

The Effect Fatigue Levels of Air Traffic Control (ATC) on Work Effectiveness in Soekarno-Hatta International Airport

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Abstract. At Soekarno Hatta International Airport there was an increase in flight frequency. As a result of increasing flight frequency it will affect the level of fatigue of air traffic controllers, causing stress. Fatigue is the most important problem and is considered a potential risk factor for human error. In the aviation industry, air traffic controllers experience a level of fatigue that affects work effectiveness and flight safety. However, fatigue is often ignored in the literature, because it is a mental and physical status that is difficult to measure. This study examines the effect of the level of fatigue of air traffic controllers on work effectiveness at Soekarno Hatta International Airport. This paper uses quantitative data collected from questionnaires. The measurement of this study uses a Likert Scale and analyzed using regression analysis. The respondents of this study were air traffic controllers. This research contributes to aviation safety by investigating the level of fatigue of air traffic controllers in Indonesia thereby helping related units to improve work effectiveness. The results of this study will show that the level of fatigue of air traffic controllers significantly influences work effectiveness.

Keywords: effect fatigue levels, air traffic control, work effectiveness

1. Introduction

Air transportation, both passengers and cargo, is increasing, according to data from the International Air Transport Association (IATA), estimating 7.2 billion passengers to travel in 2035, nearly double the 3.8 billion air passengers in 2016, resulting in serious problem with the lack of workforce in the civil aviation industry (IATA, 2016). Various job positions related to civil aviation, such as aircraft pilot, flight engineer, aircraft maintenance engineer, repairman, aircraft dispatcher, air traffic controller (ATC), flight crew, and ground crew, require long hours of training, with more than one year needed to train pilots and air traffic controllers. Moreover, due to staffing shortages many employees in this industry must work overtime. The result of high workloads can make people feel fatigued, thus increasing the possibility of human error and posing danger consequences to aviation safety (Chang, Yang, & Hsu, 2019). The national and international aviation industry is growing rapidly. At present, air transportation is in high demand by both middle and upper class citizens, so that the workload becomes high and will lead to decreased work effectiveness.

The prevailing view is that whilst fatigue is de arousing and causes a slowing of most aspects of cognitive function, these effects can be compensated for if the task is sufficiently motivating (Roach, Petrilli, Dawson, & Thomas, 2006). Fatigue is a risk factor for flight performance and safety in commercial aviation. In commercial aviation, to help to curb fatigue, the maximum duration of flight duty periods is regulated based on the scheduled start time and the number of flight segments to be flown (Honn, Satterfield, McCauley, Caldwell, & Van Dongen, 2016).

The full impact of fatigue is often underappreciated, but many of its deleterious effects have long been known. Compared to people who are well-rested, people who are sleep deprived think and move more slowly, make more mistakes, and have memory difficulties. These negative effects may and do lead to aviation errors and accidents (Caldwell et al., 2009). Work

stress refers to those aspects of work design, organization, and management, and their social and organizational contexts, that have the potential to cause harm to employee health (Puttonen, Härmä, & Hublin, 2010). From a safety perspective and found that fatigue cannot be represented as a simple summation of the individual factors. This reflects the complex interaction between, on the one hand, the timing of duty related to the circadian rhythm of fatigue and, on the other hand, the duration of duty and its impact on the timing of sleep (Powell, Spencer, Holland, Broadbent, & Petrie, 2007). fatigue must be viewed primarily as a function of work scheduling and workload intensity (Samuel, A, Wegmann, H. M., Vejvoda, 1995). Other work schedule characteristics that cause sleep difficulties for example, many consecutive work shifts (FOLKARD, LOMBARDI, & TUCKER, 2006)

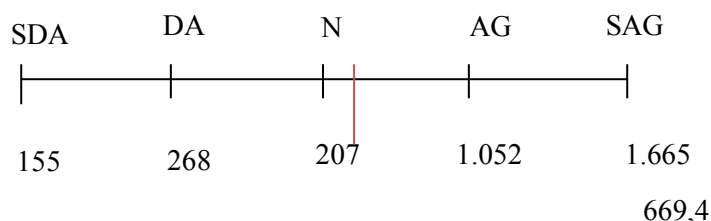
According to Handoko, (1997) in Zuliyanti (2005: 26) Work effectiveness consists of words of effectiveness and work. Effectiveness is the ability to choose the right destination or equipment for achieving the goals set (Yudhaningsih, 2011). By increasing work effectiveness it can reduce the number of accidents on flights. The authors investigated the relationship between fatigue levels and work effectiveness in air traffic controllers. In this study, we contribute to aviation safety by investigating the level of fatigue and work effectiveness. Air traffic controllers which is very busy causes work stress and can reduce performance. Therefore it is necessary to have evaluations and training for air traffic controllers.

2. Methodology

The researcher used quantitative and descriptive methods. This study examines the effect of the level of fatigue of air traffic controllers on the work effectiveness of the Soekarno-Hatta International Airport. Data sources are primary data collected directly by filling out the questionnaire. The questionnaire was filled out by 53 air traffic controllers. This journal is measured using a Likert Scale on a scale of 1 to 5. This study uses simple regression analysis techniques. In addition to primary data, this study also carried out secondary data from previous studies, books and journals. The independent variable is the level of fatigue (X) and the dependent variable is work effectiveness (Y).

3. Discussion and Result

3.1. Variable Fatigue Levels

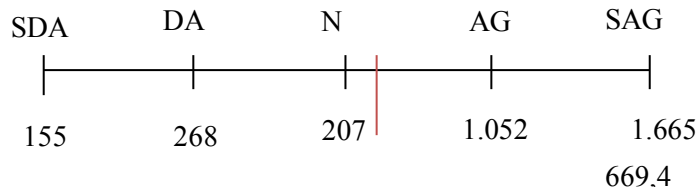


The research questionnaire the level of fatigue variable consisted of 9 statements with a scale of 1 to 5 as the highest score was 1,325 and the lowest score was 25. Based on the results of the questionnaire it was stated that the average average score of the fatigue level was 3.72. This can be interpreted that the variable level of fatigue in air traffic controllers is in a high position and that means the level of fatigue experienced by air traffic controllers can cause stress. Of each item, the highest weight of 4.79 states that the fatigue experienced by traffic officers can jeopardize flight safety. The lowest point is 1.85 in the statement that air traffic controllers are more effective at working on the night shift than working on the morning or afternoon shift.

According to these results it can be analyzed that air traffic controllers have a high risk of stress. Because in its work, the role of air traffic controllers is very important and greatly affects flight safety. Air traffic controllers cannot work for long periods of time, they must have

adequate rest periods and do not work if they are exhausted. Because it will adversely affect flight safety.

3.2. Work Effectiveness



The research questionnaire work effectiveness variable consists of 9 statements so that the lowest score is 155 and the highest score is 1.665. Based on the questionnaire, the results show that the average score in the variable workload is 2.58. The questionnaire consisted of 9 questions in the highest effectiveness variable weighted score of 4.15 which stated that employees who were too tired at work could cause fatal errors. From the questionnaire, the lowest score weighs 1.36 which states that air traffic controllers can work more than the given hour, from morning to night.

Based on the results of the study of variable fatigue levels and variable work effectiveness. High fatigue levels and poor work effectiveness can cause aircraft accidents and flight safety to be disrupted.

3.3. Simple Linear Regression Analysis

The questionnaire data have gone through validity, reliability and normality tests on 53 respondents using the SPSS 20 system. The validity test results state that all questions in the questionnaire are valid and reliability results state that the questionnaire is reliable. Based on the questionnaire the data and explanation that we got are explained below.

Table 1.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,463 ^a	,215	,199	3,61781

a. Predictors: (Constant), Fatigue Levels

Based on the results of linear regression analysis above the relationship between variables fatigue levels and work effectiveness has a strong correlation with r value of 0,463. From the output obtained the coefficient of determination (R Square) of 0,215 which implies that the influence of the independent variable (fatigue levels) on the dependent variable (work effectiveness) is 21,5%.

Table 2.
Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	9,481	4,400		2,155	,036
¹ Fatigue Leves	,438	,117	,463	3,735	,000

a. Dependent Variable: Work Effectiveness

From the results of the table above, the variable fatigue levels has a positive influence on work effectiveness. So the regression equation can be written, $Y = 9,481 + 0,438X$. This equation can be interpreted that the constant of 9.481 means the consistent value of the variable work effectiveness is 9.481. The regression coefficient X of 0.438 states that every addition of 1% the value of the fatigue levels, then the value of participation increases by 0.438. The regression coefficient is positive, so it can be said that the effect of variable X on Y is positive.

Based on the significance value obtained a significant value of $0,000 < 0,05$. It was concluded that the variable fatigue levels had an affect on work effectiveness. Based on the value of t, it is known that the value of t arithmetic is $3,735 > t$ table 2,008. So it can be concluded that the variable fatigue levels affects the variable work effectiveness.

4. Conclusion

Based on the results of this study, it was found that for variable fatigue levels has a significant effect on the work effectiveness of air traffic controllers. The results of the questionnaire showed that the average value of the variable fatigue levels received a moderate response. This means that the fatigue levels of air traffic controllers is not good enough. The results obtained for the variable work effectiveness, the highest score found that employees who are too tired at work can cause fatal errors. And the lowest score on the statement is that air traffic controllers can work more than the given hours, from morning to night. Based on the results of the study, high fatigue levels and poor work effectiveness can cause aircraft accidents and flight safety to be disrupted.

To reduce fatigue in air traffic controllers and improve work effectiveness, it is necessary to have adequate rest for air traffic controllers and add employees. This action was proposed to prevent employees from becoming stressed and improving safety on flights.

Cooperation between the government and the company is also needed to share, and socialize to air traffic controllers about the importance of health for employees to reduce workplace accidents. training is also needed for employees, training should be given to old employees and new employees. It is very important to maintain health for employees, if employees are in a state of stress, it can cause accidents on flights. So that there is a need for risk evaluation and management for air traffic controllers. Flight safety is the main thing, especially for air traffic controllers, crew and passengers.

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