ANALYSIS PASSENGER VOLUME AGAINST THE FORECAST OF CAPACITY REQUIREMENTS FOR WAITING ROOM FACILITIES AT HALU OLEO AIRPORT IN 2045

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ABSTRACT
The wide capacity of Halu Oleo Airport waiting room has 4.236 m^2 which is currently only able to accommodate 730 peak-hour passengers. The perfect airport development planning is a need in analyzing the capacity requirements for waiting room facilities with passenger data support for the last 5 years in order to create a sense of comfort and prevent the passenger stacking in 2045. The study aims to forecast the total number of passenger and to calculate the capacity requirements for waiting room facilities at Halu Oleo Airport in 2045. Applying the linear regression method to predict the number of passengers over the following twenty-one years. The number of passengers during peak hours is also calculated using this method to determine the capacity needed for waiting room facilities. The SPSS software furthermore employs a straightforward linear regression technique. To ascertain the impact of an independent variable on the dependent variable, one regression technique that can be utilized as a statistical inference tool is simple linear regression analysis. In 2014-2018, the average increase in passengers was 17.2% so in 2045 the predicted number of passengers reached 6,981,470 pax/year. Following calculating the total, it was determined that 3,491 passengers could be accommodated during peak hours, with 1,781 passengers departing and 1,710 arriving. For the number of passengers, the need to expand and increase the capacity of facilities includes a departure waiting room of 5,878 m^2, 588 seats, public facilities (toilets) of 768 m^2, and security gates (centralized) as many as 9 pairs of WTMD, HHMD, and x-ray units.

Keywords: *Halu Oleo Airport, Capacity Requirements, Waiting Room Facilities, Linear Regression Method, Peak-Hour Passengers.*

1. INTRODUCTION

Halu Oleo Class 1 Airport, (ICAO Code: WAWW; IATA code: KDI) is one of the UPBU (Airport Operating Unit) that operates under the auspices and responsibilities of the Directorate General of Civil Aviation [1]. Previously, the name of this airport was taken from the name of Robert Wolter Monginsidi, an Indonesianational hero who was executed by the Netherlands during the Indonesia National Revolution. Since February 13, 2010, the name of this airport has been changed to honor the king of Konawe, namely King HaluOleo [2]. Currently, people often call it Halu Oleo Kendari Airport which serves flights to and from the cities of Jakarta, Makassar, Surabaya, Wakatobi, andBau-bau. The general data of the airport is listed in table1.

Table 1. General Data Halu Oleo Airport

No.	Items/Facilities	Description/Capacity
1.	Airport Name	Halu Oleo
2.	Address	Jl. Lanud Wolter Monginsidi, Desa Ambaipua, Kec. Ranomeeto, Kab. Konawe Selatan, Sulawesi Tenggara, 93371
3.	Telephone	(+62401) 3121980, 3121833
4.	Email	bandarawmi@yahoo.co.id

No.	Items/Facilities	Description/Capacity
5.	Coordinate Points	4°05′03″S dan 122°24′47″E
6.	ICAO Code	WAWW
8.	Directions and Distance to City	41,49° ± 32km
9.	Operating Hours	23.00-12.00 UTC / 07.00-20.00 LT
10.	Office Hours	00.00-08.30 UTC / 08.00-16.30 LT
11.	Runway	- Designation 08 & 26 - Dimensions 2,500 x 45 m - Surface Asphalt Flexible - Runway strip 2.670 x 300 m
12.	Taxiway A	- Dimensions 355 x 23 m - Surface Asphalt Flexible
13.	Taxiway B	- Dimensions 355 x 23 m - Surface Asphalt Flexible
14.	Taxiway C	- Dimensions: 75 x 23 m - Surface Asphalt Flexible
15.	Main Apron (North)	- Dimensions 373 x 113 m - Surface Rigid Pavement - Capacity: 7 Narrow Body Aircraft (Critical B737-900ER & A320 and 1 Helicopter Stand
16.	AURI Apron (South)	- Dimensions: 177 x 60 m - Surface Asphalt Flexible
17.	Passenger Terminal Building	Luas 16.780 m^2
18.	New Office Building	1.200 m^2
19.	Old Office Building	400 m^2
20.	PKP-PK Building	554 m^2

Halu Oleo Airport is a hub airport because the number of passengers in 2022 is 944,798 people [3][4]. The factors that make the airport's annual passengers continue to increase include the tourism sector, the potential of natural resources such as various products, mining products, and natural gas, as well as the largest airport in Southeast Sulawesi Province.

The passenger terminal building is one of the many land-side facilities that have a large contribution to passenger satisfaction [5]. The passenger terminal can certainly accommodate operational, administrative and commercial activities and can meet the provisions of security and safety of flight operations, in addition to other provisions related to building issues.

The number of Peak Time Passengers (PWS) every year continues to increase rapidly with the prediction that after the end of the Covid-19 pandemic, the average airport in Indonesia will recover to its original level or even higher [6]. The following is a graph of passenger increases, which can be seen in Figure 1.

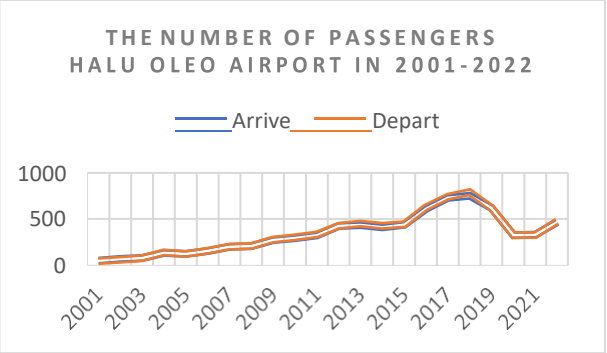

Figure 1. The Number of Passengers Halu Oleo Airport in 2001-2022

The year 2045 is the final year of the estimated capacity needs of terminal facilities as an adjustment to the direction of regional development in Indonesia in the Golden Indonesia Vision 2045 [7]. In order to prevent uncomfortable passenger terminal conditions in 2045, it is necessary to plan capacity development in several parts of the passenger terminal, especially the departure waiting room, which is in line with the Halu Oleo AirportMaster Plan 2024, stated in PM 55 of 2023 concerning Procedures and Procedures for Determining Airport Locations and Helicopter Landing and Take-off Sites Article 41 that the Airport Master Plan is made for a period of 20 years and can be reviewed return every 5 years [8]. As shown in Figure 2, the Halu Oleo Airport passenger terminal requires a gradual expansion.

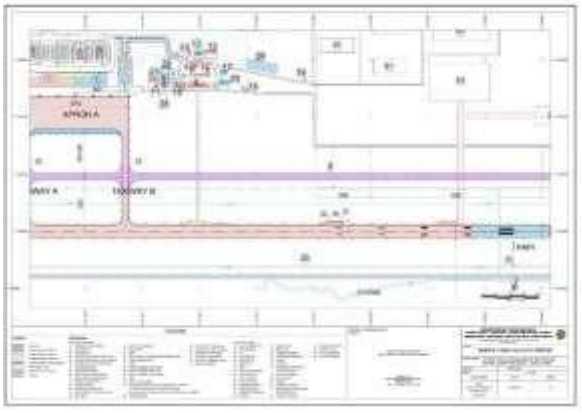

Figure 2. Halu Oleo Airport Master Plan 2024

2. METHODS

2.1. Research Design

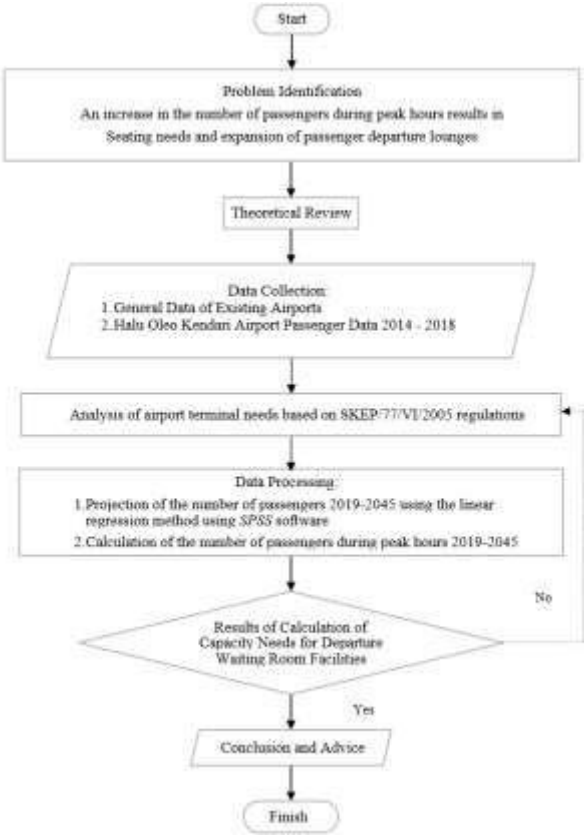

Figure 3. Research Design

2.2. Research Variables

In this study, what is included in the bound variable is the capacity requirement of departure lounge facilities in 2045 while what is included in the independent variable is the number of passengers in 2045 as shown in Figure 4.

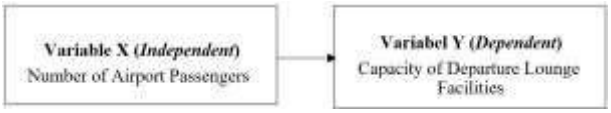

Figure 4. Research Variables

2.3. Data Collection Techniques

Studies on the comfort and service of airport customers are supplemented by secondary data that was gathered for the study. Some of the methods the author utilized to gather the data for this essay include the following:

a. The collection of data on the existing condition of the passenger terminal and the data on the number of passengers in 2014 - 2018 provided by Halu Oleo Class I Airport related to the problems raised. These data will later be needed as material for calculating the design or design of a plan.

b. Calculate passenger estimates through forecasting using SPSS software and Microsoft Excel (manual calculations) for the years 2019 – 2045.

c. Calculating to determine the number of passengers during peak hours in 2019 – 2045 for the forecast of service users increasing from year to year which will have an impact on the existing condition of the Halu Oleo Class I Airport passenger terminal.

d. Analysis of the capacity needs of departure waiting room facilities needed by Halu Oleo Class I Airport in accordance with the forecast of the number of passengers in 2045 using SKEP/77/VI/2005 concerning Technical Requirements for the Operation of Airport Technical Facilities issued by the Ministryof Transportation of the Republic of Indonesia and reference SNI 03-7046-2004 concerning Airport Passenger Terminals.

2.4. Data Analysist Techniques

A quantitative research approach that is systematic, structured, and planned from the outset to the formulation of the research design is the data analysis technique usedto conduct the study. Through the systematic collection of data that may be measured using statistical, mathematical, or computer approaches, this quantitative inquiry investigates a phenomenon. [9].

Researchers use predictive techniques to examine this data. Making predictions about the future by using pertinent historical data and applying a mathematical model to the future is known as forecasting. The data presented in this study is based on the increase in passengers at Halu Oleo Class I Airport, which is indicative of the data collected over the last five years as a tool for using the forecasting approach. Furthermore, for ease of reading, the data offered must be straightforward and uncomplicated..

The model of a simple linear regression equation is as follows:

$$Y = a + bX \quad (1)$$

Remarks:

Y = Response or Consequence Variable (Dependent)

X = Predictor or Causative Factor Variable (Independent)

a = Constant

b = The regression coefficient/response magnitude generated by the Predictor. The values of a and b can be calculated using the following formula :

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

$$b = \frac{n(\sum XY) - (\sum X)(\sum Y)}{n(\sum X^2) - (\sum X)^2} \quad (3)$$

2.5. Research Setting

In writing this final project, the research location was carried out at Halu Oleo Airport on Jalan Bandara Haluoleo, Ambaipua, Ranomeeto District, South Konawe Regency, Southeast Sulawesi 93871. In more detail, the location of Halu Oleo Class I Airport can be seen in the picture below.

Figure 5. Location of Halu Oleo Airport

The location was chosen to be used as the object of research when the author conducted On the Job Training (OJT) so that this opportunity was carried out for data collection, observation, and data processing.

The author uses this research time, which is displayed in the following table, to carry out the research from the planning step to the writing stage:

Table 2. Research Time

No.	Activities	2023	2024						
		12	1	2	3	4	5	6	7
1.	Preparation Stage								
2.	Data Collection Stage								
3.	Proposal Seminar								
4.	Data Processing Stage								
5.	Writing Stage								
6.	Final Project Hearing								

3. RESULT AND DISCUSSION

3.1 Research Result

The author obtained the results of the research and made the section into four stages that can be sorted to achieve the objectives of this study, including the description of the data obtained, the calculation of the forecast of future passengers, the calculation of the number of passengers during peak hours, and the analysis of the capacity needs of the facility.

3.1.1 Description of The Data

Table 3. Capacity of Departure Lounge Facilities

No.	Facilities	Capacity
1.	Departure Lounge Size	4.236 m²
2.	Seating	552 *seats*
3.	Public Facilities (Toilets)	361 m²
4.	*Security* Checks (Centralized)	4 units
5.	Concession Spaces	1.898 m²

Table 4. Passenger Growth 2014-2018

No.	Year	Passenger (Person)		Sum	Growth (%)
		Arrive	Depart		
1.	2014	412.526	428.526	841.052	
2.	2015	440.016	446.800	886.816	5,4%
3.	2016	612.235	629.093	1.241.328	40%
4.	2017	731.647	742.250	1.473.897	18,7%
5.	2018	752.260	792.383	1.544.643	4,8%
Average Improvement					17,2%

3.1.3 Passenger Forecast Calculation

Figure 6. Variables Entered

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Tahun[b]	.	Enter

a. Dependent Variable: Jumlah Total Penumpang

b. All requested variables entered.

Figure 7. Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.970[a]	.942	.922	90714.226

a. Predictors: (Constant), Tahun

Figure 8. ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.978E+11	1	3.978E+11	48.339	.006[b]
	Residual	2.469E+10	3	8229070755		
	Total	4.225E+11	4			

a. Dependent Variable: Jumlah Total Penumpang

b. Predictors: (Constant), Tahun

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-400886214	57831709.86		-6.932	.006
	Tahun	199446.300	28696.357	.970	6.953	.006

a. Dependent Variable: Jumlah Total Penumpang

Figure 9. Coefficients

So that the regression equation can be written: :

$Y = a + bX$

$Y = -400886214 + 199446.300\ X$ (4)

If the above equation is translated, then the consistent value of the variable number of passengers is -400886214. While the regression coefficient of year (X) is 199446,300 which means that for every 1% increase in the value of the year, the value of the number of passengers will increase by 199446,300. Because the regression value obtained is positive, the direction of the influence of variable x on y is also positive.

Analyze the Basis of Decision Making:

1. Measuring the significance value in relation to the 0.05 probability value

Variable X has an effect on variable Y if the significance value is less than 0.05. If the significance value is greater than 0.05, variable X has no influence on variable Y.

The output Anova and output coefficients results have a significance value of 0.006, which indicates that the X variable influences the Y variable, according to the data above..

2. Examining the t-table and the computed t-value

To determine whether the Year variable (X) affects the variable Number of Passengers (Y), compare the estimated T value with the T table. The T value is determined to be 6.953, as can be observed from the Coefficients output data. To ascertain Table T's value, the subsequent information is required:

Number of variables (k) = 2

Number of data used (n) = 5

Significance level = 0.025 (commonly used)

Degree of freedom (d.f) = n - k = 5 - 2 = 3 (5)

It is determined from the reading of the Distribution of t values (table) in the SPSS, the value of free degrees (d.f) with t = 0.025 is 3.182. So it can be concluded that T counts (6.953) > T table (3.182) means that variable X affects variable Y.

Table 5. Prediction of Number of Passengers (SPSS)

Prediction of Number of Passengers			
Year (X)	A	B	Y = a + bX
2019	-400886214	199.446	1.795.866
2020	-400886214	199.446	1.995.312
2021	-400886214	199.446	2.194.758
2022	-400886214	199.446	2.394.205
2023	-400886214	199.446	2.593.651
2024	-400886214	199.446	2.793.097
2025	-400886214	199.446	2.992.544
2026	-400886214	199.446	3.191.990
2027	-400886214	199.446	3.391.436
2028	-400886214	199.446	3.590.882
2029	-400886214	199.446	3.790.329
2030	-400886214	199.446	3.989.775
2031	-400886214	199.446	4.189.221
2032	-400886214	199.446	4.388.668
2033	-400886214	199.446	4.588.114
2034	-400886214	199.446	4.787.560
2035	-400886214	199.446	4.987.007
2036	-400886214	199.446	5.186.453
2037	-400886214	199.446	5.385.899
2038	-400886214	199.446	5.585.345
2039	-400886214	199.446	5.784.792
2040	-400886214	199.446	5.984.238
2041	-400886214	199.446	6.183.684
2042	-400886214	199.446	6.383.131
2043	-400886214	199.446	6.582.577
2044	-400886214	199.446	6.782.023
2045	-400886214	199.446	6.981.470

Table 6. Coefficients of Peak-hour Passengers

Number of Pax/year (Million)	Coefficients (%)	Peak-hour passengers
> 30	0,035%	> 10,500
20 - 29,999	0,040%	8000 – 11999
10 – 19,999	0,045%	4500 – 8999
1 – 9,999	0,050	500 – 4999
0,5 – 0,999	0,080%	400 – 799
0,1 – 0,4999	0,130%	130 – 649
< 0,1	0,2%	< 200

Table 7. Peak-hour Passengers Forecasting

Year	Number of Passengers	Coefficients (%)	Peak-hour Passengers
2019	1.795.866	0,050%	898
2020	1.995.312	0,050%	998
2021	2.194.758	0,050%	1097
2022	2.394.205	0,050%	1197
2023	2.593.651	0,050%	1297
2024	2.793.097	0,050%	1397
2025	2.992.544	0,050%	1496
2026	3.191.990	0,050%	1596
2027	3.391.436	0,050%	1696
2028	3.590.882	0,050%	1795
2029	3.790.329	0,050%	1895
2030	3.989.775	0,050%	1995

Year	Number of Passengers	Coefficients (%)	Peak-hour Passengers
2031	4.189.221	0,050%	2095
2032	4.388.668	0,050%	2194
2033	4.588.114	0,050%	2294
2034	4.787.560	0,050%	2394
2035	4.987.007	0,050%	2494
2036	5.186.453	0,050%	2593
2037	5.385.899	0,050%	2693
2038	5.585.345	0,050%	2793
2039	5.784.792	0,050%	2892
2040	5.984.238	0,050%	2992
2041	6.183.684	0,050%	3092
2042	6.383.131	0,050%	3192
2043	6.582.577	0,050%	3291
2044	6.782.023	0,050%	3391
2045	6.981.470	0,050%	3491

3.1.3 Calculation of Peak-hour Passengers

Table 8. Peak-hour Passengers (Depart & Arrive)

Year	Peak-hour Passengers	Coefficients (%)	Arrive	Depart
2019	898	0,050%	440	458
2020	998	0,050%	489	509
2021	1097	0,050%	537	560
2022	1197	0,050%	587	610
2023	1297	0,050%	635	662
2024	1397	0,050%	684	713
2025	1496	0,050%	733	763
2026	1596	0,050%	782	814
2027	1696	0,050%	831	865
2028	1795	0,050%	880	915
2029	1895	0,050%	929	966
2030	1995	0,050%	977	1018
2031	2095	0,050%	1026	1068
2032	2194	0,050%	1075	1119
2033	2294	0,050%	1124	1170
2034	2394	0,050%	1173	1221
2035	2494	0,050%	1222	1272
2036	2593	0,050%	1271	1322
2037	2693	0,050%	1320	1373
2038	2793	0,050%	1368	1425
2039	2892	0,050%	1417	1475
2040	2992	0,050%	1466	1526
2041	3092	0,050%	1515	1577
2042	3192	0,050%	1564	1628
2043	3291	0,050%	1613	1678
2044	3391	0,050%	1662	1729
2045	3491	0,050%	1710	1781

3.1.4 Analysis of Capacity Needs

Evidently, passenger data—which is necessary to support the departure lounge facilities' capacity needs—is required when analyzing the volume of people arriving and departing. According to Table 8, there will be 1710 passengers arriving during peak hours in 2045, and there will be 1781 passengers departing during peak hours. The number of transfer passengers is then determined using the data. According to SKEP 77/VI/2005, during peak hours, the percentage of passengers undergoing transfers is 20% of total passengers. These are the results that are obtained with this formula.

Number of transfer passengers = Peak time passengers x 20% (6)

Number of transfer passengers = 3491 x 20% = 698 passengers

3.2 Discussions of Research Results

From the results of the analysis of the calculation of the capacity needs of the departure lounge facilities at Halu Oleo Kendari Airport above, expansion and additions are needed to improve the passenger service function optimally and make passengers comfortable in carrying out several activities in the departure lounge. This is intended so that passengers can carry out activities comfortably in the terminal, especially in the departure waiting room of Halu Oleo Kendari Airport.

The results of passenger forecasting calculations in 2019-2045 using two applications, namely IBM SPSS Statistics and Microsoft Excel in the figure below:

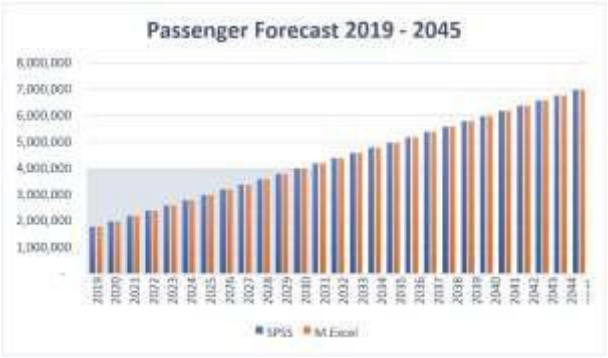

Figure 10. Passenger Forecast 2019-2045

The following is a comparison of existing capacity and analysis of the capacity needs of departure lounge facilities at Halu Oleo Kendari Airport which can be seen in the following table:

Table 9. Comparison of Existing Facility Capacity and 2045

No.	Facilities	Analysis of Facility Capacity Needs	
		(Existing)	(2045)
1.	Departure Lounge Size	4.236 m^2	5.878 m^2
2.	Seating	552 seats	588 *seats*
3.	Public Facilites (Toilet)	361 m^2	768 m^2
4.	*Security* Checks (Centralized)	4 units	9 units

4. CLOSING

4.1 Conclusions

From the results of the analysis and discussion, the following conclusions can be drawn:

a. According to data obtained from 2014 to 2018, Halu Oleo Airport experienced an average increase in the number of passengers by 17.2%. The results of the calculation using the linear regression method show

that the estimated number of passengers in 2045 is 6,981,470 people.

b. The calculation of the projected passenger growth for 2019-2045 shows that Halu Oleo Airport can accommodate passengers during peak hours in 2045 to 3,491 passengers.

c. Based on the analysis of capacity needs in 2045, it is necessary to increase the capacity of departure waiting room facilities to increase capacity according to passenger growth, including the departure waiting room area to an area of 5,878 m2, the number of passenger seats as many as 588 seats, public facilities (toilets) covering an area of 768 m2, security checks (centralized) in the form of x-ray equipment, walk-through metal detectors (WTMD), and hand held metal detectors (HHMD) as many as 9 each. Unit.

4.2 Suggestions

Suggestions that can be given based on the results of the research for development steps are as follows:

a. For Halu Oleo Kendari Airport, the results of the analysis of the calculation of the capacity needs of departure lounge facilities in the next 27 years can be used as a benchmark and input for the airport to prepare for the expansion and addition of facilities to the departure lounge of Halu Oleo Kendari Airport.

b. For readers, it is hoped that they can carry out similar advanced research. Especially calculating thecapacity needs of nursery rooms, concession rooms, and other space facilities which are the limitations of the problem in this study because until this study is completed, there are no fixed regulations related to the formula to take into account the capacity of the room area.

c. For the author, it is hoped that he can conduct research with various other methods to be used as a comparison in the results of this research.

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