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How Safe Are Pilot Schools in Indonesia? The Influence of Safety Leadership on Safety Performance in an Indonesian Government-Owned Flight School

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Accidents and serious incidents are the primary objectives to be avoided in aviation operations. Based on data from the Indonesian National Transportation Safety Commission, 190 accidents and serious incidents occurred from 2010 to early 2024. Among these 190 incidents, 10.5% were attributable to flight training operations conducted by student pilots in Indonesia; therefore, the level of safety performance in flight schools warrants measurement. This research aims to measure safety performance by using safety promotion and safety intelligence as exogenous variables. Safety leadership is both an intervening and a moderating variable in the relationship among these variables. The research was conducted at pilot schools run by the Indonesian Government. A total of 102 participants were included using a saturated sampling technique. The research employs a quantitative SEM-PLS approach in SmartPLS3. The results showed that 6 of the 7 hypotheses were accepted. All direct relationships between variables are significant, whereas the mediating and moderating variables do not influence the relationships among safety promotion, safety intelligence, and safety performance. Reflecting on the flight training operations carried out by the Indonesian government, the training flight operations fulfill the level of safety that has been determined as measured by the 3 important roles played by Quality Assurance, Quality Control, and the Chief Instructor, as well as by the level of implementation of a good safety management system in each school.

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Introduction

This research aims to assess the safety performance of flight schools operated by the Indonesian government, specifically the Ministry of Transportation. This research will enhance future literacy on aviation safety, particularly in aviation schools. This research draws on the perceptions of pilot students/cadets who conduct flight training to assess the implementation of aviation safety at their school.

Why pilot school?

Because pilot school is the first and foremost education for prospective pilots before flying commercial aircraft that carry hundreds of lives or many more assets, instilling safety principles and doctrines must be carried out from the start, during education and training, so that it is firmly embedded in their minds that safety is the most important thing to pay attention to in in-flight operations (Kalteh et al., 2021).

The Indonesian government itself, through the Ministry of Transportation, runs two flight schools: the Indonesian Aviation Polytechnic (IAP) Curug and the Indonesian Civil Pilot Academy (ICPA) Banyuwangi. IAP Curug experienced 4 accidents, with 3 fatal accidents and 1 serious incident, while ICPA Banyuwangi experienced 2 serious incidents. It should be noted that the implementation of safety performance must also be a primary concern in the flight training process, even if it is run by the government.

Literature Review and Hypothesis Development

Safety Performance

Safety is the main thing that must be of concern to the government and related stakeholders (Kaspers et al., 2019; Patriarca et al., 2019). Aviation itself has implemented a safety management system (SMS) to mitigate both incidents and accidents (Adjekum, 2014; Robert Foster & Kwasi Adjekum, 2022). To improve aviation safety, targets must be achieved, which are called safety performance targets. (ICAO, 2016). These targets become a tool for measuring aviation safety performance. (ICAO, 2018). Good safety performance will prevent accidents and incidents. (Atikasari et al., 2022; Peñaloza et al., 2020). Based on ICAO Doc. 9859 Safety Management Manual, Safety Performance is:

> "**A State's or service provider´s safety achievement as defined by its safety performance targets and safety performance indicators."**

Safety performance is one of the best measuring tools in assessing the performance of a flight school (Kaspers et al., 2019). The safety performance of aviation schools can be seen from the safety promotion that is implemented in the school environment, both from promotional communications through posters and pamphlets. (Hult et al., 2021). Safety performance can also be measured through the safety intelligence of each flight personnel at the school, which is demonstrated through the behavior shown before, during, and after flight training (Patriarca et al., 2019).

Safety Promotion

Safety promotion (SP) is directly related to safety performance, which will reduce the number of incidents or accidents (Atikasari et al., 2022; Robert Foster & Kwasi Adjekum, 2022). Safety promotion can increase stability and shared perceptions of safety in the work ecosystem (Hult et al., 2021). Safety promotion itself consists of implementing safety-related training and safety communication carried out by the organization or leadership (Karanikas et al., 2020; Majid et al., 2022). Even though it is often found that the implementation of safety promotions is only an expression, and is not implemented well (Jager-Hyman et al., 2019). Based on that statement, a hypothesis was proposed:

H1. Safety Promotion has a positive influence on safety performance

Safety Intelligence

Intelligence is the ability to collect, analyze, interpret, and disseminate data and information used in the decision-making process, while Safety intelligence is the ability to provide safety recommendations based on processed safety data and information, so that it can be followed up on and used (Wang, 2021). Serious incidents and accidents that occur cannot be separated from the intelligence of leaders in safety (Fruhen et al., 2014). At a higher level, safety intelligence becomes an aid in decision-making by leaders (Ardeshir & Mohajeri, 2018; Patriarca et al., 2019). Safety intelligence also plays an important role in the process of changing and presenting raw safety data into adequate data and information needed by leaders in decision-making (B. Wang, 2021b). Based on that statement, a hypothesis was proposed:

H2. Safety intelligence has a positive influence on safety performance

Safety Leadership

Leadership intervention in safety decisions is a key factor in achieving safety performance (Alidrisi & Mohamed, 2018; Stiles et al., 2018). Safety leadership is a form of contingency in strengthening the work environment that can motivate and influence employees and co-workers to achieve safety goals (Grill & Nielsen, 2019; Stroeve et al., 2022). Safety leadership will encourage safe behavior to achieve predetermined safety performance (Zhang et al., 2020). Based on that statement, a hypothesis is proposed:

H3. Safety promotion has a positive influence on safety leadership
H4. Safety intelligence has a positive influence on safety leadership
H5. Safety leadership's positive influence on safety performance

The role of leaders in managing safety performance is not only as a mediator of the relationship with other latent variables but also as a moderator in the relationship between safety performance and exogenous variables. Based on that statement, a hypothesis is proposed:
H6. Safety promotion through safety leadership influences safety performance.
H7. Safety intelligence through safety leadership influences safety performance.

Methodology

Participants

The respondents of this research were students from pilot schools managed by the Indonesian Government, in this case, the Ministry of Transportation. Questionnaires were distributed to cadets using a Google Form link from April to May 2024. Because the number of student pilots educated by schools at the Ministry of Transportation is not very large, the sampling technique used was saturated sampling, which allows the entire population to be sampled (Sebele-Mpofu, 2020).

Data collection was completed in May 2024 with a total of 102 respondents who were student pilots from the Indonesian Aviation Polytechnic (IAP) Curug and Indonesian Civil Pilot Academy (ICPA) Banyuwangi. Respondent statistical data are presented in Table 1 below.

Table 1
Respondent Data

Criteria	Characteristic	Total	%
Gender	Man	84	82%
	Women	18	18%
Age	17 - 20 Years Old	55	54%
	21 - 24 Years Old	43	42%
	>24 Years Old	4	4%
Program	Diploma	72	71%
	Non - Diploma	22	22%
	Executive	8	8%
School	IAP of Curug	48	47%
	ICPA of Banyuwangi	54	53%

Instrument

The instrument in this study used a questionnaire with a Likert scale (1 – 5, Very Unsatisfied to Very Satisfied). In developing the questionnaire, variables were defined as indicators of the variables (Bell et al., 2024; Hair et al., 2020). Based on these indicators, statements were compiled that were used as research instruments. Details of variable development can be shown in Table 2 below.

Table 2
Development of Variables and Indicators

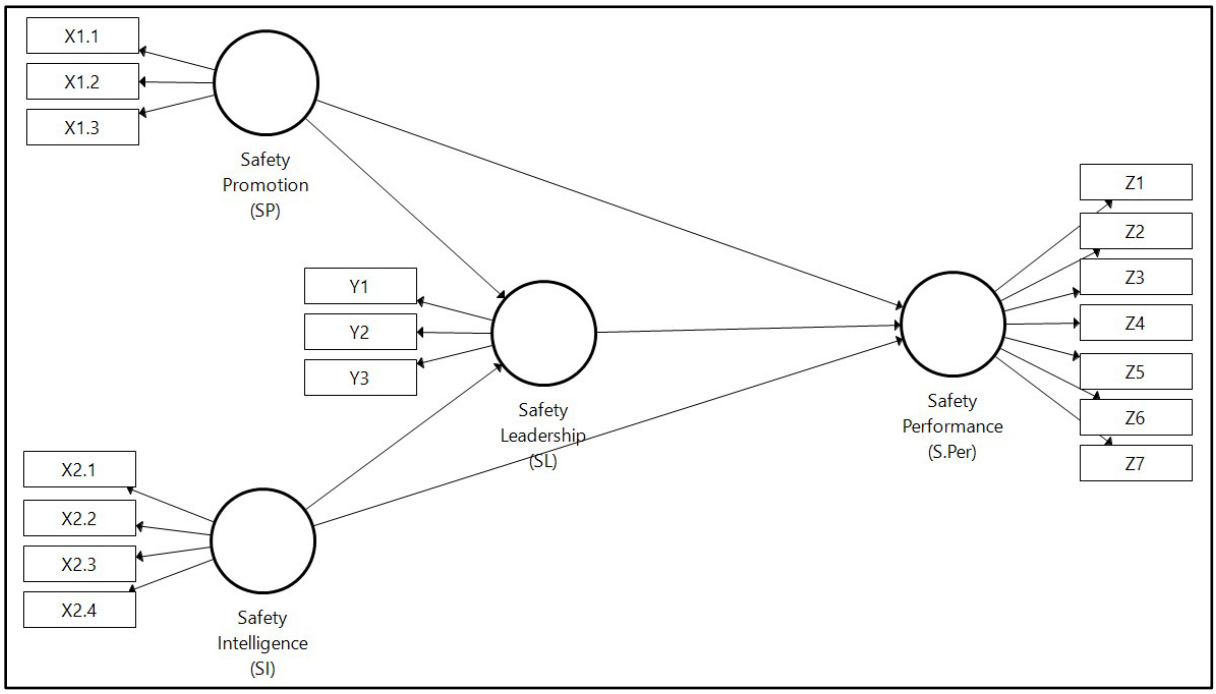
Variable	Indicator	Statement/Question
Safety Performance (S.Per) On Pilot School Based on (Indonesian CASR 141, 2017)	Quality Assurance of Flight Training	Chief Quality carries out systematic checks on the implementation of flight practices
	Quality Control of Flight Training	The Chief Quality performs a final inspection before the cadet/student pilot graduates
	Chief Instructor Role	1. The Chief Instructor is responsible for carrying out flight training 2. The Chief Instructor ensures that the instructors who teach flying are qualified
	SMS Implementation	1. Pilot School carries out hazard identification and risk assessment 2. Pilot School implements mitigation measures and ensures that risks are always at acceptable levels 3. The pilot school carries out continuous monitoring of the implementation of safety management
Safety Leadership (SL) (Stiles et al., 2018; Zhang et al., 2020)	Safety Concern	Organizational leaders/Directors care about ensuring flight safety
	Safety Policy	The policies adopted in flight training always pay attention to safety procedures
	Safety Control	The head of the organization (Director) carries out regular supervision of the implementation of safety management
Safety Promotion (SP) (Stroeve et al., 2022)	Training	Cadets/student pilots are given an understanding of the implementation of pilot safety management
	Communication	1. There are pamphlets/banners conveying information related to safety. 2. Instructors/lecturers always convey safety procedures before, during, or after flight training
Safety Intelligence (SI) (Fruhen et al., 2014)	Competence	Cadets/student pilots have aviation safety competency
	Safety Knowledge	Cadets/student pilots understand and understand the importance of safety
	Regulatory Focus	Cadets/student pilots apply flight safety procedures during flight training
	Problem-Solving	Cadets/student pilots understand and can carry out recovery actions when trouble occurs during flight training

Procedures & Data Analysis

The approach used in this research is a quantitative approach using the Structural Equation Model - Partial Least Squares (SEM-PLS) method. Quantitative research makes it possible to measure the extent of the relationship between variables, including the mediating and moderating role of the safety leadership variable on the relationship between safety promotion, safety intelligence, and safety performance in pilot schools under the Ministry of Transportation.

The use of the SEM-PLS method makes it possible to carry out a variance-based approach to confirm model measurements and describe relationships between structures to maximize the explanation of the dependent variable (Hair et al., 2020). The application used to assist the modeling process is SmartPLS 3. This SEM-PLS method uses 2 tests to measure the model: the outer model test and the inner model test (Hair et al., 2019; Wondola et al., 2020). In the outer model test, the validity of the instrument must be tested for convergent validity and discriminant validity (Ab Hamid et al., 2017; Afthanorhan et al., 2021; Paap et al., 2020; Roemer et al., 2021).

Figure 1
Model / Thinking Framework



Apart from validity, the outer model is also required to check the reliability value of the instrument using composite reliability and Cronbach's Alpha (Bell et al., 2024; Hair et al., 2020; Kalkbrenner, 2023; Lai, 2021). In the inner model test, a hypothesis test will be carried out on the model that has been created (Hair et al., 2019; Hair et al., 2020). The model or framework for thinking in this research can be seen in Figure 3. Meanwhile, the development of variables and indicators can be seen in Table 2. This research was conducted after obtaining permission from the institutional review board.

Results and Discussion

Results

The data from the 102 respondents was then processed and entered into the SmartPLS3 application for tests before concluding the model that had been created. The first test of the outer model is the validity test (convergent and discriminant), reliability (composite and Cronbach's Alpha), and multicollinearity. The results of data processing can be seen in Tables 3 and 4 as follows.

Table 3
Convergent Validity and Instrument Reliability

Variables	Indicator	Mean / Average	Outer Loading	VIF	AVE	CA*	CR*
Safety Promotion (SP)	X1.1	3.400	0.867	1.882	0.742	0.826	0.896
	X1.2	3.290	0.842	1.764			
	X1.3	3.380	0.874	2.019			
Safety Intelligence (SI)	X2.1	3.390	0.864	2.312	0.81	0.921	0.945
	X2.2	3.450	0.917	4.557			
	X2.3	3.440	0.929	4.927			
	X2.4	3.390	0.888	2.747			
Safety Leadership (SL)	Y1	3.430	0.890	2.502	0.806	0.88	0.926
	Y2	3.490	0.916	2.641			
	Y3	3.330	0.886	2.236			
Safety Performance (S.Per)	Z1	3.300	0.793	2.768	0.692	0.926	0.94
	Z2	3.310	0.820	2.687			
	Z3	3.380	0.849	3.357			
	Z4	3.440	0.842	3.286			
	Z5	3.280	0.841	3.64			
	Z6	3.260	0.891	4.433			
	Z7	3.360	0.783	2.391			

* CA: Composite Reliability, CR: Cronbach’s Alpha
Source: SmartPLS Output

Table 4
Discriminant Validity and Multicollinearity

Test	Safety Intelligence (SI)	Safety Leadership (SL)	Safety Performance (S.Per)	Safety Promotion (SP)
Fornell-Lacker Criterion				
Safety Intelligence (SI)	0.9			
Safety Leadership (SL)	0.703	0.898		
Safety Performance (S.Per)	0.743	0.745	0.832	
Safety Promotion (SP)	0.701	0.704	0.788	0.861
HTMT Ratio				
Safety Intelligence (SI)				
Safety Leadership (SL)	0.775			
Safety Performance (S.Per)	0.797	0.815		
Safety Promotion (SP)	0.798	0.821	0.898	
Inner VIF				
Safety Intelligence (SI)		1.965	2.372	
Safety Leadership (SL)			2.397	
Safety Performance (S.Per)				
Safety Promotion (SP)		1.965	2.379	

Source: SmartPLS Output

In the SmartPLS application, there are 2 test models for the validity test: the convergent validity test, with the outer loading and Average Variance Extracted (AVE) values exceeding 0.5, and the discriminant validity test, which uses the Fornell-Lacker test and the HTMT Ratio (Ab Hamid et al., 2017; Afthanorhan et al., 2021; Bagozzi & Yi, 2012; Gonzalez et al., 2021; Roemer et al., 2021). In the Fornell-Lacker test, the test results can be said to be valid if the root value of the AVE in the construct is higher than the correlation value of the construct with other latent variables (Fornell & Larcker, 1981). Meanwhile, in the HTMT ratio test, the test results can be said to be good if the HTMT value is below 0.9 (Henseler et al., 2015). Based on Tables 3 and 4 above, the value of outer loading and AVE has exceeded the required value of convergent validity, while the value on the Fornell–Lacker test and HTMT test proved that the research instrument meets the discriminant validity test.

In the reliability test, the composite reliability and Cronbach's Alpha values must exceed 0.7 (Bell et al., 2024; Kalkbrenner, 2023; Lai, 2021). In the multicollinearity test, it is required that the inner VIF value is below 3, while the outer VIF must be below 5 (Lindner et al., 2020; P. Obite et al., 2020; Wondola et al., 2020). Based on Table 3, we can see that the Cronbach's Alpha is more than 0.8, which means the research data meet the reliability test, and the value of Inner VIF (Table 4) indicates that the research instrument meets the requirement of the multicollinearity test.

Table 5
Path Coefficient and Hypothesis Testing

Path Coefficient		Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Hypothesis
Direct Effect							
H1	Safety Promotion (SP) -> Safety Performance (S.Per)	0.414	0.419	0.099	4.182	0	Accepted
H2	Safety Intelligence (SI) -> Safety Performance (S.Per)	0.266	0.273	0.121	2.203	0.028	Accepted
H3	Safety Promotion (SP) -> Safety Leadership (SL)	0.416	0.42	0.112	3.718	0	Accepted
H4	Safety Intelligence (SI) -> Safety Leadership (SL)	0.412	0.413	0.119	3.456	0.001	Accepted
H5	Safety Leadership (SL) -> Safety Performance (S.Per)	0.266	0.258	0.123	2.165	0.031	Accepted
Indirect Effect							
H6	Safety Promotion (SP) -> Safety Performance (S.Per)	0.111	0.105	0.054	2.034	0.043	Supported
H7	Safety Intelligence (SI) -> Safety Performance (S.Per)	0.11	0.109	0.067	1.628	0.104	Not Supported

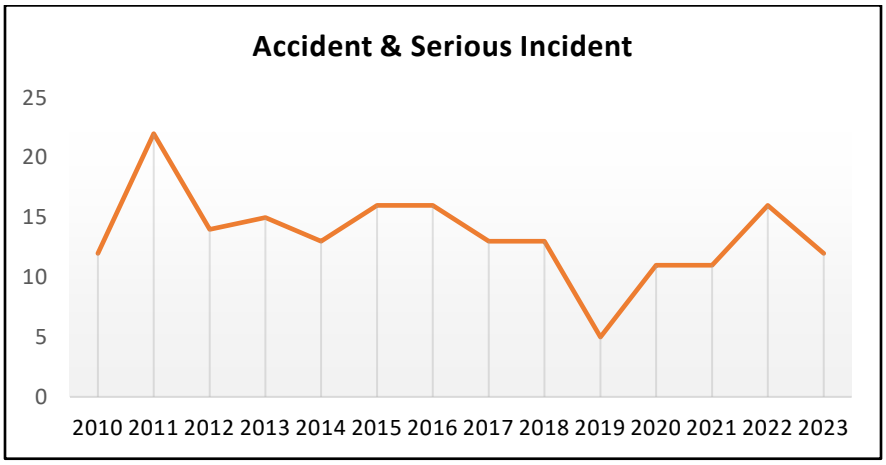
Source: SmartPLS Output

Based on the results of SmartPLS bootstrapping as listed in Table 5 above, it can be seen that 6 hypotheses can be accepted, and the rest (3 hypotheses) are rejected. The results in Table 6 were discussed in depth to determine each relationship between variables, both the mediating and moderating roles of the safety leadership variable.

Discussion

Based on data from the Indonesian NTSC, there were 190 serious incidents and accidents that occurred from 2010 to 2024. These incidents are of concern to the government and related organizations in ensuring aviation safety. These accidents occurred in various places in Indonesia under various conditions. Flight accident data from 2010 to 2023 can be seen in Figure 2.

Figure 2
Accident & Incident Record



Source: NTSC of Indonesia (2024)

Safety performance at government-owned flight schools must be better to become an example regarding the implementation of the safety management system. The fact is that data from the Indonesian National Transportation Safety Commission records that there have been accidents originating from pilot training activities, which accounted for 20 incidents out of a total of 190 (10.5%) accidents and serious incidents recorded from 2010 to 2023, and 6 accidents and serious incidents (3 accidents 3 serious incidents) of them were made by government-owned flight schools. This is a serious matter, which must be taken into account, considering that Indonesia itself has more than 20 pilot schools run by the private sector and by the government. The following is data on accidents and serious incidents that occurred during pilot training activities from 2010 to 2023.

Table 6
Accidents and Serious Incidents Originating from Flight Training Activities

Year	Pilot School	Case	A/C Registration	Type of A/C
2010	IAP of Curug	Runway Incursion	PK AGU	Socata Tobago TB-10
2010	BIFA	System Failure	PK ROG	Cessna 172
2010	IAP of Curug	Fatal Accident (wind shear/thunderstorm)	PK AGM	Socata Tobago TB-10
2012	BIFA	Collision During Take Off and Landing	PK ROI	Cessna 172
2013	Flybest Flight Academy	Accident (Swallow at the Sea)	PK KFC	Cessna 152
2013	Bandung Pilot Academy	Runway Excursion	PK IUA	Cessna 172
2014	IAP of Curug	Abnormal Runway Contact	PK AEE	Piper Warrior III

Year	Pilot School	Case	A/C Registration	Type of A/C
2014	ICPA of Banyuwangi	Abnormal Runway Contact	PK BOB	Cessna 172
2014	Merpati Pilot School	System/Component Failure or Malfunction	PK MSN	Cessna 172
2015	LIFT	System/Component Failure or Malfunction	PK LLA	Liberty XL2
2016	Global Aviasi	Runway Excursion	PK TGL	Cessna 172
2016	Nusa Flying International	System/Component Failure or Malfunction	PK NIV	Cessna 172
2016	Aeroflyer Institute	Runway Excursion	PK HAN	Cessna 172
2016	Perkasa Flight School	System/Component Failure or Malfunction	PK PBH	PA-28-161
2016	Nusa Flying International	System/Component Failure or Malfunction	PK NIZ	Cessna 172P
2016	ICPA of Banyuwangi	Runway Excursion	PK AGV	Socata Tobago TB-10
2017	MUFA	Abnormal Runway Contact	PK MUA	Cessna 172S
2017	Perkasa Flight School	Abnormal Runway Contact	PK PBO	Piper PA 28-161
2017	IAP of Curug	Runway Excursion	PK ARH	Piper PA 28
2020	Global Aviasi	Runway Excursion	PK SNR	Cessna 172

Source: Indonesian NTSC

Based on Table 6 above, the Indonesian Government (Ministry of Transportation) must take good steps to conduct safety, especially on flight training, by promoting safety promotion, safety intelligence, and good safety leadership to increase the safety performance level. Safety promotion is an important part of implementing safety performance. Safety promotion is a very effective tool for conveying understanding regarding safety and can also prevent accidents (Jager-Hyman et al., 2019).

The results of the hypothesis test show that there is a very significant relationship between safety promotion and safety performance (H1 Accepted t 3.845, P values 0). Promoting safety will increase stability and the common perception of safety in the work ecosystem (Hult et al., 2021). Safety promotion can be done verbally, either by leaders or by using communication media by the organization, such as posters or pamphlets (Ardeshir & Mohajeri, 2018; Grill & Nielsen, 2019). Safety promotion also has a significant influence on safety leadership (H3 Accepted t 3.621 P values 0). This is because the most effective promotion in aviation is promotion delivered by the leadership of the organization. In the Safety Management System, it is emphasized that leadership commitment is the key to implementing safety management (Adjekum, 2017; Atikasari et al., 2022; Grill & Nielsen, 2019).

Implementing safety also requires good knowledge about how to manage safety and existing risks (Chen et al., 2021; Gaweesh et al., 2021). So it is necessary to increase the intelligence of each aviation personnel to improve safety performance (Patriarca et al., 2019). As the research

results explain that safety intelligence has a significant effect on safety performance (H2 Accepted t 2.087 P values 0.037), the intelligence of aviation personnel will increase awareness of the importance of aviation safety. Increasing safety intelligence can be done with a good training process in the work environment in the aviation industry which is demonstrated through behavior before, during and after carrying out flight training (Ingesson, 2022; Wang et al., 2021).

Organizational leaders from the aviation industry are the first people who must have safety intelligence, so that when running a business, they not only prioritize profits but also invest in safety, so that both can run well (Dou, 2020; Fardnia et al., 2021). The results of this study indicate that safety intelligence has a significant effect on safety performance (H4 Accepted t 3.435, P values 0.001). Meanwhile, with good safety intelligence possessed by organizational leaders and flight operational actors, aviation safety performance will improve (H5 Accepted t 2.329 P values 0.02).

Meanwhile, safety leadership can mediate the relationship between safety promotion and safety performance (H6 Accepted t 2.116 P values 0.035), but is unable to mediate the relationship between safety intelligence and safety performance (H7 rejected t 1.692 P values 0.091). Safety leadership is unable to moderate the relationship between safety promotion and safety intelligence with safety performance (H8 & H9 rejected). This relationship shows that good promotion carried out by organizational leaders can improve safety performance (Grill & Nielsen, 2019; Provan et al., 2020).

However, in this study, safety leadership was not able to mediate the relationship between safety intelligence and safety performance. This was because training on safety management was only attended by operational personnel, while at the leadership level, the training was not adequate (Naor et al., 2020; Schopf et al., 2021; Z. Wang et al., 2021). In training flight operations, the role of the leader is important, in this case, including increasing the safety promotion and safety intelligence of student pilots and other aviation actors, including flight instructors (Schopf et al., 2021; Sorensen et al., 2021).

This finding meets another challenge that must be fulfilled by the Indonesian Government (Minister of Transportation). Aviation stakeholders began to be introduced to safety management systems before the 2010s, with an exclusive stakeholder approach that was then introduced to field workers. However, over time, safety policies declined as a key consideration in policymaking and implementation. Flight school leaders remained more focused on attracting students, rather than ensuring safe flight operations as a guarantee of service (Management Dilemma). They remained profit-oriented, despite the implementation of basic safety measures. So, the government must ensure that flight school leaders not only focus on production/profit, but also implement safety policies as a form of promotion to ensure flight safety during flight training operations.

The measurements conducted at these government-owned flight schools were conducted to provide an overview of safety levels, which should be superior to those of flight schools run by the private sector. Government-owned flight schools are more likely to adhere to regulations and implement higher safety standards due to the greater resources provided by the government to

ensure safety. SMS implementation does not only require reliable operators, but leaders who understand the meaning of aviation safety as applied to the policies taken.

The level of safety performance will be better with the role of school leaders (Directors) who understand the importance of aviation safety by increasing safety promotion and also increasing safety intelligence for each component of training flight operations in flight schools, whether students, flight instructors, technicians, or anyone directly or indirectly involved in training flight operations. Accidents or incidents often occur due to negligence and neglect of existing flying disciplines. This occurs because personnel are no longer aware of the existing level of safety, so the role of safety promotion and leadership becomes important as a reminder of safety awareness, so that safety performance does not decline.

Conclusion

How safe are pilot schools in Indonesia? Reflecting on the flight training operations carried out by the Indonesian government, in this case, the Ministry of Transportation, based on assessments carried out by student pilots (questionnaire results) from various existing programs, in accordance with the indicators set by CASR Part 141, the training flight operations carried out by the Indonesian Government fulfills the level of safety that has been determined as measured by the 3 important roles played by Quality Assurance, Quality Control and also by the Chief Instructor, as well as by the level of implementation of a good safety management system in each school.

The role of leaders is important, being able to improve aviation safety performance with their commitment, especially in communication and promotion of safety in the school environment they lead. The role of leadership in promoting safety can increase personnel awareness, thereby reducing the number of accidents or incidents that occur. Flight schools run by the government are sufficient to meet the level of safety as measured by the role indicators of quality control, quality assurance, and also the chief flight instructor, as well as the implementation of the safety management system, which is a general provision in CASR Part. 141.

Limitation and Future Research

This study has limitations because it only addresses safety performance issues in government-owned flight schools. The quantitative method also limits this study, as the discussion focuses solely on statistical results, which is insufficient. We recommend that future research encompass a broader scope across all flight schools in Indonesia. Other approaches could be taken to explore other perspectives, such as quantitative methods or the Q-Method, to capture safety perspectives in flight schools from personnel or students.

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that are the object of research. This research is purely in order to increase knowledge and understanding of measuring safety performance in flight schools.

Researchers experienced limitations in selecting samples due to limited time and costs, so they only selected samples in the form of flight schools run by the Indonesian Government, in this case, the Ministry of Transportation.

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