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N-219 Aircraft Traffic Distribution Model Based on The Movement Potential of The Coverage Zone at Sultan Syarif Kasim2 II Airport Pekanbaru

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ABSTRACT

Pekanbaru Sultan Syarif Kasim II Airport has a limited domestic flight schedule. Based on data from Angkasa Pura II, Pekanbaru Sultan Syarif Kasim II Airport serves flights to 14 domestic destinations. By using a small aircraft type N-129 with a capacity of 19 passengers, it will be able to produce several new routes that are possible to be formed and the aircraft can enter on short runways. The volume of passenger traffic at Sultan Syarif Kasim II Airport Pekanbaru is projected in 2029 to reach 8749856 passenger departures per year and 7515557 passenger arrivals per year. With the N-219 plan aircraft, one main zone and five coverage zones are obtained to distribute passenger movements. In the Origin-Destination Matrix analysis using the Furness and Fratar method, a more constant calculation is the Fratar Method. The number of aircraft needed per day with the Furness Method is at most 8 N-219 aircraft with the Pekanbaru - Palembang route. The maximum number of aircraft needed per day using the Fratar Method is 7 N-219 aircraft with the Pekanbaru - Palembang route and vice versa.

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1. Background

Air transportation (Khan et al, 2018) is the most recent model of transportation that emerged and developed in the 20th century. Air transportation that can be used for the general public today is an airplane. The first known flight using an airplane in Indonesia was in 1913. In 1931, Indonesia began to make scheduled flights transport passengers (Akbardin et al., 2020a; Akbardin, J., and Permana, A. Y., 2020b)

The Directorate General of Civil Aviation noted that in 2019 flights in Indonesia served more than 22 million domestic passengers (Setiawan et al, 2021), and of course, this will continue to increase every year. Indonesia has 293 airports spread across the island. One of the airports in Indonesia is Sultan Syarif Kasim II Airport which is located in Pekanbaru, Riau.

Sultan Syarif Kasim II Airport (Fazli et al, 2022) is an international airport that has an area of 321.21 ha. Based on data from Angkasa Pura II, Pekanbaru Sultan Syarif Kasim II Airport (Adelia et al, 2020) serves flights to 14 domestic destinations and 4 international destinations. Domestic flights at the airport itself still have limited flight destinations. Currently, the destination of domestic flights from Pekanbaru Sultan Syarif Kasim II Airport is still within the scope of Sumatra Island and some flights to Java Island.

Destinations that are not too far away but require too long a travel time if using land routes can still be streamlined by air routes using small airplanes. Small planes can land on short runways and are more fuel-efficient. This will make the destination easier to reach quickly. By using a small aircraft type N-129 with a capacity of 19 passengers, it will be able to produce several new routes that allow distribution.

Based on the background that has been stated above, the formulation of the problem is made as follows:

(i) How is the growth of air traffic at Sultan Syarif Kasim II Airport Pekanbaru?
(ii) How is the generation and pull of the coverage zone movement at Sultan Syarif Kasim II Airport Pekanbaru?
(iii) How is the distribution of air traffic at Sultan Syarif Kasim II Airport Pekanbaru?
(iv) How much is the need for N-219 aircraft in the coverage zone at Sultan Syarif Kasim II Airport, Pekanbaru?

The research objectives are as follows:

(i) Analyzing the growth of air traffic at Sultan Syarif Kasim II Airport Pekanbaru.
(ii) Analyzing the generation and attraction of coverage zone movements at Sultan Syarif Kasim II Airport Pekanbaru.
(iii) Analyzing the distribution of air traffic at Sultan Syarif Kasim II Airport Pekanbaru.
(iv) Analyzing how many N-219 aircraft are needed in the coverage zone at Sultan Syarif Kasim II Airport, Pekanbaru

Annual air traffic movement data is used to express the generation and attraction of current movements, which will be used to predict future movements for the next 10 years in this study. The variables analyzed were based on socio, economic and demographic variables with dominant factors, as well as growth values using the average method.

2. Literature Review

2.1 Airport

The airport (Rajapaksha, A., and Jayasuriya, D. N., 2020) is an area on land and/or waters with certain boundaries that are used as a place for aircraft to land and take off, boarding passengers, loading and unloading goods, and a place for intra and intermodal transportation, which is equipped with flight safety and security facilities. as well as basic facilities and other supporting facilities. (Muchtar, D. A. A., 2020)

Meanwhile, according to ICAO (International Civil Aviation Organization) in Annex 14 (1999), an airport is a certain area on land or waters (including buildings, installations, and airport operating equipment) which is intended either in whole or in part for arrivals, departures, and departures aircraft movement.

2.2 Air Transportation System

The basic provisions governing air transportation (Spasojevic et al, 2018) modes are the Law of the Republic of Indonesia Number 1 of 2009 concerning Aviation wherein Aviation is defined as a unified system consisting of the use of airspace, aircraft, airports, air transportation, flight navigation, safety and security, the environment. living, as well as supporting facilities and other public facilities. Air mode, which is defined

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as an aircraft, is defined as any machine or device that can fly in the atmosphere because of the lift from the reaction of the air, but not because of the reaction of the air to the earth's surface is used for flight. The characteristics of transportation planning studies are characterized by the presence of multi-modal, multi-disciplinary, multi-sectoral, and multi-problem.

2.3 Movement Generation and Pull

Movement generation is a modeling stage (Rohmat et al, 2021) that estimates the number of movements originating from a zone or land use and the number of movements attracted to a zone or land use. The generation in Figure 1.1 is on the left, while the pull is in Figure 1.1 on the right.

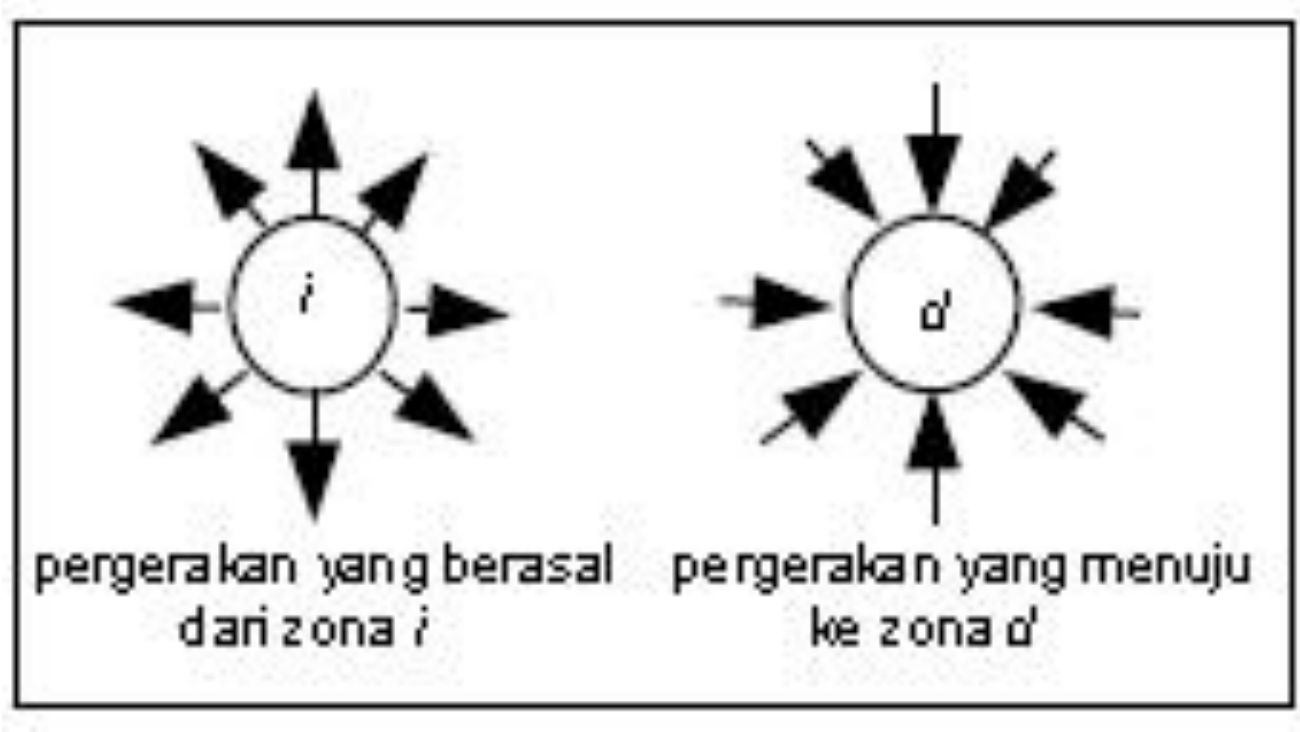

Figure 1. Travel Generation
Source: Tamin (2000)

(i) Population Growth

To find out the number of residents in the coming year, the equation of the average method is used, namely

$$Pn = ((Pn-1) - Po)/Po \ldots\ldots\ldots\ldots\ldots\ldots (1.1)$$

Where:
Pn = future amount
Po = current amount
n = next year
i = growth percentage

(ii) Correlation Coefficient

This statistical test must be carried out to meet the requirements of the mathematical model that the independent variables must not be correlated with each other, while between the dependent and independent variables there must be a strong correlation (both positive and negative).

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$$r = \frac{N\sum_{i=1}^{N}(X_iY_i) - \sum_{i=1}^{N}(X_i) * \sum_{i=1}^{N}(Y_i)}{\sqrt{(\sum_{i=1}^{N}(X_i)^2 - (\sum_{i=1}^{N}(X_i)^2) * (\sum_{i=1}^{N}(Y_i)^2)(\sum_{i=1}^{N}(Y_i)^2)}} \text{ ……}\textbf{(1.2)}$$

Where:

r = Correlation coefficient
Xi = independent variable
Y = dependent variable
N = Sample size

The value of r = 1 means that the correlation between the variables y and x is positive (an increase in the value of x will result in the value of y). The following are guidelines for providing interpretation and analysis of the correlation coefficient according to Sugiyono:

0.00 - 0.199 = very low
0.20 - 0.3999 = low
0.40 - 0.5999 = moderate
0.60 - 0.799 = strong
0.80 - 1,000 = very strong

(iii) Multiple Linear Regression

This concept is a further development of the description above, especially in cases that have more independent variables. Equation (1.6) shows the general form of the method of multiple linear regression analysis

$$Y = A + B1X1 + B2X2 + \ldots + BZXZ \quad \ldots\ldots\ldots\ldots(1.3)$$

Y = Change is not free
X1…Xz = free change
A = Regression constant
B1….Bz = Regression coefficient

After getting the equation, continue to calculate the coefficient of determination (R2)

$$R^2_{y.12} = \frac{b_1 \sum X_{1i}Y_i + b_1 \sum X_{2i}Y_i}{\sum Y_i^2} \quad \ldots\ldots\ldots\ldots\ldots(1.4)$$

R2 is getting closer to 1, playing well X1, X2, X3,…Xn explains Y or the more "fit" the regression of X against Y is.

2.4 Origin-Destination Matrix

Movement Matrix or Origin–Destination Matrix is a two-dimensional matrix that contains information about the magnitude of movement between locations (zones) within a certain area. The row represents the origin zone and the column represents the destination zone so that the matrix cells represent the magnitude of the flow from the origin zone to the destination zone. In this case, the notation Tid states the amount of movement flow (vehicles, passengers, or goods) moving from the origin zone i to the destination zone d during a certain time interval.

Fratar (1954) developed a method that tried to overcome the shortcomings of the uniform method and the average method. The basic assumptions of this method are:

(i) The distribution of movements from the origin zone in the future is proportional to the distribution of movements in the present;
(ii) The distribution of future movements is modified by the value of the growth rate of the target zone of the movement.

The number of moves from zone i increases according to the growth rate Ei, this movement must also be propagated to zone d in proportion to Ed divided by the global growth rate (E).

Mathematically, the Furness and frater method can be expressed as:

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$$T_{id} = t_{id} \, x \, E_i \, x \, E_d \, x \, \frac{L_i + L_d}{2} \quad \text{.....(1.5)}$$

Tid = future movement from origin zone i to destination zone d
sleep = current movement from origin zone i to destination zone d
E = global growth rate

It should be noted at that time that research development was directed not only at efforts to increase accuracy but also at efforts to produce an efficient calculation process (the number of repetitions as small as possible and the calculation process as simple as possible).

2.5 Planned Plane Specifications

The N-219 aircraft (Nugroho et al, 2022) is an aircraft made by PT. Dirgantara Indonesia and the National Institute of Aeronautics and Space (LAPAN) can be used for various purposes and are easily adapted to flight missions, including passenger aircraft, cargo (cargo) aircraft, and patrol aircraft. (Sutjahjono et al, 2017)

N-219 (Prijambodo et al, 2021) will be the most suitable mode of transportation for opening up, increasing people's economic growth, and maintaining defense and security in remote areas. Apart from passenger transport configurations, the N-219 (Fitwantyo, A. T., and Najib, M., 2020) can also be equipped with suitable equipment to meet various mission requirements such as Troop Transport, Medical Evacuation, Cargo Transport, Surveillance and Search and Rescue (SAR) configurations.

Figure 2. N-219. Aircraft
Source: https://www.indonesian-aerospace.com/

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3. Research Methodology

3.1 Research Sites

The research location is at Sultan Syarif Kasim II Airport Pekanbaru, Riau.

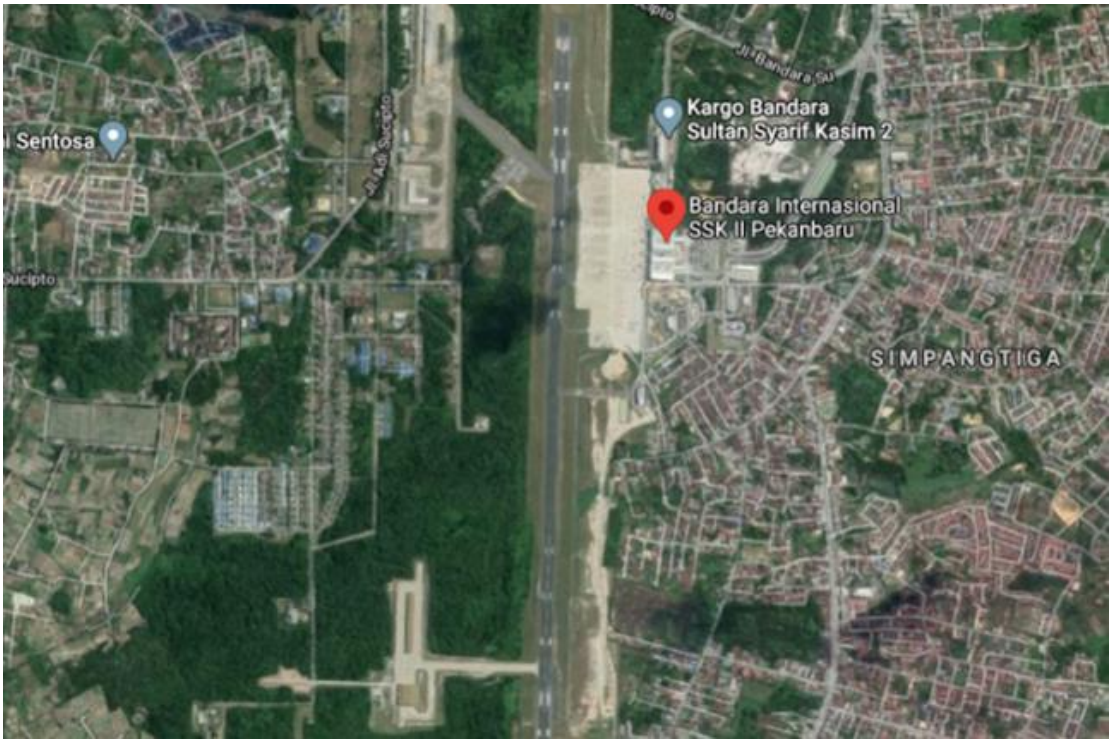

Figure 3. Research Locations
source: Google Maps

3.2 Data Collection

The data needed to support the research process are secondary data. The data obtained are as follows:

Table 1. Secondary Data Collection

No.	Data Type	Data source
1	Number of Passengers at Sultan Syarif Kasim II Airport Pekanbaru	Directorate General of Air Transportation
2	Gross Regional Domestic Product (GRDP)	BPS Pekanbaru
3	Total population	BPS Pekanbaru
4	Tourist Visit	BPS Pekanbaru
5	Export Value	BPS Pekanbaru

4. Research Results and Discussion

4.1 Generating and Attractive Movement Calculation Model

Analysis to find out which variables will be used in the next modeling, a variable settlement process is carried out by conducting a correlation test between all the variables reviewed, and the dominant correlation value is taken. The value of the determinant cannot be negative and the closer to 1, the more influential the equation (Rustiandi et al, 2021).

(i) Correlation Analysis between Variables

The variables that have a significant relationship or large influence on the movement of passengers (Y) are obtained, namely:

(i) Passenger Departure
X1 is 0.81, X2 is 0.79, X3 is 0.99, X4 is 0.81.

(ii) Passenger Arrival
X1 is 0.93, X2 is 0.86, X3 is 0.94, X4 is 0.94.

(ii) Movement Generation and Pull Analysis

Multiple linear regression model is used and obtains equations from various directions under review, as well as with the results of the determinants of these equations

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Table 2. Generating and Attractive

	b0	b1	b2	b3	b4	R2
Bangkitan	19413.486	-1.956	0.193	-1.570	15.470	0.991
Tarikan	17641.798	-1.796	0.183	29.673	1.058	0.995

(i) Movement Awakening

Dd = 19413,486 – 1,956 X1 + 0.193 X2 – 1,570 X3 + 15,470 X4

Table 3. Generating Equations

Year	Passenger Departures Per Year	
	Before	After
2015	1377503	1156370
2016	1407880	1501592
2017	1974284	1699824
2018	1814265	2088220
2019	1899363	2027289

Source: Analysis Results

(ii) Movement Drag

Dd = 17641.798 – 1.796 X1 + 0.183 X2 + 29,673 X3 + 1,058 X4

Table 4. Equation of Tensile

Year	Passenger Arrivals Per Year	
	Before	After
2015	1389749	1127205
2016	1410644	1426405
2017	1729969	1713817
2018	1761503	2023695
2019	1903399	1904141

Source: Analysis Results

Table 5. Number of Passenger Movements

Year	Number of Passenger Departures	Number of Passenger Arrivals
	Y1	Y2
2015	1156370	1127205
2016	1501592	1426405
2017	1699824	1713817
2018	2088220	2023695
2019	2027289	1904141
2020	2346520	2184366
2021	2716019	2505830
2022	3143701	2874602
2023	3638729	3297645
2024	4211708	3782946
2025	4874912	4339667
2026	5642549	4978317
2027	6531063	5710955
2028	7559488	6551413
2029	8749856	7515557

Source: Analysis Results

4.2 Movement Distribution Planning

The generation and attraction are distributed to 6 zones that have been planned with their respective proportions.

Table 6. Origin-Destination Matrix

MAT	Pekanbaru	Bengkulu	Palembang	Batam	Padang	Pangkal Pinang
Pekanbaru	0	9501	32996	20667	12516	3827
Bengkulu	8160	0	13814	8652	5240	1602
Palembang	28342	11865	0	30050	18197	5564
Batam	17752	7432	25811	0	11398	3485
Padang	10750	4500	15630	11398	0	2110

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Pangkal Pinang	3287	1376	4779	3485	2110	0

The method used is the Fratar method, which requires fewer repetitions than other methods, but the calculations are quite complicated, the following is the fratar method formula:

$$T_{id} = t_{id} \, x \, E_i \, x \, E_d \, x \, \frac{L_i + L_d}{2} \quad \text{.....(1.6)}$$

Where :
Ei = Generating Growth Factor
Ed = Attractive Growth Factor

Table 7. Origin Destination Matrix

MAT	Pekanbaru	Bengkulu	Palembang	Batam	Kab. Padang	Pangkal Pinang	oi	Oi	Ei	Li
Pekanbaru	0	9501	32996	20667	12516	3827	79507	102200	1.285	0.707
Bengkulu	8160	0	13814	8652	5240	1602	37468	42786	1.142	0.706
Palembang	28342	11865	0	30050	18197	5564	94018	148597	1.581	0.771
Batam	17752	7432	25811	0	11398	3485	65878	93075	1.413	0.727
Kab. Padang	10750	4500	15630	11398	0	2110	44389	56363	1.270	0.714
Pangkal Pinang	3287	1376	4779	3485	2110	0	15037	17233	1.146	0.718
dd	68291	34674	93031	74253	49461	16588	336297			
Dd	87783	36750	127636	79945	48412	14802		460255		
Ed	1.285	1.060	1.372	1.077	0.979	0.892			1.37	
Ld	0.853	0.823	0.891	0.814	0.814	0.827				

Source: Analysis Results

The next iteration is done by calculating Tid using the formula (3.2). Example of calculating the direction of west to east as follows:

$$T_{id} = t_{id} \, x \, E_i \, x \, E_d \, x \, \frac{L_i + L_d}{2} = (8160 \, x \, 1.142 \, x \, 1.285 \, \frac{(0.706 + 0.853)}{2}) = 9337$$

Table 8. Matrix of Origin Destination 1st Iteration

Iterasi 1	Pekanbaru	Bengkulu	Palembang	Batam	Kab. Padang	Pangkal Pinang	oi	Oi	Ei	Li
Pekanbaru	0	9902	46492	21749	11974	3365	93483	102200	1.093	0.921
Bengkulu	9337	0	17286	8087	4452	1251	40414	42786	1.059	0.918
Palembang	46747	15844	0	40527	22312	6269	131698	148597	1.128	0.943
Batam	25469	8628	40486	0	12148	3414	90144	93075	1.033	0.911
Kab. Padang	13742	4654	21849	11903	0	1842	53990	56363	1.044	0.917
Pangkal Pinang	3802	1288	6044	3293	1813	0	16239	17233	1.061	0.921
dd	99096	40315	132158	85558	52700	16141	425968			
Dd	87783	36750	127636	79945	48412	14802		460255		
Ed	0.886	0.912	0.966	0.934	0.919	0.917			1.08	
Ld	1.059	1.072	1.098	1.073	1.071	1.072				

Source: Analysis Results

Then the matrix continues to be iterated according to the formula (1.6) so that the value converges or if the value of Oi = oi, Dd = dd or the value of Ei/d is convergent and constant (a matrix that is iterated sequentially gets the same result). MAT results in the 7th iteration because the values are repeated the same.

Table 9. Matrix of Origin and Destination of Final Iteration Results

Iterasi 7	Pekanbaru	Bengkulu	Palembang	Batam	Kab. Padang	Pangkal Pinang	oi	Oi	Ei	Li
Pekanbaru	0	9510	49509	21120	11544	3256	94939	102200	1.076	0.930
Bengkulu	8537	0	18094	7718	4219	1190	39758	42786	1.076	0.930
Palembang	47840	16740	0	43293	23665	6672	138210	148597	1.075	0.929
Batam	22740	7954	41386	0	11242	3170	86491	93075	1.076	0.930
Kab. Padang	12431	4347	22627	11240	0	1733	52378	56363	1.076	0.930
Pangkal Pinang	3506	1226	6381	3170	1733	0	16016	17233	1.076	0.930
dd	95054	39776	137998	86541	52403	16021	427792			
Dd	87783	36750	127636	79945	48412	14802		460255		

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Ed	0.924	0.924	0.925	0.924	0.924	0.924	1.08
Ld	1.082	1.082	1.083	1.082	1.082	1.082	

Source: Analysis Results

Here are the graphic results:

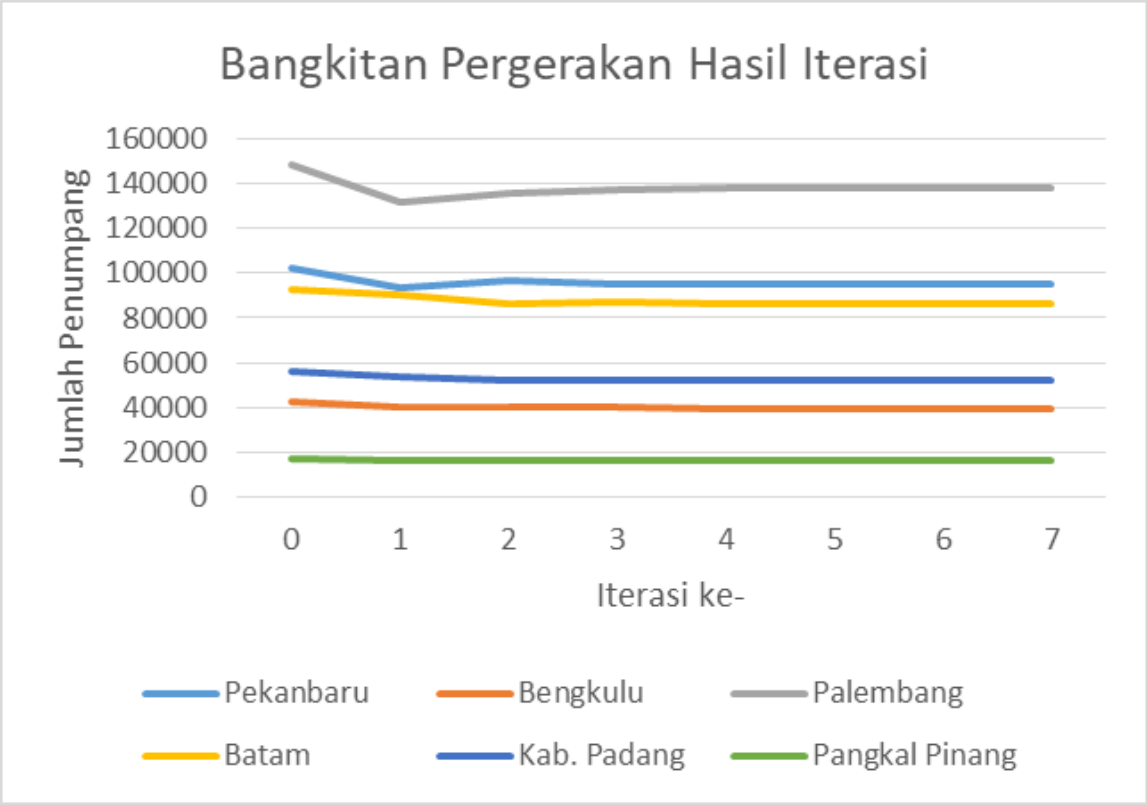

Figure 4. Generation of Iteration Results
Source: Data Analysis Results

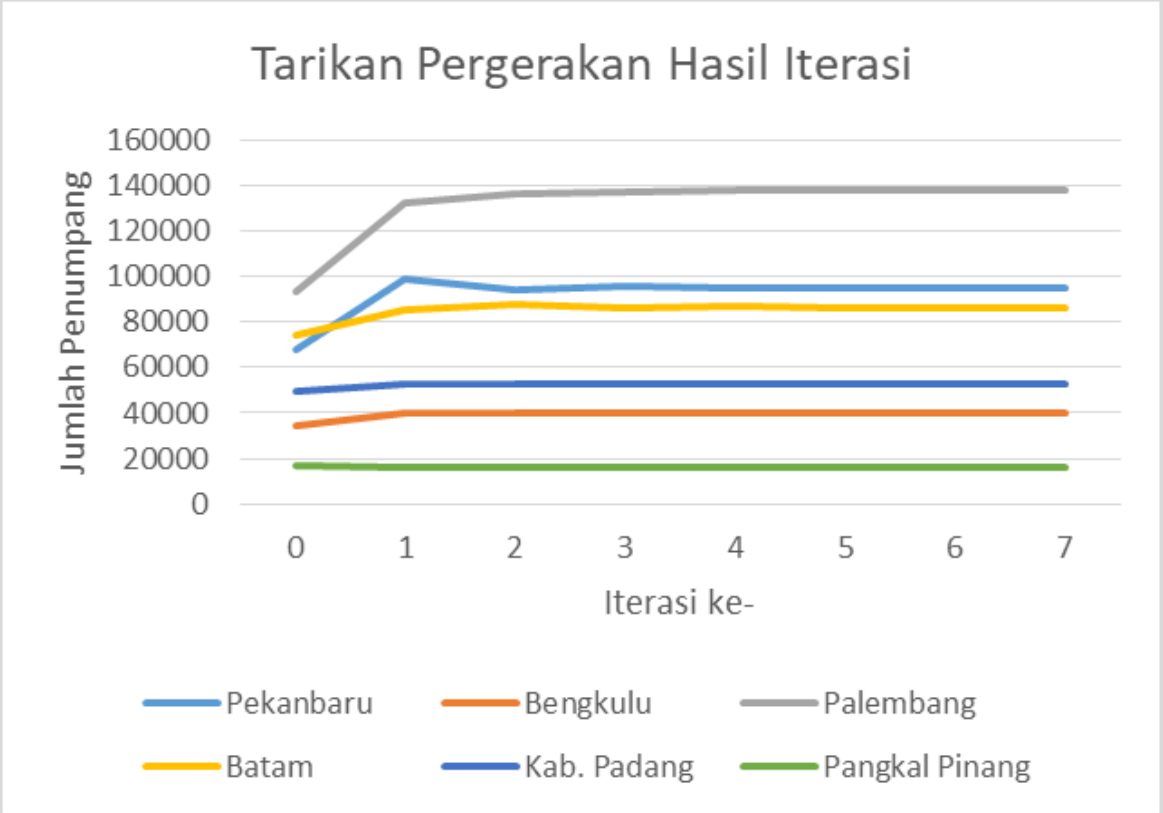

Figure 5. Pull Iteration Results
Source: Data Analysis Results

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(i) Simulation using Soft Computing

The Origin-Destination matrix is then simulated using the application. The purpose of using this app is only to show convergence and simulate movement estimation. Here are the simulation results:

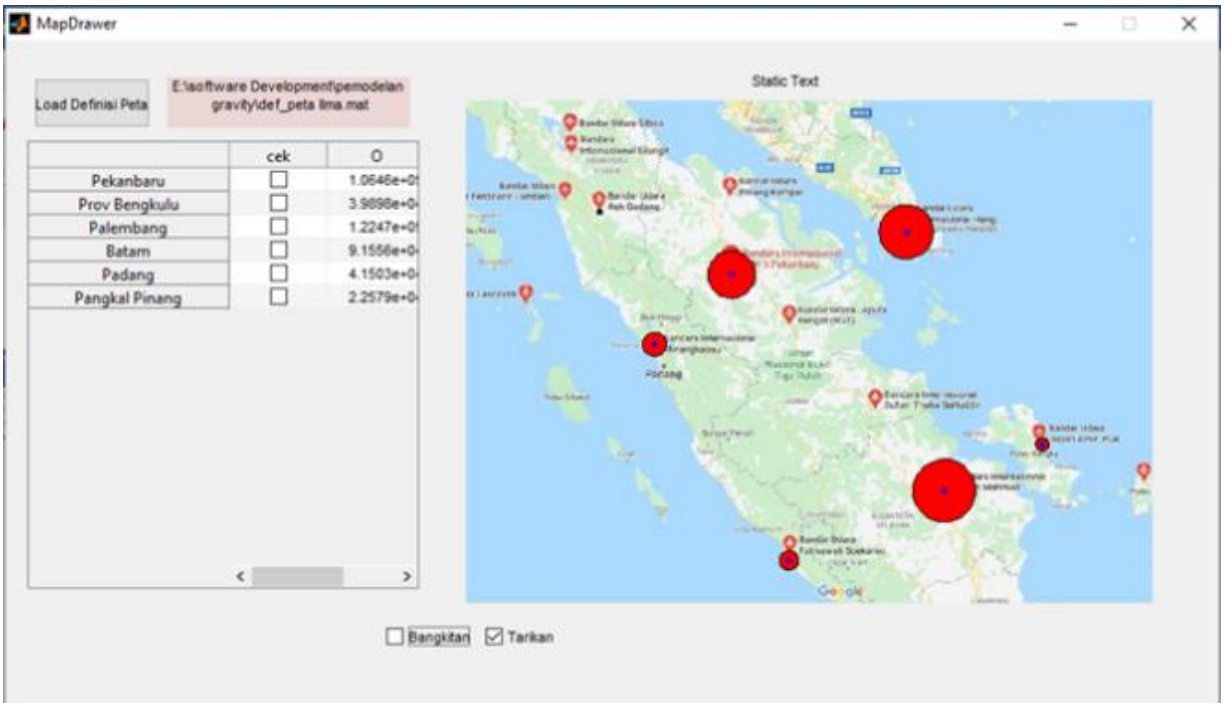

Figure 6. Computing the Amount of Pull
source: Results of data analysis

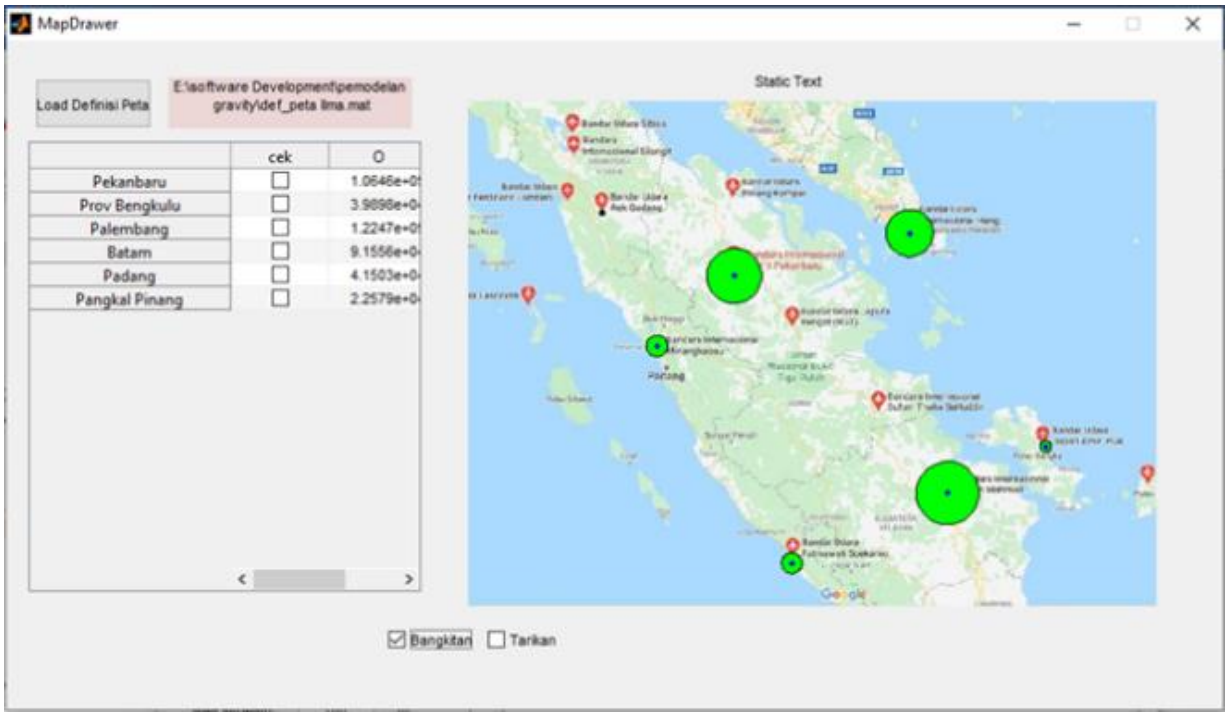

Figure 7. Computing Generating Quantities
source: Results of data analysis

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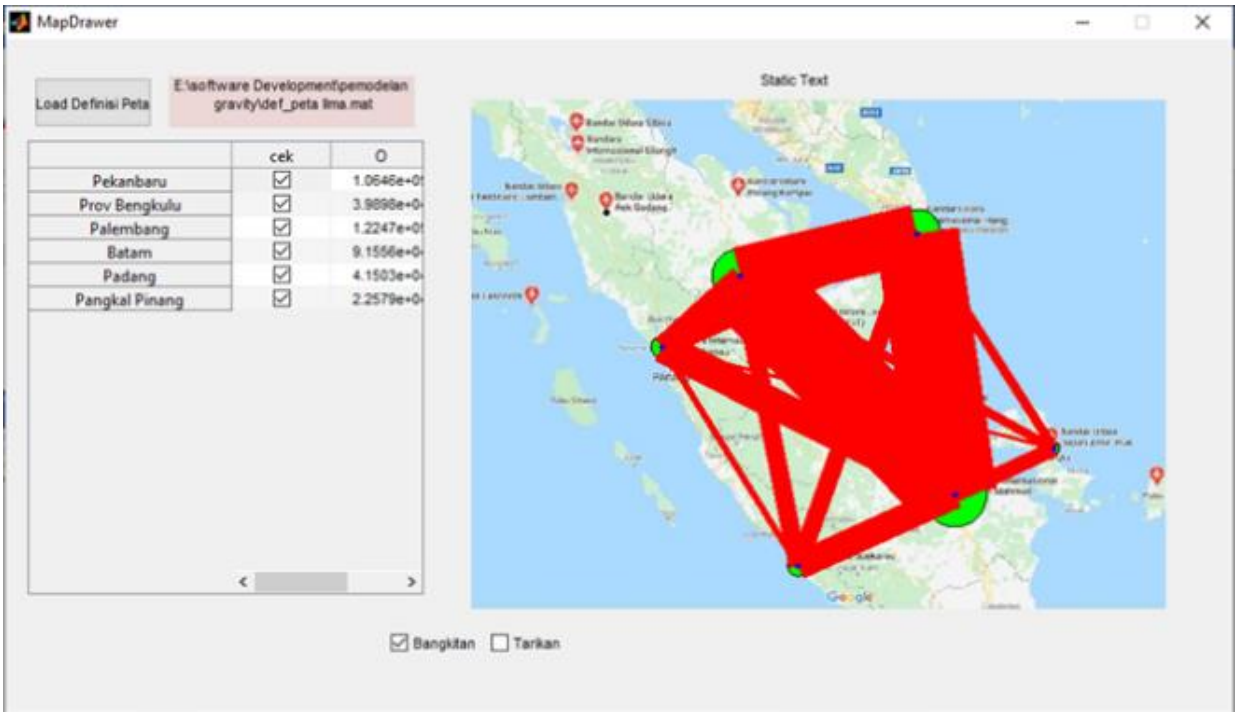

Figure 8. Generating Distribution Computing
Source: Data Analysis Results

4.3 Transportation Mode Planning

The mode of transportation planning in this analysis is to use the N-219 type aircraft with a capacity of 19 passengers with a maximum distance of 889 km.

Table 10. Distance Matrix

	Pekanbaru	Kab. Padang	Batam	Palembang	Bengkulu	Pangkal Pinang
Kota Pekanbaru	0	190.22	306.17	519.53	488.64	600.04
Kab. Padang Pariaman	190.22	0	477.98	545.42	411.87	668.41
Kota Batam	306.17	477.98	0	445.18	590.84	432.36
Kota Palembang	519.53	545.42	445.18	0	282.14	173.96
Kota Bengkulu	488.64	411.87	590.84	282.14	0	461.86
Kota Pangkal Pinang	600.04	668.41	432.36	173.96	461.86	0

Source: Google Maps

- Example of calculating aircraft needs per year

Number of planes $= \frac{Total\ Passenger}{19}$

$= \frac{9179}{19}$

= 483 aircraft per year

Table 11. Number of Aircraft N-219

	Passengers Per Year	Number of N-219 Aircraft (Capacity 19 Passengers)			
		Per year	Per month	Per week	Per day
Pekanbaru – Bengkulu	9510	501	42	10	1
Pekanbaru – Palembang	49509	2606	217	54	7
Pekanbaru – Batam	21120	1112	93	23	3
Pekanbaru - Kab. Field	11544	608	51	13	2
Pekanbaru - Pangkal Pinang	3256	171	14	4	0
Bengkulu – Pekanbaru	8537	449	37	9	1
Bengkulu – Palembang	18094	952	79	20	3
Bengkulu – Batam	7718	406	34	8	1
Bengkulu - Kab. Field	4219	222	19	5	1
Bengkulu - Pangkal Pinang	1190	63	5	1	0
Palembang – Pekanbaru	47840	2518	210	52	7
Palembang – Bengkulu	16740	881	73	18	2
Palembang – Batam	43293	2279	190	47	6

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Palembang - Kab. Field	23665	1246	104	26	3
	Passengers Per Year	Number of N-219 Aircraft (Capacity 19 Passengers)			
		Per year	Per month	Per week	Per day
Palembang - Pangkal Pinang	6672	351	29	7	1
Batam – Pekanbaru	22740	1197	100	25	3
Batam – Bengkulu	7954	419	35	9	1
Batam – Palembang	41386	2178	182	45	6
Batam - Kab. Field	11242	592	49	12	2
Batam - Pangkal Pinang	3170	167	14	3	0
Regency. Padang – Pekanbaru	12431	654	55	14	2
Regency. Padang – Bengkulu	4347	229	19	5	1
Regency. Padang – Palembang	22627	1191	99	25	3
Regency. Padang – Batam	11240	592	49	12	2
Regency. Padang - Pangkal Pinang	1733	91	8	2	0
Pangkal Pinang – Pekanbaru	3506	185	15	4	1
Pangkal Pinang – Bengkulu	1226	65	5	1	0
Pangkal Pinang – Palembang	6381	336	28	7	1
Pangkal Pinang – Batam	3170	167	14	3	0
Pangkal Pinang - Kab. Field	1733	91	8	2	0

Source: Analysis Results

From the results of the analysis above, we can find out how many aircraft are needed per year, per month, per week, and day in each zone that has been determined. The highest number of flights are departures from Pekanbaru to Palembang. The factor that causes this route to have the highest number of flights is because the population of Palembang is the largest.

5. Conclusions And Recommendations

Conclusion

The conclusion of the research on the Air Traffic Distribution Model Based on the Potential Movement of the Coverage Zone at Sultan Syarif Kasim II Airport Pekanbaru is as follows:

(i) The generated generation and pull are: (a) The average growth of passenger departures that occurred in 2015-2019 was 15.75%, and in 2029 it reached 8749856 passenger movements per year. And (b) The average growth in passenger arrivals that occurred in 2015-2019 was 14.72%, and in 2029 it reached 7515557 passenger movements per year.

(ii) Generations obtained in 2029 are 102200 passengers per year in Pekanbaru City, 42786 passengers per year in Bengkulu City, 148597 passengers per year in Palembang City, 93075 passengers per year in Batam City, 56363 passengers per year in Kab. Padang Pariaman, 17233 passengers per year in Pangkal Pinang City. The towing obtained in 2029 is 87783 passengers per year in Pekanbaru City, 36750 passengers per year in Bengkulu City, 127636 passengers per year in Palembang City, 79945 passengers per year in Batam City, 48412 passengers per year in Kab. Padang Pariaman, 14802 passengers per year in Pangkal Pinang City.

(iii) The number of generation and withdrawal that has been divided according to the proportion will be formed into a matrix of origin and destination as shown in table (4.11). The first method used is the Origin-Destination Matrix Furness Method, and iterated 16 times with the following results: (a) Awakening: Sultan Syarif Kasim II Airport is from 79507 passengers per year to 102200 passengers per year, Minangkabau Airport is from 37468 passengers per year to 42786 passengers per year, Hang Nadim Airport is from 94018 passengers per year to 148597 passengers per year, Sultan Mahmud Badaruddin II Airport totals from 65878 passengers per year to 93075 passengers per year, Fatmawati Soekarno Airport amounts from 44389 passengers per year to 56363 passengers per year, and Depati Amir Airport amounts from 15037 passengers per year to 17233 passengers per year. And (b) Pull: Sultan Syarif Kasim II Airport is from 68291 passengers per year to 102202 passengers per year, Minangkabau Airport is from 34674 passengers per year to 42785 passengers per year, Hang Nadim Airport is from 93031 passengers per year to 148596 passengers per year, Sultan Mahmud Badaruddin II Airport totals from 74253 passengers per year to 93075 passengers per year, Fatmawati Soekarno Airport amounts from 49461

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passengers per year to 56363 passengers per year, and Depati Amir Airport amounts from 16588 passengers per year to 17233 passengers per year.

The number of generation and withdrawal that has been divided according to the proportion will be formed into a matrix of origin and destination as shown in table (4.11). The second method used is the Fratar Origin-Destination Matrix, and iterates up to 7 times with the following results: (a) Awakening: Sultan Syarif Kasim II Airport is from 79507 passengers per year to 94939 passengers per year, Minangkabau Airport is from 37468 passengers per year to 39758 passengers per year, Hang Nadim Airport is from 94018 passengers per year to 138210 passengers per year, Sultan Mahmud Badaruddin II Airport totals from 65878 passengers per year to 86491 passengers per year, Fatmawati Soekarno Airport amounts from 44389 passengers per year to 52378 passengers per year, and Depati Amir Airport amounts from 15037 passengers per year to 16016 passengers per year. And (b) Pull: Sultan Syarif Kasim II Airport is from 68291 passengers per year to 95054 passengers per year, Minangkabau Airport is from 34674 passengers per year to 39776 passengers per year, Hang Nadim Airport is from 93031 passengers per year to 137998 passengers per year, Sultan Mahmud Badaruddin II Airport totals from 74253 passengers per year to 86541 passengers per year, Fatmawati Soekarno Airport amounts from 49461 passengers per year to 52403 passengers per year, and Depati Amir Airport amounts from 16588 passengers per year to 16021 passengers per year.

(iv) The mode of transportation used is the N-219 aircraft. The number of the most operating N-219 aircraft is 8 aircraft per day, namely on the Pekanbaru - Palembang route; followed by the route Palembang – Pekanbaru and Palembang – Batam with 7 planes per day; the route of Batam – Palembang as many as 6 aircraft per day; route Palembang – Kab. Padang, Batam – Pekanbaru, and Kab. Padang – Palembang as many as 4 planes per day; Pekanbaru – Batam, Bengkulu – Palembang, and Palembang – Bengkulu routes are 3 planes per day; Pekanbaru – Kab. Padang, Batam – Kab. Padang, Kab. Padang Pekanbaru, and Kab. Padang – Batam as many as 2 planes; Pekanbaru – Bengkulu, Pekanbaru – Pangkal Pinang, Bengkulu – Pekanbaru, Bengkulu – Batam, Bengkulu – Kab. Padang, Palembang – Pangkal Pinang, Batam – Bengkulu, Kab. Padang – Bengkulu, Pangkal Pinang – Pekanbaru, and Pangkal Pinang – Palembang as much as 1 plane per day; and there are some routes that don't operate every day but there are still 1 to 4 planes per week that operate.

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