# THE EFFECT OF SAFETY BEHAVIOR, ENERGY INTAKE, AND WORK ENVIRONMENT ON PRODUCTIVITY OF MICRO, SMALL, AND MEDIUM ENTERPRISES IN PURBALINGGA REGENCY

**Suryanto[1]*, Siti Harwanti[2], Syifa Ula Hamidya[3], M. Febriansyah[4], Lieza DS[5]**

[1,2,3]Faculty of Health Sciences, Universitas Jenderal Soedirman, Purwokerto, 53122, Jawa Tengah, Indonesia

[4]Faculty of Economics and Business, Universitas Jenderal Soedirman, Purwokerto, 53122, Jawa Tengah, Indonesia

[5]Faculty of General Medicine, Universitas Jenderal Soedirman, Purwokerto, 53122, Jawa Tengah, Indonesia

*Email: suryanto@unsoed.ac.id

**Abstract.** This study aims to examine the effects of safety behavior, work nutrition, and the work environment on productivity among micro, small, and medium enterprise (MSME) actors in Purbalingga Regency. A quantitative cross-sectional design was applied involving 73 respondents selected through incidental sampling. Data were collected using questionnaires, nutritional assessments, and measurements of workplace conditions, including lighting and noise levels. Data analysis included univariate, bivariate (chi-square), and multivariate (multiple regression) analyses. The results showed that most respondents demonstrated good energy intake (56.2%), safety behavior (50.7%), and implementation of 5R practices (52.1%), with 57.5% categorized as having good productivity. The majority of respondents were female (58.9%), aged 35–44 years (35.6%), and engaged in the culinary sector (47.9%). Multivariate analysis indicated that safety behavior and work nutrition significantly influenced productivity among MSME workers. In conclusion, improving occupational safety practices and ensuring adequate nutritional intake are important factors in enhancing productivity in the informal sector.

**Key Words**: Safety behavior, work nutrition, productivity, MSMEs, informal sector.

## 1. Introduction

Safety behavior refers to actions undertaken by individuals to reduce or prevent risks of accidents that may harm workers in the workplace [1]. This concept is often applied to identify and reinforce safe practices at work so that workers can protect both themselves and others in their environment.

Several studies have emphasized a strong correlation between safety behavior and worker productivity. For instance, Ratnasari et al. found that safety style positively and significantly affects productivity, with occupational health being the most dominant factor [2]. Similarly, Atidira and Tien (2023) emphasized that adequate knowledge of Occupational Safety and Health (OSH) motivates workers to implement safe practices, thereby enhancing productivity [3]. In line with this, Nur Ulfah et al. demonstrated that safety behavior training effectively improves knowledge and attitudes among informal workers, making them more consistent in maintaining workplace safety [4].

In addition to safety, other factors such as work environment, incentives, and motivation are also crucial determinants of productivity. Ahmad Abdul Muiz et al. found that incentives, motivation, work environment, and training had a positive and significant impact on productivity, while leadership showed a negative and insignificant influence among MSMEs

producing Batik Sarung Kalungguh in Pekalongan [5]. These findings indicate that MSME productivity is influenced by both individual factors and organizational support systems, including incentives and workplace conditions.

Purbalingga Regency was selected as the study area due to its significant number of MSMEs, particularly in the informal sector, such as culinary and home-based industries, which play an important role in the local economy. However, many MSME actors in this region still operate with limited awareness and implementation of Occupational Safety and Health (OSH) practices, suboptimal nutritional intake, and varying workplace conditions. These challenges make Purbalingga a relevant and representative setting to examine how safety behavior, energy intake, and work environment influence productivity among MSME workers.

Enhancing the productivity of MSME workers sustains business performance at the micro level while driving macroeconomic growth. When MSME workers become more productive, production capacity increases, costs are managed efficiently, and competitiveness strengthens. This ultimately enhances MSMEs' contribution to regional economic growth. At the national level, MSMEs significantly contribute to public welfare and economic growth by increasing production output and national income share [6,7]. Therefore, this study aims to analyze the effects of safety behavior, energy intake, and work environment on the productivity of MSME workers in Purbalingga Regency.

## 2. Methods

This study employed an analytical quantitative approach with a cross-sectional design conducted among MSME workers in Purbalingga Regency. The study population consisted of MSME actors who had operated their businesses for at least one year in permanent or semi-permanent locations (e.g., shops, stalls, kiosks, or tents). A total of 73 respondents were selected using an incidental sampling technique based on availability during the data collection period.

The independent variables included safety behavior, energy intake, work environment (including lighting and noise levels), implementation of 5R (Tidy, Neat, Clean, Maintain, and Diligent), length of work, and workload, while worker productivity was defined as the dependent variable. Safety behavior and 5R implementation were measured using structured questionnaires, which had been tested for validity and reliability prior to data collection. Energy intake was assessed using dietary recall methods and analyzed based on recommended nutritional adequacy standards. Work environment variables were measured directly using appropriate instruments for lighting intensity and noise levels. Productivity was assessed based on self-reported output and work performance indicators.

Data collection was carried out through both online and direct approaches, including Google Forms and field observations to ensure data completeness and accuracy. Primary data were obtained directly from respondents, while secondary data were collected from the Purbalingga District Health Office to support contextual analysis.

Data analysis was performed using SPSS software. Univariate analysis described respondent characteristics and variable distributions. Bivariate analysis using the Chi-square test examined associations between independent variables and productivity, while multivariate analysis using multiple linear regression identified the most influential factors. Ethical clearance for this study was obtained prior to data collection, and all respondents provided informed consent before participation.

## 3. Results And Discussion

### 3.1. 1. Respondent Characteristics

The data collected from respondents during the study revealed the characteristics of MSME workers and business actors in Purbalingga Regency, as presented in Table 1.

Table 1. Characteristics of MSME Worker Respondents in Purbalingga Regency

| No | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **1.** | **Gender** | | |
| | Male | 30 | 41,1% |
| | Female | 43 | 58,9% |
| **2.** | **Age** | | |
| | <25 years | 5 | 6,8% |
| | 25-34 years | 9 | 12,4% |
| | 35-44 years | 26 | 35,6% |
| | 45-54 years | 21 | 28,8% |
| | 55-64 years | 12 | 16,4% |
| **3.** | **Education** | | |
| | Primary education (Elementary & Junior High School | 18 | 24,6% |
| | Secondary education (Senior High School) | 36 | 49,3% |
| | Higher education (Diploma, Bachelor, Master) | 19 | 26,1% |
| **4.** | **Type of Business** | | |
| | General trading (grocery) | 16 | 21,9% |
| | Culinary | 35 | 47,9% |
| | Services | 12 | 16,4% |
| | Creative Industry | 5 | 6,9% |
| | Agriculture, livestock, fisheries | 5 | 6,9% |
| **5.** | **Body Mass Index (BMI)** | | |
| | Underweight | 2 | 2,7% |
| | Normal | 43 | 58,9% |
| | Overweight | 19 | 26,1% |
| | Obese | 9 | 12,3% |
| **6.** | **Marital Status** | | |
| | Married | 63 | 86,3% |
| | Unmarried | 10 | 13,7% |
| **7.** | **Length of Business** | | |
| | < 2 years | 18 | 24,7% |
| | > 2 years | 55 | 75,3% |
| **8.** | **Working Hours per Day** | | |
| | < 8 hours | 51 | 69,9% |
| | > 8 hours | 22 | 30,1% |
| **9.** | **Energy Intake** | | |

| No | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| | Good | 38 | 52,1% |
| | Poor | 35 | 47,9% |
| **10.** | **Implementation of 5R** | | |
| | Good | 34 | 46,6% |
| | Poor | 39 | 53,4% |
| **11.** | **Safety Behavior** | | |
| | Good | 37 | 50,7% |
| | Poor | 36 | 49,3% |
| **12.** | **Work Productivity** | | |
| | Good | 32 | 43,8% |
| | Poor | 41 | 56,2% |

(Source: Primary Data Processed, 2025)

Table 1 presents the characteristics of MSME workers in Purbalingga Regency. Most respondents were female (58.9%) and aged 35–44 years (35.6%). Education levels showed that 49.3% had completed secondary school (SMA). A large proportion worked in the culinary sector (47.9%), 58.9% had a normal Body Mass Index (BMI), and 86.3% were married.

Most respondents had been in business for more than two years (75.3%) and worked fewer than 8 hours daily (69.9%). Good energy intake was reported by 52.1%. Safety behavior was well-practiced by 50.7%, and productivity was rated good in 57.5% of respondents.

3.2. 2. Bivariate Analysis

The results of the bivariate analysis using the Chi-Square test are as follows:

Table 2. Relationship between Safety Behavior and Work Productivity

| **Safety Behavior** | **Work Productivity** | | | | | | *P Value* | CC |
|---|---|---|---|---|---|---|---|---|
| | Good | | Poor | | Total | | | |
| | F | % | F | % | F | % | | |
| Good | 29 | 62,2 | 14 | 37,8 | 37 | 100,0 | 0.001 | Very weak |
| Poor | 3 | 25 | 27 | 75 | 36 | 100,0 | | |

Based on Table 2, it can be seen that among 37 respondents with good safety behavior, 29 respondents (62.2%) had good work productivity and 14 respondents (37.8%) had poor work productivity. Meanwhile, among 36 respondents with poor safety behavior, 3 respondents (25%) had good work productivity and 27 respondents (75%) had poor work productivity. The Chi-square test indicated a significant association ($p = 0.001$), although the correlation strength was weak. Since the p-value $< 0.05$, it indicates a significant relationship between safety behavior and work productivity among MSME workers in Purbalingga Regency.

Table 3. Relationship between Length of Employment and Work Productivity

| **Length of Employment** | **Work Productivity** | | | | | | *P Value* | CC |
|---|---|---|---|---|---|---|---|---|
| | Good | | Poor | | Total | | | |
| | F | % | F | % | F | % | | |
| < 2 Years | 12 | 66,6 | 6 | 33,4 | 18 | 100,0 | 0.025 | Very weak |
| > 2 Years | 20 | 26,3 | 35 | 63,7 | 55 | 100,0 | | |

(Source: Processed Primary Data, 2025)

Based on Table 3, it can be seen that among 18 respondents with less than 2 years of work experience, 12 respondents (66.6%) had good work productivity and 6 respondents (33.4%) had poor productivity. Among 55 respondents with more than 2 years of work experience, 20 respondents (26.3%) had good productivity and 35 respondents (63.6%) had poor productivity. The chi-square analysis showed a p-value of 0.025 with a very weak contingency coefficient. Since the p-value < 0.05, this indicates a significant relationship between length of employment and work productivity among MSME workers in Purbalingga Regency.

Table 4. Relationship between Workload and Work Productivity

| **Workload** | **Work Productivity** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Good | | Poor | | Total | | *P Value* | CC |
| | F | % | F | % | F | % | | |
| < 8 Hours | 25 | 49 | 26 | 51 | 51 | 100,0 | 0.174 | |
| > 8 Hours | 7 | 31,8 | 15 | 68,2 | 22 | 100,0 | | |

(Source: Processed Primary Data, 2025)

Based on Table 4, it can be seen that among 51 respondents with a workload of less than 8 hours per day, 25 respondents (49%) had good work productivity and 26 respondents (51%) had poor productivity. Meanwhile, among 22 respondents with a workload of more than 8 hours, 7 respondents (31.8%) had good productivity and 15 respondents (68.2%) had poor productivity. The chi-square analysis showed a p-value of 0.174. Since the p-value > 0.05, it means that there is no significant relationship between workload and work productivity among MSME workers in Purbalingga Regency.

Table 5. Relationship between Work Nutrition and Work Productivity

| **Work nutrition** | **Work Productivity** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Good | | Poor | | Total | | *P Value* | CC |
| | F | % | F | % | F | % | | |
| Good | 23 | 60,5 | 15 | 39,5 | 38 | 100,0 | 0.003 | Very weak |
| Poor | 9 | 25,7 | 26 | 74,3 | 35 | 100,0 | | |

(Source: Processed Primary Data, 2025)

Based on Table 5, it can be seen that among 38 respondents with good work nutrition, 23 respondents (60.5%) had good work productivity and 15 respondents (39.5%) had poor productivity. Meanwhile, among 35 respondents with poor work nutrition, 9 respondents (25.7%) had good productivity and 26 respondents (74.3%) had poor productivity. The chi-square analysis showed a p-value of 0.003 and a very weak contingency coefficient. Since the p-value < 0.05, it indicates that there is a significant relationship between work nutrition and work productivity among MSME workers in Purbalingga Regency.

3.3. 3. Multivariate Analysis

Candidate Variables for Multivariate Testing:

Table 6. Candidate Variables for Multivariate Testing

| **No** | **Variable** | ***P-Value*** | **Description** |
|---|---|---|---|
| 1. | Length of Employment | 0,025 | Continue to Multivariate Analysis |
| 2. | Workload | 0,174 | Not Continued to Multivariate Analysis |
| 3. | Safety Behavior | 0,001 | Continue to Multivariate Analysis |
| 4. | Work Nutrition | 0,003 | Continue to Multivariate Analysis |

(Source: Processed Primary Data, 2025)

Based on Table 6, the variables selected as candidates for multivariate analysis were those with a p-value < 0.025, namely length of employment, safety behavior, and work nutrition. These variables were then included in the multivariate analysis modeling.

Results of Final Multivariate Analysis Modeling

Table 7. Variables in the Multivariate Analysis

| Variabel | P-Value | OR | 95CL | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Length of Employment | 0,171 | 2,961 | 0,627 | 13,995 |
| Workload | 0,146 | 2,917 | 0,689 | 12,343 |
| *Safety Behavior* | 0,004 | 6,515 | 1,836 | 23,125 |
| Work Nutrition | 0,008 | 5,370 | 1,565 | 18,421 |

(Source: Processed Primary Data, 2025)

Based on Table 7, the variables that significantly influence work productivity are safety behavior and energy intake, with each having a p-value < 0.05. Good safety behavior increases the likelihood of achieving higher productivity by 6.515 times compared to poor safety behavior. Similarly, respondents with good work nutrition are 5.370 times more likely to have better work productivity compared to those with insufficient or inadequate nutrition.

These findings have significant economic implications for MSME actors. Every work accident or deterioration in workers' health creates additional costs, such as lost working hours, medical expenses, and potential declines in production quality. Such indirect costs ultimately reduce business profit margins and weaken competitiveness. Conversely, the consistent implementation of safety behavior and the fulfillment of adequate work nutrition can be considered strategic investments that improve production efficiency, enhance productivity, and maintain business income stability in the long run. Thus, occupational health and safety are not only related to worker protection but also play a critical role in supporting the economic resilience of MSMEs.

This study also shows that the majority of respondents were women, totaling 43 people (58.9%). This is because many mothers work as traders to earn additional income, while their husbands are employed in other professions, such as civil servants, private sector employees, and others. A study by Broucke and Colemont among farmers in Belgium reported that male workers are more prone to occupational hazards or injuries compared to female workers, and the analysis revealed a correlation between gender and safe behavior among agricultural workers [8].

Educational and training efforts are required to bring about behavioral changes in individuals or groups. Learning or education provides long-term effects on safe work practices [9]. Broucke and Colemont also found that workers with lower educational attainment tend to have a higher risk of accidents or injuries [8]. Practicing safe work behavior is essential for individuals, as it helps prevent injuries or accidents, which are often unplanned and accidental. Therefore, initiatives such as providing rewards or positive reinforcement can encourage workers to perform their tasks safely. Behavioral change requires feedback mechanisms to increase awareness of error-generating work habits, particularly mistakes that could potentially cause workplace accidents [10].

Work nutrition, or the nutritional status of workers, is another important factor influencing productivity. Nutritional status can be assessed directly (e.g., anthropometric measurements) or indirectly (e.g., food consumption surveys) to determine whether energy intake meets the required levels, which vary by age, gender, and workload. The body's energy needs are not only supplied by stored nutrients but also by the intake of carbohydrates, proteins, and fats from daily food consumption. Poor work nutrition, indicated by inadequate energy intake, reflects a low nutritional status that can decrease worker productivity. Nutritional intake refers to the amount of energy derived from consumed food [11].

The work environment is also a critical factor in the workplace, as it directly affects worker productivity. A suitable environment enhances comfort and supports efficiency and

effectiveness at work. Conversely, poor workplace conditions may cause injuries, accidents, or other health problems, which ultimately reduce overall productivity [12]. The work environment can influence occupational safety and, consequently, improve productivity. Environmental factors affecting workplace safety may include storage and arrangement of goods, workspace design, waste disposal systems, machine placement, and the use of tools without safety features [13]. In carrying out their activities, workers consistently focus on improving their productivity. According to Hasibuan, work productivity is the ratio between output and input, where output must generate added value and be achieved through improved work techniques [14].

## 4. Conclusion

Respondents who had operated their businesses for more than one year generally demonstrated awareness and consistency in implementing safe work practices. There is a significant influence of safety behavior and work nutrition on the work productivity of MSME workers in Purbalingga Regency.

## 5. Acknowledgement

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