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Effect of Electronic Flight Bag Usage and Safety Culture on Flight Safety Performance at PT. Garuda Indonesia

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Abstract

Purpose: This study aimed to determine the effectiveness of electronic flight bag use and safety culture on Garuda Indonesia's flight safety performance.
Research Methodology: The data used in this study were primary data collected through online questionnaires distributed to 35 Garuda Indonesia pilots operating Airbus A330 aircraft. The analysis employed a quantitative descriptive approach using SPSS version 25. The results indicated a strong, positive, and unidirectional relationship between variables. Furthermore, electronic flight bag usage effectiveness and safety culture had a positive and significant effect on flight safety performance, contributing 78.8%, with safety culture identified as the dominant factor.
Results: The findings indicate a strong and positive relationship between EFB usage, safety culture, and flight safety performance. The study concludes that EFB usage and safety culture contribute 78.8% to flight safety performance, with safety culture having a more significant impact..
Conclusions: The use of EFB and the implementation of a strong safety culture have a substantial positive effect on the flight safety performance at PT. Garuda Indonesia.
Limitations: The study's scope is limited to pilots of Garuda Indonesia flying Airbus A330 aircraft, which may not be representative of all aviation sectors.
Contributions: This study provides valuable insights into how technology (EFB) and organizational factors (safety culture) enhance aviation safety, contributing to both academic literature and practical applications in the aviation industry.

Keywords: *Aviation Safety, Electronic Flight Bag, Flight Safety Performance, Performance Safety, Safety Culture*

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1. Introduction

Law No. 1 of 2009 states that aviation is part of the national transportation system that has the characteristics of being able to move quickly, using high technology, capital intensive, reliable management, and requires effective and efficient potential and roles, and helps create a stable and dynamic national distribution pattern. Safety is the main priority in aviation; therefore, optimal safety standards are needed in accordance with current technological developments. Every individual or agency must comply with every standard or regulation issued by international bodies such as the International Civil Aviation Organization (ICAO), the Federal Aviation Administration (FAA), and the European Aviation Safety Agency (EASA), where the responsibility is carried out by the Joint Aviation Authority (JAA), which is

a member of the European Economic Community (EEC) (Abeyratne, 2019; Turcˇinovic´ & Kovacˇevic´, 2018; Wakimoto, 2019).

All aviation activities can pose unwanted risks, such as aircraft accidents. According to the FAA (Federal Aviation Administration (FAA), there are three factors that cause accidents: weather factors (13.2%), aircraft factors (27.1%), and human error (approximately 66% of all aviation accidents and incidents). The official KNKT report states that the largest aviation safety factor is human error (human factor), which accounts for 67.12%, followed by technical factors at 15.75%, and the rest are environmental and facility factors. The data above show that aircraft accidents in Indonesia are still high, indicating that the level of aviation safety in Indonesia is still low. This is still far from expectations when linked to global aviation safety standards (Kucuk Yilmaz, 2019; Kuklev & Žilinskis, 2018).

These problems are inextricably linked to the increasingly sophisticated technology used in the aviation industry. The more sophisticated the technology, the harder people must learn to keep up with it (Bal & Erkan, 2019). The changes brought about by globalization have impacted the business environment, including technological and product competition. Consequently, companies must improve product quality, service, efficiency, production costs, and productivity (Prasanna et al., 2019; Zeibote et al., 2019).

Furthermore, developments in information technology have a significant impact on a company's competitive advantage, which can be measured based on economic criteria such as effectiveness, efficiency and productivity. These developments have created products with high capacity, energy efficiency, and the ability to perform an increasing number of functions and types of work. They also allow for the processing, storage, and display of data (Haseeb et al., 2019; Hosseini et al., 2018; Mauerhoefer et al., 2017).

The latest information technology used by Garuda Indonesia is the Electronic Flight Bag (EFB), a hardware-based technology that helps pilots and flight crew perform flight management tasks, such as completing flight performance and takeoff and landing calculations more easily and efficiently (Ates¸, 2017; Schwartzentruber, 2017). The Electronic Flight Bag (EFB) also makes it easier for airlines to confirm that pilots have the latest manuals and information. and distribute updates when necessary (Dutov et al., 2018).

The Electronic Flight Bag (EFB) can now only be used on wide-body aircraft, namely the Garuda Indonesia A330 and B777 aircraft, and only inputs the data needed for one flight, such as Airport Map, Performance Calculation, Terminal Chart, Manual-Manual books. According to research conducted by (Haddock and Beckman (2015) compared the work of pilots who still use conventional paper and those who already use Electronic Flight Bag (EFB). The results showed a significant improvement when using an Electronic Flight Bag (EFB) and reduced workload or stress (Babb, 2017; Suppiah et al., 2020).

Despite its sophistication, technology inevitably has flaws that can cause problems for both aircraft and airline operations. If an Electronic Flight Bag application update is available, operations support personnel must review each Electronic Flight Bag individually before loading it onto the aircraft. This is due to the lack of an integrated system for recording Electronic Flight Bag updates (Misra & Halleran, 2019).

Another issue is that the Electronic Flight Bag (EFB), which contains the Navigation Chart, cannot be used during the Critical Eleven period, which is three minutes before takeoff and eight minutes before landing (Misra & Halleran, 2019; Suppiah et al., 2020). However, there is a solution for using the Electronic Flight Bag during Critical Eleven: installing an iPad mount so that the pilot can still concentrate on controlling the aircraft while viewing the navigation chart on the Electronic Flight Bag.

Awareness of culture safety (safety culture) in world flight is very important for supporting the safety of a flight mission. Safety culture awareness (safety culture) in aviation is not yet completely attached to

the proof that there are still accidents caused by human factors (Corrigan et al., 2019; Van Nunen et al., 2018).

Based on background behind Which researchers explain on so can identified in the form of the following problems:

1. Reason accident flight in Indonesia in domination by factor man
2. Not yet There is his system Which integrated with EFB For know it There is app update
3. Electronic Flight Bag No can used on critical eleven
4. Not yet attachment in a way intact implementation safety culture
5. Flights that are still using conventional paper causes high levels of workload or stress pilots are higher than those on flights that already use EFBs

This study aimed to:

1. To determine the influence of effectiveness of using an electronic flight bag and safety culture on aviation safety performance at PT. Garuda Indonesia
2. To determine the influence of the effectiveness of the use of electronic flight bags, safety culture, and flight safety performance at PT. Garuda Indonesia.
3. To determine the effectiveness of the use of electronic flight bags on the flight safety performance of PT. Garuda Indonesia.
4. To know the influence of Culture Safety on Performance Safety Flight PT. Garuda Indonesia.

2. Literature Review & Hypothesis Development

A safety management system is defined as a set of processes established throughout an organization that provides effective risk-based decisions related to day-to-day business (Elamir, 2020; Lefsrud et al., 2020). A Safety Management System is a systematic approach to managing safety, including the necessary organizational structure, accountability, policies, and procedures (Nævestad et al., 2018; Turner, 2019).

Safety Management System requirements are training that focuses on the role played by individual flight attendants in the operator's safety management system and how their contributions fit into the larger picture of safety management at the overall organizational level (Piza et al., 2018). The Federal Aviation Administration (Federal Aviation Administration, 2009) suggests four essential components for developing a safety management system: safety policy, safety assurance, safety risk management, and safety promotion. The FAA places management commitment, establishes clear objectives, defines methods and processes for meeting safety objectives under the safety policy, and also places training, communication, safety awareness, matching competency requirements with system requirements, and other elements for a positive safety culture under safety promotion (Kline & Hutchins, 2017; Politis, 2018).

According to Griffin and Neal (2000) and Poerwanto and Mauidzoh (2017), safety performance is a safety-relevant work behavior that can be conceptualized as other work behaviors that are the result of work. This model combines two components of safety performance: compliance and participation. Compliance involves adherence to safety procedures, performing work safely, and preparing and using appropriate safety equipment. Participation is an involvement behavior that is not directly related to individual safety but supports the realization of a safe environment (Griffin & Neal, 2000; Piers et al., 2009). The purpose of measuring safety performance according to Hasim (2017) and Jazayeri (2017) is to get early warning signs and act quickly if emergency action is needed; it can also be a bonus or

incentive program for the organization. The main purpose of measuring safety performance is to check the current safety status and observe progress with the current safety management system compared to that in the past.

In general, effectiveness is the achievement of goals appropriately or selecting the right goals from a series of alternatives or choices of methods and determining the choice from several other choices. Effectiveness can also be interpreted as the measurement of success in achieving goals. For example, if a task can be completed by selecting predetermined methods, then the method is correct or effective. The purpose of using information technology in taxation is to save time, be easy, accurate, and paperless (Pujiani & Rizal, 2014). An electronic flight bag (EFB) is a device/calculation/display system that can be used by flight crew/pilots for various functions. The use of an EFB can reduce or eliminate the need for paper and other reference materials in the cockpit (Allen, 2003; Hasim, 2017).

EFB stands for Electronic Flight Bag, which is an additional tool in the form of a computer set to simplify and lighten the pilot's routine work and eliminate the use of paper (Less paper cockpit). The EFB features depend on the options or choices of each airline. Usually, airlines have standard options for what is needed for their flights in the EFB installed on their aircraft (Wibowo & Pertahanan, 2017). The Electronic Flight bag (EFB) is a device that allows the flight crew to perform various functions that are currently performed using an iPad. reduce reference paper. In its simplest form, an EFB can perform basic flight planning calculations and display a variety of digital documents, including navigation charts, operating manuals, and aircraft operating lists. The most advanced EFBs are fully certified as part of the avionics system and are integrated with aircraft systems such as the Flight Management System (FMS) (Chase & Hiltunen, 2014; Haddock & Beckman, 2015).

Electronic Flight Bags can be divided into three classes according to equipment specifications: class 1, class 2, and class 3.

System Electronic Flight Bag class 1:
is a commercial-off-shelf (COTS)-based computer system that is commonly used for flight operations. It is portable, connects directly to certified aircraft power, is considered a controlled portable electronic device, does not use mounting in the aircraft, does not have an aircraft data connection except under certain conditions, and does not require airworthiness approval.

System Electronic Flight Bag class 2:
It is a commercial-off-the-shelf (COTS) computer system commonly used for flight operations. It is portable, connects directly to certified aircraft power, is considered a controlled portable electronic device, uses mounting in the aircraft, can be connected to the avionics system, and requires airworthiness approvals.

System Electronic Flight Bag class 3
It is installed as equipment requiring airworthiness approval. This approval (including the integrity of the Electronic Flight Bag hardware installation, e.g., server, display, keyboard, power, and maneuvering) covers the aspect of compatibility between the human face and machine, including hardware and software quality.

Garuda Indonesia uses an Electronic Flight Bag class 2 for A330/200/300/900 and B777-300ER aircraft. Using iPad 6, which contains manuals such as (OM, FCOM, ROM, FCTM, ACL/Opspec, etc.), e-QRH, and performance calculation software, FLYSMART for A330-200/300/900 and OPT for B777-300ER, and e-navigation chart. According to (Ates¸, 2017), there are six indicators of the influence of EFB use in the operational field, namely:

1. Convenience access

2. More Lots information (management control And operation control)
3. Increase the volume of information.
4. The text is more concise and formatted better.
5. Accurate And reliable

Safety culture is a set of enduring values and attitudes regarding safety issues shared by every member at every level of the organization. Safety culture refers to the extent to which each individual and organizational group is aware of the unknown risks and dangers caused by its activities, consistently behaves to maintain and improve safety, is willing and able to adapt when faced with safety issues, is willing to communicate safety issues, and consistently evaluates safety-related behavior (Piers et al., 2009).

According to research conducted by the FAA Federal Aviation Administration (2009) quoted in the journal (EASA, 2015), which was collected voluntarily from aviation safety organizations from various countries such as ASRS (Aviation Safety Reporting System), ATSB (Australian Transportation Safety Bureau), CAA (Civil Aviation Authority), BEA (French Bureau of Inquiry and Analysis for Civil Aviation Safety), and TSB (Transportation Safety Board of Canada).

Reports indicate that many pilots lack training in the use of electronic flight bags and are unfamiliar with conventional paper flight bags. Pilots also complain that the electronic flight bag display is too small and that the information on it is outdated. latest. There is also a report of failure of the electronic flight bag, Which No cause inoperability, total death, and screen brightness issues.

Based on research conducted by Ates¸ (2017), with the use of the EFB system, operators can access information about flight operations more quickly and easily. In the EFB system, the information required by users is presented in a better format in an electronic environment. Information is stored in an electronic environment by minimizing the level of errors caused by human factors and increasing the reliability and authenticity of the information presented to the users. The use of EFB in operation flights provides more accurate information For User operational control. Using EFB, it is possible to provide users with more information that is relevant for administrative control purposes when necessary.

According to research conducted by Wibowo and Pertahanan (2017), safety culture has a positive impact on aviation safety. Organizational culture as a basic pattern accepted by an organization for acting and solving problems, developing employees who are able to adapt to the environment, and uniting its members.

Safety Culture or safety culture which is a set of enduring values and attitudes regarding safety held by every member at every level of the organization. Safety culture refers to the extent to which each individual and organizational group is aware of the risks and invisible dangers caused by activities, how to behave to maintain and improve safety, are willing and able to adapt when facing safety problems, are willing to communicate safety issues, and consistently evaluate safety-related behavior.

The framework of this study is as follows:

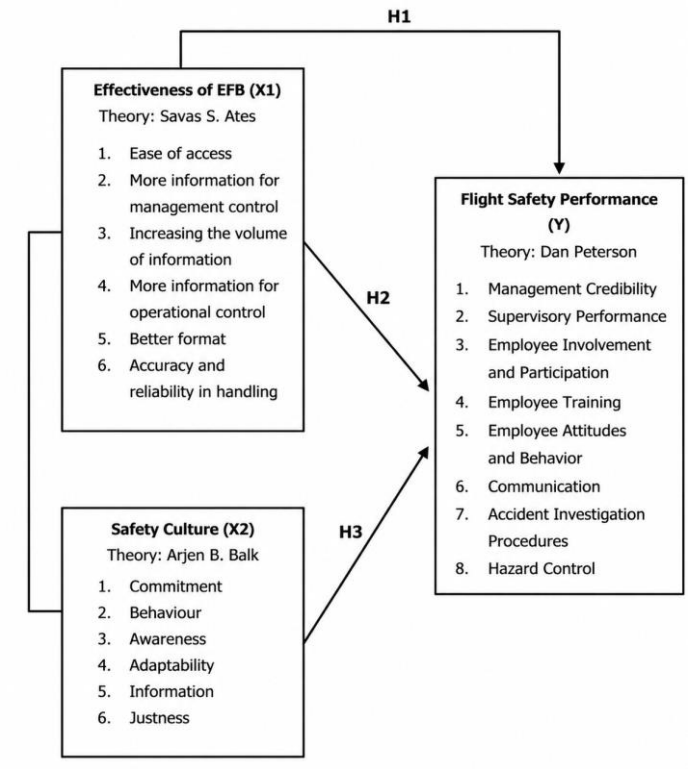

Figure 1. Research Framework

Based on Figure 1, the diagram illustrates the relationships between the effectiveness of the Electronic Flight Bag (EFB), safety culture, and flight safety performance. The effectiveness of the EFB (X_1) is based on the theory of Savas S. Ates and includes factors such as ease of access, more information for management and operational control, better formats, and accuracy in handling data. This is connected to flight safety performance (Y), as outlined by Dan Peterson's theory, which includes elements like management credibility, employee performance, training, and hazard control. The safety culture (X_2), based on the theory of Arjen B. Balk, encompasses commitment, behavior, awareness, adaptability, information, and justness. The arrows indicate the hypothesized influences: H1 for EFB effectiveness, H2 for safety culture, and H3 for their combined impact on flight safety performance.

2.1 Hypothesis Development

The hypothesis of this study is as follows:

H_1: The effectiveness of using EFB And Culture Safety together has a positive influential impact on flight safety performance at PT. Garuda Indonesia

H_2: Effectiveness of using EFB is positive and significant to PT performance. Garuda Indonesia flight safety

H_3: Culture Safety influential positive And significant to performance safety PT. flights Garuda Indonesia

3. Methodology

The data used in this study are primary data obtained by distributing questionnaires online to a sample of 35 Garuda Indonesia pilots who specialize in fly aircraft Airbus A330. The technique used was

quantitative descriptive analysis. Data calculations using SPSS version 25 showed a very strong, unidirectional, and positive relationship between the variables (Sugiyono, 2017).

4. Results and Discussion

Reliability testing was carried out using the test-retest technique, with reference to alpha Cronbach, which is level reliability or price r (alpha) reached 0.6. Following this, the reliability of variable X_2 is tested.

Table 1. Reliability Test

Variable	Cronbach Alpha	Comparison	Description
Safety Culture	0.982	> 0.600	Reliable

Table 1 shows that the Cronbach's Alpha value for this variable is 0.982, which is greater than the threshold value of 0.600. This indicates that the variable is reliable according to the test. The source of the data is the processed data from SPSS.

4.1 Regression Linier Multiple

Multiple linear regression was used to determine the magnitude of the influence of electronic flight bag effectiveness variables (X_1) and safety culture (X_2) partially or jointly on flight safety performance (Y). The complete statistical calculations for the multiple linear regression analysis are provided in the appendix and are further explained in the following Figure:

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-19.191	6.755		-2.841	.008
Effectiveness of EFB	1.161	.319	.406	3.638	.001
Safety Culture	.112	.022	.559	5.012	.000

a. Dependent Variable: flight safety performance

Figure 2. Correlation Between Variables

Based on Figure 2, the regression equation model that can be written from these results in the form of a linear regression equation is as follows:
Y = -19,191+1,161 X 1 + 0.112 X 2

Information :

1. Mark constant a = -19,191 give meaning that If variables free ignored or with say other If there are no variables on EFB effectiveness and safety culture, then the aviation safety performance at PT. Garuda Indonesia had a value of -19.191.
2. The coefficient value b 1 = 1.161 means that for every one-unit change in the effectiveness of the EFB, assuming a safety culture is implemented, the safety performance of PT. Garuda Indonesia

will increase. as large as 1,161 and move in the same direction. mark coefficient b2 = 0.112 matter This means that for every single change in safety culture, assuming the implementation of effective EFB, PT Garuda Indonesia's flight safety performance will increase by 0.112 and move in the same direction.

4.2 Analysis Coefficient Correlation Multiple

This multiple correlation coefficient is used to determine the magnitude of the relationship between the independent variables (EFB effectiveness and safety culture) and the dependent variable (flight safety performance). The following are the results of the multiple correlation coefficient calculations:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.888[a]	.788	.775	1.965

a. Predictors: (Constant), safety culture, effectiveness of efb

Figure 3. Coefficient Correlation Multiple

Based on Figure 3, the multiple correlation coefficient value R was 0.888. Thus, the magnitude of the relationship between the effectiveness of EFB and safety culture on the flight safety performance of PT. Garuda Indonesia's CR is 0.888 in the interval 0.80–1.000, meaning it has a very strong positive relationship. This coefficient of determination is used to determine the contribution or influence of the independent variable on the dependent variable, obtained using the following formula:

$$KD = R^2 \times 100\% = 0.788 \times 100\% = 78.8\% \quad (1)$$

Thus, the effectiveness of the use of electronic flight bags and safety culture is significant. on the flight-safety performance of PT. Garuda Indonesia is 78.8%, and isanya 21.2 % represents the influence of other factors. To determine whether there is a simultaneous influence between all independent variables (EFB effectiveness and safety culture) on the dependent variable (flight safety performance), the following equation was used:

1. Ho: p = 0, meaning that if the sig value > 0.05, or F count < F table, then there is no simultaneous influence of variables X_1 and X_2 on variable Y.
2. Ha: p = 0, meaning that if the sig value < 0.05, or F count > F table, then there is a simultaneous influence of variables X_1 and X_2 on variable Y.

	Sum of Squares	df	Mean Square	F	Sig.
Regression	458.758	2	229.379	59.421	.000[b]
Residual	123.528	32	3.860		
Total	582.286	34			

a. Dependent Variable: flight safety performance

b. Predictors: (Constant), safety culture, effectiveness of efb

Figure 4. Test F Anova

Based on Figure 4, the actual rate (α)/confidence level $(1-\alpha)$ to find t_α is $\alpha = 5\%$ or confidence level $(1-\alpha) = 1-5\% = 95\%$, because the greater the confidence level, the more accurate the results obtained. Therefore, the author chose a statistical test with the following formula using the F table.

$$F_{\text{table}} = F_{(1-\alpha)}\{(dk = k), (dk = n-k)\} \tag{2}$$

$$F_{\text{table}} = F_{(1-0.05)}\{(dk = 2), (dk = 33-2)\} \tag{3}$$

$$= F\{(1-0.05)(2, 33)\} \tag{4}$$

The method looks for $F_{\text{table}} = 2$, as numerator = 33, as number denominator $F_{\text{table}} = 3.28$.

Based on the F test calculation using SPSS, the calculated F was obtained as 59.421 which means that:

$0.000 < 0.05,$ so H_0 was rejected And H_a was accepted.

$59.421 > 3.28,$ so from results the H_0 was rejected And H_a was accepted.

The regression equation model that can be written from these results in the form of a linear regression equation is as follows:

$$Y = -19.191 + 0.112X_2 \tag{5}$$

From testing in a way partial based on Table 4.15 can be obtained the influence of the effectiveness of EFB on flight safety performance, where it is known that the significance level is 0.000 and t_{count} was as large as 5.012. And from the number of respondents (n) that is as much as 35 persons so can be obtained t_{table} is as big as:

$$t_{\text{table}} = t_{(\alpha/2)(n-k-1)} = t_{(0.025)(35-2-1)} = t_{(0.025)(32)} = 2.03693 \tag{6}$$

The results obtained are as follows:

$0.000 < 0.05$, so from the results, H_0 rejected H_a accepted.

$5.012 > 2.03693$, so from the results, H_0 rejected H_a accepted.

The results show that the effectiveness of the EFB give influence which has a significant and positive impact on the flight safety performance of PT. Garuda Indonesia.

5. Conclusions

The effectiveness of electronic flight bags on flight safety performance is categorized as very effective. The lowest indicator was found in statement 2 (EFB provides more information about control management), while the highest indicator was found in statement 6 (EFB improves the accuracy and reliability of information). Safety culture was categorized as very good, with the lowest indicator in statement 42 (the agreed reporting method was satisfactory) and the highest in statement 22 (good training makes employees more capable of dealing with existing hazards). Flight safety performance was also categorized as very good, where the lowest indicator was statement 3 (high employee involvement or participation in every safety meeting) and the highest was statement 9 (overtime work causes stress).

Based on the results of multiple regression analysis, the equation $Y = -19.191 + 1.161X_1 + 0.112X_2$ shows that both electronic flight bag effectiveness and safety culture have a positive influence on flight safety performance. The multiple correlation coefficient of $R = 0.888$ indicates a very strong relationship, while the coefficient of determination of 77.8% shows that both variables significantly contribute to flight safety performance, with the remaining 21.2% influenced by other factors. Simultaneous testing results ($F_{count} = 59.421 > F_{table} = 3.28$, significance $0.000 < 0.05$) indicate that both variables together have a significant effect. Partial testing also shows that EFB effectiveness ($t_{count} = 3.638 > 2.03693$, significance $0.001 < 0.05$) and safety culture ($t_{count} = 5.012 > 2.03693$, significance $0.000 < 0.05$) each have a positive and significant influence on the flight safety performance of PT. Garuda Indonesia.

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Author Contributions

HK conceptualized the study, conducted the data analysis, and wrote the manuscript. VH assisted with data collection, provided expertise in safety culture, and reviewed the manuscript. Both authors collaborated in interpreting the results and ensuring the accuracy and integrity of the research findings.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this study. This research was conducted independently, and no financial or personal relationships influenced the results or interpretation of the findings.

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