 The calculation of air cargo average capacity (the amount of ton/ aircraft)

	Cargo traffic	**movement/**	**The amount of**	**The amount of**	**The amount of**	**traffic**
	ton	**The amount of aircraft**	**ton/**	**aircraft/**	**cargo**	**traffic**
	2011	2011	aircraft	day	(ton/day)	m2 /day
Outgoing	176,152	252,191.0	0.698	700.5	489.3	14,819.0
Export	180,800	53,774.0	3.362	149.4	502.2	15,209.9
Incoming	28,265	252,191.0	0.112	700.5	78.5	2,377.8
Import	178,121	53,774.0	3.312	149.4	494.8	14,984.6
-green line	124,684	10,570.0	11.796	29.4	346.3	10,489.2
-yellow line	35,624	3,020.0	11.796	8.4	99.0	2,996.9
-red line	17,812	5,377.4	3.312	14.9	49.5	1,498.5
Import rush	70,987	6,017.8	11.796	16.7	197.2	5,971.8
Total	634,324	636,915.2		1,769.2	2,256.8	68,347.7

Source: LAPI-ITB, PT. Angkasa Pura II, PT. Jasa Angkasa Semesta (2012) and processed by the writer (based on the least square method and linier regression forecasting calculation)

The Calculation of Average of Warehouse Space and Cargo Weight

(length x width x height)/6000 gr = 100 x 100 x 100 cm3/6000 gr		
1 000 000 cm3 = 1 m3 ≈ 6000 gr		
1 ton = 1000 kg = 1 000 000 gr		0.50
1 ton ≈ 1,000,000gr/6000gr ≈	166.6666667	m3
length = 3√ 166.67 m3 =	5.503212081	m
L x l = 5.5032	= 30.28534321	m2, for 1 ton

Table 6 The Calculation of the needs of Air Cargo Warehouse Space based on the height of the rack (tier)

	Traffic		**Needs**	**Needs**	**Needs**
	m2 /day	**dwelling time**	**Space** m2 /day	Space m2 / day	Space m2 /day
	1 tier	adjusted (day)	1 tier	3 tier	2 tier
Outgoing	14,819.0	0.50	7,409.5	2,469.83	3,704.7
Export	15,209.9	0.50	7,605.0	2,534.99	3,802.5
Incoming	2,377.8	0.50	1,188.9	396.30	594.5
Import	14,984.6		0.0	0.00	0.0
-green line	10,489.2	0.50	5,244.6	1,748.20	2,622.3
-yellow line	2,996.9	4.00	11,987.6	3,995.88	5,993.8
-red line	1,498.5	10.00	14,984.6	4,994.85	7,492.3
Import rush	5,971.8	1.00	5,971.8	1,990.61	2,985.9
Total	68,347.7		54,392.0	18,130.7	27,196.0

Source: LAPI-ITB, PT. Angkasa Pura II, PT. Jasa Angkasa Semesta (2012) *and processed by the writer (using microsoft excell file calculation)*

Table 7 The Needs of Air Cargo Warehouse Capacity in Kg.

	Forecasting			
	Dwelling	**Warehouse Capacity in kg**	**Percentage of warehouse space**	**Cargo Traffic Average**
	time (day)	**Comparative (kg)**		**per day (kg)**
Outgoing	0.50	150,259,225	28%	75,129,613
Export	0.50	154,223,691	29%	77,111,846
Incoming	0.50	24,110,305	4%	12,055,153
Import		151,938,459	28%	0
-Green line (70%)	0.50	106,356,921	20%	53,178,461
-Yellow line (20%)	4.00	30,387,692	6%	121,550,767
-Red line (10%)	10.00	15,193,846	3%	151,938,459
Import Rush	1.00	60,552,456	11%	60,552,456
Total		541,084,136	100%	551,516,753
Warehouse space need				
Existing air cargo warehouse space	49,956 m2			

Source: LAPI-ITB, PT. Angkasa Pura II, PT. Jasa Angkasa Semesta, LAPI-ITB (2012) and processed by the writer (using microsoft excell file calculation)

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Table 8 The Forecasting of Air Cargo Capacity 2010 – 2014 Period (in kg, utilization, the needs of warehouse space and warehouse space + loose)

	2010	2011	2012	2013	2014
Outgoing	**162,936,761**	**176,151,963**	**190,439,088**	**205,885,334**	**222,584,008**
Export	167,235,714	180,799,587	195,463,666	211,317,449	228,456,704
Incoming	26,144,518	28,265,004	30,557,488	33,035,963	35,715,400
Import	164,757,674	178,120,563	192,567,355	208,186,222	225,071,513
-Green line(70%)	115,330,372	140,715,245	152,128,210	164,467,115	177,806,495
-Yellow line(20%)	32,951,535	35,624,113	38,513,471	41,637,244	45,014,303
-Red line(10%)	16,475,767	17,812,056	19,256,736	20,818,622	22,507,151
Import Rush	65,661,333	70,986,883	76,744,403	82,969,033	89,698,375
Total Cargo	586,736,000	634,324,000	685,772,000	741,394,000	801,526,000
The needs of warehouse space (m2)		27,196	29,402	31,787	34,365
Utilization if it isn't widen		54%	59%	64%	69%
The needs of warehouse space + loose-ness (m2)		49,956	49,003	52,978	57,274

Source: LAPI-ITB, PT. Angkasa Pura II, PT. Jasa Angkasa Semesta (2012) *and processed by the writer (based on least square method and linier regression forecasting calculation)*

Table 9 The Forecast of Air Cargo Capacity 2015 – 2019 Period (in kg, utilization, the needs of warehouse space The needs of warehouse space +

	2015	2016	2017	2018	2019
Outgoing	**240,637,304**	**260,154,636**	**281,257,637**	**304,066,829**	**328,728,837**
Export	246,986,321	267,018,602	288,678,389	312,089,382	337,402,077
Incoming	38,612,197	41,743,910	45,130,057	48,789,976	52,747,194
Import	243,326,566	263,062,015	284,400,855	307,464,952	332,402,572
-Green line(70%)	192,227,987	207,818,992	224,676,675	242,897,312	262,598,032
-Yellow line(20%)	48,665,313	52,612,403	56,880,171	61,492,990	66,480,514
-Red line(10%)	24,332,657	26,306,202	28,440,085	30,746,495	33,240,257
Import Rush	96,973,612	104,838,835	113,343,062	122,534,861	132,473,320
Total	866,536,000	936,818,000	1,012,810,000	1,094,946,000	1,183,754,000
Warehouse space needed (m2)	37,152	40,165	43,423	46,945	50,752
Utilization if it isn't widen	74%	80%	87%	94%	102%
Warehouse space needed + looseness (m2)	61,920	66,942	72,372	78,241	84,587

Source: LAPI-ITB, PT. Angkasa Pura II, PT. Jasa Angkasa Semesta (2012) and processed by the writer (based on least square method and linier regression forecasting calculation)

Table 10 The Forecast of Air Cargo Capacity 2020 – 2023 Period (in kg, utilization, the needs of warehouse space, the needs of warehouse space + looseness)

	2020	2021	2022	2023
Outgoing	355,391,120	384,216,133	415,378,827	449,068,872
Ekspor	364,767,822	394,353,360	426,338,256	460,917,184
Incomming	57,025,373	61,650,579	66,650,884	72,056,724
Import	359,362,822	388,509,971	420,020,927	454,087,477
-Jalur Hijau(70%)	283,896,629	306,922,877	331,816,532	358,729,107
-Jalur Kuning(20%)	71,872,564	77,701,994	84,004,185	90,817,495
-Jalur Merah(10%)	35,936,282	38,850,997	42,002,093	45,408,748
Import Rush	143,217,863	154,833,958	167,392,106	180,968,743
Jumlah	1,279,765,000	1,383,564,000	1,495,781,000	1,617,099,000
kebutuhan *space* gudang (m2)	54,869	59,319	64,130	69,331
utilisasi	110%	119%	128%	139%
kebutuhan *space* gudang + kelonggaran (m2)	91,448	98,865	106,884	115,552

Source: LAPI-ITB, PT. Angkasa Pura II, PT. Jasa Angkasa Semesta (2012) and processed by the writer (based on least square method and linier regression forecasting calculation)

Warehouse Cargo Utilization in 2023

Table 11 Air Cargo Warehouse Utilization

Utilization	Meaning
0% – <30%	Under Utilized
30% - <50%	Normally Utilized
50% - <60%	Fully Utilized
60% -100%	Over Utilized

Source: processed by the writer based on the training data conducted by UNCTAD (1993) and field experience.

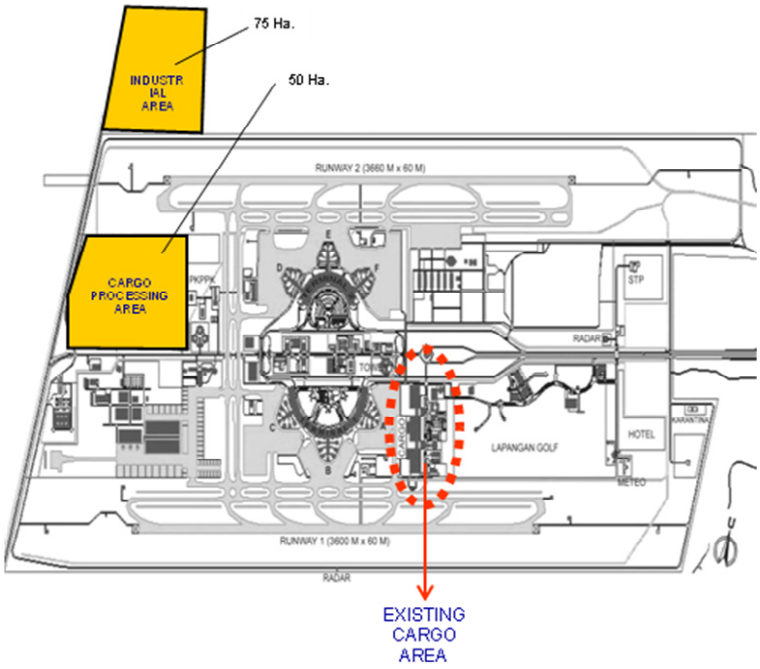

Figure 1 Cargo Terminal Development Plan
Source: PT. Angkasa Pura II (2012)

Figure 2 Location of Existing Cargo Terminal towards Passengers' Terminal
Source: PT. Angkasa Pura II (2012)

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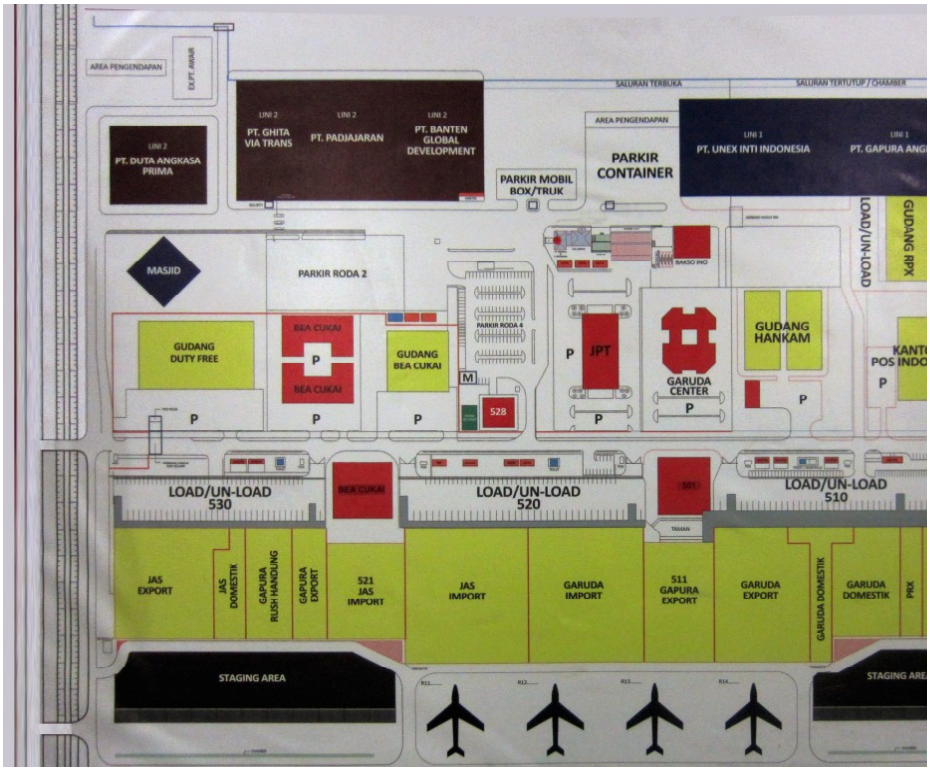

Figure 3 Sitemap of Cargo Location at Terminal IA (existing)
Source: PT. Angkasa Pura II (2012)