

Operational Performance of Railways on Jakarta Kota - Bekasi Route

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ABSTRACT

Bekasi is one of the cities supporting the regional economy of the State Capital City, namely Jakarta. As Jakarta's economic support city, the commuter movement pattern of the residents of Bekasi is very high every day, especially during peak hours. The operation of the Jakarta - Bekasi KRL Commuterline is one of the efforts to serve transportation needs for those who commute daily to work. This study aims to measure the operational performance of railroad transportation based on variable Quality (X1) consisting of On Time Performance and Safety Index, Quantity (X2) including Passenger Occupancy, and Commerce (X3) covering the difference in income with BIOP-KA.

Operational performance analysis is carried out on the achievement of On Time Performance, Safety Index, Occupancy of train circuit usage, and Benefit / Cost Ratio comparison of the operation of Jakarta - Bekasi KRL Commuterline. From the results of the performance analysis, then a SWOT analysis is carried out to formulate recommendations in order to improve the operational performance of railroad transportation.

Based on the results of the analysis, it can be concluded that the operational performance of railroad transportation in Jakarta - Bekasi crossing from the On Time Performance aspect still exceeds the delay tolerance, while from the Safety Index aspect there is a significant increase. From the aspect of occupancy, the high frequency of train travel is not comparable with the fulfillment of the average occupancy, this also has an impact on the inefficient operation of rail transport because there is a negative B / C ratio.

Keywords: On Time Performance, Delay Propagation, Safety Index, Occupancy, Operational Cost, and Operational Performance of Railways.

1. INTRODUCTION

Bekasi is one of the cities supporting the regional economy of the State Capital City, namely Jakarta. As Jakarta's economic support city, the commuter movement pattern of the residents of Bekasi is very high every day, especially during peak hours. The operation of the Jakarta

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2. THEORY FOUNDATION

2.1 Operational Performance

Performance is a translation of performance that is often interpreted by scholars as appearance, performance, or achievement (Yeremias T. Keban, 2004: 191). According to Sylvain Duranton, Agnès Audier, Joël Hazan, Mads Peter Langhorn, and Vincent Gauche in the European Railway Performance Index / RPI (2017), the performance of the railroad system is measured based on 3 dimensions, which includes:

a. Intensity of Use

To what extent railroad transportation is used. In this case it measures the effectiveness of railroad transportation (occupancy).

b. Quality of Service

It is about trains that tends to be on time and fast. In this case it measures the On Time Performance of train travel.

c. Safety

It refers to what is the safety performance of the train travel operation (Safety Index).

According to Julison Arifin in Technical Analysis of Railroad Transportation Planning (2015), the output of the train business process that can be used as a benchmark in the assessment of operational performance of rail transport consists of:

a. Transport Unit

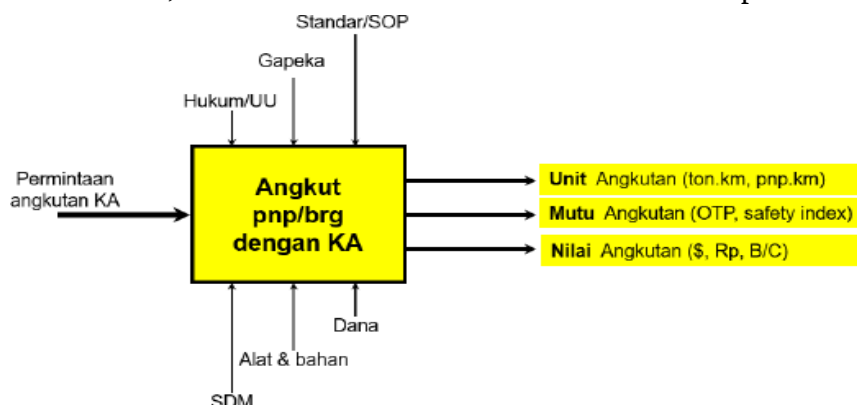
Measured by *km.pnp*, *km.ton*, or *km.ka*, which is a measure of the effectiveness of the use of transport capacity (occupancy).

b. Transport Quality

Measured by On Time Performance (OTP) and Safety Index (Safety Index).

c. Transport Value

Measured by the currency (Rupiah) or benefit (B / C Ratio) income, which is the commercial value of railroad operation.



2.2 On Time Performance (OTP)

Timely, in the sense that transportation services are carried out with the right schedule, people can plan trips with certainty both on departure and arrival.. These conditions can be measured, among others, by the number of timely departures and arrivals to the number of transportation facilities departing and arriving (National Transportation System: 2005).

On Time Performance comes from a foreign language. "On Time" which means on time and "Performance" means display, the appearance referred to in this case is a display of performance or service in the railroad field. On Time Performance (OTP) is the timeliness of service, which means that the train departs and arrives according to a predetermined schedule.

2.3 Safety Index (SI)

Safety is a classic slogan that is very well known in the world of transportation services business, including trains. This implicitly shows every transportation user. Railroad transportation services make safety a major component in the railroad business and provide more opportunities for profit. Part of the profits is reallocated to increase safety so that business continuity can be achieved. To realize the railroad business by promoting safety as a "brand", it is necessary to implement safety management.

According to Yi Jia Yang and Xiaoning Zhu in "A Railway Transportation Safety Assessment Method Based on the Safe State Index" (2015), the Safety Index is an index of the level of train travel safety, which is a benchmark for assessing the level of train travel safety. The Safety Index calculates the number of train accidents in 1 million kilometers of train travel. The Safety Index reflects the level of safety risk on the train journey.

2.4 Transport Productivity

Productivity is a term in production activities as a comparison between outputs and inputs. According to Herjanto, productivity is a measurement that states how well resources are regulated and utilized to achieve optimal results. Productivity can be used as a benchmark for the success of an industry in producing goods or services. So the higher the comparison, the higher the product produced. Productivity measurement can vary depending on aspects of output or input used as basic aggregates, for example:

labor productivity index, direct cost productivity, total cost productivity, energy productivity, raw material productivity, and others.

According to Julison Arifin in the Aspects of Railway Transportation Productivity (2015), the productivity of railway-undertakings is measured from the output of the KA business process with a performance indicator / $PI = \text{performance indicators}$, which includes: primary performance indicators / Key Performance Indicators KPI (*pnp. km, ton.km, and wpg* / circulation time of carriages or trains), other PIs concerning productivity (varying according to management requirements, including those relating to cross rail / railway lines, locomotives, carriages, trains, and labor).

2.5 Commerce

Commercial value is something that allows a person to profit from the product of creation (Roger Hamilton: 2003). When referring to the large dictionary of Indonesian, commercial understanding is anything that is related to trade, has a high commercial value, so that sometimes it sacrifices social and cultural values. Or, commercial can also mean anything that has economic value or has more value so that it can be taken as an advantage.

According to Julison Arifin in Commercial Aspects of Railway Transportation (2015), the transport value (commercial aspect) of rail transportation is determined by an agreement with service users or subsidy given by the government. The determinants of the commercial aspects of railway transportation include: freight rates, passenger ticket prices, non-transport revenues, externalities, B / C ratio.

3. RESEARCH METHODS

This research method is used to find out the main elements that are studied in the operational performance assessment of railroad transport in Jakarta - Bekasi crossing, that this research has a problem which is unclear and complex so that this study uses descriptive research methods with a qualitative approach in order to answer the problem in detail includes: research place and time, population determination and sampling techniques, data sources and methods of data collection, data analysis methods, data validation, and conclusions of research results.

In this research ,a qualitative approach does not use the term

population, but it is called a "social situation" or a social situation consisting of three elements, namely: place, actor, and activity which interact synergistically (spradley). Researchers made in-depth observations about the operation of railroad transportation in Jakarta - Bekasi crossing.

To achieve the goal of reasoning, the data analysis method that will be used is analytical method by calculating the operational performance of railroad transportation with a mathematical formula. The next step is to make the order of the factors that have the most influence / impact on the operational performance of railroad transportation, to further search for strategies that can be taken to achieve the optimal operational performance of railroad transportation with SWOT analysis.

3.1 Data analysis

Analytical methods are carried out by calculating the operational performance of railroad transportation based on quality aspects (On Time Performance and Safety Index), transport productivity aspects (seating per kilometer or capacities of transport per kilometer), and commercial aspects (calculation of operating costs and transport tariff revenues).

a. On Time Performance

Measurement of on time train travel performance is done by

No	Formula	Arti	Satuan
1.	Tepat (0-5 menit)	KA berangkat tepat	KA
2.	Lambat A (5-15 menit)	KA berangkat lambat A	KA
3.	Lambat B (>15 menit)	KA berangkat lambat B	KA

classifying / classifying the time of train trip delay to then be scaled against the delay of train travel.

b. Safety Index

The Safety Index is to measure the level of safety in the implementation of railroad transportation. The size of the safety index is to calculate the number of train accident events that occur in every 1 million kilometers of operational travel by train.

3.2 SWOT Analysis

SWOT analysis is a form of situation analysis by identifying various factors systematically against the strengths and weaknesses of an organization and opportunities and threats (threats) from the environment to formulate an organizational strategy. Strengths are organizational activities that run well or resources that can be controlled. Weaknesses are organizational activities that are not running well or resources needed by the organization but not owned by the organization. Opportunities are

		Helpful <i>to achieving the objective</i>	Harmful <i>to achieving the objective</i>
Internal Origin <i>(attributes of the system)</i>	Internal Origin	Strengths ▪	Weaknesses ▪
	External Origin <i>(attributes of the environment)</i>	Opportunities ▪	Threats ▪

positive external environmental factors. Threats are negative external environmental factors. The SWOT matrix is a tool for developing organizational strategic factors that can clearly illustrate how external opportunities and threats faced by an organization can be adjusted to their strengths and weaknesses.

ANALYSIS AND DISCUSSION

4.1 Findings of Research Results

a. Quality of Transport

1) On Time Performace

The average delay in the departure of Commuterline KRL trips in Jakarta of Bekasi is more than 15% included in

No.	Lintas Pelayanan	Jumlah KA	Kelambatan Pemberangkatan KA		
			Tepat (0-5 menit)	Lambat A (5-15 menit)	Lambat B (>15 menit)
1.	Jakarta Kota – Manggarai	170	6	24	140
2.	Manggarai – Jakarta Kota	170	4	22	144
3.	Manggarai – Bekasi	77	5	7	65
4.	Bekasi – Manggarai	76	12	13	51
5.	Jakarta Kota – Kp. Bandan	21	21	-	-
6.	Kp. Bandan – Jakarta Kota	21	21	-	-
7.	Kp. Bandan – Jatinegara	48	11	8	29
8.	Jatinegara – Kp. Bandan	49	5	6	38
	Total KA	632	85	80	467

Sumber: Hasil Analisis Data Kelambatan

the slow category A (5-15 minutes) and more than 80% included in the slow category B (> 15 minutes). The following table describes the result of the delays analysis data.

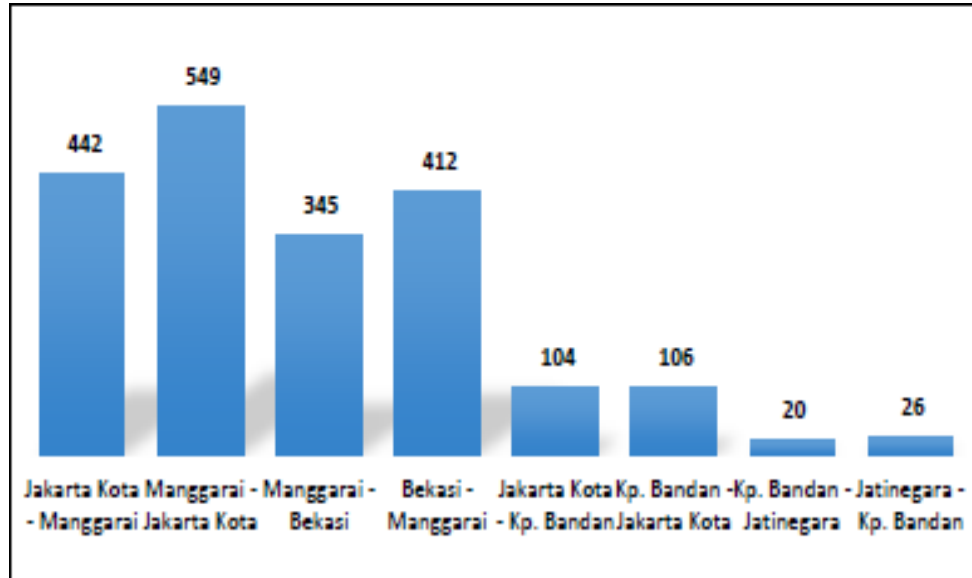
As for the average delay in the arrival of Commuterline KRL in Jakarta - Bekasi crossings, more than 12% are included in the slow category A and more than 85% are in the slow category B as described in the following table:

No.	Lintas Pelayanan	Jumlah KA	Kelambatan Kedatangan KA		
			Tepat (0-5 menit)	Lambat A (5-15 menit)	Lambat B (>15 menit)
1.	Jakarta Kota – Manggarai	170	2	22	146
2.	Manggarai – Jakarta Kota	170	2	18	150
3.	Manggarai – Bekasi	77	3	8	66
4.	Bekasi – Manggarai	76	3	9	64
5.	Jakarta Kota – Kp. Bandan	21	21	-	-
6.	Kp. Bandan – Jakarta Kota	21	21	-	-
7.	Kp. Bandan – Jatinegara	48	2	15	31
8.	Jatinegara – Kp. Bandan	49	1	7	41
	Total KA	632	55	79	498

Sumber: Hasil Analisis Data Kelambatan

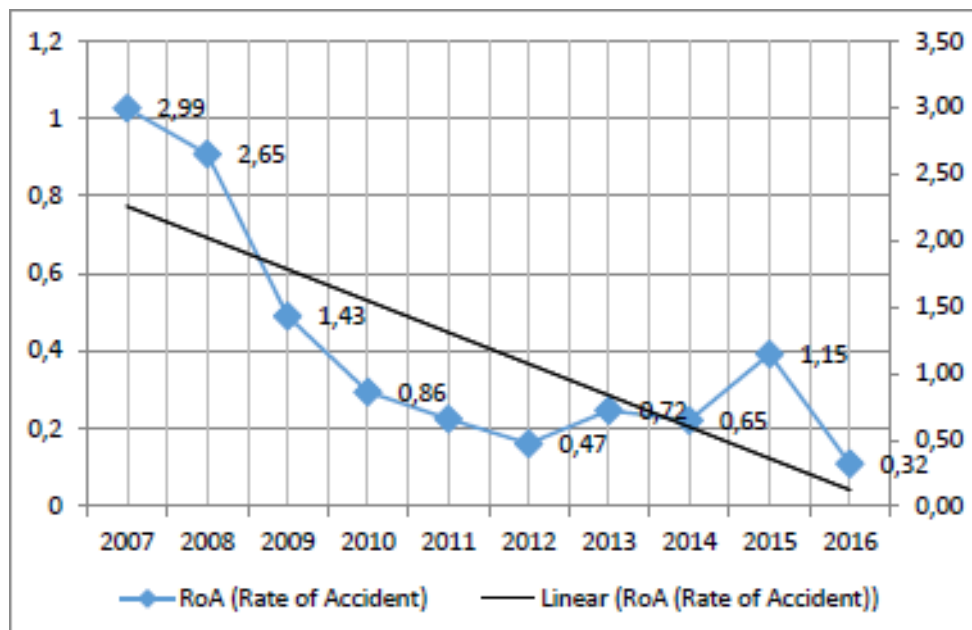
2) Cancellation due to delay

KRL travel delays have resulted in the occurrence of Delay Propagation, namely KRL trip cancellations in adjacent operational hours, due to KRL travel delays that exceed headway.



3) Safety Index

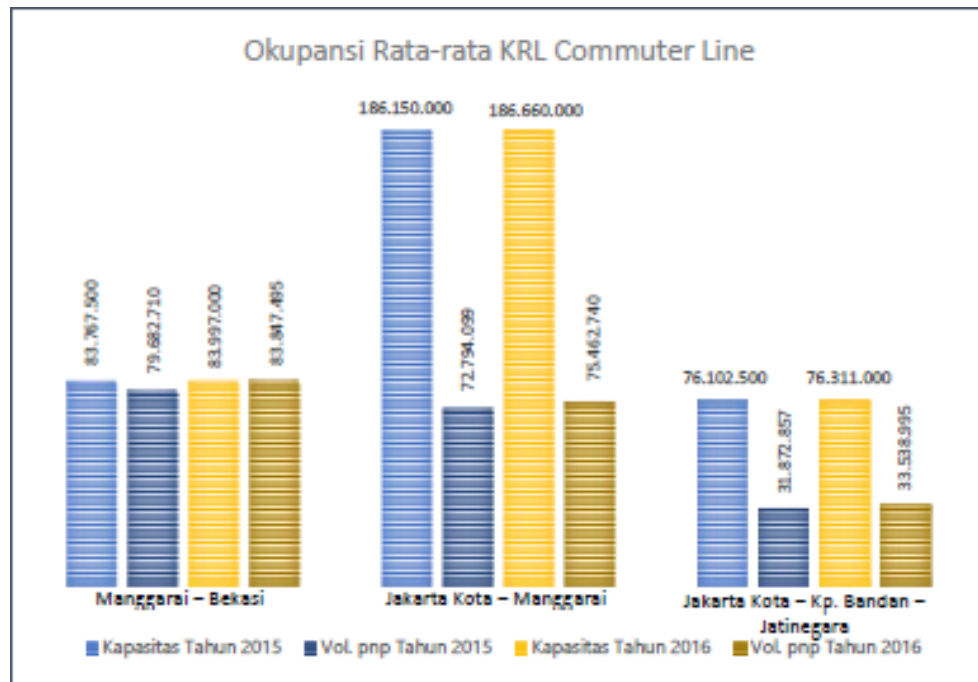
Based on the RoA graph of the railway above, it can be seen that there is an increase in the operational performance of trains from the aspect of safety. This is indicated by the RoA figure which has decreased continuously from year to year. Railway accidents are



dominated by external factors, where throughout 2015, of the 73 numbers of accidents that occurred 53 were caused by external factors. Whereas in 2016, out of 25 train accidents, and 12 events were caused by external factors.

b. Quantity of Transport

Based on the average occupancy chart in the study area above, it can be seen that the current frequency of Commuter Line KRL trips is not effective in Jakarta Kota - Manggarai and



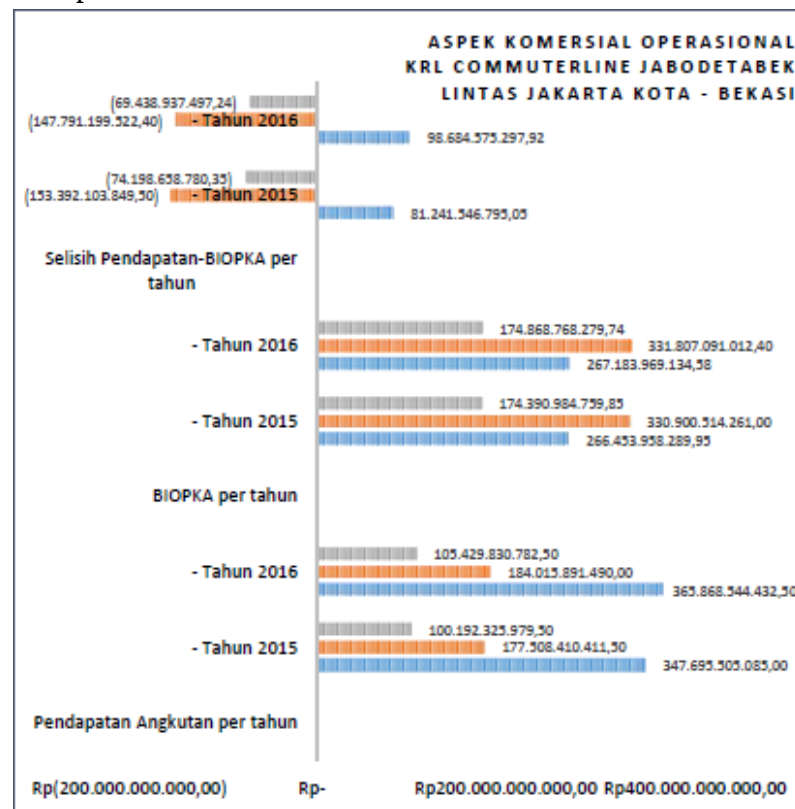
Jakarta City cross roads - Kp. Bandan - Jatinegara, where the average occupancy of Commuter Line KRL trips is only around 40%. The high frequency of Commuter Line KRL operating in Jakarta Kota - Manggarai crossing was not followed by a significant number of passenger volumes. So the number of Commuter Line KRL operating in Jakarta Kota - Manggarai crossing is not effective.

c. Commerce

Based on the results of the analysis of the commercial aspects of KRL Commuter Line transport across Jakarta Kota - Bekasi, it can be seen that there is a negative income difference between BIOP-KA, namely in the crossing of Jakarta Kota - Manggarai and Jakarta Kota - Kp. Bandan - Jatinegara. This is due to low occupancy and the uneven distribution of passengers on the crossing of the service. From

the comparison of income and BIOP-KA, it can be seen that from the commercial aspect, the operation of railroad transportation in Jakarta Kota - Bekasi crossing is inefficient, where in 2015 there was a difference in income with BIOP-KA of minus Rp. 74,198 Billion for Jakarta City crossing Kp. Bandan - Jatinegara and minus Rp. 153,392 billion for Jakarta Kota - Manggarai crossing, and in 2016 there was a difference in income with BIOP-KA of minus Rp. 69,438 billion for Jakarta City crossing - Kp. Bandan - Jatinegara and minus Rp. 147,791 Billion for Jakarta Kota - Manggarai crossing, but the calculation is only limited to the study area, namely Jakarta Kota - Manggarai, Jakarta Kota - Kp. Bandan - Jatinegara, and Manggarai

- Bekasi. The inefficient operation of railroad transport in the Jakarta-Bekasi city traffic will certainly cause problems whether the railroad operating income can cover the operational costs of railroad transportation.

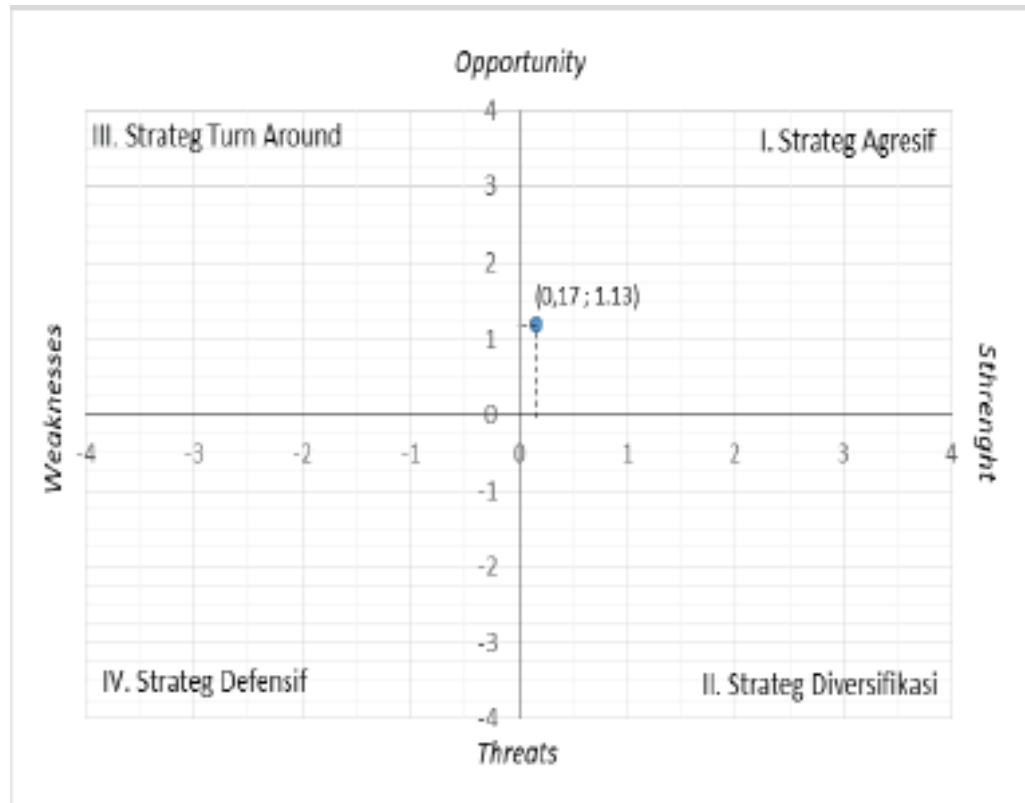


4.2 SWOT Analysis

Based on the IFAS EFAS matrix above, these strategic factors will be processed into the SWOT matrix to formulate a strategy that can be used by relevant parties, both operators and railway

Internal Factor Eksternal Factor	Kekuatan/Strength (S)	Kelemahan/Weaknesses (W)
	a. Perjalanan KA terjadwal	a. Intervensi Pola Operasi
	b. Stasiun mudah dijangkau	b. Kelambatan KA
	c. Waktu tempuh singkat	c. Antrian KA
	d. Frekuensi KA/Kapasitas	d. Gangguan Operasional
	e. <i>Safety and Secure</i>	e. Biaya Operasional tinggi
	f. Tarif terjangkau	f. <i>Delay Propagation</i>
Peluang/ Opportunity (O)	SO Strategi	WO Strategi
a. Pertumbuhan penumpang	a. Optimalkan rangkaian KA intercity melayani penumpang BKS-GMR dan BKS-PSE; b. Optimalisasi pemanfaatan usaha non angkutan.	a. Penggabungan operasi;
b. <i>Government Policy</i>		b. <i>Quick Flow of Traffic</i> ;
c. Rencana pemisahan pola operasi		c. Pengaturan ulang pola operasi KA;
d. <i>Usaha Non-Farebox</i>		d. Peningkatan kehandalan sarana dan prasarana.
e. Pertumbuhan TOD		
Ancaman/ Threats (T)	ST Strategi	WT Strategi
a. Persaingan antar moda	a. Peningkatan kualitas pelayanan KA;	a. Pengaturan ulang pola operasi KA;
b. Penyebaran penumpang tidak merata	b. Optimalisasi rangkaian KA;	b. Sterilisasi jalur KA;
c. Perlintasan sebidang	c. Sterilisasi jalur KA.	c. Peningkatan kualitas pelayanan KA.
d. Bencana alam/ banjir		
e. Vandaliisme		

regulators, in order to optimize the operational performance of railroad transportation in Jakarta City - Bekasi crossings. From the results of IFAS EFAS analysis, the calculation results are plotted into the Cartesian diagram to get the strategy to be chosen. From the results of the SWOT analysis diagram, the calculation results are in quadrant I, so the strategy that can be applied to improve the operational performance of railroad transportation in Jakarta City - Bekasi is an aggressive strategy (Growth Oriented Strategy), where this condition is the most favorable condition.



4. CONCLUSION OF RECOMMENDATIONS AND POLICY IMPLICATIONS

5.1 Conclusion

- a. The operational performance of railroad transportation is based on the aspect of On Time Performance, as follows:
 - 1) The average delay of daily commuter line KRL trips across Jakarta Kota - Bekasi crossings is both high departures and arrivals, especially in Jakarta Kota - Manggarai crossing where the average delay in KRL trips reaches more than 95% (delays above 5 minutes). The high KRL trip on Jakarta Kota crossing - Manggarai resulted in a very high cross-load on the cross, where the average headway on peak hour was only 3 minutes.
 - 2) The existence of Delay Propagation or cancellation of KRL trips due to delays. During 2016 there were 2,004 KRL trips (± 5 KRL trips / day) in Jakarta City - Bekasi crossing services canceled due to delays.
- b. Railroad travel safety index shows an increase from year to year. In 2016 the Railway Safety Index decreased, with the Rate of Accident falling by 0.32. While the number of accidents that occurred in 2016 was 25 train accidents. Of the

25 train accidents that occurred, 12 train accidents were caused by external factors, such as accidents at a level crossing.

- c. The average occupancy in the study area shows that the current frequency of Commuter Line KRL trips is not effective in Jakarta Kota - Manggarai and Jakarta City crossing - Kp. Bandan - Jatinegara, where the average occupancy of Commuter Line KRL trips is only around 40%.
- d. There is a difference income with BIOP-KA of minus Rp. 74,198 Billion for Jakarta City crossing - Kp. Bandan - Jatinegara and minus Rp. 153,392 billion for Jakarta Kota crossing - Manggarai in 2015, and in 2016 there was a difference income with BIOP- KA of minus Rp. 69,438 billion for Jakarta City crossing - Kp. Bandan - Jatinegara and minus Rp. 147,791 Billion for Jakarta Kota - Manggarai crossing.

5.2 Recommendation

- a. Increase On Time Performance, with:
 - 1) KRL frequency reduction across Jakarta Kota - Manggarai and Jakarta Kota - Kp. Bandan - Jatinegara, by combining several nearby KRL trips;
 - 2) Rearranging the train operating pattern, where the current operating patterns accumulate on the Manggarai-Jakarta Kota crossing, so the headway on the cross is very short. Rearranging the operating pattern is expected to improve headway, especially in the Manggarai-Jakarta Kota crossing, so that the number of train delays can be minimized.
- b. Railway sterilization to prevent acts of vandalism, as well as minimize events (train accidents) that can interfere with the operation of railroad travel.
- c. The merger of adjacent railroad operations, to optimize the use of railroad transport capacity (occupancy).
- d. The Quick Flow of Traffic service, among others, is by optimizing the intercity train circuit to serve passengers in the Bekasi-Gambir and Bekasi-Pasar Senen relations, and by opening the KRL Commuter Line Express service.

5.3 Policy Implications

- a. Railway Operational Performance can be analyzed based on

On Time Performance, Safety Index, transport effectiveness (occupancy), and transport efficiency.

- b. In this study, the authors only took the object of research on the operational performance of railroad transport in Jakarta City - Bekasi crossings, but the results of this study can be used as a reference in measuring the operational performance of railroad transport in other services.
- c. In terms of measuring the operational performance of railroad transportation, especially in Jakarta City - Bekasi crossings, more in-depth research on Quality, Quantity, and Commerce variables can be conducted as described in this study.

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