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Employee Workload Analysis Using the Full Time Equivalent Method in the Production Division at PT. Indonesian Ship Industry (Persero) Makassar

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ABSTRACT

PT. IKI is a shipbuilding company owned by the Indonesian government engaged in production. Preliminary observations found that there was an imbalance in the workload received by each employee, causing employees to work beyond operating hours, sometimes also working outside the company's working days. Workload analysis is very important to calculate exactly how many employees are needed to complete all tasks in a part or department in the company. In this research was conducted to identify the workload received by employees of the plumbing department, and determine the number of employee needs based on their workload. This study uses the full time equivalent method to identify the workload received by employees and determine the number of employee needs based on their workload. The results of this study indicate that there is an uneven workload at one work station, where from the results of calculations using the FTE method it is known that the workload of employees 1 and 2 is classified as overload and employees 3, 4, 5, 6, 7, 8, 9, and 10 in the normal category. Based on the results of this study, the number of employees was increased, namely 2 people. So the optimal number of employees is 12 people. Another suggestion is for employees who experience an overloaded workload or an uneven workload at one work station, then some of the job descriptions for employees who have an overloaded workload are given to employees who have a normal workload.

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INTRODUCTION

Human resources can be a barometer of the success of a company if it is planned properly which is useful for optimizing workforce needs so that they are more effective, efficient and productive at work. The accuracy of the number of employees employed in a production system is a basic condition that must be considered in preparing work plans. The work design process ultimately aims to balance the physical and mental aspects of humans in completing certain tasks so that the accuracy of the number of employees with the existing workload will support the mental and physical conditions at work.

PT. IKI is a shipbuilding company owned by the Indonesian government engaged in production which was established in 1977 with its head office in Makassar, South Sulawesi. Some of the industrial activities included are shipbuilding, shiprepair, docking and steel construction . As one of the Indonesian government-owned shipyard companies engaged in production. Where this company requires to be able to achieve targets in order to survive and compete in the shipping industry or other shipyards. So to achieve the production target, the accuracy of the number of employees employed in a production system is a basic condition that must be considered in preparing work plans.

Full time equivalent method is considered quite appropriate for analyzing time-based workloads by measuring the length of time it takes to complete work and then converting it into an FTE value index (WC Dewi and Al-Ghofari 2020). The FTE method has the goal of simplifying work measurement by converting workload hours into the number of people needed to complete certain jobs (Wardanis 2018). In addition, the FTE method will provide information about the allocation of human resources needed to complete work and the time in each work activity which can be seen through the results of measuring work time which is directly observed using the stopwatch method.

So, based on the explanation above, a study was conducted with the aim of identifying the workload received by the plumbing department employees and knowing the number of employee needs based on their workload.

RESEARCH METHODS

1. Types Of Research

The research location which is the object of writing in data collection is PT. IKI which is located at Jalan Shipyard No. 31, Kaluku Bodoa, Kec. Tallo, Makassar City, South Sulawesi which will be held for approximately one month.

2. Data Collection Techniques

The data collection method used in the research is as follows:

2.1 Observation Method

The observation method is a method that is carried out by way of direct surveys in the field. There are two kinds of survey methods, namely:

1. Secondary Data Collection

In collecting supporting data or secondary data, it is done by looking at data or reports from company management, to see the number of employees and their working hours.

2. Primary Data Collection

Primary data was obtained by using a questionnaire and conducting direct observations and conducting debriefings, both with employees and with the company's management.

RESULTS AND DISCUSSION

The data used in this study is the result of a questionnaire distributed to 10 respondents, namely company employees in the plumbing department. Questionnaires that have been filled in by

respondents are then processed using the full time equivalent method. The research variables used in the questionnaire to determine the amount of workload are as follows:

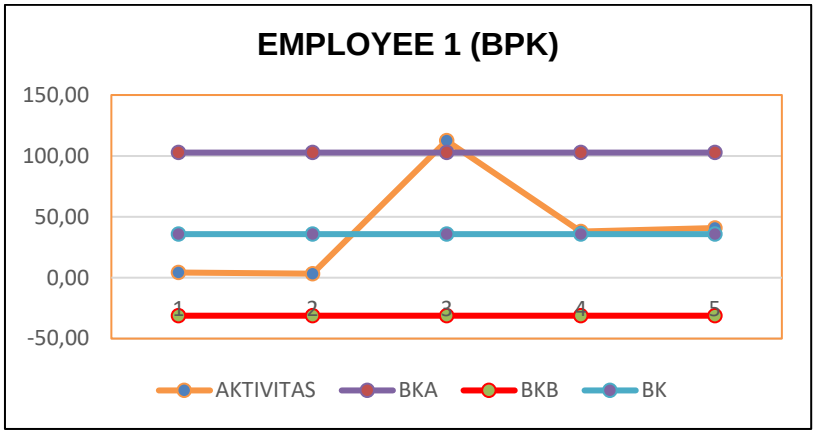
a. Data on the number of employees of the plumbing department
b. Job element data
c. Employee workload data
d. Data on the number of hours worked by employees
e. Data Amount of time available
f. Performance rating data
g. Data allowances

1. Data Adequacy Test and Data Uniformity

At this stage of data processing, the first thing to do is to test the data adequacy. In the data adequacy test, there are 2 influencing factors, namely the level of confidence (k) and the level of accuracy (s). The level of confidence used is 95% or equal to 2 and the level of accuracy used is 5% or 0.05%.

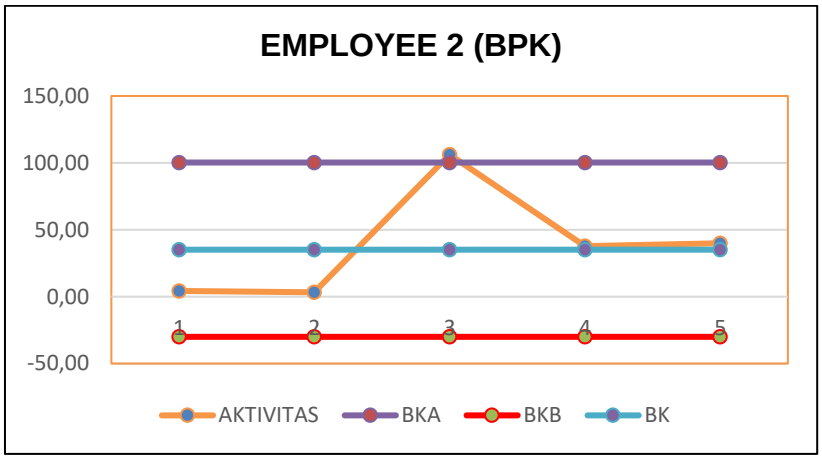
Table 1. Employee Data Adequacy Test

Employee	No.	Activity	Intensity	N	N'	Ket.
Employee 1 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	4	1.06	Enough
	2	Setting up tools	Daily	4	0.88	Enough
	3	Open the faucet	Daily	4	0.65	Enough
	4	Pipe cleaning	Daily	4	0.20	Enough
	5	Faucet installation	Daily	4	0.17	Enough
Employee 2 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	4	1.27	Enough
	2	Setting up tools	Daily	4	2.54	Enough
	3	Open the faucet	Daily	4	0.75	Enough
	4	Pipe cleaning	Daily	4	1.11	Enough
	5	Faucet installation	Daily	4	0.17	Enough
Employee 3 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	4	1.34	Enough
	2	Setting up tools	Daily	4	2.85	Enough
	3	Open the faucet	Daily	4	1.53	Enough
	4	Pipe cleaning	Daily	4	0.86	Enough
	5	Faucet installation	Daily	4	0.33	Enough
Employee 4 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	4	2.85	Enough
	2	Setting up tools	Daily	4	2.50	Enough
	3	Open the faucet	Daily	4	0.48	Enough
	4	Pipe cleaning	Daily	4	1.15	Enough
	5	Faucet installation	Daily	4	1.85	Enough
Employee 5 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	4	1.27	Enough
	2	Setting up tools	Daily	4	2.54	Enough
	3	Open the faucet	Daily	4	0.84	Enough
	4	Pipe cleaning	Daily	4	1.97	Enough
	5	Faucet installation	Daily	4	1.97	Enough
Employee 6 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	4	1.97	Enough
	2	Setting up tools	Daily	4	0.54	Enough
	3	Open the faucet	Daily	4	0.23	Enough
	4	Pipe cleaning	Daily	4	0.82	Enough
	5	Faucet installation	Daily	4	0.98	Enough
Employee 7 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	4	0.94	Enough
	2	Setting up tools	Daily	4	0.32	Enough
	3	Open the faucet	Daily	4	0.17	Enough
	4	Pipe cleaning	Daily	4	0.25	Enough
	5	Faucet installation	Daily	4	0.28	Enough
Employee 8 (SK)	1	Prepare tools and materials	Daily	9	3.42	Enough
	2	Faucet component removal	Daily	9	0.46	Enough
	3	Faucet cleaning	Daily	9	3.16	Enough
	4	Installation of faucet components	Daily	9	5.68	Enough
	5	Replacement of rames packing on the faucet	Daily	9	1.49	Enough
	6	Faucet painting	Daily	9	1.89	Enough
Employee 9 (SK)	1	Prepare tools and materials	Daily	9	4.71	Enough
	2	Faucet component removal	Daily	9	0.58	Enough
	3	Faucet cleaning	Daily	9	5.72	Enough
	4	Installation of faucet components	Daily	9	2.51	Enough
	5	Replacement of rames packing on the faucet	Daily	9	4.93	Enough
	6	Faucet painting	Daily	9	2.96	Enough
Employee 10 (SK)	1	Prepare tools and materials	Daily	9	4.91	Enough
	2	Faucet component removal	Daily	9	0.37	Enough
	3	Faucet cleaning	Daily	9	5.78	Enough
	4	Installation of faucet components	Daily	9	0.94	Enough
	5	Replacement of rames packing on the faucet	Daily	9	8.31	Enough
	6	Faucet painting	Daily	9	2.05	Enough



Graph 1. Uniformity of Employee Data 1

From graph 1 it shows that there is data that is out of the control limits. That is, the data obtained is not uniform.



Graph 2. Uniformity of Employee Data 2

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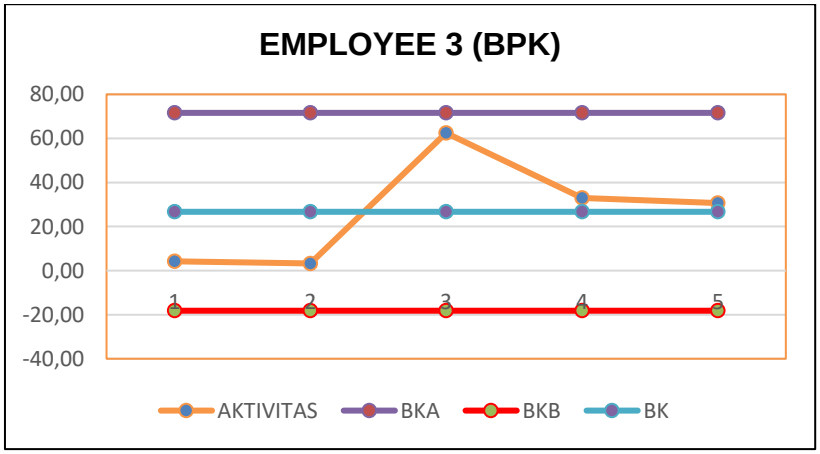
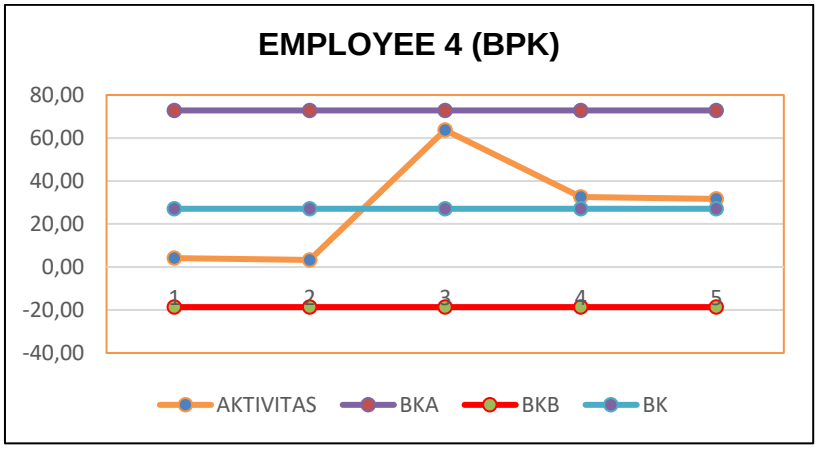


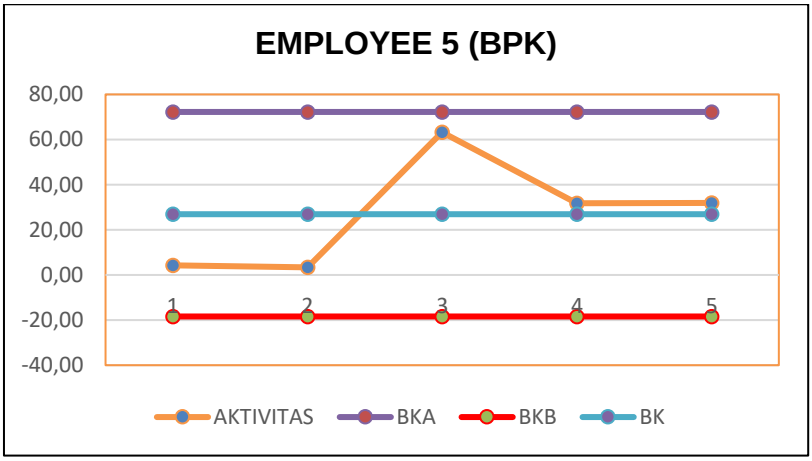
Graph 3. Uniformity of Employee Data 3

Graph 3 shows that there is no data outside the control limits. That is, the data obtained is uniform.



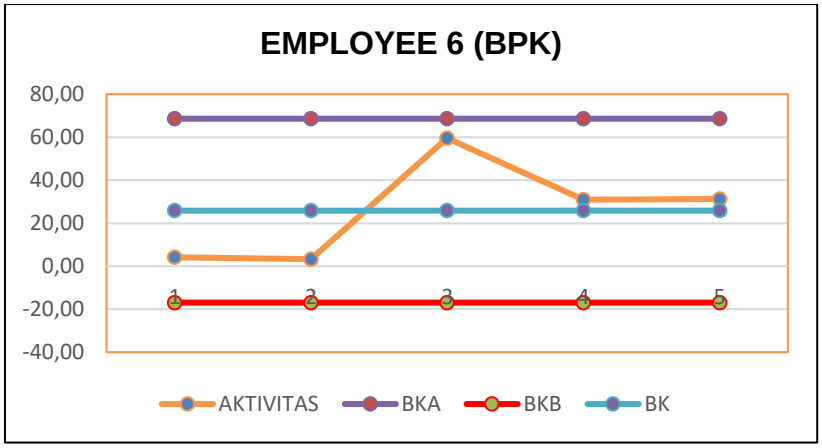
Graph 4. Uniformity of Employee Data 4

Graph 4 shows that there is no data outside the control limits. That is, the data obtained is uniform.



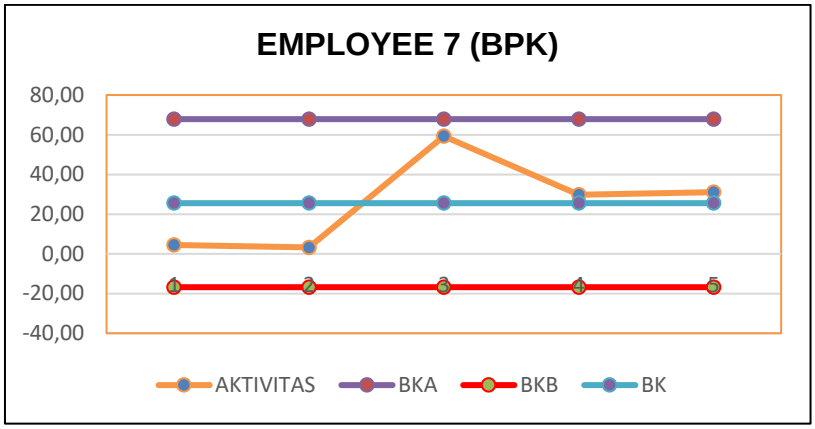
Graph 5. Uniformity of Employee Data 5

Graph 5 shows that there is no data outside the control limits. That is, the data obtained is uniform.



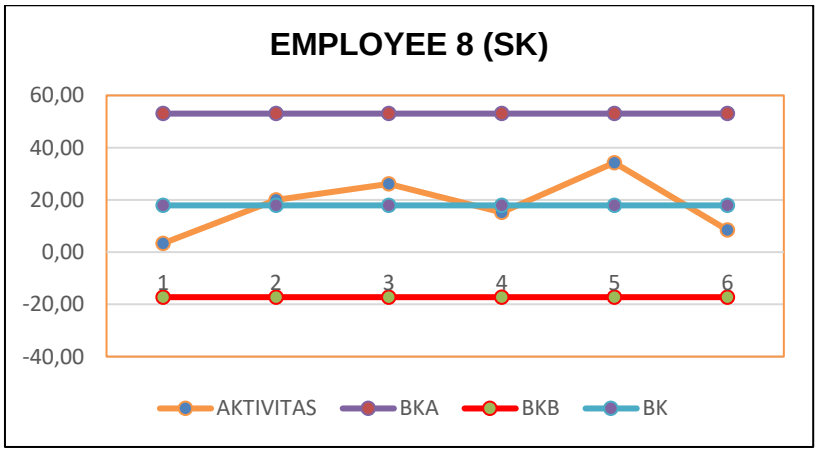
Graph 6. Uniformity of Employee Data 6

Graph 6 shows that there is no data outside the control limits. That is, the data obtained is uniform



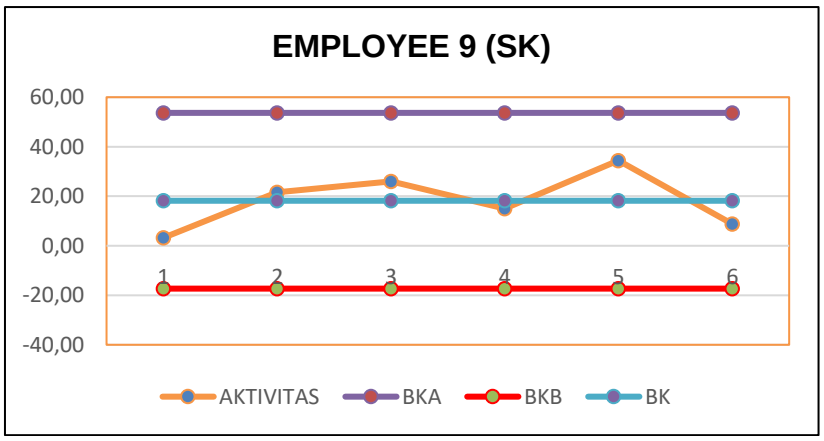
Graph 7. Uniformity of Employee Data 7

Graph 7 shows that there is no data outside the control limits. That is, the data obtained is uniform.



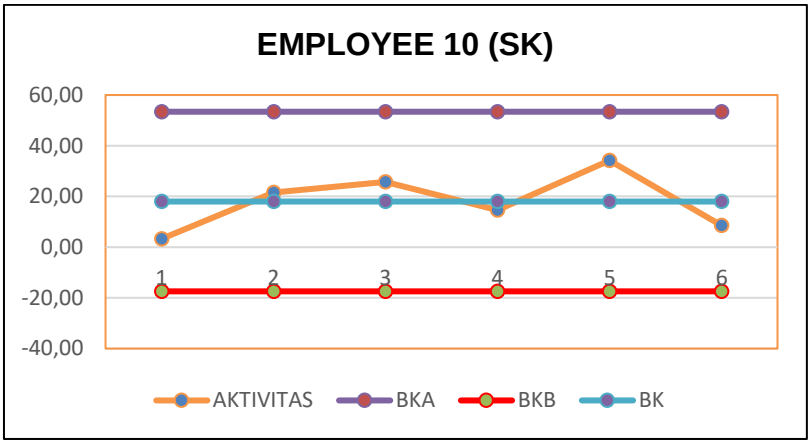
Graph 8. Uniformity of Employee Data 8

Graph 8 shows that there is no data outside the control limits. That is, the data obtained is uniform.



Graph 9. Uniformity of Employee Data 9

Graph 9 shows that there is no data outside the control limits. That is, the data obtained is uniform.



Graph 10. Uniformity of Employee Data 10

Graph 10 shows that no data is outside the control limits. That is, the data obtained is uniform.

2. Factor Ratings

The adjustment factor or performance rating is the activity of assessing or evaluating the operator's work speed. By doing this rating, it is hoped that the measured working time can be normalized again. The method used is the Westinghouse method. The value of the performance rating is assessed in accordance with direct observations made by researchers on the performance of each employee in each element.

Table 2 Factor Rating Test

Employee	No	Activity	Intensity	KP	UH	KJ	KS	RF
Employee 1 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	0.05	0.02	0.00	0.03	1.10
	2	Setting up tools	Daily	0.00	0.02	0.00	0.01	1.03
	3	Open the faucet	Daily	0.05	0.02	0.00	0.03	1.10
	4	Pipe cleaning	Daily	0.03	0.02	0.00	0.01	1.06
	5	Faucet installation	Daily	0.03	0.02	0.00	0.01	1.06
Employee 2 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	0.03	0.02	0.00	0.01	1.06
	2	Setting up tools	Daily	0.00	0.00	0.00	0.01	1.01
	3	Open the faucet	Daily	0.03	0.02	0.00	0.03	1.08
	4	Pipe cleaning	Daily	0.03	0.02	0.00	0.01	1.06
	5	Faucet installation	Daily	0.03	0.02	0.00	0.01	1.06
Employee 3 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	0.03	-0.01	0.00	0.01	1.03
	2	Setting up tools	Daily	0.00	0.02	0.00	0.01	1.03
	3	Open the faucet	Daily	0.03	0.02	0.00	0.01	1.06
	4	Pipe cleaning	Daily	0.03	0.02	0.00	0.03	1.08
	5	Faucet installation	Daily	0.03	0.02	0.00	0.03	1.08
Employee 4 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	0.03	-0.01	0.00	0.01	1.03
	2	Setting up tools	Daily	0.00	0.02	0.00	0.01	1.03
	3	Open the faucet	Daily	0.03	0.02	0.00	0.03	1.08
	4	Pipe cleaning	Daily	0.03	0.02	0.00	0.01	1.06
	5	Faucet installation	Daily	0.03	0.02	0.00	0.01	1.06
Employee 5 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	0.03	-0.01	0.00	0.01	1.03
	2	Setting up tools	Daily	0.00	0.02	0.00	0.01	1.03
	3	Open the faucet	Daily	0.03	0.02	0.00	0.03	1.08
	4	Pipe cleaning	Daily	0.03	0.02	0.00	0.01	1.06
	5	Faucet installation	Daily	0.03	0.02	0.00	0.01	1.06
Employee 6 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	0.03	-0.01	0.00	0.01	1.03
	2	Setting up tools	Daily	0.00	0.02	0.00	0.01	1.03
	3	Open the faucet	Daily	0.03	0.02	0.00	0.01	1.06
	4	Pipe cleaning	Daily	0.03	0.02	0.00	0.01	1.06
	5	Faucet installation	Daily	0.03	0.02	0.00	0.03	1.08
Employee 7 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	0.03	0.02	0.00	0.01	1.06
	2	Setting up tools	Daily	0.00	0.02	0.00	0.01	1.03
	3	Open the faucet	Daily	0.03	0.02	0.00	0.01	1.06
	4	Pipe cleaning	Daily	0.03	0.02	0.00	0.01	1.06
	5	Faucet installation	Daily	0.03	0.02	0.00	0.03	1.08
Employee 8 (SK)	1	Prepare tools and materials	Daily	0.00	0.02	0.00	0.01	1.03
	2	Faucet component removal	Daily	0.03	0.02	0.00	0.01	1.06
	3	Cleaning of faucet components	Daily	0.03	0.02	0.00	0.01	1.06
	4	Installation of faucet components	Daily	0.03	0.02	0.00	0.01	1.06
	5	Replacement of rames packing on the faucet	Daily	0.05	0.02	0.00	0.03	1.10
	6	Faucet painting	Daily	0.03	0.02	0.00	0.01	1.06
Employee 9 (SK)	1	Prepare tools and materials	Daily	0.00	0.02	0.00	0.01	1.03
	2	Faucet component removal	Daily	0.03	0.02	0.00	0.01	1.06
	3	Cleaning of faucet components	Daily	0.03	0.02	0.00	0.01	1.06
	4	Installation of faucet components	Daily	0.03	0.02	0.00	0.01	1.06
	5	Replacement of rames packing on the faucet	Daily	0.05	0.02	0.00	0.03	1.10
	6	Faucet painting	Daily	0.03	0.02	0.00	0.01	1.06
Employee 10 (SK)	1	Prepare tools and materials	Daily	0.00	0.02	0.00	0.01	1.03
	2	Faucet component removal	Daily	0.03	0.02	0.00	0.01	1.06
	3	Cleaning of faucet components	Daily	0.03	0.02	0.00	0.01	1.06
	4	Installation of faucet components	Daily	0.03	0.02	0.00	0.01	1.06
	5	Replacement of rames packing on the faucet	Daily	0.05	0.02	0.00	0.03	1.10
	6	Faucet painting	Daily	0.03	0.02	0.00	0.01	1.06

3. Activity Processing Time

This normal time calculation uses cycle time data per employee job description which is obtained by involving the performance rating value per employee. Getting the normal time is by multiplying the cycle time by the rating factor.

Normal Time = Cycle Time x Factor Rating

Standard Time = WN + (WN x allowance)

Table 3. Activity Processing Time for All Work Stations

Employee	No.	Activity	Intensity	RF	WS (Min)	WN (Min)	WB (Min)
Employee 1 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	1.10	4.27	4.69	5.82
	2	Setting up tools	Daily	1.03	3.32	3.42	4.24
	3	Open the faucet	Daily	1.10	112.44	123.68	153.37
	4	Pipe cleaning	Daily	1.06	37.80	40.06	49.68
	5	Faucet installation	Daily	1.06	40.68	43.12	53.47
Employee 2 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	1.06	4.29	4.54	5.63
	2	Setting up tools	Daily	1.01	3.26	3.29	4.08
	3	Open the faucet	Daily	1.08	106.17	114.66	142.18
	4	Pipe cleaning	Daily	1.06	37.81	40.08	49.70
	5	Faucet installation	Daily	1.06	39.94	42.33	52.49
Employee 3 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	1.03	4.19	4.31	5.26
	2	Setting up tools	Daily	1.03	3.26	3.36	4.10
	3	Open the faucet	Daily	1.06	62.47	66.22	80.79
	4	Pipe cleaning	Daily	1.08	32.94	35.57	43.40
	5	Faucet installation	Daily	1.08	30.61	33.06	40.34
Employee 4 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	1.03	4.21	4.33	5.29
	2	Setting up tools	Daily	1.03	3.30	3.40	4.14
	3	Open the faucet	Daily	1.08	63.69	68.78	83.91
	4	Pipe cleaning	Daily	1.06	32.62	34.58	42.18
	5	Faucet installation	Daily	1.06	31.66	33.56	40.94
Employee 5 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	1.03	4.28	4.41	5.38
	2	Setting up tools	Daily	1.03	3.37	3.47	4.23
	3	Open the faucet	Daily	1.08	63.24	68.29	83.32
	4	Pipe cleaning	Daily	1.06	31.84	33.75	41.17
	5	Faucet installation	Daily	1.06	31.85	33.76	41.19
Employee 6 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	1.03	4.16	4.29	5.17
	2	Setting up tools	Daily	1.03	3.29	3.39	4.08
	3	Open the faucet	Daily	1.06	59.56	63.14	76.08
	4	Pipe cleaning	Daily	1.06	30.99	32.85	39.59
	5	Faucet installation	Daily	1.08	31.27	33.77	40.69
Employee 7 (BPK)	1	Inspection of pipes to be repaired on ships	Daily	1.06	4.41	4.67	5.63
	2	Setting up tools	Daily	1.03	3.25	3.34	4.03
	3	Open the faucet	Daily	1.06	59.23	62.78	75.65
	4	Pipe cleaning	Daily	1.06	29.76	31.54	38.01
	5	Faucet installation	Daily	1.08	31.00	33.48	40.34
Employee 8 (SK)	1	Prepare tools and materials	Daily	1.03	3.34	3.44	4.12
	2	Faucet component removal	Daily	1.06	20.03	21.23	25.37
	3	Faucet cleaning	Daily	1.06	26.11	27.68	33.08
	4	Installation of faucet components	Daily	1.06	15.22	16.13	19.27
	5	Replacement of rames packing on the faucet	Daily	1.10	34.25	37.67	45.02
	6	Faucet painting	Daily	1.06	8.41	8.91	10.65
Employee 9 (SK)	1	Prepare tools and materials	Daily	1.03	3.22	3.32	3.97
	2	Faucet component removal	Daily	1.06	21.60	22.89	27.36
	3	Faucet cleaning	Daily	1.06	26.00	27.56	32.93
	4	Installation of faucet components	Daily	1.06	15.00	15.90	19.00
	5	Replacement of rames packing on the faucet	Daily	1.10	34.44	37.88	45.27
	6	Faucet painting	Daily	1.06	8.84	9.37	11.20
Employee 10 (SK)	1	Prepare tools and materials	Daily	1.03	3.29	3.39	4.05
	2	Faucet component removal	Daily	1.06	21.62	22.92	27.39
	3	Faucet cleaning	Daily	1.06	25.76	27.31	32.64
	4	Installation of faucet components	Daily	1.06	14.62	15.49	18.52
	5	Replacement of rames packing on the faucet	Daily	1.10	34.18	37.60	44.93
	6	Faucet painting	Daily	1.06	8.50	9.01	10.77

4. Full Time Equivalent

Calculation of workload is carried out based on the total normal time per employee per day and working time per day. Calculation of employee workload using normal time data and rating factors per employee job description that can be seen in each, namely in the table above. The following is an example of a calculation to get the FTE value for employee 1:

Total Elemental Hours = Frequency x Normal Time x Number of Workdays/60

Total Hours/ Years = 20 x 4.69 minutes x 260 days/3600 =

FTE = (Total Working Hours of Elements per Year/Effective Working Hours per Year)

FTE = 6.78/1580.8 = 0.00

Table 4. FTE Value of Each Employee

No	Work Station	FTE Employees
1	Employee 1 (Open The Faucet Fair)	2.12
2	Employee 2 (Open The Faucet Fair)	2.01
3	Employee 3 (Open The Faucet Fair)	1.16
4	Employee 4 (Open The Faucet Fair)	1.18
5	Employee 5 (Open The Faucet Fair)	1.17
6	Employee 6 (Open The Faucet Fair)	1.01
7	Employee 7 (Open The Faucet Fair)	1.00
8	Employee 8 (Faucet Service)	1.04
9	Employee 9 (Faucet Service)	1.06
10	Employee 10 (Faucet Service)	1.05

Based on the table above, it can be concluded that employee 1 has an excessive workload, this is because the total FTE of all activity elements is above >1.28, namely 2.12, which is classified as an *overload category* , therefore a recommendation is needed. Employee 2 gets an excessive workload, this is because the total FTE of all activity elements is above > 1.28, namely 2.01 which is classified as an *overload category* , therefore a recommendation is needed. Employee 3 gets a normal workload, this is because the total FTE of all activity elements is between 1-1.28, namely 1.16 which belongs to the normal category therefore need a recommendation. Employee 4 gets a normal workload, this is because the total FTE of all activity elements is between 1-1.28, namely 1.18 which belongs to the normal category therefore need a recommendation. Employee 5 gets a normal workload, this is because the total FTE of all activity elements is between 1-1.28, namely 1.17 which belongs to the normal category therefore need a recommendation. Employee 6 gets a normal workload, this is because the total FTE of all activity elements is between 1-1.28, namely 1.01 which belongs to the normal category therefore need a recommendation. Employee 7 gets a normal workload, this is because the total FTE of all activity elements is between 1-1.28, namely 1.00 which belongs to the normal category therefore need a recommendation. Employee 8 gets a normal workload, this is because the total FTE of all activity elements is between 1-1.28, namely 1.04 which belongs to the normal category therefore need a recommendation. Employee 9 gets a normal workload, this is because the total FTE of all activity elements is between 1-1.28, namely 1.06 which belongs to the normal category therefore need a recommendation. Employee 10 gets a normal workload, this is because the total FTE of all activity elements is between 1-1.28, namely 1.05 which belongs to the normal category therefore need a recommendation.

CONCLUSION

Based on the results of the FTE calculation, it is known that the workload of employees 1 and 2 belongs to the overload category and employees 3, 4, 5, 6, 7, 8, 9 and 10 belong to the normal category. Based on the table of labor requirements for workload, the initial number of employees is 10 employees and the additional number of employees is 2 employees. So the optimal number of employees in the plumbing department is 12 employees. In addition, as for suggestions for employees

who experience an overloaded workload or an uneven workload at one work station, some of the job descriptions for employees who have an overloaded workload are given to employees who have a normal workload.

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