The Effect Of Implementing Expected Approach Time On Smooth Air Traffic Flow At International Airports Syamsudin Noor Banjarmasin, Indonesia

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ABSTRACT
This study aims to analyze the effect of implementing the Expected Approach Time (EAT) on air traffic smoothness at Syamsudin Noor International Airport, Banjarmasin. The research background stems from the continued occurrence of airborne holding and go-arounds due to the suboptimal application of EAT by ATC. This study employs a quantitative approach with an associative design. Data were collected through observation, questionnaires, documentation, and literature review, involving 20 ATC personnel from the APP unit of Perum LPPNPI Banjarmasin Branch as respondents. The research instrument was tested for validity and reliability, and the data were analyzed using simple linear regression, t-test, Pearson correlation, and coefficient of determination (R^2). The results show a significant t-value (Sig. < 0.05), with a correlation coefficient of 0.878, indicating a very strong relationship between EAT implementation and air traffic smoothness. The coefficient of determination (R^2) value of 0.771 indicates that 77.1% of the variation in air traffic smoothness can be explained by EAT implementation, while the remaining 22.9% is influenced by other factors outside this study. It is concluded that optimal EAT implementation has a positive and significant effect on improving air traffic smoothness, reducing holding time, minimizing delays, and enhancing the efficiency of airspace utilization.

Keywords: *Expected Approach Time, air traffic smoothness, Air Traffic Controller, Syamsudin Noor International Airport.*

1. INTRODUCTION

Syamsudin Noor International Airport, located in Syamsudin Noor Village, Landasan Ulin District, Banjarbaru City, South Kalimantan, Indonesia, has experienced a significant increase in aircraft movements in line with economic growth and community mobility The airport's domestic terminal, capable of accommodating 7,000,000 passengers, was established in 2011 (Amin et al., 2023). The increasing volume of aircraft movements demands a more orderly, safe, and efficient air traffic management, especially during the approach and landing phases. One important procedure used to manage air traffic density during these phases is the Expected Approach Time (EAT), which is the estimated time for an aircraft to begin its approach after experiencing a delay, as regulated by the International Civil Aviation Organization (ICAO). The main purpose of implementing EAT is to avoid aircraft being delayed and to arrange the landing sequence within a safe distance and timeframe. This procedure also assists Air Traffic Controllers (ATC) in arranging the landing sequence efficiently, especially in heavy traffic conditions or during operational disruptions (Budi, 2015).

In the On-The Job Training (OJT) activity in the field of Approach Control Procedural (APP) of Perum LPPNPI Banjarmasin Branch, the author obtained holding data during On-The Job Training (OJT) for five months. One example observed occurred on February 1, 2025, where there were eight aircraft traffic with close Estimate Time of Arrival (ETA), namely with a time difference of 1 to 2 minutes, and all of them used Runway 10 (Setiawan, 2004). The estimated approach time for aircraft using Runway 10 is around 10 minutes, taking into account that after landing, the aircraft must perform a make one eighty maneuver (turn 180 degrees) at the end of the runway before rolling and vacating (leaving the runway) (Bahrawi, 2021).

From the holding data, if the Expected Approach Time (EAT) is not applied to pilots, it can result in aircraft congestion and increase the workload of Air Traffic Controllers (ATC) which not only disrupts the smooth operation of the airport but also impacts flight safety (Khasanah, 2020) . The trip report on February 1, 2025 noted a go-around (re-climb) due to the failure to implement EAT at Syamsudin Noor International Airport, Banjarmasin.

Based on this, the increasing volume of aircraft movements at Syamsudin Noor International Airport, South Kalimantan, requires more orderly, safe, and efficient air traffic management. Implementing Expected Approach Time (EAT) is crucial to prevent aircraft delays and ensure smooth operations. This study aims to assess the impact of the Expected Approach Time (EAT) implementation on air traffic flow at Syamsudin Noor International Airport, Banjarmasin. This study is limited to the implementation of EAT and aims to determine its impact on airport air traffic flow. The objective of this study is to improve airport air traffic management.

1.1. The Enduring Challenge of Airspace Congestion and Arrival Management

The sustained growth of global air transportation has placed unprecedented demand on the capacity of the world's airspace, particularly within the terminal maneuvering areas (TMAs) surrounding major airports. This has created an enduring challenge for Air Navigation Service Providers (ANSPs) to balance air traffic demand with system capacity to ensure the maximum efficient utilization of the National Airspace System (NAS). The core discipline developed to address this challenge is Air Traffic Flow Management (ATFM), a system-wide approach to managing traffic flows collaboratively to prevent excessive demand and minimize operational disruptions (Traffic & Techniques, n.d.).

Within the broader ATFM framework, arrival management is a critical function dedicated to creating a safe, orderly, and expeditious flow of traffic destined for an airport. Since the earliest days of air traffic control (ATC), when controllers used visual signals to manage aircraft on the field, the fundamental objective has remained the same: to sequence arriving aircraft in a manner that maximizes runway throughput while maintaining stringent safety standards. As traffic density and complexity have increased, the methods for achieving this objective have evolved from rudimentary manual procedures to highly sophisticated, automated decision-support systems (Traffic & Techniques, n.d.).

1.2. The Evolution of Arrival Sequencing: From Procedural Control to Automated Systems

At the heart of procedural arrival management lies the concept of the Expected Approach Time (EAT). Defined internationally for decades, the EAT is the time at which ATC expects an arriving aircraft, following a delay, will leave a designated holding fix to complete its approach for a landing. This procedure is a cornerstone of the International Civil Aviation Organization's (ICAO) Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM, Doc 4444). The regulations specify that an EAT shall be determined for an arriving aircraft subjected to a delay of 10 minutes or more and must be transmitted to the pilot as soon as practicable. Furthermore, any revision to the EAT that differs by 5 minutes or more from the previously transmitted time must be communicated without delay. By providing a precise time target, the EAT allows pilots to manage their flight path and speed to absorb delays efficiently, either en route or in a holding pattern, thereby creating a predictable and orderly sequence of arrivals (Service, 2009).

However, the manual application of EAT and other procedural sequencing techniques faces significant cognitive and operational limitations in high-density, complex airspace. The process of calculating, communicating, and updating EATs for numerous aircraft simultaneously can impose a high workload on controllers, leading to inefficiencies and potential errors. Recognizing these limitations, aviation authorities in the United States and Europe began developing automated decision-support tools in the late 20th century.

In the United States, this led to the development of Time-Based Flow Metering (TBFM) systems, with the Traffic Management Advisor (TMA) being the principal operational tool. TBFM is an advanced function that schedules aircraft to an active runway threshold with the least amount of delay by assigning delays on the ground or through speed control en route, thereby preventing excessive airborne holding. The TMA system continuously predicts aircraft Estimated Times of Arrival (ETAs) and uses sophisticated scheduling algorithms to compute Scheduled Times of Arrival (STAs) at key metering points, providing controllers with advisories to help aircraft meet these times .

Concurrently, European initiatives, such as the EUROCONTROL PHARE program, led to the development of the Arrival Manager (AMAN). AMAN systems, whose operational requirements were developed in the late 1990s, provide automated sequencing support for controllers by continuously calculating optimal arrival sequences and times based on landing rates, required spacing, and other criteria.

The evolution from the manual EAT to automated systems like TBFM and AMAN represents a technological leap, yet it is crucial to recognize that these advanced systems are built upon the same fundamental principle. The core problem that a multi-million dollar TBFM system solves is identical to the one a controller issuing a simple EAT solves: managing an arrival sequence and absorbing delay efficiently by assigning a target time to an aircraft at a specific point in space. EAT represents the manual, tactical implementation of this concept, while TBFM and AMAN represent its strategic, system-wide, and optimized automation. The development of these complex systems was a direct response to the operational challenges of applying the EAT concept at scale in increasingly congested airspace. EAT is therefore not an obsolete procedure but the conceptual precursor and fundamental building block upon which modern ATFM is constructed.

1.3. *The Research Problem: Procedural Gaps in a Growing Operational Environment*

While advanced automation is prevalent at the world's busiest hubs, a vast number of secondary international and regional airports continue to rely heavily on procedural control. This study focuses on such an environment: Syamsudin Noor International Airport (WAOO) in Banjarmasin, Indonesia. Serving the growing economic region of South Kalimantan, the airport has experienced a significant and steady increase in aircraft movements in recent years. This growth places increasing pressure on its air traffic services to manage arrivals safely and efficiently.

Despite the availability of internationally standardized procedures like EAT, preliminary observations at WAOO revealed persistent operational inefficiencies. The research was prompted by documented instances of aircraft being placed in airborne holding patterns and, more critically, by multiple go-around events. Analysis of operational records, such as ATC logbooks and trip reports, indicated that these events were often linked to runway occupancy conflicts. For example, an incident on February 1, 2025, involved an aircraft executing a go-around because the preceding aircraft had not yet vacated the runway, despite the arriving aircraft having received landing clearance. These situations arose when multiple aircraft were scheduled to arrive with minimal time separation—often only 1 to 2 minutes apart—insufficient to account for runway occupancy time, particularly for the runway configuration at WAOO.

The core problem identified was a gap between established procedure and operational practice. Observations during a five-month period confirmed that ATCs were not consistently providing EATs to pilots, even when traffic density and close arrival spacing clearly warranted it. This suboptimal application of a fundamental arrival management tool was leading to tangible negative consequences, including increased fuel burn from holding, heightened controller workload, and compromised safety margins during the critical final approach phase. This discrepancy between the intended function of the EAT procedure and its real-world application at a growing airport forms the central rationale for this investigation.

1.4. *Research Objective and Hypothesis*

The primary objective of this study is to quantitatively analyze and determine the influence of Expected Approach Time (EAT) implementation on the smoothness of air traffic at Syamsudin Noor International Airport. Based on the theoretical framework and preliminary observations, the following hypotheses were formulated:

1. Alternative Hypothesis (H1): There is a significant positive influence of EAT implementation on air traffic smoothness at Syamsudin Noor International Airport.
2. Null Hypothesis (H0): There is no significant influence of EAT implementation on air traffic smoothness at Syamsudin Noor International Airport.

2. RESEARCH METHODS

The methods used in this research include quantitative, qualitative, and R&D research aimed at collecting rational, empirical, and systematic data. These methods ensure that the data obtained is more accurate and synchronous with the situation in the field (Sugiyono, 2019).

Rationality in research implies that all activities within the study must be conducted in ways that are reasonable, logical, and in accordance with established principles of scientific inquiry. Meanwhile, empiricism emphasizes that the methods used in the implementation of research should be observable, measurable, and verifiable through human senses, ensuring that findings are grounded in real and tangible evidence rather than speculation. In addition, systematic refers to the principle that the research process must follow a sequence of logical, organized, and structured steps so that every stage can be justified scientifically. To adhere to these principles, the authors adopted a range of research methods in compiling their Final Assignment. One of the approaches employed was the use of a flowchart framework, which visually illustrates the sequence of processes or instructions in a structured and coherent manner, much like the systematic steps found in a computer program. This ensures that the research is not only methodologically sound but also transparent and replicable.

In line with these principles, the study also emphasizes the role of research variables as essential elements in drawing accurate conclusions. Variables serve as the measurable factors that researchers rely upon to understand causal relationships and test hypotheses. Typically, variables are classified into independent variables (X), which influence or affect, and dependent variables (Y), which are influenced or affected. In this study, the authors carefully determined both the independent and dependent variables to ensure alignment with the research objectives. Specifically, the independent variable (X) and dependent variable (Y) were operationalized through the analysis of Expected Approach Time (EAT) as a determinant factor, and Air Traffic Smoothness as the outcome being measured. By structuring the study around these variables, the research provides a clear analytical focus and establishes a solid foundation for interpreting results and drawing meaningful conclusions.

2.1. Research Design

The study adopted a quantitative approach combined with an associative research design, which is particularly suitable for examining measurable phenomena and establishing relationships between variables. A quantitative approach emphasizes the use of numerical data, statistical tools, and objective measurements, allowing researchers to test hypotheses and draw conclusions based on empirical evidence. By using this approach, the research avoids subjective bias and ensures that the results are grounded in verifiable data. The associative design, in particular, provides a framework for identifying patterns of connection between two or more variables, which is crucial when the objective is to evaluate how certain factors influence one another within the scope of the study.

This design is considered highly relevant for research that aims to explore causal relationships between an independent variable and a dependent variable. Through this framework, the study seeks to determine the extent to which variations in one variable correspond with, or potentially cause, variations in the other. In practical terms, the associative design enables the researcher to test whether changes in the independent variable, such as operational factors or procedural elements, have a statistically significant impact on the dependent variable, in this case the level of air traffic efficiency or safety outcomes. By structuring the investigation in this way, the research not only identifies the strength of the relationship but also contributes to a deeper understanding of how these variables interact in real-world aviation contexts.

2.2. Variables and Indicators

Two primary variables were defined and operationalized through a set of measurable indicators derived from authoritative ICAO documents.

1. Independent Variable (X): EAT Implementation. This variable represents the degree to which ATCs correctly apply the EAT procedure. It was measured using five indicators based on the principles outlined in ICAO Doc 4444:
    a. Timeliness of EAT issuance and accuracy of time estimation.
    b. Clarity of communication and adherence to standard phraseology.
    c. Appropriateness and timeliness of EAT revisions based on changing traffic conditions.
    d. Effectiveness of EAT in managing the arrival sequence and reducing holding time.
    e. Observed pilot adherence to issued EATs.
2. Dependent Variable (Y): Air Traffic Smoothness. This variable represents the quality and efficiency of the air traffic flow in the terminal area. It was measured using five indicators derived from the objectives of air traffic services as described in ICAO Annex 11:
    a. Regularity and orderliness of the arrival sequence.
    b. Reduction in airborne holding time for arriving aircraft.
    c. Minimization of delays resulting from traffic conflicts.
    d. Efficiency of runway and airspace capacity utilization.
    e. Enhancement of overall operational safety and security.

2.3. Population, Sample, and Research Object

The population in this study is the data writer at Syamsudin Noor Airport, which totals 20 people, including all Air Traffic Control (ATC) personnel. The sample is a portion of the population that represents the entire population, and the complete sampling technique is used when the population is relatively small or the researcher wants to conduct research with high precision (Sugiyono, 2017). Complete sampling is used when all members of the population are sampled, with the aim of obtaining a comprehensive and in-depth picture of the phenomenon being studied. The total sample used in this study was 20 people, consisting of ATC Supervisors and ATC at Syamsudin Noor International Airport, Banjarmasin.

The object of research is something that becomes the point of attention in a study, such as symptoms, events, people, objects, or processes chosen by the researcher to answer the problem formulation (Sugiyono, 2019). In this study, the object of research is the influence of Expected Approach Time (EAT) on air traffic launch at Syamsudin Noor International Airport, Banjarmasin. Understanding the population and sample is very important for collecting research data, because errors in determining the population can result in inaccurate data collection and poor quality research results.

2.4. Data Collection Techniques and Research Instruments

The authors used data collection techniques to study the effect of Expected Approach Time (E.AT) on air traffic safety at Syamsudin Noor Airport, Banjarmasin. They collected data using a questionnaire based on the identified problems. The research instrument was a structured Likert Scale-based questionnaire to measure two main variables: Expected Approach Time (EAT) as the independent variable (X) and air traffic safety as the dependent variable (Y). The questionnaire was developed based on relevant indicators of each variable, with four answer choices reflecting the level of agreement. The Likert Scale was chosen because of its flexibility in analyzing quantitative data and its ability to produce valid and reliable conclusions. The Likert Scale is a measuring tool that allows a comprehensive and measurable understanding of a person's opinions, attitudes, and perceptions towards a research object, making it suitable for research involving behavioral variables and work performance. The Likert Scale provides flexibility in analyzing quantitative data and producing valid and reliable conclusions.

2.5. Data analysis techniques

Data analysis techniques are key to answering the identified problem formulation. Data analysis in this study emphasizes scientific statistical principles. The data analysis process was conducted after all data was collected. The data analysis used statistical responses from all respondents identified prior to the study. To conduct the data analysis, the researcher used Statistical Product and Service Solutions (SPSS) software version 29 as a data analysis tool.

The quantitative data collected from the questionnaires were analyzed using the Statistical Product and Service Solutions (SPSS) software, version 29. The analytical framework was designed to validate the research instrument and test the study's hypotheses.

1. Instrument Validation: Before hypothesis testing, the questionnaire was subjected to rigorous validation. The validity of each item was assessed using Pearson's product-moment correlation to determine the corrected item-total correlation. An item was considered valid if its correlation coefficient was significant at the $p < 0.05$ level. The internal consistency and reliability of the scales for both variables were assessed using Cronbach's Alpha, with a coefficient of $\alpha \geq 0.60$ considered the threshold for acceptable reliability.
2. Inferential Statistics: To test the research hypothesis, a series of inferential statistical tests were performed:
    a. Pearson Product-Moment Correlation: To measure the strength and direction of the linear relationship between EAT Implementation (X) and Air Traffic Smoothness (Y).
    b. Simple Linear Regression: To model the relationship and determine the extent to which the independent variable could predict the dependent variable. The regression equation is expressed as $Y = a + bX + e$.
    c. t-Test: To determine the statistical significance of the regression coefficient, thereby testing whether the influence of the independent variable on the dependent variable was statistically significant ($p < 0.05$).
    d. Coefficient of Determination (R2): To quantify the proportion of the variance in the dependent variable (Air Traffic Smoothness) that is predictable from the independent variable (EAT Implementation).

3. RESULTS AND DISCUSSION

3.1. Research Results

The data utilized in this research consists of primary data, which refers to information collected directly by the researcher from original sources in order to answer the formulated research questions. Primary data is considered highly valuable because it reflects actual conditions in the field and has not been previously processed or interpreted by other parties. In this study, the collection of primary data was carried out through the distribution of structured questionnaires, which were designed to capture the perceptions, experiences, and evaluations of respondents who are directly related to the operational aspects of air traffic management. By focusing on firsthand responses, the researcher ensures that the findings are authentic, relevant, and capable of providing accurate insights into the research problem.

Specifically, the questionnaires were developed to gather information concerning the effect of Expected Approach Time (EAT) implementation on the smoothness of air traffic flow at Syamsudin Noor International Airport, Banjarmasin. Respondents were asked to provide their assessments based on their knowledge and involvement in daily operations, thereby making the collected data both practical and contextually meaningful. The use of questionnaires also allowed the researcher to collect data systematically and efficiently from a targeted group of participants, ensuring that the variables under study could be quantitatively measured and analyzed. The research results obtained from this field process are then presented in the following sections, forming the empirical foundation upon which the analysis and conclusions of this study are built.

Figure 3. 1 Results of Validity Test of Variable X (Source: SPSS 29)

Correlations

		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	TOTALX
X1	Pearson Correlation	1	.608**	.721**	.540*	.491*	.678**	.648**	.685**	.773**	.510*	.820**
	Sig. (2-tailed)		.004	<,001	.014	.028	.001	.002	<,001	<,001	.022	<,001
	N	20	20	20	20	20	20	20	20	20	20	20
X2	Pearson Correlation	.608**	1	.665**	.808**	.564**	.648**	.723**	.633**	.721**	.569**	.859**
	Sig. (2-tailed)	.004		.001	<,001	.010	.002	<,001	.003	<,001	.009	<,001
	N	20	20	20	20	20	20	20	20	20	20	20
X3	Pearson Correlation	.721**	.665**	1	.499*	.564**	.523*	.508*	.503*	.947**	.442	.788**
	Sig. (2-tailed)	<,001	.001		.025	.010	.018	.022	.024	<,001	.051	<,001
	N	20	20	20	20	20	20	20	20	20	20	20
X4	Pearson Correlation	.540*	.808**	.499*	1	.614**	.757**	.715**	.547*	.540*	.640**	.824**
	Sig. (2-tailed)	.014	<,001	.025		.004	<,001	<,001	.012	.014	.002	<,001
	N	20	20	20	20	20	20	20	20	20	20	20
X5	Pearson Correlation	.491*	.564**	.564**	.614**	1	.486*	.737**	.629**	.621**	.580**	.769**
	Sig. (2-tailed)	.028	.010	.010	.004		.030	<,001	.003	.004	.007	<,001
	N	20	20	20	20	20	20	20	20	20	20	20
X6	Pearson Correlation	.678**	.648**	.523*	.757**	.486*	1	.716**	.670**	.553*	.563**	.811**
	Sig. (2-tailed)	.001	.002	.018	<,001	.030		<,001	.001	.011	.010	<,001
	N	20	20	20	20	20	20	20	20	20	20	20
X7	Pearson Correlation	.648**	.723**	.508*	.715**	.737**	.716**	1	.782**	.648**	.666**	.878**
	Sig. (2-tailed)	.002	<,001	.022	<,001	<,001	<,001		<,001	.002	.001	<,001
	N	20	20	20	20	20	20	20	20	20	20	20
X8	Pearson Correlation	.685**	.633**	.503*	.547*	.629**	.670**	.782**	1	.553*	.517*	.796**
	Sig. (2-tailed)	<,001	.003	.024	.012	.003	.001	<,001		.011	.020	<,001
	N	20	20	20	20	20	20	20	20	20	20	20
X9	Pearson Correlation	.773**	.721**	.947**	.540*	.621**	.553*	.648**	.553*	1	.510*	.848**
	Sig. (2-tailed)	<,001	<,001	<,001	.014	.004	.011	.002	.011		.022	<,001
	N	20	20	20	20	20	20	20	20	20	20	20
X10	Pearson Correlation	.510*	.569**	.442	.640**	.580**	.563**	.666**	.517*	.510*	1	.733**
	Sig. (2-tailed)	.022	.009	.051	.002	.007	.010	.001	.020	.022		<,001
	N	20	20	20	20	20	20	20	20	20	20	20
TOTALX	Pearson Correlation	.820**	.859**	.788**	.824**	.769**	.811**	.878**	.796**	.848**	.733**	1
	Sig. (2-tailed)	<,001	<,001	<,001	<,001	<,001	<,001	<,001	<,001	<,001	<,001	
	N	20	20	20	20	20	20	20	20	20	20	20

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Figure 3.1 shows the results of the validity test conducted to assess whether each statement item in the Expected Approach Time (EAT) Implementation variable (X1–X10) has a significant correlation with the total construct, so that it can be considered valid as a measuring tool. Basis for decision making:

1. Number of respondents: N = 20
2. Degrees of freedom (df) = n – 2 = 40
3. Table r value for df = 40 and α = 0.05 ≈ 0.304
4. Criteria: If the Pearson Correlation value > r table and Sig. < 0.05, then the item is valid.

Item	Nilai r Tabel	Nilai r	Validitas
X1	0.444	0.820	Valid
X2	0.444	0.859	Valid
X3	0.444	0.788	Valid
X4	0.444	0.824	Valid
X5	0.444	0.769	Valid
X6	0.444	0.811	Valid
X7	0.444	0.878	Valid
X8	0.444	0.796	Valid
X9	0.444	0.848	Valid
X10	0.444	0.733	Valid

Table 3. 1 Results of Validity Test of Variable X

Source: Spss 29

Validity test of variable X show that all items (X1 to X10) have a significant positive correlation with the total score (TOTALX). The Pearson Correlation value between each item and the total score ranges from 0.733 (X10) to 0.878 (X7). All significance values (Sig. 2-tailed) are below 0.05, even the majority are below 0.01, which means the relationship is statistically significant.

Thus, all statement items in variable X are declared valid because they meet the validity test criteria, namely the item-total correlation value is greater than the r-table (for N = 20, α = 0.05, r-table ≈ 0.444) and the significance value is < 0.05. This indicates that each item is able to measure the same construct and is suitable for use in further analysis.

After conducting a validity test on variable X, the next step is to test variable Y, namely Air Traffic Smoothness, which consists of 10 statement items (Y1–Y10). This validity test aims to determine the extent to which each statement item in variable Y has a correlation with the total construct. The test process is carried out using Pearson Correlation analysis via SPSS, with the criteria that items are considered valid if the calculated r value is > r table (0.304) and the significance value (Sig. 2-tailed) is less than 0.05. The results of the validity test for variable Y are presented in the following figure.

Figure 3. 2 Results of the Validity Test of Variable Y

Correlations

		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	TOTAL_Y
Y1	Pearson Correlation	1	.729**	.468*	.662**	.608**	.516*	.670**	.570**	.579**	.621**	.767**
	Significance(2-tailed)		.000	.037	.001	.004	.020	.001	.009	.007	.003	.000
	N	20	20	20	20	20	20	20	20	20	20	20
Y2	Pearson Correlation	.729**	1	.639**	.785**	.617**	.591**	.685**	.639**	.756**	.667**	.854**
	Significance(2-tailed)	.000		.002	.000	.004	.006	.001	.002	.000	.001	.000
	N	20	20	20	20	20	20	20	20	20	20	20
Y3	Pearson Correlation	.468*	.639**	1	.720**	.574**	.372	.574**	.815**	.855**	.590**	.788**
	Significance(2-tailed)	.037	.002		.000	.008	.106	.008	.000	.000	.006	.000
	N	20	20	20	20	20	20	20	20	20	20	20
Y4	Pearson Correlation	.662**	.785**	.720**	1	.594**	.520*	.606**	.720**	.724**	.548*	.824**
	Significance(2-tailed)	.001	.000	.000		.006	.019	.005	.000	.000	.012	.000
	N	20	20	20	20	20	20	20	20	20	20	20
Y5	Pearson Correlation	.608**	.617**	.574**	.594**	1	.881**	.866**	.739**	.725**	.762**	.890**
	Significance(2-tailed)	.004	.004	.008	.006		.000	.000	.000	.000	.000	.000
	N	20	20	20	20	20	20	20	20	20	20	20
Y6	Pearson Correlation	.516*	.591**	.372	.520*	.881**	1	.718**	.457*	.598**	.606**	.759**
	Significance(2-tailed)	.020	.006	.106	.019	.000		.000	.043	.005	.005	.000
	N	20	20	20	20	20	20	20	20	20	20	20
Y7	Pearson Correlation	.670**	.685**	.574**	.606**	.866**	.718**	1	.734**	.674**	.727**	.876**
	Significance(2-tailed)	.001	.001	.008	.005	.000	.000		.000	.001	.000	.000
	N	20	20	20	20	20	20	20	20	20	20	20
Y8	Pearson Correlation	.570**	.639**	.815**	.720**	.739**	.457*	.734**	1	.764**	.672**	.851**
	Significance(2-tailed)	.009	.002	.000	.000	.000	.043	.000		.000	.001	.000
	N	20	20	20	20	20	20	20	20	20	20	20
Y9	Pearson Correlation	.579**	.756**	.855**	.724**	.725**	.598**	.674**	.764**	1	.692**	.883**
	Significance(2-tailed)	.007	.000	.000	.000	.000	.005	.001	.000		.001	.000
	N	20	20	20	20	20	20	20	20	20	20	20
Y10	Pearson Correlation	.621**	.667**	.590**	.548*	.762**	.606**	.727**	.672**	.692**	1	.830**
	Significance(2-tailed)	.003	.001	.006	.012	.000	.005	.000	.001	.001		.000
	N	20	20	20	20	20	20	20	20	20	20	20
TOTAL_Y	Pearson Correlation	.767**	.854**	.788**	.824**	.890**	.759**	.876**	.851**	.883**	.830**	1
	Significance(2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	20	20	20	20	20	20	20	20	20	20	20

Figure 3.3 presents the results of the validity test on the statement items in the Air Traffic Smoothness variable. This test aims to determine the extent to which each indicator (Y1–Y10) has a significant relationship with other indicators within a construct. The following is a summary of the results of the Validity Test for Variable Y in the table below.

Item	Nilai r Tabel	Nilai r	Validitas
Y1	0.444	0.767	Valid
Y2	0.444	0.854	Valid
Y3	0.444	0.788	Valid
Y4	0.444	0.824	Valid
Y5	0.444	0.890	Valid
Y6	0.444	0.759	Valid
Y7	0.444	0.876	Valid
Y8	0.444	0.851	Valid
Y9	0.444	0.883	Valid
Y10	0.444	0.830	Valid

Table 3. 2 Results of Validity Test of Variable Y

Source: Spss 29

All statement items contained in the Air Traffic Safety variable, which are represented by indicators Y1 through Y10, demonstrate results that are categorized as very strong in terms of validity. This is reflected in the correlation values (r calculated) that range from 0.750 for the lowest item (Y6) up to 0.893 for the highest item (Y5). The magnitude of these correlation coefficients shows that each individual statement item is highly consistent with the overall measurement of the Air Traffic Safety construct. In other words, every single item is able to represent the concept being measured and aligns closely with the total score of the variable, which is essential in ensuring that the instrument captures the intended dimensions of air traffic safety.

Moreover, when viewed from the significance test results (Sig. 2-tailed), it is found that all items meet the criteria for statistical significance with values less than 0.05, and even the majority of them achieve a higher level of significance at less than 0.01. This finding strengthens the evidence that each statement is not only valid but also has a highly significant relationship with the total score of the variable. Therefore, it can be concluded that the Air Traffic Safety variable, as measured through the ten statement items, possesses strong internal consistency and accuracy in reflecting the concept under study. This outcome provides confidence that the research instrument is both robust and credible, thereby ensuring the reliability of subsequent analysis involving this variable.

Figure 3. 3 Result of the Reability Test X

Reliability Statistics

Cronbach's Alpha	N of Items
.943	10

Figure 3.5 presents the results of the reliability test for the Expected Approach Time (EAT) variable, which was conducted using the Cronbach's Alpha technique. Reliability testing is an essential step in quantitative research to ensure that the instrument used is consistent in measuring the intended construct. The Case Processing Summary table shows that all responses from the 20 participants in this study were successfully processed, with no data excluded, resulting in a complete dataset of 100% validity. This confirms that the data obtained from the field can be fully utilized for further analysis without the need for adjustments or eliminations, thereby strengthening the accuracy of the statistical results.

Furthermore, the Cronbach's Alpha value obtained for this variable was 0.943, which is well above the commonly accepted threshold of 0.70 for research instruments. A coefficient of this magnitude indicates that the set of items used to measure the Expected Approach Time (EAT) variable possesses excellent internal consistency, meaning the items are highly correlated with one another and reliably represent the same underlying construct. In other words, respondents' answers to the different items are consistent, reinforcing the conclusion that the questionnaire is both dependable and robust for capturing the effect of EAT on air traffic flow. This strong reliability result provides confidence that subsequent analyses based on this variable will be credible and reflective of the actual conditions being studied.

Figure 3. 4 Result of the Reability Test Y

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Figure 4. presents the results of the reliability test on variable Y. Based on information from the Case Processing Summary table, all data collected from 20 respondents can be fully used because there is no eliminated data. This indicates that there are no gaps or discrepancies in the data in the tested items. The Cronbach's Alpha value of 0.933 indicates that all statement items in this variable have very good internal consistency. If the Cronbach's Alpha value ≥ 0.70, then the instrument is considered reliable, which means that the items in the Y variable instrument have strong and stable internal relationships (Suwarsa & Aicha, 2021).

Figure 3. 5 Correlations Test

Correlations

		Religiusitas	Agresivitas
Religiusitas	Pearson Correlation	1	.668**
	Sig. (2-tailed)		.001
	N	20	20
Agresivitas	Pearson Correlation	.668**	1
	Sig. (2-tailed)	.001	
	N	20	20

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 5. Correlation test was conducted to determine the relationship between Religiosity and Aggressiveness of respondents. The analysis was conducted using the Pearson Product Moment technique with the help of SPSS software. Based on the results of the correlation test, a correlation coefficient (r) value of 0.668 was obtained with a significance value of < 0.001. This correlation value is in the strong category of 0.60-0.799 interpretation of the Pearson correlation coefficient value, and a significance value smaller than 0.05 indicates that the relationship between the two variables is statistically significant.

Figure 3. 6 Resuts of Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.878[a]	.771	.759	1.858

a. Predictors: (Constant), X

Figure 6. The results of the regression analysis are displayed in the Model Summary table. It can be concluded that the implementation of Expected Approach Time (EAT) has a positive and significant effect on the smoothness of air traffic, with a contribution of 87.8% to the change in the dependent variable. This shows that the better the implementation of the Expected Approach Time (EAT) procedure, the higher the level of smoothness of air traffic (Union, 2012).

Figure 3. 7 Coefficients table of the t-test results

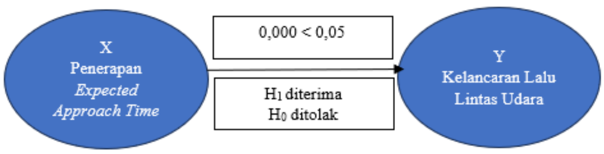
Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	13.258	2.707		4.898	<,001
	X	.618	.079	.878	7.793	<,001

a. Dependent Variable: Y

Next in Figure 7, Based on the Coefficients table of the t-test results, variable X has a t-count value of 7.793 with a significance value (Sig.) of <0.001. Because the Sig. value is smaller than 0.05, it can be concluded that variable X has a significant effect on variable Y. The regression coefficient (B) value for variable X is 0.618, which means that every 1 unit increase in variable X will increase the value of Y by 0.618 units, assuming other variables are constant. In addition, the Standardized Coefficient Beta value of 0.878 indicates that the influence of X on Y is very strong. Thus, the results of this t-test prove that variable X has a positive and significant influence on variable Y.

Figure 3. 8 The results of the T test



The results of the T test show that the variable of Expected Approach Time (EAT) implementation has a strong, positive, and significant influence on the smoothness of air traffic. This is proven by the results of the Pearson correlation test which shows a correlation value of 0.668 with a significance value of p = 0.000. Thus, the alternative hypothesis (H1: There is a significant influence between the implementation of Expected Approach Time (EAT) on the smoothness of air traffic at Syamsudin Noor Airport, Banjarmasin) is accepted, and the null hypothesis (H0: There is no significant influence between the implementation of Expected Approach Time (EAT) on the smoothness of air traffic at Syamsudin Noor Airport, Banjarmasin) is rejected, which means that there is a real relationship between the two variables.

Figure 3. 9 *Model Summary*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.878[a]	.771	.759	1.858

a. Predictors: (Constant), X

Figure 4.11 analysis results in the *Model Summary table* , obtained a coefficient of determination (R Square) value of 0.771. This means that 77.1% of the variation in the dependent variable Air Traffic Smoothness can be explained by the independent variable EAT Implementation, while the remaining 23.9% is influenced by other factors outside this research model. The correlation coefficient (R) value of 0.878 indicates a fairly strong positive relationship between EAT Implementation and Air Traffic Smoothness. Meanwhile, the Adjusted R Square value of 0.415 has taken into account the number of predictor variables and sample size, thus providing a more accurate estimate of the model's ability to explain the dependent variable (Tjiptono, 2015).

3.2 Discussion

3.2.1. The Dominant Influence of a Foundational Procedure

The most striking result of this study is the exceptionally high coefficient of determination ($R^2 = 0.771$). This value suggests that in the operational context of WAOO—an airport characterized by growing traffic but lacking advanced arrival automation systems—the correct and consistent application of a foundational procedure by the human controller is not merely one factor among many, but the single most dominant determinant of arrival efficiency. This finding implies that the local air traffic management system operates on what can be described as a "procedural backbone." When this backbone is strong and rigidly applied—that is, when EAT is used correctly to sequence traffic and absorb delays proactively—the system functions with a high degree of smoothness and predictability. Conversely, when this backbone is weak or inconsistently applied, the system rapidly degrades into the inefficiencies observed in the preliminary research, namely airborne holding and go-arounds.

This conceptualization reframes the importance of procedural control. It is not simply a "helpful tool" but rather the primary stabilizing and organizing mechanism for the entire arrival system. This has profound implications for ANSPs managing similar airports worldwide. It suggests that before significant capital is invested in technological overlays, the first and most critical step is to ensure that the underlying procedural backbone is robust, resilient, and universally adhered to through rigorous training and operational oversight.

3.2.2. Situating the Findings in the Global Regulatory and Operational Context

The empirical results of this study serve as a powerful real-world validation of ICAO's long-standing principles for air traffic management. The EAT procedure, as codified in Doc 4444, was specifically designed to mitigate the risks of airborne congestion and sequencing conflicts by introducing temporal predictability into the arrival stream. The documented go-arounds and holding patterns at WAOO are not abstract risks; they are the precise operational failures that the EAT procedure was engineered to prevent. The strong positive correlation and high

R^2 value provide quantitative proof that when the procedure is applied as intended, it is highly effective in achieving its safety and efficiency objectives. The study demonstrates that adherence to these global standards directly translates into smoother, safer, and more efficient local operations.

3.2.3. EAT in the Age of Automation: A Case for Foundational Excellence

These findings do not argue against the industry's progression toward automation with systems like AMAN and TBFM. Instead, they highlight a critical prerequisite for the successful integration of such technology. The cognitive skills required to effectively manage an arrival flow procedurally—strategic sequencing, temporal planning, proactive problem-solving, and clear communication—are the very same skills that controllers must possess to effectively oversee, interact with, and, when necessary, intervene in an automated system.

An automated arrival manager provides advisories and optimized solutions, but the controller remains the ultimate authority, responsible for validating the system's output and managing exceptions. The situation at WAOO demonstrates the consequences of a breakdown in these foundational skills. Therefore, mastering procedural control is not an outdated requirement but an essential foundation upon which the competencies for managing automated systems are built.

3.2.4. Implications for Secondary Airports and Developing Regions

The conclusions drawn from this single-airport case study have significant global relevance. Thousands of secondary and regional airports around the world operate under similar conditions: rising traffic demand without the immediate prospect of acquiring expensive, large-scale automation systems. This study delivers a powerful and encouraging message to the ANSPs that manage them. It demonstrates that substantial and measurable improvements in safety, efficiency, fuel economy, and airspace capacity can be achieved not through massive capital expenditure, but through a renewed and disciplined focus on the rigorous training and consistent implementation of existing, low-cost, internationally standardized procedures. The path to enhanced performance for a significant portion of the global aviation network lies in achieving excellence in the fundamentals of air traffic control.

3.2.5. Study Limitations

To maintain academic rigor, it is important to acknowledge the limitations of this study. The primary limitation is the small, single-site sample size (N=20), which, while representing a census of the target population, restricts the statistical generalizability of the findings to other airports. The results are deeply contextualized within the specific operational environment of WAOO. Secondly, the study relies heavily on the self-reported perceptions of ATCs via the questionnaire.

While these perceptions are from expert practitioners, they may be subject to social desirability or other response biases. Future research could strengthen these findings by incorporating objective performance data, such as actual holding times and track miles flown per arrival, and correlating them with observed procedural application. Finally, a minor discrepancy was noted within the source document, where the abstract and conclusion cited different statistical values ($t=3.804$, $R^2=0.446$) from those presented in the detailed results chapter ($t=7.793$, $R^2=0.771$). This report has utilized the more detailed and robust values from the main results chapter, but this inconsistency in the original source is noted.

4. CONCLUSION

Based on the results of the study on "The Application of Expected Approach Time to Air Traffic Smoothness at Syamsudin Noor International Airport, Banjarmasin", the following conclusions can be drawn. Based on the results of data analysis and discussion, it can be concluded that the application of Expected Approach Time (EAT) has a positive and significant effect on the smoothness of air traffic at Syamsudin Noor International Airport, Banjarmasin. This is evidenced by the calculated t value = 3.804 and a significance of 0.001 (<0.05), and the R Square value = 0.446 which indicates that 44.6% of the variation in the smoothness of air traffic can be explained by the application of EAT.

Thus, the better the implementation of EAT, the smoother the air traffic flow, indicated by reduced holding time, regular aircraft arrival sequence, and increased efficiency in the use of airspace and runway capacity. These results answer the research problem formulation, namely that the implementation of EAT has a significant impact on the smoothness of air traffic at the airport.

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