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# The workload analysis for the mackarel cracker industry's workers uses the full-time equivalents method

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## ABSTRACT

Kerupuk Ikan Tenggiri Cap Kuda Laut is one of the fish-based cracker industries. The industry is located at Pangkalan Brandan, North Sumatra, Indonesia. The fish-based cracker industry employs 15 workers and six workstations, which include fish processing stations, fish grinding stations, kneading stations, printing stations, frying stations, and packing stations. According to the observations, there is an unequal division of workers, which can result in an inappropriate workload for the worker. This study aims to analyze workers' workloads as a basis for determining the optimal number of workers. The full-time equivalent (FTE) method simplifies the measurement of work by aligning the number of people required to complete a specific job with the hours of workload. The study's findings revealed that one worker at the grinding stations had an overload, three workers in fish processing, two workers in kneading, and three workers in frying and printing had normal workloads. Also at the packaging station, there are 3 workers with an underload.

**Keywords**: Workload; full-time equivalent; the optimal number of workers; ergonomic

## 1. INTRODUCTION

Ergonomics is a scientific discipline that focuses on the study of individuals and their working environments, with the primary objective of enhancing efficiency [1][2][3][4]. Ergonomics is closely linked to industry [5][6][7][8]. The industry should apply the principle of ergonomics in running its production processes. Industry plays an important role in the economy and progress of a country because of its ability to produce tradable products and create jobs [9][10][11][12][13]. We need to develop industry in a balanced manner, involving society in the best use of all available natural and human resources [14]. The evolution of technology has led to the emergence of numerous industries in Indonesia, including the fish-based cracker industry [15][16]. The fish-based cracker industry is widespread in different regions of Indonesia, especially in the countryside. It uses raw materials such as various types of flour and other supplementary materials [17][18]. However, most of the fish-based cracker industry is still a household business and a small industry [19][20]. The process of making crackers is very simple and easy to do. Both modern and traditional equipment are suitable for this endeavor. Households and small businesses play an important role in the fish-based cracker industry. Kuda Laut is one of the fish-based cracker industries. The industry is in Pangkalan Brandan, North Sumatra, Indonesia. This industry was established in 2010. This industry operates with working hours of about 7 hours a day, starting from 08.00 to 12.00 PM and continuing again from 13.30 to 17.00 PM. The industry employs 15 workers and operates six workstations, which include fish processing stations (which clean fish by cleaning seals and fish dirt, removing fish dust, and separating meat from skin), fish grinding stations, dew printing stations, frying stations, and packing stations. Based on the results of the observations, it was found that there is a lack of workload disbursement in the fish-based

cracker industry, where there are workers who catch jobs and there are unemployed employees. The interviews with the workers reveal that the number of employed workers does not match the amount of work they receive, resulting in overworked workers. Therefore, it is essential to conduct a workload calculation to determine the optimal number of workers. This study aims to analyze the workload of workers as a basis for determining the optimum number of workers. Workers who have workloads that align with their abilities will be more productive at work, leading to an increase in productivity, and this research directly contributes to this goal.

## 2. METHOD

This type of research is quantitative and descriptive. We collect the necessary data by observing the production process, conducting interviews with the owner and 15 workers, and collecting and studying relevant workload-related literature. The stage of the study is as follows

a. Calculate cycle time, normal time and standard time
   Normal time = cycle time x (performance rating/100) (1)
   Standard time = normal time/(1-allowance) (2)
b. Creating periodical tables
c. Calculates total activity time
   Total activity time = main activity time + time activity (3)
d. Specify allowance
e. Calculate total available time
   Total available time = working hours a day x number of effective days per year (4)
f. Calculating full time equivalent values
   Full time equivalent = (Total activity time + allowance)/ total available time (5)

## 3. RESULTS AND DISCUSSION

Number of workers and working hours: This industry employs 15 workers in the production section with six working days; in one day, they work for 7.5 hours. The number of working days: Numbers of working days at the fish-based cracker industry Cap Kuda Laut can be seen in Table 1.

Table 1. Number of working days

| Working Days | Amount | Unit |
|---|---|---|
| 1 month | 26 | Days |
| 1 year | 365 | Days |
| Days off | | |
| National Day | 14 | Days |
| Sunday | 52 | Days |
| Sick leave | 3 | Days |
| Annual leave | 7 | Days |
| Numbers of days of | 76 | Days |
| Effective working days | 289 | Days |

Works elements: The number of working days at the fish-based cracker industry Cap Kuda Laut can be seen in Table 2.

Table 2. Work elements

| No | Workstation | Description of Activities |
|---|---|---|
| 1. | Fish processing | Cleaning seals |
| | | Cleaning fish dirt |
| | | Removing fish dust |
| | | Separating meat from skin |
| 2. | Fish grinding | Grinding fish meat |
| 3. | Kneading | Mix the flour and fish meat. |
| | | Stir all the ingredients until well-mixed. |
| 4. | Cracker printing | Printing knead cracker |
| 5. | Frying | Frying cracker |
| | | Draining cracker |

| No | Workstation | Description of Activities |
|---|---|---|
| 6. | Packing | Putting crackers into packaging |

According to Table 2, there are 11 work elements in the mackerel fish cracker production process. Figure 1 shows work elements from the workstation.

Figure 1. Work elements from the workstation.

Calculate working time

The standard working hours for workers are calculated using both normal time and allowance. Table 3 displays the standard time for six workstations.

Table 3. Working time

| No | Workstation | Normal Time (minutes) | Allowance | Standard Time (minutes) |
|---|---|---|---|---|
| 1. | Fish processing | 7.13 | 0.14 | 8.12 |
| 2. | Fish grinding | 3.62 | 0.15 | 4.16 |
| 3. | Kneading | 9.37 | 0.14 | 10.68 |
| 4. | Cracker printing | 14.01 | 0.12 | 15.69 |
| 5. | Frying | 13.88 | 0.11 | 15.40 |
| 6. | Packing | 4.97 | 0.10 | 5.46 |

Calculating a full-time equivalent value

Before calculating the full-time equivalent value, first determine the total activity value, allowance, and total available time to obtain the FTE index value. We create a periodic job table to convert the total activity time into effective working time for a year. We convert the time units by multiplying the daily period by 289 working days per year, the monthly period by 12 months per year, and the weekly period by 48 weeks per year. Based on the periodical job in fish processing, the total main workload is 472226 minutes, the supporting workload is 180 minutes, and the incidental workload is 60 minutes. Table 4 gives an example of a periodic job in fish processing.

a. Calculates total activity time
   Total activity time = main activity time + time activity
   = 472.226 + 180 + 60 = 472.466 minutes
b. Specify allowance
   Allowance time = (allowance)(numbers of working days)(working hours)
   = 14% x 289 x 450 = 18.207 minutes
c. Calculate the total available time
   Total available time = working hours a day x number of effective days per year
   = 450 x 289 = 130.050 minutes
d. Calculating full-time equivalent values
   Full time equivalent = (Total activity time + allowance)/total available time
   = (472.266+18.207)/130.050 = 3,773

Each activity in its specified period, then categorized as whether it includes the main activity, supporting or incidental, is calculated so that the value of its workload is obtained. Table 4 presents the calculations in table form.

Table 4. Periodical job at the fish processing

| No | Activity | Period | related to the task | | | frequency | Duration (minutes) | Worker | Conversion | Workload | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main | Support | Incidental | | | | | Main | Support | Incidental |
| 1. | Preparation | Daily | 1 | | | 1 | 5 | 3 | 289 | 1445 | 0 | 0 |
| 2. | Fish processing | Daily | 1 | | | 200 | 8,12 | 3 | 289 | 469336 | 0 | 0 |
| 3. | Cleaning tools | Daily | 1 | | | 1 | 5 | 3 | 289 | 1445 | 0 | 0 |
| 4. | Briefing | Monthly | | 1 | | 1 | 15 | 3 | 12 | 0 | 180 | 0 |
| 5. | Meeting | Yearly | | | 1 | 2 | 30 | 3 | 1 | 0 | 0 | 60 |
| | | Total workload | | | | | | | | 472226 | 180 | 60 |

Determining the optimal number of workers

The calculations show that one worker at the fish grinding is experiencing overload, while three workers in fish processing, two workers in kneading, three workers in printing, and three workers in frying have a normal workload. At the packing station, there are workers with a value of FTE 2,55. With 3 workers, the worker has an underload. An excessive workload can quickly fatigue a worker, while a lesser workload can lead to a lack of exhaustion, resulting in a high rate of unemployment. The computation of the FTE value yields an optimal worker count of 15. When we disaggregate the workload at each workstation, we find that the optimal number of workers is 3 for fish processing, 2 for fish mowing, 2 for discharging, 3 for printing, 3 for frying, and 5 for packing. Table 5 illustrates the optimal number of workers in Kuda Laut fish-based cracker industries

Table 5. Determining the optimal number of workers

| No | Workstation | Workload | Number of Workers (Actual) | Number of Workers (Recommendation) |
|---|---|---|---|---|
| 1 | Fish processing | 3,77 | 3 | 3 |
| 2 | Fish grinding | 2,02 | 1 | 2 |
| 3 | Kneading | 2,53 | 2 | 2 |
| 4 | Cracker printing | 3,63 | 3 | 3 |
| 5 | Frying | 3,55 | 3 | 3 |
| 6 | Packing | 2,55 | 3 | 2 |

According to the calculations in Table 5, it is evident that there is a deficiency of workers at the fish grinding workstation. Therefore, we should hire an additional worker. At the packing workstation, one man was overworked.

## 4. CONCLUSION

The production part of the fish-based cracker industry analyzes the workload using the full-time equivalent method, identifying the following roles: a worker for fish processing, which includes the normal workload category; a worker for fish grinding, which includes the overload working load category; a worker for grinding, which includes the normal working load category; a worker for printing, which includes the standard workload class; a worker for freezing, which includes the normal working load category; and a worker for packaging, which includes the underload category. The production section of the fish-based cracker industry optimally employs three workers for fish processing, two for fish grinding, two for grilling, three for printing, three for frying, and two for packaging.

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