# Analysis of Mental Workload on Counter Sales Using NASA-TLX Method

Dinda Safitri Ramadhani*, Arinda Soraya Putri, Niken Fauziah Ambarwati

Department of Industrial Engineering, Faculty of Engineering, University of Muhammadiyah Surakarta, Surakarta 57169, INDONESIA

| Article Info | Abstract |
|---|---|
| | PT. XYZ is a service-oriented branch company that provides consumers with a wide range of products. Services provided by this company is divided into three main sections, namely sales, service, and spare part. One of the main parts is sales, which is selling units of cars carried out by counter sales to meet targets. The demand for achieving targets provides a psychological workload for counter sales. Therefore, it is necessary to measure the mental workload in this area. The work measurement method used in this research is NASA-TLX. This method was developed based on the emergence of subjective measurement needs in measuring workload using six indicators, namely mental demand, physical demand, temporal demand, own performance, effort, and level of frustration. The results showed that WWL values were in the range of 88.33-91.67 and had a very high category. Several recommendations for improvement that need to be implemented include evaluating picket scheduling by considering predictions of increased customer visits, conducting routine training and providing motivation, and providing rewards as a form of appreciation for workers according to their achievements. |

## 1. INTRODUCTION

The population increase in Indonesia impacts all aspects of people's lives, especially in the transportation sector. Communities need transportation facilities to support their daily activities. The socio-demographic conditions affect the performance of transportation in the region. The amount of population density also has a considerable impact on transportation's ability to accommodate the demands of society (Soehardi & Dinata, 2018). Global competition in the sale of vehicles in Indonesia is relatively high because many people already want to own and use private vehicles that are comfortable and of good quality when they want to travel anywhere. The higher the number of consumers interested in owning transportation, the higher the company's transportation sales level. Sales is a decisive marketing function to achieve company goals (Lestari & Hafiz, 2020).

PT. XYZ is one of the operational divisions of an automotive company engaged in the field of authorized car dealers responsible for sales, service, and spare parts. Sales are one of the most influential main parts of increasing the company's income. Sales is a business that aims to identify potential customers, nurture and encourage them to meet their needs with the products being offered, and reach the agreed-upon price for both parties to achieve their

business goals. Vehicle unit sales activities carried out by counter sales workers are expected to meet the target. A lot of physical and mental work occurs in carrying out its activities. The demands of achieving targets certainly affect the mental workload of workers. If the worker's ability is lower than the work demands, the worker will feel excessive fatigue (Ramadhana *et al*., 2021).

Mental workload is defined as the difference between the workload needs of a job and the maximal capacity of a person's mental load in a motivated situation (Mutia, 2016). Measurement of mental workload needs to be considered by companies to avoid excessive workload. Because employees or workers are one important factor in influencing the company's quality, the mental workload can also cause physical, mental, and social symptoms (Hancock & Meshkati, 1988).

Therefore, research on the mental workload of PT XYZ employees must be conducted. The NASA TLX method can be applied in various environments and tasks. The scale used can be adapted to the specific needs of the analyzed task. In addition, this method is relatively easy and can be done with a short introduction to the individuals involved. The dimension of the mental workload may be subjectively executed using the Modified Cooper Harper Scale (MCH) method, Bedford Scale, NASA-Task Load Index (NASA-TLX),

*Corresponding author. Dinda Safitri Ramadhani
Email address: dsr708@ums.ac.id

Workload Assessment Technique (SWAT), Workload Assessment instrument (Workload Profile) (Riono *et al.*, 2018). This study tries to evaluate the employees' mental workload, determine the dominant factors that have more influence on the level of mental workload, and provide suggestions for improvement to the company.

## 2. LITERATUR REVIEW

### 2.1 Definition of mental workload

Human activity can be divided into two groups: physical and mental activity. This physical and mental activity has consequences, namely the emergence of fatigue from the workload. Junaedi, Rizkiyah & Pratya (2020) argues that human activity requires energy which depends on the amount of workload carried out and the physical abilities of each individual. This is due to the limited human capabilities causing humans to experience fatigue, both physical and mental fatigue, which will result in a decrease in work performance. This statement also follows research conducted by Pratiwi, Astuti & Jauhari (2019) that the perceived workload is too large for workers' ability, so that it can cause work fatigue. Based on research conducted by Theresia, Ranti & Sudri (2021) states that behavioral demands play a more important role in the mental workload of workers assembling difficult types of products from task and individual demands. This is indicated by the high level of effort required to complete the work due to its monotonous. Then in research conducted by Junaedi, Rizkiyah & Pratya (2020) conducted research due to the reduced number of production operators, the workers bear the workload. Therefore it is necessary to do a workload analysis in the production department. Workload studies have been carried out using several methods. The workload can be measured based on the time allocated to complete the job. So, the measurement of mental workload is an important thing that must be considered for a worker to provide the expected productivity of the company but still provide welfare to his workers.

### 2.2. NASA TLX

The NASA TLX is a method used to assess the mental workload when people engage in tasks or jobs (Putri & Handayani, 2017). Sandra G. Hart and Lowell E. Staveland invented the NASA-TLX in 1981. This method uses a questionnaire developed based on the emergence of subjective measurement needs and has undergone validity and reliability tests with the Pearson test ($\alpha = 0.781$, r-count = 0.734, p = 0.00) (Zetli, 2019). Measurement of mental workload is carried out in the following stages.

a. Indicator of NASA-TLX

When measuring workload, the NASA-TLX method needs to consider six indicators.

**Table 1.**
Indicator of NASA-TLX

| Factor | Rating | Descriptions |
|---|---|---|
| *Mental Demand* (MD) | Low-High | How much mental and perceptual work was required (thinking, determining, calculating, remembering, looking, seeking, etc.)? Was the task simple or complicated, easy or difficult, demanding or forgiving? |
| *Physical Demand* (PD) | Low-High | How much physical movement was necessary (such as twisting, pushing, pulling, controlling, activating, and so on)? Was the task simple or difficult, leisurely or dangerous, sluggish or taxing, tranquil or relentless? |
| *Temporal Demand* (TD) | Low-High | How much pressure did the rate or pace at which the task or its components occurred put on your time? Was the pace leisurely and slow or fast and frantic? |
| *Own Performance* (OP) | Good-Poor | How well do you think you achieved the task objectives set by the researcher? How comfortable were you, and how well did you achieve these goals? |
| *Effort* (EF) | Low-High | How much effort did you put in to reach your performance level? |
| *Frustration Level* (FL) | Low-High | How unreliable, deterred, aggravated, focused, and irritated versus secure, satisfied, content, loose, and careless did you feel during the task? |

b.  Weighting

At the weighting stage, counter sales were asked to use the pairwise comparison technique to compare two different dimensions. The total pairwise comparisons for all dimensions (6 dimensions) are 15. The total tally for each dimension is what will be the dimension weight. In this questionnaire, respondents were asked to select one of two signs they believed were the most dominant in producing mental workload on the job. Then after obtaining several indicators, they are then processed to calculate the weight in each indicator to proceed to the next stage.

c. Rating

Giving a rating on each indicator is done subjectively according to the mental workload experienced by workers in the counter sales. It provides ratings to indicators using a scale of 0-100. The rating that is given is subjective and depends on the mental load that the respondent feels.

d. Score Interpretation

The interpretation of this assessment is used to get the value of the mental workload using this formula for each indicator:

WWL = Rating x Weight Factor …………..  (1)

Then, calculate the average workload value with the formula:

$$Average\ WWL = \frac{\sum(Rating\ x\ Weight)}{15} \quad ……….. \ (2)$$

According to (Simanjuntak, 2010) on the NASA-TLX, the workload value obtained is divided into several categories, which can be found in the following table.

**Table 2.**
The Interpretation Score of NASA-TLX

| Category | Range of Value |
|---|---|
| Very Low | 0-9 |
| Low | 10-29 |
| Medium | 30-49 |
| High | 50-79 |
| Very High | 80-100 |

## 3. RESEARCH METHODOLOGY

### 3.1 Research Object

This research was conducted in the field of authorized car dealers responsible for sales, service, and spare parts located in Jakarta. This activity includes an interview phase for three respondents as counter sales to fill the NASA TLX weighting and rating table.

### 3.2 Data Collection

Interviews and questionnaires are active primary data collection by questioning the respondent. Data collection is done by giving the NASA-TLX questionnaire that has been made to three respondents related to the mental workload they receive while working. The steps taken in this study are as follows:
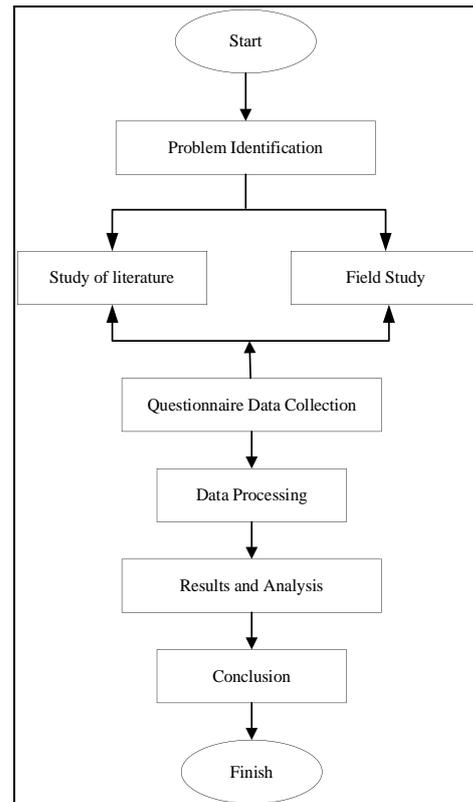


**Figure 1.**
Flowchart of Research Methodology

## 4. RESULT

Subjective mental workload measurement on the NASA-TLX method assessed the workload based on workers' preferences.

### 4.1 Weighting

The weighting stage is carried out by asking the counter sales workers to complete a questionnaire by selecting one of the two indicators or elements considered more dominant according to the worker's preferences that affect mental weight when doing work. The results of the weighting of the three respondents are shown in Table 3.

**Table 3.**
Weight

| Object | Factor | | | | | |
|---|---|---|---|---|---|---|
| | MD | PD | TD | OP | EF | FL |
| Respondent 1 | 4 | 0 | 2 | 5 | 3 | 1 |
| Respondent 2 | 3 | 0 | 2 | 4 | 2 | 4 |
| Respondent 3 | 2 | 0 | 1 | 3 | 4 | 5 |
| Average | 3 | 0 | 1,67 | 4 | 3 | 3,3 |

### 4.2 Rating

Giving a rating using a scale from 0-100 on each indicator according to the mental workload felt by the counter sales department. The results of the rating are displayed in Table 4.

**Table 4.**
Rating

| Object | Factor | | | | | |
|---|---|---|---|---|---|---|
| | MD | PD | TD | OP | EF | FL |
| Respondent 1 | 100 | 65 | 80 | 80 | 100 | 65 |
| Respondent 2 | 70 | 80 | 80 | 90 | 100 | 100 |
| Respondent 3 | 100 | 90 | 85 | 80 | 100 | 90 |
| Average | 90 | 78,3 | 81,7 | 83,3 | 100 | 85,0 |

### 4.3 Results Interpretation

The weight values obtained will be processed by multiplying the weight values and rating values of each indicator according to the contents of the questionnaire. The WWL calculation stage aims to produce a value for each workload based on the respondents' preferences, which can be categorized into heavy, medium, or light categories. Table 5 contains the results of computing this WWL value.

**Table 5.**
Average of WWLs

| Object | Products | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | MD | PD | TD | OP | EF | FL | WWL | Average of WWL |
| Respondent 1 | 400 | 0 | 160 | 400 | 300 | 65 | 1325 | 88,33 |
| Respondent 2 | 210 | 0 | 160 | 360 | 200 | 400 | 1330 | 88,67 |
| Respondent 3 | 200 | 0 | 85 | 240 | 400 | 450 | 1375 | 91,67 |
| Average | 270 | 0 | 135 | 333 | 300 | 305 | 1343,3 | 89,56 |

Then the data processing results based on the WWL values obtained will be categorized according to the range of workload level categories; these assessment categories can be found in Table 6.

**Table 6.**
Categories of Workload Assessment

| Object | Indicator | Average of WWL | Category |
|---|---|---|---|
| Respondent 1 | Mental Demand (MD) | 88,33 | Very High |
| | Effort (EF) | | |
| Respondent 2 | Effort (EF) | 88,67 | Very High |
| | Own Performance (OP) | | |
| Respondent 3 | Effort (EF) | 91,67 | Very High |
| | Frustration Level (FL) | | |
| Average | | 89,56 | |

Based on calculations and data processing, the average value of WWL is 89.56, with each respondent producing a WWL value in the very high work category, so the workload of the counter sales department is very high.

## 5. DISCUSSION

Based on the results and calculation of weight workload (WWL) values, the average of each indicator of mental load was tested in this study. According to the processing of each indicator in NASA-TLX, the top three indicators with a weight workload value are produced: own performance, frustration level, and effort.

The highest WWL calculation is found in the own performance (OP) indicator with a value of 333 because the work of the counter sales section is required to be able to achieve a level of success, such as being able to meet the sales target of vehicle units by producing a level of satisfaction from target achievements and customer satisfaction.

The second highest WWL value is found in the frustration level (FL) indicator with an average WWL value of 305 because the work done by the counter sales department needs to feel safe, comfortable, and satisfied with their work. However, when doing their work, the counter sales part often feels uncomfortable, irritable, and despairing regarding achieving the target within one month to attract customers to buy a vehicle.

The third highest WWL value lies in the effort indicator (EF), with an average WWL value of 300. This indicator is very high because this job requires a lot of mental and physical effort to complete work and provide service and attention. Which is more to the customer in providing vehicle unit promotions, conducting customer surveys in advance so that counter sales workers must visit the prospective customer's residence to carry out related administrative processes, Vehicle Order Letters, customer integrity data, and all matters that include the unit sales process vehicle.

The average WWL value generated by the mental demand (MD) indicator is 270, the effort indicator (EF) is 135, and physical demand (PD) is the lowest WWL average value, which is 0. Based on the average value of WWL, the results obtained for each sales counter are for Respondent 1 of 88.33; Respondent 2 was 88.67; Respondent 3 was 91.67. The three respondents as a whole are included in the very high category because the resulting WWL values are in the range of 80-100. The following graph shows the results of the workload score calculation.
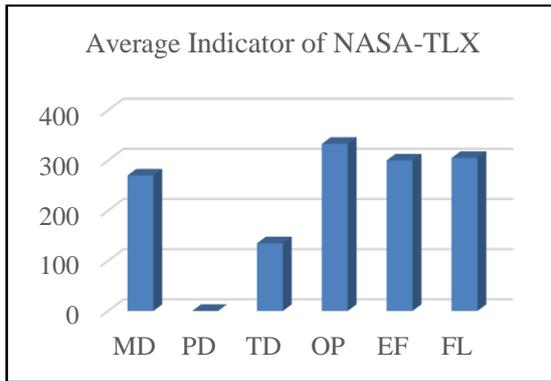
**Figure 2.**
Average Indicator of NASA-TLX

The graph shows that the average value of each indicator varies. The highest indicator is own performance (OP), and the lowest is physical demand (PD). Therefore, the higher the workload experienced by a worker for a long period will affect the worker's performance. Based on the outcomes of data processing to determine the level of workload, especially mental or psychological workload, it can be concluded that the workload experienced by the counter sales department is very high, so gradually, it will affect the performance of the counter sales department and have an unfavorable effect on the counter sales and in terms of providing services to customers

## 6. CONCLUSION AND RECOMMENDATION

Mental workload is the difference between the workload demands of a job and the maximum capacity of a person's mental load in a motivated condition. The mental workload value of each respondent is 88.33, 88.67, and 91.67. The three counter sales respondents had very high workload levels with jobs classified as heavy. The dominant indicators influencing counter sales most are own performance, frustration level, and effort, with the highest WWL final score of the other indicators. Recommendations are needed to reduce mental workload, such as evaluating counter sales picket scheduling by considering predictions of increased customer visits to the showroom to provide excellent service to customers quickly and precisely. Then it can conduct routine training and evaluation to motivate counter sales to provide excellent customer service. In addition, giving rewards as a form of appreciation is following what is done by workers so that they are always enthusiastic and achieve the sales target of vehicle units that have been determined by the company, one of which is through increasing allowances or bonuses that can be given to workers in the company. Further research should be carried out on a broader range of objects and consider other variables affecting employees' mental workload.

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