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# The Influence of Personal Protective Equipment (PPE) Usage, Age, and Work Tenure on Workplace Accidents

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**ABSTRACT** Workplace accidents can reduce productivity, which occurs because of unsafe actions and unsafe conditions in the Small and Medium Enterprises (SMEs) of leather tanning in Magetan. Workplace accidents could be caused by workers low awareness of wearing Personal Protective Equipment (PPE), as well as factors like age and work tenure on workplace accidents in the leather tanning SMEs in Magetan 2024. The research design employed an observational analytic method with a Cross-Sectional approach. The sample size consisted 66 people out of a population of 190, selected through proportional random sampling. The variables of PPE use, age, and work tenure, which were collected through observation and interviews, were then processed and analyzed using the Spearman Correlation statistical test ( $r^2$ ). The results indicated that the use of PPE, including masks, gloves, and boots, was at 36,4%, the proportion of workers aged over 30 years was 54,5%, and those with a work tenure over 5 years was 59,1%. The analysis showed that PPE use ( $p=0.000$ ) and age ( $p=0.035$ ) had an impact on workplace accidents, with a correlation value of  $p=0.232$  more than 0.05. The study concluded that the use of PPE and the age of workers in the leather tanning SMEs in Magetan influenced workplace accidents. It is recommended that management provide complete PPE such as masks, boots, gloves and conduct regular monitoring of PPE use conditions. Additionally, workers should use PPE according to standards while performing their duties.

**INDEX TERMS** Age, PPE, Work Tenure, Workplace Accidents

## I. INTRODUCTION

According to the Indonesian Ministry of Manpower Regulation No. 5 of 2018 on Occupational Safety and Health (OSH) in the Workplace, Article 1 paragraph (1), OSH refers to all efforts aimed at achieving and maintaining worker safety and health through preventive measures against accidents and occupational diseases. OSH efforts ensured the physical and mental integrity and health of every worker and provided a sense of comfort to the workers during their employment [1].

According to data from the International Labour Organization (ILO), workplace accidents and occupational diseases remained critical issues worldwide. Each year, an estimated 2.3 million workers died due to workplace accidents or occupational diseases. In addition to fatal cases, about 313 million workers suffered nonfatal work-related accidents each year. More than 160 million workers suffered

from occupational diseases related to their work, creating a heavy burden in terms of both health and economics [2].

Workplace accidents in the industry were unexpected events that could cause loss of time, property, and lives [3]. Accidents could also be caused by risks behaviors such as carelessness, ignoring regulations, not following work procedures, and lacking understanding of the use of PPE [4].

Workplace accidents generally occurred among workers aged 30 and above, where the frequency of accidents increased with declining physical abilities, such as vision, hearing, and reaction speed. Excessive self-confidence in one's ability to complete tasks could also lead to work incidents. Additionally, workers who had never experienced accidents tended to pay less attention to safety actions to avoid workplace risks [5].

Another important aspect of workplace accidents in the industry was the work tenure. Work tenure was the total duration a worker spent at a location up to a certain time and

could affect the frequency of workplace accidents. A person's knowledge and experience usually increased with the work tenure, reducing the risk of accidents. Conversely, new workers might be less trained or unfamiliar with specific risks in the workplace. Work tenure encompassed the period from when a person first started working until the present [6].

The aim of this study was to identify and analyze the risk factors for workplace accidents, including the use of PPE, age, and work tenure. Based on preliminary survey results, workplace accidents were influenced by non-compliance in using PPE according to safety standards.

One of the industries in Magetan Regency was the leather tanning industry, aimed at processing raw hides into ready to use leather. The production process in the Small and Medium Enterprises (SMEs) in the leather tanning industry in Magetan included several stages: preservation, hair removal, tanning, drying, coloring, finishing, and cutting or shaping[7].

The use of machines and equipment, such as tanning machines, dryers, and cutting machines, posed potential risks for workplace accidents. According to a preliminary survey, workplace accidents were often caused by workers non-compliance with using personal protective equipment (PPE) that met safety standards. Workers compliance with fully and properly using PPE during the production process only reached 43%. Additionally, 64% of the total workers were over 30 years old.

## II. METHOD

This study was an analytical observational type that examined the influence between dependent variables, namely the use of Personal Protective Equipment (PPE), age, and work tenure, using a cross-sectional research design. This location was chosen because there were cases of workplace accidents, it had never been researched, and not all workers used complete PPE from the beginning to the end of work activities.

The research design employed an analytical observational method with a cross-sectional approach. The sample size consisted of 66 people from a population of 190, selected through proportional random sampling. The variables of PPE use, age, and work tenure were collected through observation and interviews using a questionnaire and were then processed and analyzed using the Spearman correlation statistical test ( $r^2$ ).

## III. RESULT

### A. UNIVARIATE ANALYSIS

#### a. Use of Personal Protective Equipment

The results of the study on the use of PPE, age, work tenure, and workplace accidents by workers in the leather tanning SMEs in Magetan, gathered through interviews, were presented in TABLE 1 below.

TABLE 1

Distribution of PPE Used, Age, Work tenure, and Work Accidents in Magetan Leather Tannery SMEs in 2024

Variable		Frequency (f)	Percentage (%)
PPE	Qualify	24	36,4
	Unqualify	42	63,6
Age (Years)	< 30	30	45,5
	>30	36	54,5
Work tenure (Years)	≤ 5	34	40,9
	> 5	32	59,1
Work Accidents	Ever	26	39,4
	Never	40	60,6

Source: Primary Data from SME Worker Interviews

According to TABLE 1, it was found that of the 66 workers, 63.3% used PPE that did not meet the requirements, while 36.4% met the requirements. Furthermore, it was found that of the 66 workers, 45.5% were aged less than or equal to 30 years, while 54.5% were aged more than 30 years. Additionally, of the 66 workers, 40.9% had a work tenure of less than or equal to 5 years, and 59.1% had a work tenure of more than 5 years.

### B. BIVARIATE ANALYSIS

#### a. The Influence of PPE Use on Workplace Accidents

The results of the study on the influence of PPE use on workplace accidents among leather tanning SMEs workers in Magetan in 2024 are presented in Table II below.

TABLE 2  
Distribution PPE Use Workers of Leather Tanning SMEs in Magetan 2024

2024							
Kecelakaan Kerja							
PPE USE	Ever		Never		Total		p-value
	N	%	n	%	n	%	
Unqualify	26	61,9	16	38,1	42	100	0,000
Qualify	0	0	24	100	24	100	
Total	26		40		66		

According to TABLE 2, data analysis was conducted using the Spearman correlation test to evaluate the influence of PPE use on workplace accidents in the leather tanning industry. The test results showed a P-value of 0.000 less than 0.05, indicating that there was an influence of PPE use on the occurrence of workplace accidents, thus rejecting H0. Out of 66 workers in the leather tanning SMEs, 26 workers, or 39.4%, experienced workplace accidents, which occurred when the workers did not use complete PPE.

#### b. The Influence of Age on Workplace Accident

The results of the study on the influence of Age on workplace accidents among leather tanning SME workers in Magetan in 2024 are presented in TABLE 3 below.

TABLE 3  
Distribution Age Workers of Leather Tanning SMEs in Magetan 2024

Distribution Age Workers of Leather Tanning SMEs in Gujarat 2024							
Age (Years)	Work Accidents						p- value
	Ever		Never		Total		
	n	%	n	%	N	%	

≤ 30	16	53,3	14	46,7	30	100	0,035
> 30	10	27,8	26	72,2	36	100	
Total	26		40		66		

According to TABLE 3, data analysis was conducted using the Spearman correlation test to assess the influence of age on work accidents among workers SME in the leather tanning industry. The test results showed a p-value = 0.035, which was less than 0.05, indicating an influence of age on the incidence of work accidents[8] leading to the rejection of H0. Out of 66 workers in the leather tanning SMEs, 26 workers or 39.4% had experienced work accidents[9]. Of those, 16 workers or 53.3% who had experienced work accidents were aged less than or equal to 30 years, while 10 workers or 38.4% were aged less than 30 years.

#### c. The Influence of Work tenure on Workplace Accident

The results of the study on the influence of Work tenure on workplace accidents among leather tanning SME workers in Magetan in 2024 are presented in TABLE 4 below.

**TABLE 4**  
**Distribution Work tenure Workers of Leather Tanning SMEs in Magetan 2024**

2024							
Work tenure (Year)	Work Accident						p- value
	Ever		Never		Total		
	N	%	n	%	n	%	
≤ 5	13	48,1	14	51,9	27	100	0,035
> 5	13	33,3	26	66,7	39	100	
Total	26		40		66		

Based on TABLE 4, data analysis was conducted using the Spearman correlation test to assess the influence of work tenure on work accidents SME in the leather tanning industry. The test results showed a p-value = 0.232, which was greater than 0.05, indicating that there was no influence of work tenure on the incidence of work accidents, leading to the acceptance of H0. Out of 66 workers in the leather tanning SMEs, 26 workers experienced work accidents, divided based on work tenure of less than or more than 5 years. Among workers with a work tenure of less than or equal to 5 years, 13 workers or 48.1% experienced work accidents, while 14 workers or 51.1% did not experience work accidents. On the other hand, work accidents also occurred among 13 workers out of 39 workers with a work tenure of more than 5 years, which represents 33.3% of the total workers in the work tenure category.

## IV. DISCUSSION

### A. OVERVIEW OF THE LEATHER TANNING PROCESS IN MAGETAN SMES

The leather tanning process initially involved using plant-based materials with traditional tools. Over time, the tanning process has evolved to utilize cutting-edge machinery with the addition of chemicals. The leather tanning process begins with skin preservation, followed by cleaning & hair removal, tanning, balancing, coloring, drying, and finishing with cutting and shaping the tanned leather according to the required specifications. The cleaning & hair removal

process, as well as the cutting, involve the use of sharp tools to ensure that the leather is free of hair and shaped as needed. Additionally, the coloring and preservation stages involve the use of chemicals such as chrome, sodium sulfide, ammonium sulfate, table salt, sulfuric acid, and lime.

Frank E. Bird and George L. stated that workplace accidents are caused by unsafe conditions or actions by workers, which reduce productivity. Causes include a lack of caution and attention while working. As a result, workplace accidents can lead to injuries, fatalities, and work-related losses[10].

According to research, workplace accidents in leather tanning SMEs reach 39.4%, which is 26 out of 66 workers. Observations and interviews with workers in Magetan revealed that the hazards include cuts, getting caught in machinery, slips, and hearing damage due to machinery noise. Workers acknowledged a lack of attention to work safety. Therefore, researchers emphasize the importance of paying attention to safety and security while working to reduce risks.

Workplace accidents are caused by unsafe behavior, a lack of system oversight, and machine maintenance[11]. Although the severity of accidents is low, the incidence and frequency of accidents are high due to unsafe behavior and failures in machine operation programs[12].

PPE is used to protect against the risk of accidents and reduce the likelihood of accidents in the workplace[13]. Observations in the leather tanning production section in Magetan indicated problems in the use of PPE, such as masks, gloves, and boots. Out of 66 workers, 36.4% did not fully use PPE. According to workers, the main reason for not using PPE is that it is perceived as hindering movement and that the available PPE is no longer suitable[14]. The use of PPE can cause discomfort, especially in hot and stuffy conditions, leading to accidents such as cuts and getting caught in machinery [15].

The age of workers affects productivity and accident risk. Research shows that 45.5% of workers are aged less than or equal to 30 years, and 54.5% are aged more than 30 years. Younger workers are often enthusiastic and try to avoid accidents to show good performance, although they can also be careless. Conversely, older workers may experience accidents due to declining physical conditions and a lack of attention to risks [16]. Age also impacts productivity, with younger workers typically being more productive due to greater physical strength, while older workers may experience a decline in productivity due to diminishing physical capabilities[17].

Work tenure, or the length of time working in a particular place, can enhance a workers experience and performance. However, research shows that work tenure does not affect workplace accidents. In the leather tanning SMEs in Magetan, 40.9% of workers have a work tenure of less than or equal to 5 years, and 59.1% have a work tenure of more than 5 years. Longer work experience increases knowledge,

skills, and safety, creating a more efficient and safe work environment[18].

### **B. THE IMPACT OF PERSONAL PROTECTIVE EQUIPMENT (PPE) ON WORKPLACE ACCIDENTS AMONG WORKERS IN LEATHER TANNING SMES**

The use of PPE influenced workplace accidents, with a correlation test showing a significant impact (value 0.000 less than 0.05). Only 36.6% of workers used PPE that met the required standards, while 42 workers did not meet the standards. Among them, 26 workers had experienced accidents, and 40 had not experienced any workplace accidents.

The use of PPE was a global obligation to reduce workplace accidents and occupational diseases[19]. Workers who did not use PPE were at higher risk of accidents, including cuts, being caught in machinery, slips, and hearing loss [20]. The risk of workplace accidents in the leather tanning industry was related to the availability and adequacy of PPE. Workers stated that thick gloves hindered their speed and comfort at work, and some felt PPE was unnecessary as the risk was perceived to be low [21].

Based on the research findings, the researcher concluded that the use of PPE had a significant effect on workplace accidents, with PPE use reducing the risk of accidents and increasing work productivity [22]. However, some workers did not use PPE because they found it uncomfortable, did not fully understand how to use it, or found that it was inadequate or unavailable. Some workers only used gloves and boots when they should also have been wearing masks [23]. Management needed to provide suitable PPE and train workers on its proper use to reduce the risk of accidents.

In line with the study results [24], the analysis revealed a correlation between PPE and workplace accidents. It was found that out of 44 field workers at PT. PLN (Persero) Belawan, 15 workers (34.1%) used PPE, while 29 workers (65.9%) did not use PPE. The results of the analysis using the chi-square test showed a p-value of 0.034. With this value less than (0.05), it could be concluded that there was a correlation between the use of PPE and the occurrence of workplace accidents.

Workers who wore complete PPE were those who adhered to the applicable regulations, and this compliance led to safer work practices. On the other hand, workers who did not follow the rules tended to make mistakes that could harm both the company and them [25].

### **C. THE IMPACT OF AGE ON WORKPLACE ACCIDENTS AMONG WORKERS IN LEATHER TANNING SMES**

Age was one of the factors that influenced workplace accidents, with a correlation test value of 0.035, indicating a weak positive relationship between age and workplace accidents. In a sample of 66 workers, 54% were over the age of 30, and among this group, 27.7% experienced workplace accidents. Conversely, among workers under the age of 30,

53.3% experienced workplace accidents. This showed that although the relationship between age and workplace accidents was relatively weak, there was a difference in the incidence of accidents between older and younger age groups.

The data indicated that workers under the age of 30 were at higher risk of workplace accidents compared to those over 30. Younger workers faced higher risks, while older workers experienced accidents with increased severity.

The risk of work-related injuries increased for aging workers if their jobs involved heavy physical efforts, such as lifting heavy objects or frequently bending or kneeling. Workers facing these physical demands almost constantly had twice the risk of injury compared to those who did not face such demands.

In line with the study [20], workers aged 30 years or younger had a higher likelihood of workplace accidents compared to those over 30. In line with research [16] also showed that there was an influence of age on workplace accidents. While younger workers were more likely to have workplace accidents, the severity of these accidents tended to increase with age.

### **D. THE IMPACT OF WORK TENURE ON WORKPLACE ACCIDENTS AMONG WORKERS IN LEATHER TANNING SMES**

Length of service did not influence workplace accidents, with a correlation value of 0.232 (p more than 0.05). Of the 66 workers, 51.5% had a service length of  $\leq 5$  years, with 47.1% experiencing accidents. Meanwhile, 48.5% of workers with more than 5 years of service also experienced accidents.

New or short-term workers may be at higher risk of workplace accidents due to a lack of experience compared to more seasoned workers [26]. Workers with less than one year of service tend to have a higher risk of accidents [27].

In Huda's study [26], it was stated that new or short-term workers might be at risk of workplace accidents due to their lack of experience compared to long-term workers. Sovira & Nurjanah (2017) similarly found that workers with less than one year of service tend to have a higher risk of accidents. However, research by Asriani et al. (2016) showed no significant link between length of service and workplace accidents.

## **V. CONCLUSION**

The use of PPE and age influenced workplace accidents, while work tenure did not have a significant effect on workplace accidents.

The recommendation for the industry association leader was to control hazard risks through elimination, substitution, engineering controls, administrative measures, and the use of PPE. For workers, the recommendation was to use complete PPE, report damaged PPE, and remind each other to act safely to prevent workplace accidents. For researchers, the



recommendation was to add research variables that could expand the scope of analysis on workplace accidents.

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