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Analysis of Fatigue Levels Using Multiple Linear Regression Methods on PT XYZ Workers

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Abstract

PT XYZ is a company engaged in warehousing. In every process, there are various activities that can cause fatigue in workers. Currently, researchers want to analyze the effect of body condition, material, and warehouse conditions on the fatigue level of warehouse workers. To do this, companies can use multiple linear regression tests with SPSS software. In the multiple linear regression test that has been carried out, it is known that the body condition and material factors do not have a strong influence on the level of fatigue that occurs. This is because the Pvalue >0.05. While the warehouse condition factor has a strong influence on the level of fatigue, H0 is rejected because it has a Pvalue of 0.015 <0.05. From the results of the anova test conducted, it can be seen that the three existing factors simultaneously affect the fatigue level of PT XYZ workers. This is because the significance value in the anova test is 0.004; smaller than the value of 0.005. The benefit of this research is that PT XYZ can determine the right solution in order to reduce the level of fatigue so that warehouse productivity increases.

Keywords: *Anova, Fatigue, Multiple Linear Regression, Warehouse, Workers*

1. Introduction

In the industrial world, companies require human resources in it to have high productivity in order to achieve the targets of the Company. But often, high productivity levels require workers to carry out heavy work activities and do not pay attention to the physical and mental abilities of these workers. This condition can cause fatigue which triggers work accidents. This can threaten the welfare of employees. Law No.17 of 1970 states that work safety is the right of every worker to get protection for safety while working, as well as every other person who is in the workplace must be guaranteed safety and must use every source of production carefully and effectively. Based on the laws that have been regulated, the Company is obliged to ensure the welfare of its workers. Fatigue is one of the occupational safety and health problems or potential hazards that are often found in workers in the workplace. Fatigue has various criteria, namely physical and psychological fatigue, decreased motivation, feeling easily tired, decreased productivity levels in work, and decreased physical work. Working time that exceeds the threshold can cause difficulty concentrating, thinking, tired of talking, and forgetting easily [1].

PT XYZ is one of the companies included in the Bonded Logistics Association or PLB. Companies that are members of this PLB have several privileges, such as the suspension of import duties and taxes until the release of PLB cargo to reduce storage costs / demurrage handling ports in Indonesia. PT XYZ has many branches in Indonesia, one of which is in the Sidoarjo area. For material commodities in PT XYZ, this Sidoarjo warehouse focuses on vehicle components. Activities that take place in this warehouse include the process of receiving materials, storing materials, and shipping materials to customers. From observations made by researchers, the activities carried out often make workers experience fatigue in certain conditions and are likely to have an impact that can harm the company and the workers themselves.

This study conducted by researcher aims to determine the causes of fatigue in PT XYZ workers. Where the method used is the multiple linear regression method to test the level of strength or correlation of each indicator of the cause of fatigue / independent variable with an indicator of the level of fatigue / dependent variable. After observations and discussions, it was determined that the factors that can cause fatigue are factors of body condition, material, and warehouse conditions. The topic of this research focuses on one of the existing shift units using data from the entire population of 40 workers. The results of this research are expected to find out the variables that greatly affect the level of fatigue that occurs and can find solutions on how to reduce the level of fatigue so that later the company can increase its productivity figures and can maintain the level of accuracy that is useful for maintaining customer confidence.

2. Literature Review

2.1. Regression

Simple linear regression is a method used to determine the magnitude of the influence of variable X on variable Y. By using this method, researchers can predict the magnitude of the dependent character through the influence of the independent character. Knowledge of the magnitude of the yield relationship is helpful in assessing the different components of yield [2]. Regression analysis states the functional relationship between the independent variable and the dependent variable expressed in the regression equation. The regression equation is used to estimate or predict the dependent variable due to the influence of the independent variable. In regression calculations, simple linear regression and multiple linear regression are known [3].

2.2. Multiple Linear Regression

Multiple linear regression is a method to measure the strength of the relationship between the dependent variable (Y) and the independent variable (X). In this case, the independent variable can consist of two or more variables. In this method, the direction of the relationship, whether positive or negative, can be determined through the analysis carried out. This can be known to determine how much influence each X variable has on Y [4].
According to Sari [5] Multiple linear regression analysis is an analysis model that describes the relationship between the response variable (Y) and the variables that influence it (X) where the variable (X) is more than one. The equation used in multiple linear regression is
$Y = b0 + b1X1 + bnXn$
Description:
Y: dependent / response variable
X: independent / predictor variable
b0: intercept
b: coefficient

2.3. Fatigue

Fatigue is a common problem in the workforce. Take a break after do something difficult can help individuals return from a state of fatigue. If left unchecked, fatigue will affect work capacity and efficiency. Fatigue is a feeling of tiredness and a decrease in worker alertness caused by psychological and physical factors. Work fatigue can reduce performance so that it affects the productivity and concentration of workers and increases the risk of work errors. Work fatigue can be caused by several factors which can include age, gender, work period, education level, physical and mental workload, nutritional status, work environment, and so on. Workload is all matters that must be carried out by labor to fulfill their obligations, such as carrying loads, walking fast or running, pushing and so on [6].
Fatigue is one of the risk factors that has a domino effect on fatal incidents that occur during work. Workers who feel fatigue will be prone to make mistakes, reduce productivity, reduce concentration, reduce work quality, and increase the risk of work accidents and death. There are various factors that can contribute to fatigue. Factors such as age, marital status, education level, and nutritional status are internal factors, while sleep deprivation and disturbance, workplace demands, workplace social support, workplace roles, and job satisfaction are external factors [7].

2.4. Warehouse

The warehouse is one of the important components that must be present in a business. The warehouse must be able to ensure that its role in maintaining the spearhead of the supply chain is appropriate. Currently, the system in the warehouse is quite good. This is due to the collaboration between workers and the warehouse management system (WMS). This WMS system is used to assist every process or activity in the warehouse. With a system that already exists and is maintained regularly, the work in the warehouse is greatly assisted. Starting from the process of material arrival, material storage, to searching for materials that have not been found [8].

2.5. Productivity

Productivity is an activity that uses human resources as the main driver in business. This is done by producing a commodity or service that can be useful for human life. The output of company productivity can utilize every available resource and generate more profit with careful calculation. The productivity of each worker is influenced by different things, ranging from internal factors of the worker's body such as a healthy body condition, regular diet, to mental burden. In achieving each productivity, KPI can be used which will later have several assessments of each worker in stages. When productivity in workers has increased, it is impossible that the existing organizational goals can be achieved immediately in order to create other targets that can trigger the enthusiasm of workers [9].

2.6. SPSS

SPSS is a software that plays a major role in statistics. Currently, SPSS has gone through several version updates, where in 1968 Norman Nie created the first version of this software. SPSS is very helpful for solving various problems, ranging from calculations, factor tests, to in-depth analysis, especially in statistical analysis. SPSS has various advantages in its role as software that is currently featured. This software can be used by someone who is growing, academics, to professionals. When SPSS is in the right hands, it is certain that statistical problems will soon be resolved properly and with analysis that has a basis [10].

3. Analysis and Design

3.1. Research Methods

The research method carried out by researchers is to use quantitative research. This is because there are calculations and use numerical and statistical data models. The data collection method used is to use multiple linear regression tests. The data needed are:

1. PT XYZ worker fatigue level data.
2. Fatigue data based on body condition factors,
3. Fatigue data based on material factors.
4. Fatigue data based on warehouse conditions.

3.2. Flowchart

Data processing is a series of processing to produce information or produce output from raw data. The following are the stages of this research flowchart.

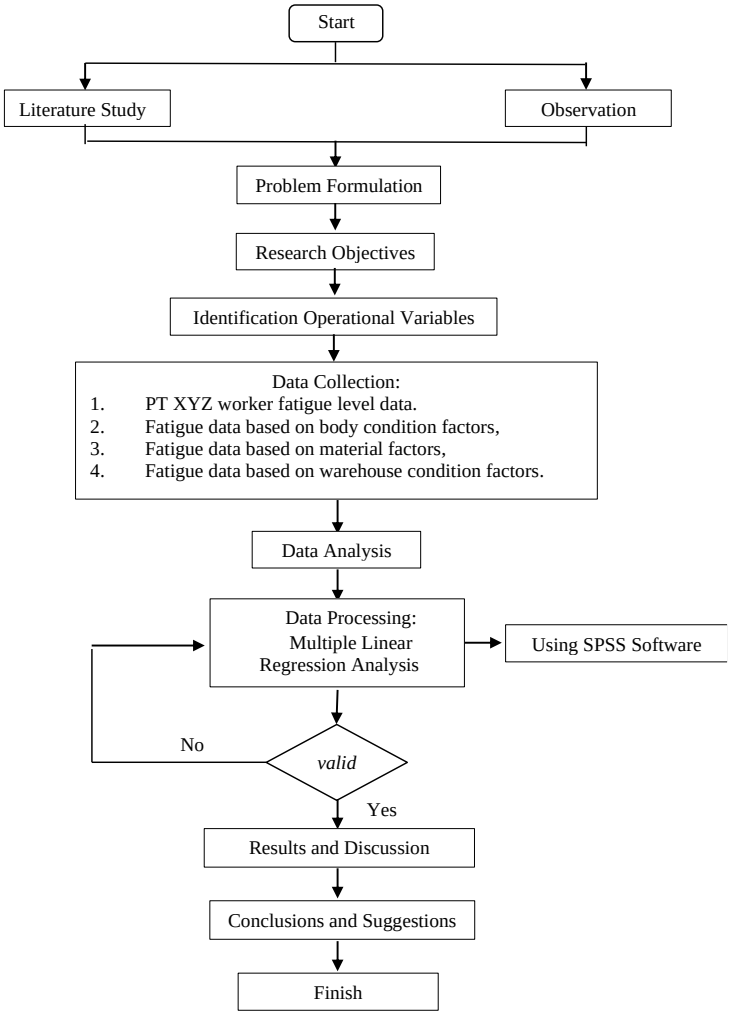

Fig. 1: Flowchart of Multiple Linear Regression Process Design

3.3. Observation Data

PT XYZ is a warehousing sector company that has several customers. To help solve the problems that occur, researcher can use multiple linear regression analysis. The first step that can be taken is to observe the condition of the warehouse, after the observation, it is continued with a discussion to determine the factors that represent each cause of fatigue that occurs during work. The next step is to find raw data to be processed by interviewing 40 workers. The result of the data obtained is the fatigue level of each worker and the influence of each factor in causing fatigue in workers.

3.4. Parameters

Parameter is a standard obtained from calculations and has its own rules. the parameters in this method are:

If: p-*value* $\geq 0{,}05 = H_0$ accepted
p-*value* $< 0{,}05 = H_0$ rejected

4. Result and Discussion

4.1. Coefficient Test

Hypothesis:
H0 = There is no relationship (correlation) between Fatigue Level and Factors Causing Fatigue
H1 = There is a relationship (correlation) between Fatigue Level and Factors Causing Fatigue.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.068	1.773		1.167	.251					
	Kondisi Tubuh	.209	.192	.169	1.092	.282	.286	.179	.152	.804	1.244
	Material	.156	.180	.150	.869	.390	.402	.143	.121	.654	1.529
	Keadaan Warehouse	.395	.154	.400	2.561	.015	.488	.393	.356	.795	1.259

a. Dependent Variable: Tingkat Kelelahan

Fig. 2: Coefficient Test with SPSS Software

In the output above, the regression model Y = 2.068 + 0.209X1 + 0.156X2 + 0.395X3 is obtained. Because the Pvalue of the body condition factor and material> 0.05, then H0 is accepted so that there is no influence or significant relationship between the effect of fatigue level with body condition and material. While the Pvalue of the warehouse condition factor <0.05, then H0 is rejected so that there is an influence or significant relationship between the effect of fatigue levels and warehouse conditions.

4.2. Anova Test

Hypothesis:
H0 = There is no simultaneous relationship (correlation) between Fatigue Level and Fatigue Causing Factors
H1 = There is a simultaneous relationship (correlation) between Fatigue Level and Factors Causing Fatigue

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	49.404	3	16.468	5.231	.004[b]
	Residual	113.343	36	3.148		
	Total	162.747	39			

a. Dependent Variable: Tingkat Kelelahan

b. Predictors: (Constant), Keadaan Warehouse, Kondisi Tubuh, Material

Fig. 3: Anova Test with SPSS Software

In the ANOVA output above, the significance value is 0.004. Because the Pvalue <0.05, H1 is accepted so that the three factors causing fatigue simultaneously together affect the level of fatigue.

4.3. Discussion

In solving the root of the problem regarding the influence of body condition factors, materials, and warehouse conditions on the level of fatigue, SPSS software is used to help perform calculations. From the results of data processing using SPSS software, the regression analysis between the level of fatigue and the type of product obtained a constant value of 2.068, so that the regression model Y = 2.068 + 0.209X1 + 0.156X2 + 0.395X3 is obtained. Because the Pvalue of the body condition factor and material > 0.05, then H0 is accepted so that there is no influence or significant relationship between the effect of fatigue level with body condition and material. For the Pvalue of the warehouse condition factor <0.05, then H0 is rejected so that there is an influence or significant relationship between the effect of fatigue levels and warehouse conditions. Meanwhile, the results of the anova test obtained a significance value of 0.004. This shows that the factors of body condition, material, and warehouse conditions simultaneously affect the level of fatigue that occurs in PT XYZ workers.

5. Conclusion

The conclusion obtained from this research is that by using SPSS software, PT XYZ can analyze whether there is a relationship between the independent variables, namely body condition, material, and warehouse conditions on the level of fatigue of PT XYZ workers using multiple linear regression methods. The most influential factor on the level of worker fatigue is the warehouse condition factor, where the indicators forming this factor are temperature, lighting, and noise. From the observations made by researchers directly regarding the real conditions in the warehouse, the temperature conditions during the day are indeed quite high and cause thirst and are prone to loss of focus in workers. In certain corners, the level of information is still quite minimal, this is because at some points there are materials that block the light source, causing the eyes to become tired when looking for materials. At certain moments, each division produces sound simultaneously due to the process being carried out, this sometimes disturbs the focus of other workers in doing their part. So it can be concluded that the calculations carried out with SPSS software are in line with the observations made by researchers in real life. The advice that can be given to the company is to conduct periodic evaluations of the conditions that occur in each worker, so that workers can work optimally and can indirectly increase the level of worker accuracy to company productivity.

References

[1] E. N. Pabumbun, S. S. Russeng, and M. Muis, "Faktor Yang Berhubungan Dengan Kelelahan Kerja Pada Pekerja PT Maruki International Indonesia," Hasanuddin Journal of Public Health, vol. 3, no. 1, pp. 90-98, 2022.

[2] T. Hidayat, A. Soegianto, and P. N. Aini, "Analisis Korelasi, Regresi, dan Evaluasi Karakter Morfologi 24 Aksesi Kapas (*Gossypium sp.*)," Agrin, vol. 24, no. 1, pp. 81-93, 2020.

[3] Endaryono, N. Dwitiyanti, "Aplikasi Korelasi dan Regresi dalam Penentuan Koefisien Muai Volume Beberapa Minyak Nabati," Jurnal Matematika dan Statistika serta Aplikasinya, vol. 11, no. 1, pp. 81-87, 2023.

[4] M. D. Sianturi, I. O. L. Tobing, F. Effendy, B. Maulana, G. T. Sinaga, and Y. A. Sitorus, "Pengaruh Pendidikan, Pengalaman, Umur, dan Jam Kerja Terhadap Pendapatan Bulanan Karyawan Menggunakan Model Regresi Linear Berganda," Jurnal Matematika dan Ilmu Pengetahuan Alam, vol. 5, no. 1, 2024.

[5] A. Sari and D. U. Putri, "Penerapan Regresi Linear Berganda Untuk Memprediksi Diabetes Secara Dini," Jurnal Teknologi Komputer dan Sistem Informasi, vol. 3, no. 1, pp. 32-39, 2023.

[6] A. A. Zakaria, D. Lestantyo, and S. Jayanti, "Analisis Faktor Risiko Kelelahan Kerja Pada Pekerja di Pabrik Tahu X Semarang," Jurnal Kesehatan Masyarakat, vol. 12, no. 2, pp. 148-153, 2024.

[7] L. Adytra and D. H. Ramdhan, "Faktor-Faktor Yang Berhubungan Dengan Kelelahan Kerja di PT X di Jabodetabek," Jurnal Cahaya Mandalika, 2023.

[8] A. Padhil, A. S. Rini, and A. M. Husni, "Pengaruh Penerapan Warehouse Management System (WMS) Sebelum dan Sesudah Terhadap Kinerja Karyawan Gudang Finish Good Pada Pt. Triteguh Manunggal Sejati Gowa," Jurnal Taguchi, vol. 3, no. 1, pp. 46-52, 2023.

[9] N. A. Ningsih and L. Khaerunnisa, "Determinasi Produktivitas: Skill, Motivasi dan Lingkungan Kerja (Literature Review Pengantar Manajemen SDM)," Jurnal Teknologi Komputer dan Sistem Informasi, vol. 3, no. 2, pp. 550-560, 2022.

[10] G. P. Suri and N. Y. Arifin, "Pelatihan Pengolahan Data Aplikasi SPSS Pada Siswa Smk Ibnu Sina Batam," Jurnal Teknologi Komputer dan Sistem Informasi, vol. 1, no. 1, pp. 29-32, 2022.