

The Effect Of Workload On Air Traffic Controller Performance At Perum LPPNPI Kupang Branch

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Abstract – This research was conducted at Perum LPPNPI Kupang Branch, which is located at El Tari Airport Kupang, from February to July 2021. The problem with this research is the difficulty of communicating between ATC and pilots caused by the blind spot making the ATC workload level increase. One of the reasons for the high workload is the high traffic from year to year. This study aims to obtain an overview of the workload level and performance of air traffic controller personnel at Perum LPPNPI Kupang Branch and find out how much influence the load has on work has on the performance of air traffic controllers at Perum LPPNPI Kupang Branch. Based on this research, the level of workload in Perum LPPNPI Kupang branch is shown at 70.03%. The workload is said to be high in the work group. Then on the Y variable, the performance level obtained is 52.6%, which is quite a percentage. In the calculation of the workload correlation coefficient of -0.8782, The figure is the interpretation of the correlation coefficient of the results obtained between the relationship between the variable x (workload) and the variable y (performance) is strong. The coefficient of determination (r^2) is 77.13%; the remaining 22.87% is influenced by other factors that are not examined.

Keywords – air traffic control, performance, quantitative, workload

I. INTRODUCTION

Perum LPPNPI Kupang branch is an institution that serves flight navigation at El Tari Kupang International Airport. The developments that occurred in the number of aircraft movements made the Kupang branch of LPPNPI perum always increase the level of awareness for air traffic controller personnel who served as Aviation Traffic Guides. The workload of an air traffic controller is very heavy because it must prevent collisions between aircraft; prevent the occurrence of aircraft in the area of movement and obstacles in the area; speed up and facilitate the flow of flight traffic; provide advice and information useful in aviation safety; provide information to relevant organizations in efforts to help and search for victims of aircraft accidents. The existence of a blindspot in the Kupang Branch of LPPNPI Perum makes the workload of air traffic control even heavier. In the same year, it was recorded that the amount of traffic at the Kupang Branch of LPPNPI Perum increased, which made the workload of air traffic control personnel increase, coupled with the difficulty of establishing 2-way communication carried out in serving flights between the air traffic controller and the pilot in the blindspot area. The higher the workload of air traffic control, the more it will affect the performance of air traffic control personnel. The high workload of an air traffic controller can affect the performance of an air traffic controller. Performance is the result of work that can be achieved by a person or group of people in a company in accordance with their respective authorities and responsibilities in an effort to achieve organizational goals illegally, not violating the law and not contrary to morals and ethics (Afandi, 2018: 83).

Definition of Workload According to Kurnia (2010), workload is a process of analyzing the time used by a person or group of people in completing the task of a job (position) or group of jobs (work units) that is carried out under normal circumstances or conditions. Workload aspect According to Munandar (2001: 381), there are two aspects that constitute workload, namely: workload

as physical demands and workload as work demands. According to Tarwaka (2004,95), the factors influencing workload are: a) external factors; b) internal factors. According to Putra (2012), there are 4 indicators in the workload, namely: targets to be achieved, individual views, working conditions, use of working time, and work standards. Cain (2007) has broadly classified 3 categories of workload measurement, namely: subjective measurement, performance measurement, and physiological measurement.

Understanding performance According to Sedarmayanti (2017: 260), performance is the result of a person's work, a management process as a whole, where the results of a person's work must be shown with concrete evidence and can be measured According to Mangkunegara (2016: 67), there are several factors that can affect performance, including: ability factors, motivation factors.

II. RESEARCH METHOD

The authors used quantitative research methods in completing this study. This research method is used to research on certain populations or samples. Data collection is using research instruments. Data analysis is statistically quantitative, with the aim of describing and testing predetermined hypotheses.

In this study, the authors divided it into 2 variables, namely: Independent Variable (X) Independent variables are often called stimulus, predictors, or antecedent variables. In Indonesian, it is often referred to as a free variable. Free variables are variables that affect dependent or bound variables (Sugiyono, 2019). In this study, the free variable is workload.

Dependent variables (Y) dependent variables are often called output, criteria, or consequent variables. In Indonesian, it is often referred to as a bound variable. Bound variables are variables that are influenced or that become an effect due to the existence of free variables (Sugiyono, 2019). In this study, the bound variable is the performance load. (Sugiyono, 2019). In this study, the dependent variable is the workload of the air traffic controller.

A questionnaire was used by the authors to obtain variable x (workload) data using NASA-TLX. The NASA-TLX method was developed by Sandra G. Hart of the NASA-Ames Research Center and Lowell E. Staveland of San Jose State University in 1981 (Hancock and Meshkati, 1988). This method, in the form of a questionnaire, was developed based on the emergence of the need for subjective measurements that are easier but more sensitive to workload measurements. The NASA-TLX method is a multidimensional rating procedure that divides workloads on the basis of an average 6-dimensional loading, namely mental demand, physical demand, temporal demand, effort, own performance, and frustration. The data processing phase can be done, starting with the results of the NASA-TLX questionnaire, which can be calculated using NASA-TLX assessment calculations, and measuring each dimension, then calculating the level of performance, and the last step is to get the weighted workload (WWL) level. A questionnaire was used by the authors to obtain variable x (workload) data using NASA-TLX. The NASA-TLX method was developed by Sandra G. Hart of the NASA-Ames Research Center and Lowell E. Staveland of San Jose State University in 1981 (Hancock and Meshkati, 1988). This method, in the form of a questionnaire, was developed based on the emergence of the need for subjective measurements that are easier but more sensitive to workload measurements.

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1. Research Instrument Test

- a. Validity Test Validity testing according to Sugiyono (2019) is carried out with the intention of knowing whether the instrument used can already measure something that the author wants or not.
 - b. The Reliability Test is used to determine the consistency of the measuring instrument. Whether the measuring instrument used is reliable and remains consistent if the measurement is repeated, as revealed by Sugiyono (2019).
2. Data Normality Test According to Ghazali (2016), the normality test is carried out to test whether, in a regression model, an independent variable and a dependent variable or both have a normal or abnormal distribution. Therefore, the author uses the method of liliefors with the help of Microsoft Excel.

3. Individual Product Moment A correlation test is used to test the hypothesis of the relationship between one free variable and one fixed variable. To test the correlation, the author uses the help of Microsoft Excel.
4. Calculating the Coefficient of Determination According to Ghazali (2016), the coefficient of determination test aims to measure the model's ability to explain the variation of dependent variables. The formula used to calculate the coefficient of determination is $KD = (r^2) \times 100\%$.

III. RESULTS AND DISCUSSION

Data from workload research (variable x) was obtained by providing questionnaires to all air traffic control personnel at the Kupang Branch of LPPNPI Perum, which amounted to 20 people. The data is in accordance with the books Physiology and Work Measurements (2016:8) and NASA-TLX according to Ensley (2000:A-5), and then paraphrased into Indonesian to make it easier for respondents to understand the content of the statements given. The first phase of the questionnaire can be calculated using a formula from NASA-TLX by measuring each dimension, then calculating the performance level of each dimension, in order to obtain the weighted workload (WWL) rate.

Table 1. Working class level

Load Group Work	Value
Very Low	0 – 20
Low	21 – 40
Netral	41 – 60
High	61 – 80
Very High	81 – 100

Based on the results of data processing assisted by Microsoft Excel 2010 software, the WWL rate in the questionnaire results was 70.03%. These results, when entered into the categories by the table, show a high workload category. In other words, the air traffic controller at Perum LPPNPI Kupang Branch has a high workload.

The research data was obtained in the form of answers from the Y (Performance) variable questionnaire. The questionnaire was distributed to ATC personnel at the Kupang branch of Perum LPPNPI, which numbered 20 people. The questionnaire consists of 10 statements, each of which will represent the performance conditions of ATC personnel when performing on duty. The data is weighted using a likert scale that has a range of 1–5 (strongly disagree–strongly agree). The performance questionnaire uses a SHELL concept where each item of the statement can represent software, hardware, environment, liveware, or liveware.

The lowest number of scores uses a likert scale that shows the performance of ATC personnel: $1 \times 20 \times 10 = 200$. The highest number of scores uses a likert scale that shows the performance of ATC personnel: $5 \times 20 \times 10 = 1000$. Total Score / Highest Score 100% The result is $526/1000 \times 100\% = 52.6\%$.

Table 2. Interpretation of the number of scores (Likert)

0 % - 19.9 %	Very Bad
20 % - 39.9 %	Bad
40 % - 59.9 %	Enough
60 % - 79.9 %	Good
80 % - 100 %	Excellent

Based on calculations assisted by Microsoft Excel software, the performance level of ATC personnel at Perum LPPNPI Kupang Branch is 52.6%. This value can be categorized in the likert table with sufficient criteria, which means that the performance of ATC personnel at the Kupang branch of the LPPNPI Perum is quite sufficient.

a. Validity Test

In variable x (workload), there is no need to use validity tests because statements or questionnaires have been standardized in the book Situation Awareness in Air Traffic Control: Enhanced Displays for Advanced Operations (2000: A-5). statements or questionnaires on variable y (performance) have received approval from the supervisor. So for testing the validity of the variable y (performance) using the product moment correlation table, where if r count is smaller than r table, then the data is declared invalid and if r count is greater or equal to r table, then the data is declared valid.

Table 3. Test the validity of variable Y

No Item Question	rcount	rtabel	Ket
1	0.7483	0.468	Valid
2	0.91326	0.468	Valid
3	0.80155	0.468	Valid
4	0.80233	0.468	Valid
5	0.64048	0.468	Valid
6	0.754	0.468	Valid
7	0.82461	0.468	Valid
8	0.65735	0.468	Valid
9	0.83355	0.468	Valid
10	0.89416	0.468	Valid

b. Reliability Test

In the reliability test on variable y (performance), the author used the help of Microsoft Excel 2010 software. The authors used Cronbach's Alpha formula on reliability tests. This test uses manual calculations with a variation of each question item, for a total of 10 questions. The validity test using Alpha Cronbach's has a provision whereby a research instrument is declared reliable when it is greater than 0.6. From the author's calculations, the calculated value for the variable y (performance) is 0.9305. Then the research instrument is declared reliable.

c. Data Normality Test

In testing the data normality of variables x (workload) and y (performance) using the Liliefors test, It is known that the critical value of L for the Liliefors test with a sample size of 20 people is 0.231. The Liliefors test has a provision, namely if L_o is smaller than L_{table} , then the data is declared normal, and if L_o is larger than L_{table} , then the data is declared abnormal. With the help of Microsoft Excel software, a result of L_o of 0.045032 was obtained for variable x (workload). With it, the variable data x is declared normal and can be continued with the subsequent processing of the data.

Table 4. Test the normality of variable X data

TEST DATA NORMALITY VARIABLE X (WORKLOAD)	
Lo = 0.045032	Ltabel = 0.231
$0.045032 < 0.231$ $Lo < Ltabel$ Conclusion: Ha received, data it is stated "NORMAL"	

With the help of Microsoft Excel software, we obtained a result of 0.082266 for the variable y (performance). With it, the variable data is declared normal and can be continued with the subsequent processing of the data. Table 5. Test the normality of variable data Y.

TEST DATA NORMALITY VARIABLE Y (PERFORMANCE)	
Lo = 0.088853	Ltabel = 0.231
$0.088853 < 0.231$ $Lo < Ltabel$ Conclusion: Ha received, data it is stated "NORMAL"	

Associative hypothesis testing is done manually with the help of Microsoft Excel 2010 software and uses the product moment correlation formula. From the results of data processing variables x (workload) and y (performance) obtained, rx results are -0.8782. The number shows that the relationship between variable x and variable y is the opposite, which means that the higher the workload, the lower the performance, with a value of 0.8782. Based on the results of the interpretation table, the correlation coefficient of the results obtained between the relationship of variable x (workload) and variable y (performance) is strong. With it, the hypothesis in the product moment correlation test is acceptable.

d. Coefficient of Determination

The coefficient of determination is the percentage value of how much influence the variable x (workload) has on the variable y (performance). From the results of data processing assisted by Microsoft Excel software through Product Moment correlation, a Coefficient of Determination of 77.13% was obtained. The results showed that the contribution of variable x (workload) to variable y (performance) was 77.13%.

IV. CONCLUSION

The level of workload in the Kupang branch of Perum LPPNPI through the NASA-TLX questionnaire and WWL (Work Weighted Load) calculation is shown at 70.03%. Which is where if it is tabulated on the work group table, then the workload is said to be high.

Based on the results of the questionnaire distributed and calculated on variable y (Performance), the percentage of calculation was 52.6%. Which percentage, if tabulated in the table of interpretation criteria for the number of scores (likert), is quite sufficient. In the sense that the performance provided by ATC in service is sufficient, it is better that ATC performance can be optimized so that it can reach the excellent category.

Based on the results of the study, the results showed the effect of workload on the performance of the air traffic controller at the LPPNPI Perum Kupang Branch were 77.13%, which means that the influence of workload on performance has a

negative and significant effect. This explains that if the workload increases, it will reduce the potential performance of ATC personnel; if, on the contrary, the workload decreases, it will increase the performance potential of ATC personnel.

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