



Workload Analysis Using Full-Time Equivalent and NASA-TLX Methods to Optimize Employee Performance at PT. Z

Rizka Hafizah¹, Hery Hamdi Azwir^{1*}

¹⁾ Faculty of Engineering, Industrial Engineering Department, President University
Jl. Ki Hajar Dewantara
Kota Jababeka, Cikarang, Bekasi - Indonesia 17550
Email: rizka.hafizah@president.ac.id, *hery.azwir@president.ac.id

ABSTRACT

Human resources are the most valuable asset for companies to improve the quality of products or services, so optimizing an effective workforce is an effort to maintain performance. As the demand for certification increases, the number of employees required will also increase. Then there is the problem of uneven workloads imposed on employees in the PCC division of PT Z. which causes workers to feel stress, burnout, and often overtime that can affect the productivity of workers so that there are often human errors and unmet company targets. To achieve maximum productivity and performance, this research was conducted to determine the factors causing mental workload, and to calculate the optimal number of employees according to the competence and responsibility of each employee. The NASA-TLX method will be used to subjectively determine the weight of the workload. Based on the results of NASA-TLX calculations, the average WWL is up to 71.4 which belongs to the 'Overload' category. Two of the three employees are classified as overloaded with a total WWL of 79.67 and 81.67 positions, respectively. While the Full-Time Equivalent method is used to determine the workload related to the work itself, performance, and allowance factors. Based on the results of the FTE calculation, it shows that two of the three employees also fall into the 'overload' category with an index of 1.63 and 2.42, respectively. The results of the FTE index show that the optimal number of employees requires the recruitment of 2 people for each position in certification and quality management. The company should review the activity elements of each work unit and move the activity elements from overloaded employees to underloaded employees to get a normal workload.

Keywords: Workload Analysis, NASA-TLX, Full Time Equivalent, Work Sampling, Human Resources.

ABSTRAK

Sumber daya manusia merupakan aset yang paling berharga bagi perusahaan untuk meningkatkan kualitas produk atau jasa, sehingga mengoptimalkan tenaga kerja yang efektif merupakan upaya untuk menjaga kinerja. Dengan meningkatnya permintaan sertifikasi, jumlah karyawan yang dibutuhkan juga akan meningkat. Kemudian masalah beban kerja yang tidak merata yang dikenakan pada karyawan di divisi PCC PT Z. menyebabkan pekerja merasa stres, kelelahan, dan sering lembur mempengaruhi produktivitas pekerja sehingga sering terjadi human error dan target perusahaan yang tidak tercapai. Untuk mencapai produktivitas dan kinerja yang maksimal, penelitian ini dilakukan untuk mengetahui faktor-faktor penyebab beban kerja mental, serta menghitung jumlah karyawan yang optimal sesuai kompetensi dan tanggung jawab masing-masing karyawan. Metode NASA-TLX akan digunakan untuk menentukan bobot beban kerja secara subyektif. Berdasarkan hasil perhitungan NASA-TLX, rata-rata WWL hingga 71,4 yang tergolong kategori 'Overload'. Dua dari tiga karyawan tersebut tergolong overload dengan total WWL masing-masing posisi 79,67 dan 81,67. Sedangkan metode Full-Time Equivalent digunakan untuk menentukan beban kerja yang berkaitan dengan pekerjaan itu sendiri, kinerja, dan faktor tunjangan. Berdasarkan hasil perhitungan FTE menunjukkan bahwa dua dari tiga karyawan juga termasuk kategori 'overload' dengan indeks masing-masing 1,63 dan 2,42. Hasil indeks FTE menunjukkan bahwa jumlah karyawan yang optimal membutuhkan perekrutan 2 orang untuk setiap posisi di sertifikasi dan manajemen mutu. Perusahaan sebaiknya meninjau kembali elemen aktivitas masing-masing unit kerja dan memindahkan elemen aktivitas dari karyawan overload ke karyawan underload untuk mendapatkan beban kerja yang normal.

Kata kunci: Analisis Beban Kerja, NASA-TLX, Full Time Equivalent, Pengambilan Sampel Kerja, Sumber Daya Manusia.

1. Introduction

The workload is the amount or quantity of activities that must be accomplished by an organization. Working is essential for growth and improved accomplishment, to achieve a productive life as one of the goals of life. Employee activities certainly cannot be separated from the workload, both physically and mentally. On the other

hand, working indicates that the body will be burdened by an external body. Specifically, every job is a burden for the individual involved. From the point of view of ergonomics, every workload received by a person must be under the physical, mental, and human limitations of who receives workload. Based on an interview with the Head of PCC (Professional Certification Center) in an Indonesian State-owned Enterprise, there are allegations of problems with the workload of officers in the PCC division. The Head of PCC stated that the workload of officers was high. This is evidenced by interviewing directly and giving a questionnaire to officers from the head of PCC regularly and the result 2 out of 3 employees feel the job is overloaded. This happens because the workload received by a person in carrying out the given task is not under the abilities and limitations of the person it can cause stress, burnout, and often overtime that can affect the productivity of workers so that there are often human errors and unmet company targets. This factor is what causes a decrease in customer satisfaction because of the length of time the certificate is issued from the time that has been determined by the company. This workload determination is very necessary for PCC in determining employee formations that are under their capabilities. Certification officers in charge of controlling and organizing the certification process often work outside of operating hours compared to the administration and finance officer divisions who serve as controlling the pre-assessment and regulating all financial transactions. Because of this difference, often the certification officer division has a tougher task compared to the administration and finance officer division so certification divisions are often over time and do not meet targets. Though the workload is not only seen from the physical workload but must consider the mental burden as well. Mental burden if optimized can reduce human error, improve the performance of a department, and customer satisfaction. Productivity must be increased for effective workload planning by optimizing worker capacity. To establish the starting workload of officers at PT. Z, National Aeronautics and Space Administration Task Load Index (NASA-TLX) was used to calculate subjective workload. The subjective workload method was carried out at the beginning because it was easy and practical to use (Hart & Staveland, 1988). Full-Time Equivalent is the approach often used to quantify or measure workload objectively (FTE). The FTE technique may be used to compute the number of hours worked by a full-time worker over a specified period, such as one month or one year. Based on the above problems, then to overcome the inequality of tasks needs to be done a calculation of workload to improve the efficiency of human resources. In this research, it took the mental workload and physical workload of employees at each job, so that the number of employees in each section was under the work charge. Furthermore, it is expected from the calculation of optimal employee numbers based on this workload, that can be used as a reference in the determination of employees.

2. Methods

This section will describe the theoretical steps or methodology of this research, from observation, identification problem, data collection, data analysis, and conclusion and recommendations for further research. Each phase will have distinct aims and ways of achieving the objective. It will be shown in Figure 1.

2.1 Initial Observation

This research began with information movements in PT. Z, some problems resulted in the workload of employees, and inequality of tasks in each division. After getting all of the information, the main focus will be on the main cause for determining the optimal number of employees. Therefore, the main goal of this research is to find out how many employees the Professional Certification Centre in PT. Z. needs and how much workload each employee received.

2.2 Problem Identification

This problem was founded on a reliable theory that aimed to identify and evaluate the elements that directly and indirectly impact the performance of workers based on workload analysis. This research was done on purpose to find out what problems are out there. It will help figure out how many employees and identify factors that affect the mental workload that occurs at the Professional Certification Center.

2.3 Literature Study

In this research, the literature study describes the approach used to evaluate and analyze data to verify their reliability and validity and is also readily readable. The research includes the NASA TLX method and the Full-Time Equivalent (FTE) method. According to (Eggemeier & Wilson, 2020), the workload is one of the factors that affect the success rate of a business or organization. A high workload rate will affect how well employees perform in an organization to achieve an organization's goals. Additionally, workload analysis attempts to establish the number of worker and the number of duties or workloads, use of work time and workload calculations using the workload analysis method measured by the volume of work and performance standards (Puspawardhani et al., 2016).

In this research, two work sampling methods are used, namely NASA-TLX and Full Time Equivalent. Work sampling is a technique for collecting many observations of the work activities of equipment, processes, or

workers/operators. This method of work measurement, which resembles stopwatch time studies, is classified as direct work measurement because measuring operations must be carried out directly at the workplace under examination. The work sampling method is very suitable to be used in making observations on non-repetitive and cyclical work, relative time long. Basically, the implementation procedure is quite simple, namely: observation of work activities for an interval of time taken at random from one or more machines/operators and then record them whether they are in working or idle state (Buchholz et al., 1996).

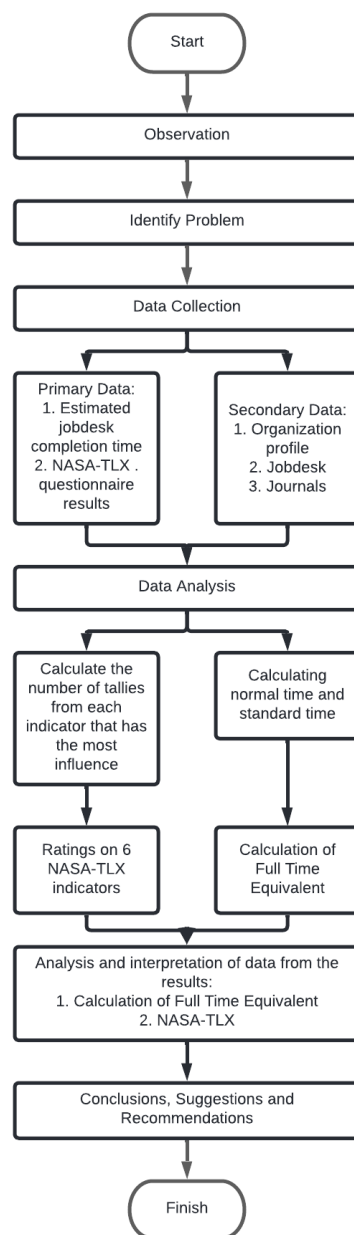


Figure 1 Research framework

In 1981, NASA-TLX (National Aeronautics and Space Administration Task Load Index) was created by NASA-Ames Research Centre's Sandra G. Hart and Lowell E. Staveland of San Jose State University. This approach in the form of a questionnaire was created in response to the rise in demand for subjective workload evaluations that are simpler and more sensitive (Hart & Staveland, 1988). NASA-TLX evaluates mental load across six dimensions: mental demand, physical demand, temporal demand, performance, effort, and frustration. If the WWL score exceeds 60% is classified as overload, while the WWL score between 40% - 60% is classified as normal and a score below 40% is classified as underload (Hart & Staveland, 1988).

Subjective measurements have been widely utilized to gauge officer effort and are becoming a more crucial element in system assessments. Subjective techniques are frequently used because of their practical benefits

(easiness of implementation, non-intrusiveness), as well as because of current evidence that supports their capability to provide sensitive measures of officer load. Evaluations of the officer's performance have gotten more challenging as human-machine systems have grown more sophisticated and automated, making it essential to measure subjective mental workload (Rubio et al., 2004).

According to (Oesman, 2012), FTE is a way to count the number of people in a population or organization. FTE is a way of measuring people who work "full time" (according to established standards) so that it is the actual number of hours worked as a full-time employee. The implications of FTE numbers are categorized as overload, normal, or underload. Following the State Staffing Agency's 2010 workload analysis recommendations, the total FTE index value that exceeds 1.28 is classified as overload, while a value between 1 and 1.28 is classified as normal and a value between 0 and 0.99 is classified as underload or the workload is inadequate. To determine the FTE value of a work procedure, use Equation (1):

$$Total\ Hours = \frac{Freq \times Process\ time \times Working\ days\ current\ years}{60} \tag{1}$$

The result of the total hour's computation is then used as a reference for FTE calculation with Equation (2) as follows:

$$FTE = \frac{Total\ \frac{Hours}{Year}}{Effective\ \frac{Hours}{Year}} \tag{2}$$

The measurement of working time is a technique for achieving a balance between the human activities that contributed to a unit of output. It is vital to use the concepts and methods of work measurement to establish the average time necessary to execute a job in order to choose the optimal alternative working approach. There are three common methods used to measure the elements of work using stopwatches, namely continuous timing, repetitive timing, and accumulative timing (Wignjosoebroto, 2003). In the measurement of working time, cycle time, normal time, and standard time will be computed.

2.4 Data Collection and Analysis

The relevant data will consist of both primary and secondary data. The primary data from conducting direct observations on the ground includes data observing work elements and measuring cycle time in employees at PT Z, then all employees are asked to conduct interviews and fill out NASA-TLX Form, and FTE Form. Secondary data is data obtained indirectly or through other sources that were available before the author conducted his research obtained from libraries and literature that support this research topic such as books containing theories, journals, thesis, or data search results conducted through internet browsing and some data obtained from PT.Z.

The collection of relevant data in this research was conducted by way of interviews and direct observations at PT. Z. In field observation activities, researchers use work sampling with NASA-TLX, and FTE methods, which are observations of worker's activities performed during working hours. Activities observed through work sampling in the research were categorized according to categories of productive and unproductive activities. The observations are then recorded in the work sampling form and asked to fill out the required formula. The data was then used to analyze workloads to determine the normal time and standard time, through the description of basic tasks using NASA-TLX and Full-Time Equivalent observation techniques to calculate work time and workload. Collecting the form from the interview section for the workers, the result is obtained by continuing to compute the data into each method calculation form.

2.5 Conclusion and Recommendation

Conclusions and recommendations are the final stages of the research. The conclusion began with the calculation and analysis of data results. Calculating and analyzing data will provide the solution to the problem. The recommendation is supplemented by a suggestion for further research.

3. Result and Discussion

Professional Certification Centre (PCC) is a department under the auspices of the human resource division. There are 4 positions, which are Head of Professional Certification Centre, Administration and Finance Officer, Certification Officer, and Quality Management Officer. All position is working on the morning shift. PCC

department is an institution that carries out testing activities and grants professional certification. The task of the PCC is to design and create competency tests, and carry out and control the process during the assessment by providing assessors, competency test sites, collecting supporting documents, and others. The main goal of PCC is to develop the skills and knowledge of professional workers who have international-class capacities and capabilities. Because PCC department workers felt that their work was overloaded and often overtime, the department decided to hire the intern employee. That's why need to know the workload of each worker with the NASA-TLX, and Full-Time Equivalent.

3.1 NASA-TLX

Through the NASA-TLX method employee's workload will be calculated, the form has six main indicators that become assessments, there are mental demand, physical demand, temporal demand, performance, frustration, and effort. By entering the six indicators in pairs, an assessment is carried out with weighting, then the six indicators will also be given a rating by what is felt by the employee. The total number of responders corresponds to the number of PCC department officers, which is as many as 3 officers. The further analysis will be described in the subsequent subchapter.

For the weighting questionnaire, fifteen pairs of the six indicators were given, then respondents were asked to choose (tick) one and had to fill in the fifteen pairs. Here is Table 1 is a recap of data from a paired comparison questionnaire for division indicators within the PCC department.

Table 1. Weighting Calculation of PCC Department

	Indicator					
	MD	PD	TD	OP	EF	FR
Administration & Finance Officer	0.20	0.07	0.27	0.07	0.20	0.20
Certification Officer	0.13	0.20	0.27	0.13	0.13	0.13
Quality Management Officer	0.27	0.07	0.13	0.07	0.13	0.33

Table 1 explained the weighting calculation of each position which has a different factor as a difficult job to do. The highest concern is the quality management officer on the frustration and mental demand factors with a percentage of 33% and 27% respectively and then the smallest score is found in the physical demand and performance indicator which is 7%. Then the score for other positions can be seen in Table 2. Every position has its factors that must be considered and what are not.

Table 2. Classification of Weighting Score of PCC Department

	Mental Category			Physical Category		
	Mental Demand	Effort	Frustration	Physical Demand	Temporal Demand	Performance
Total	0.60	0.47	0.67	0.33	0.67	0.27
Average	0.20	0.11	0.22	0.09	0.16	0.22
	0.53			0.47		
	53%			47%		

According to Table 2, the cumulative average of the two categories, namely mental and physical categories from PT Z of the PCC Department, is dominated by the mental category, which is 53%. For the rating questionnaire, the same respondents were asked to fill in a large-scale load concerning the work of each indicator. The results of the questionnaire recap and interview rating as seen in Table 3.

Table 3. Rating Score of PCC Department

	Indicator					
	MD	PD	TD	OP	EF	FR
Administration & Finance Officer	60	10	70	25	45	55
Certification Officer	75	85	90	80	70	65
Quality Management Officer	85	45	85	70	75	90
Total	220	140	245	175	190	210
Average	73.33	46.67	81.67	58.33	63.33	70

Based on Table 3, it can also be concluded that the largest rating score of the temporal demand indicator with a score of 81.67%, means that respondents' work is needed time requirements or related to deadlines within given time limits. Then there is the mental demand indicator of 73.33%, this happens because of the need for mental perception when doing tasks. Followed by an indicator of frustration with 70% because respondents often feel

stress under certain conditions. Then followed by indicator effort, performance, and physical demand with a score of 63.33%, 58.33%, and 46.67%.

After doing calculations on weighting and rating, the next is to find the amount of weighted workload (WWL) value. By multiplying from the weighting score and rating, the results of this multiplication are then summed up from each position, and got the number of WWL values is then divided by 15 derived from the number of pairs from the indicator in the questionnaire, resulting in a high average WWL value. Table 4 shows the details of WWL calculations and determination of workload classification in each position in the PCC Department.

Table 4. Summary of Workload NASA-TLX of PCC Department

	Indicator						WWL	AVG WWL	Workload Score
	MD	PD	TD	OP	EF	FR			
Administration & Finance Officer	180	10	280	25	135	165	795	53.0	Optimal Load
Certification Officer	150	255	360	160	140	130	1195	79.7	Overload
Quality Management Officer	340	45	170	70	150	450	1225	81.7	Overload
Average								71.4	Overload

Based on Table 4 there are two classifications of weighted workload calculations, there are optimal load and overload. The average weighted workload was categorized as overload with a score is 71.4. It has been identified that certification officers and quality management officers are classified as overloaded because the percentage of their workload exceeds 60%. The results of weighted workload in administration and finance officers are classified as optimal load because their workload percentage is not more than 60% and not less than 40%. This percentage classification restriction has been determined from the NASA-TLX theory by (Hancock & Meshkati, 1988). Figure 2 will show the average workload for each indicator after final calculation using NASA-TLX.

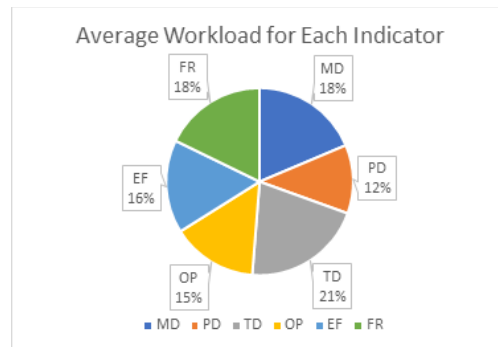


Figure 2. Average Workload for Each Indicator

Figure 2 depicts the indicator that most affects the workload of officers based on the survey results as Temporal Demand at 21%, followed by Frustration and Mental Demand at 18%, Then continued with Effort and performance at 16% and 15%. While the lowest is Physical Demand up to 12%. Because this method measures mental load subjectively and relies on surveys filled out by respondents, which of course will be based on an assessment of each individual's perception, in the process of collecting data or filling out questionnaire forms, mentoring and close communication with respondents are carried out to answer questions things that are not understood from the contents of the survey, ensure that they understand the context and fill it out correctly so that the results obtained can be ascertained to be under the conditions and nature of the work.

Based on the results of the NASA-TLX research, the mental officer's average WWL (Weighted Workload) is up to 71.4, which may be classified as 'Overload.' Furthermore, from the results of data processing, the most influential descriptor is Temporal Demand (TD) of 21%. This conforms to the nature of each work performed by the officer, for which there is always a predefined completion deadline based on the project timeline. The current condition, when the officer does not complete a task on time, will affect the overall project schedule, and the individual officer's performance appraisal. The indicator with the second-highest score of 18% is Mental Demand and Frustration, which is also consistent with the expectations placed on each officer, who is always expected to do excellent work following the project's goals. While the lowest description is Physical Demand, which indicates that each work requires less physical activity.

3.2 Full-time Equivalent

To determine the effective working time of the employee, the data needed are the number of holidays and leaving allotment in a year. Table 5 are the data used to calculate the effective working time. The data are obtained from an interview with the Head of the PCC Department in the company. From the interview, it is known that the employees start working at 08.00 and finish at 16.00 on Monday to Friday. In between the working hours, there is rest time from 12.00 to 13.00. In Table 5, the specifics of the working effective timer each year will be shown.

Table 5. Effective Working Time

Weekdays	Total	Unit
1 Day	7	Hour
1 Week	5	Day
1 Month	30	Day
1 Year	365	Day
Holidays 2021		
Public Holiday	19	Day
Weekend Holiday	104	Day
Annual Leave	12	Day
Total Holidays	135	Day
Calculation Amount		
Weekdays 2021	230	Day
Working Hours per Year	1610	Hour
Effective Working Time	85	%
Total Effective Working Time	1368.5	hours/year

Numerous stages must be followed to identify the number of optimal officers. The first step is determining the activities the officer performs to deliver services to the customer. The effective working time of the officer and the standard time of each activity is therefore required as additional data. Furthermore, the frequency of each action performed in a year could be determined using the company's historical data. Using the calculation of Full-Time Equivalent (FTE), the ideal number of officers will be found.

Data was collected by direct observation at the Professional Certification Centre Department during working hours, which began at 07.00 WIB and ended at 16.00 WIB, with a 60-minute break. Working time and downtime, as well as minor stoppages, were both observed in this research. Do Observation and time measurement for every type of activity with the time average shown in Table 6 until Table 8.

Table 6. Summary of Time Measurement in Administration and Finance Area

Process	Total (Seconds)	Average (Seconds)
Receive and record certification registrations from customers	13082	1308.2
Provide certification scheme information to customers	5423.91	542.391
Provide and validate document forms that have been filled out by customers	14434	1443.4
Establish assessment criteria related to pre-assessment	8894.55	889.455
Doing pre-assessment for customers	25995.53	2599.55
Provide assessment results and certificates to customers based on the assessment results that have been implemented	15001	1500.1
Perform all financial transactions into reports	18462.69	1846.27

Table 7. Summary of Time Measurement in Certification Area

Process	Total (Seconds)	Average (Seconds)
Set the schedule with the assessor	15379	1537.854
Assign Person In Charge (PIC) and create a group of participants or examiners	13541.01	1354.101
Prepare the Competency Test Place, tools, and materials needed	41979	4197.948
Observing the ongoing assessment process	125617.25	12561.73
Recommend the name of the customer based on the results of the assessment by predetermined standards	8010.22	801.022
Collect and validate reports and supporting documents from Assessors or Examiners	15305	1530.547
Registering customers who pass the assessment for the issuance of certificates from BNSP	6911.96	691.196

Table 8. Summary of Time Measurement in Quality Management Area

Process	Total (Seconds)	Average (Seconds)
Develop scheme and assessment criteria following applicable laws and regulations	102052	10205.187
Preparing reports by collecting, analyzing, and summarizing data	54395.48	5439.548
Make sure customer satisfaction	5010	500.978
Evaluate the certification process by holding a plenary meeting	36091.07	3609.107
Training and managing assessor	141617.25	14161.725

Because the observation in this research took 10-time recordings for each activity, the total number of data is greater than N', indicating that all data passed the sufficiency test. Determination of normal time and standard time is influenced by the performance rating (rating factor), allowances, and working time of each officer. To determine the value of the performance rating, the Westinghouse method (Barnes, 1980) consists of skill, effort, condition, and consistency factors. To determine the value of the allowance, several appropriate categories are selected and related (applicable) to each task based on the standards and tables of the ILO (International Labor Organization) (Frevalds, 2012) which are generally divided into two, the first is personal allowance and variable fatigue allowance.

To calculate the workload with Full-Time Equivalent needed the frequency of work carried out per year and the normal time of each work element performed by the operator per year. The frequency is obtained from an approach to the average company's demand per year. Table 9 until Table 11 shows the details of the workload of each officer per position process.

Table 1. Full-Time Equivalent Index of Administration and Finance Officer

Process	Intensity	Frequency	Normal Time	Total Hours/Year	Effective Hours/Year	FTE
Receive and record certification registrations from customers	Daily	70	0.464	124.408	1368.5	0.091
Provide certification scheme information to customers	Daily	70	0.191	51.209	1368.5	0.037
Provide and validate document forms that have been filled out by customers	Daily	70	0.524	140.496	1368.5	0.103
Establish assessment criteria related to pre-assessment	Daily	70	0.309	82.872	1368.5	0.061
Doing pre-assessment for customers	Daily	70	0.926	248.472	1368.5	0.182
Provide assessment results and certificates to customers based on the assessment results that have been implemented	Daily	70	0.540	144.988	1368.5	0.106
Perform all financial transactions into reports	Daily	70	0.637	170.833	1368.5	0.125
Total						0.704

Table 9 shows the total FTE for the administration and finance officers was 0.704 and the workload was overloaded because the total FTE for each activity was 0 - 0.99. Therefore, recommendations were made to increase the workload.

Table 10. Full-Time Equivalent of Certification Officer

Process	Intensity	Frequency	Normal Time	Total Hours/Year	Effective Hours/Year	FTE
Set the schedule with the assessor	Daily	70	0.530	142.296	1368.5	0.104
Assign Person In Charge (PIC) and create a group of participants or examiners	Daily	70	0.481	128.967	1368.5	0.094
Prepare the Competency Test Place, tools, and materials needed	Daily	70	1.418	380.461	1368.5	0.278
Observing the ongoing assessment process	Daily	70	4.766	1278.868	1368.5	0.935
Recommend the name of the customer based on the results of the assessment by predetermined standards	Daily	70	0.312	83.588	1368.5	0.061
Collect and validate reports and supporting documents from Assessors or Examiners	Daily	70	0.528	141.620	1368.5	0.103
Registering customers who pass the assessment for the issuance of certificates from BNSP	Daily	70	0.255	68.498	1368.5	0.050
Total						1.625

In Table 10 it is found that the FTE score for the certification officer is 1.625 and the workload is overloaded, this is because the total FTE is > 1.28. Therefore, it is necessary to make recommendations to reduce the workload by adding new officers.

Table 11. Full-Time Equivalent of Quality Management Officer

Process	Intensity	Frequency	Normal Time	Total Hours/Year	Effective Hours/Year	FTE
Develop scheme and assessment criteria following applicable laws and regulations	Daily	70	3.608	968.118	1368.5	0.707
Preparing reports by collecting, analyzing, and summarizing data	Daily	70	1.898	509.167	1368.5	0.372
Make sure customer satisfaction	Daily	70	0.195	52.193	1368.5	0.038
Evaluate the certification process by holding a plenary meeting	Daily	70	1.312	352.041	1368.5	0.257
Training and managing assessor	Daily	70	5.322	1428.128	1368.5	1.044
Total						2.418

In Table 11 it is found that the FTE value for quality management officers is 2,418 and has an overload workload, this is because the total FTE is > 1.28. Therefore, it is necessary to make recommendations to reduce the workload by adding new officers. The summary of the FTE workload calculation will be shown in Table 12 and Figure 3.

Table 12. Summary of FTE Workload

	FTE	Category
Administration & Finance	0.704	Underload
Certification	1.625	Overload
Quality Management	2.418	Overload

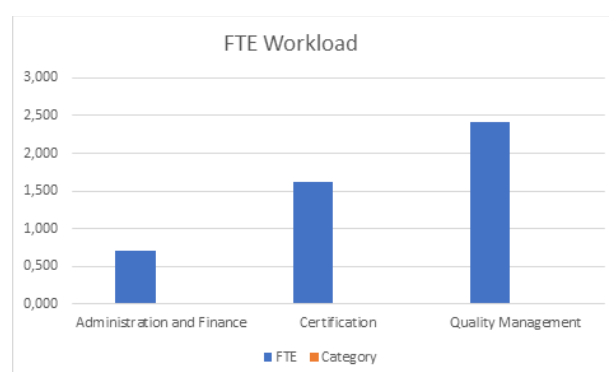
**Figure 3. Summary of FTE Workload**

Figure 3 shows the total workload of each officer. From the results of the Full-Time Equivalent calculation, two officers were found with the 'overload' category (FTE > 1.28), namely a certification officer with a value of 1.625 and a quality management officer with a value of 2.418. The FTE Calculation result indicates that the workload experienced by officers is not evenly distributed where one has a workload in the underload category, and two people experience an overload workload.

After calculating the workload, the calculation is carried out an optimal number of operators required. According to (P. Groover, 2014), the optimal number of workers may be determined by comparing total standard time to total available time. The following Table 13 is an optimal number officer's calculation in the Professional Certification Centre Department.

Table 13. Optimal Number Officers Calculation

	Standard Time	Effective Hours	Optimum Officer	Current Officer
Administration & Finance	3.590	8	0.449 (1)	1
Certification	8.289	8	1.036 (2)	1
Quality Management	12.334	8	1.542 (2)	1

Table 13 is the result of calculating the optimal number of employees for each position shown for the position in administration and finance. It can be seen that one person is the optimal number, which is currently optimal, and for certification and quality management positions the optimal number should be 2 people so that currently each position still lacks 1 officer. As is well known that the certification and quality management position only have 1 officer who has been calculated with the FTE method and is categorized as overload. Because the demand used is the average demand of the last 1 year, the optimal calculation of the officer number is highly recommended to hire the new officer in accordance with the calculations in Table 13.

3.3 Comparison of NASA-TLX and Full-time Equivalent

In calculations using the FTE method, what is calculated as workload is the time to complete a task, so it is assumed that the longer it takes to complete it, the greater the physical workload experienced by the officer. While the NASA-TLX method is a subjective mental workload measurement technique, where this subjective workload assessment is based on individual personal feelings and perceptions, which provides an assessment of effort related to the performance of one or more tasks. NASA-TLX was developed using only activities requiring considerable temporal activity and low physical exertion (Hart & Staveland, 1988) so it remains relevant to be used in this research with results as shown in Figure 2, where the descriptor with a high value is needs related to temporal demand, and the lowest is physical demand.

The difference between the FTE and NASA-TLX calculation methods causes the workload results obtained to be very different. For example, an officer who is assigned to handle only one project with high complexity and a tight schedule will feel a high mental workload even though the results of the FTE calculation are low (underload) because the estimated working time is still lacking. Table 14 below shows the comparison between the results of the NASA-TLX and FTE calculations that have been carried out. From table 14, it can be seen, especially for administration and finance positions, that the physical and mental workloads are quite contradictory, where employees in this position seem to still have time to be assigned a new task, but the results of the NASA-TLX research show that this position has an optimal mental load.

Table 14. Comparison of NASA-TLX and FTE

Position	NASA-TLX Result		FTE Result	
	WWL	Category	Index	Category
Administration & Finance	53	Optimal Load	0.70	Underload
Certification	79.67	Overload	1.63	Overload
Quality Management	81.67	Overload	2.42	Overload

To determine whether an officer can still be assigned a project assignment and distribute physical workloads (in this instance relating to the time necessary to perform a task), the FTE results need to be used as a reference where the officer with the FTE underload index category becomes a priority choice if there is a new project that requires a related position. From the results of the FTE calculations carried out, the administration and finance positions need to be given additional new projects. Another option that can be done is a full project handover from an officer who is currently in the overload category to an officer who is still in the underload category. An example of the FTE calculation results obtained, the project currently assigned to the Certification officer can be transferred to the administration and finance officer, so it is hoped that all tasks can still be delivered on time according to the target and the project schedule has been set.

In this case, due to its highly subjective nature, the mental workload from the NASA-TLX results cannot be used as a reference for equalizing the workload or determining whether the officer can still be given project assignments or not. So, what needs to be done is to reduce the mental workload so that the motivation, consistency, and ownership of the workers are maintained and can still provide optimal performance.

There are three methods for reducing physical and mental workload: elimination, reduction, and isolation. Elimination is a solution that reduces manual tasks or work and then replaces it with an automated system, this can be done especially for administrative and finance positions. It could be by making a registration form system that can go directly into the company database, especially for customers who come from one group, this can make it easier for the human resource department if the customer concerned has certified, and the system has provided the required information and also a formula that must be filled in by the customer so that the officer does not need to send one by one to the customer so that it can be more efficient and also minimize errors. Then, there are methods to reduce it, such as increasing the number of workers, extending rest periods, and modifying work procedures to prevent excessive physical or mental activity. Isolation is a solution because it prevents unskilled or inexperienced personnel from doing a job. Related to the NASA-TLX results, the mental workload can be reduced by isolation, it is by giving project assignments according to the position and role profile of each officer.

The mental workload can also be reduced by giving rewards which consist of two types, there are extrinsic and intrinsic rewards. Extrinsic rewards such as salary increases, annual bonuses, or accelerated promotions for officers in the high-performing performance category are also programs that can keep employees motivated to keep giving their best performance because the company appreciates the efforts that have been made. Extrinsic rewards can also be as simple as giving verbal praise, public recognition, and appreciation, or requiring a financial investment such as physical improvements in the office and work environment.

A “one-on-one” feedback program for existing employees should also be more utilized by the head of a department to carry out open and transparent communication to their subordinates, which aims to build intrinsic motivation in the form of satisfaction with personal achievements and professional improvement, as well as feelings of pride in the success and involvement of officers in a project. This intrinsic reward has a greater influence on employee motivation, compared to financial rewards.

4. Conclusion

Based on the survey results using the NASA-TLX method calculation, the mental workload of an officer shows an average Weighted Work Load (WWL) of up to 71.4 which may be classified as the 'Overload' category. The indicator with the highest score is Temporal Demand with a score of 21%, which corresponds to the job desk carried out by the officer, which always has a predetermined completion target. The indicator with the second highest score of 18% is frustration and mental demand, it is also consistent with the expectations placed on each worker, who is always expected to do excellent work following the project's goals. While the indicator with the lowest score of 12% is Physical Demand, where there is not much physical activity done in each task.

On the other hand, the mental officer's workload based on the Full-Time Equivalent calculation method shows overload. For certification and quality management positions, it shows category overload with each total index of 1.63 and 2.42. while the position of administration and finance shows the underload category with a total index of 0.70. From the calculation results, the optimal number for administration and finance is currently 1 person, and certification and quality management officers are required 2 people each.

References

1. Barnes, R. M. (Ralph M. (1980). Motion and time study: design and measurement of work. 689.
2. Buchholz, B., Paquet, V., Punnett, L., Lee, D., & Moir, S. (1996). PATH: A work sampling-based approach to ergonomic job analysis for construction and other non-repetitive work. *Applied Ergonomics*, 27(3), 177-187. [https://doi.org/10.1016/0003-6870\(95\)00078-X](https://doi.org/10.1016/0003-6870(95)00078-X)
3. Eggemeier, F. T., & Wilson, G. F. (2020). Performance-based and subjective assessment of workload in multi-task environments. *Multiple-Task Performance*, 217-278. <https://doi.org/10.1201/9781003069447-13>
4. Freivalds, A. (2012). Niebel's methods, standards, and work design. *Niebel's Methods, Standards, and Work Design*, (12th edition), 735.

5. Hart, S. G., & Staveland, L. E. (1988). Development of NASA-TLX (Task Load Index): Results of Empirical and Theoretical Research. *Advances in Psychology*, 52(C), 139-183. [https://doi.org/10.1016/S0166-4115\(08\)62386-9](https://doi.org/10.1016/S0166-4115(08)62386-9)
6. Oesman, O. (2012). Penerapan Penggunaan FTE RACI dan Head Count Analysis dalam Pengelolaan SDM. *Pengelolaan SDM Dalam Rangka Modernisasi Layanan*.
7. P. Groover, M. (2014). *Work Systems and the Methods, Measurement, and Management of Work*. Pearson Prentice Hall.
8. Puspawardhani, E. H., Suryoputro, M. R., Sari, A. D., Kurnia, R. D., & Purnomo, H. (2016). Mental Workload Analysis Using NASA-TLX Method Between Various Level of Work in Plastic Injection Division of Manufacturing Company. *Advances in Intelligent Systems and Computing*, 491, 311-319. https://doi.org/10.1007/978-3-319-41929-9_29
9. Rubio, S., Díaz, E., Martín, J., & Puente, J. M. (2004). Evaluation of Subjective Mental Workload: A Comparison of SWAT, NASA-TLX, and Workload Profile Methods. *Applied Psychology*, 53(1), 61-86. <https://doi.org/10.1111/J.1464-0597.2004.00161.X>
10. Wignjosoebroto, S. (2003). Ergonomi, studi gerak dan waktu: teknik analisis untuk peningkatan produktivitas kerja. In I. Gunarta (Ed.), *Ergonomi Studi Gerak dan Waktu*. Guna Widya.