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APPLICATION OF THE BEHAVIORALLY ANCHORED RATING SCALE (BARS) IN ASSESSING EMPLOYEES' OCCUPATIONAL SAFETY AND HEALTH SITUATIONAL AWARENESS

PENERAPAN BEHAVIORALLY ANCHORED RATING SCALE (BARS) DALAM MENILAI KESADARAN SITUASIONAL KESELAMATAN DAN KESEHATAN KERJA KARYAWAN

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A B S T R A C T

Background: *In 2017, at PT. XY, the average Frequency Rate (FR) was 4.68 accidents for every one million working hours, while the average severity rate (SR) was 336.16 lost workdays per one million work hours. These indicators reveal that 264 accidents and 18.983 working days lost during 56.469.736 working hours throughout the current year.* ***Purpose:*** *This research aims to determine the level of alertness among workers and investigate their behavior in carrying out tasks at the PT. XY factory.* ***Method:*** *Worker data were collected using sampling techniques and analyzed employing the Behaviorally Anchored Rating Scale (BARS) method to provide potential dangers and worker behavior in the PT. XY factory section. The research approach applied was quantitative, collecting data through the distribution of 44 questionnaires to workers in that section.* ***Result:*** *The potential hazards occurring in the PT. XY factory were attributed to workers' lack of attention to Situational Awareness (SA) while doing work, where in the PT. XY factory section there are three processes, namely first press, second press, and filtration stage. The results of the confidence levels in the office section of the PT. XY factory showed actual accuracy and perceived accuracy values of 46.67% and 86.67%, respectively. In the process section, workers exhibited actual accuracy and perceived accuracy values of 42.85% and 84.28%, while in the maintenance section, the actual accuracy value was 44.81% and the perceived accuracy was 84.90%.* ***Conclusion:*** *Based on data analysis, office workers showed the highest level of alertness (65.00%), followed by maintenance workers (63.67%), while workers in the process section showed the lowest alertness level (63.00%).*

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A B S T R A K

Latar belakang: PT. XY pada tahun 2017, rata-rata Tingkat Frekuensi (TF) sebesar 4,68 kecelakaan per satu juta jam kerja, sementara rata-rata Tingkat Keparahan (TK) sebesar 336,16 hari kerja yang hilang dalam satu juta jam kerja. Indikator ini menunjukkan terdapat 264 kecelakaan dan 18.983 hari kerja hilang selama 56.469.736 jam kerja sepanjang tahun tersebut. **Tujuan:** Penelitian ini bertujuan untuk mengetahui tingkat kewaspadaan para pekerja dan mengetahui perilaku pekerja dalam melakukan pekerjaan di bagian pabrik PT. XY. **Metode:** Data pekerja dikumpulkan menggunakan teknik sampling dan dianalisis dengan metode Behaviorally Anchored Rating Scale (BARS) untuk mengidentifikasi potensi bahaya dan perilaku pekerja di bagian pabrik PT. XY. Pendekatan penelitian yang diterapkan adalah kuantitatif, dengan mengumpulkan data melalui penyebaran 44 kuesioner kepada pekerja di bagian tersebut. **Hasil:** Potensi bahaya yang terjadi di pabrik PT. XY disebabkan oleh kurangnya perhatian pekerja terhadap *Situational Awareness* (SA) dalam melakukan pekerjaan. Di pabrik PT. XY terdapat 3 proses, yaitu first press, second press, dan tahap filtrasi. Hasil tingkat kepercayaan di bagian kantor pabrik PT. XY menunjukkan nilai akurasi aktual sebesar 46.67% dan akurasi persepsi sebesar 86.67%. Pada bagian proses, pekerja menunjukkan nilai akurasi aktual sebesar 42.85% dan akurasi persepsi sebesar 84.28%. Sementara itu, di bagian pemeliharaan, nilai akurasi aktual adalah 44.81% dan akurasi persepsi sebesar 84.90%. **Kesimpulan:** Berdasarkan analisis data, tingkat kewaspadaan tertinggi dimiliki oleh pekerja bagian kantor (65,00%), diikuti oleh pekerja bagian pemeliharaan (63,67%), sedangkan pekerja di bagian proses menunjukkan tingkat kewaspadaan terendah (63,00%).

Kata kunci:
Behaviorally Anchored Rating Scale (BARS), Keselamatan, Kesadaran situasional

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INTRODUCTION

In a company, it is very important to consider health and safety at work to avoid accidents that might occur. The importance of paying attention to the situation and location of the workplace, or situational awareness, before doing work, needs to be emphasized. In the production process, the working conditions or place must always be in a safe condition in terms of the environment, the condition of the production machines used, and the Personal Protective Equipment (PPE) provided to the employees. Providing PPE to employees must follow basic procedures, and they must be informed about the dangers posed and trained on how to use and care for them properly (Sepang *et al*., 2013). Apart from that, work discipline influences work safety, where one indicator of work discipline is always obeying existing regulations. This means that workers who apply work discipline will minimize the occurrence of work accidents, usually caused by the worker's negligence (Saputra and Mahaputra, 2022).

One effort to protect workers is by implementing Occupational Health and Safety (OHS) programs, such as carrying out training. Training serves as a forum for employees to improve their skills. In this context, training has a very broad scope related to the work process, including skills acquired from the learning process and field practice. Job training activities provide benefits to both employees and companies, in the form of expertise and skills which become valuable assets for the company (Susilo and Kasmir, 2022). Work safety indicates a condition of being safe from suffering, damage, or loss in the workplace. Meanwhile, occupational health refers to a condition that is free from physical, mental, emotional, or pain disorders caused by the work environment (Khair *et al*., 2021).

Occupational Health and Safety (OHS) is a form of protection for employees when carrying out their duties, aimed at preventing from potential risks such as work accidents or work-related illnesses. This also aims to create a comfortable and safe work environment, with the hope of increasing employee productivity (Rosento *et al*., 2021). Companies must pay attention to the implementation of OHS at work to minimize undesirable incidents related to the risk of work accidents, which can result in losses for the company (Tambunan *et al*., 2021). Every activity in the workplace has potential dangers that can cause work accidents. Work accidents are undesirable and often unexpected events that can cause loss of time, property, or life (Hamdani *et al*., 2018). Achieving zero accidents is one of the goals of OHS (Panjaitan, 2017).

In general, there are two factors that can cause work accidents, namely humans and the environment (Pangkey *et al*., 2023). Lack of caution or awareness of the situation, as well as unintentional acts that violate work safety regulations, are human factors. Meanwhile, unsafe actions from the work environment include issues with machinery and work equipment, as well as environmental factors (Suminar *et al*., 2015).

The Ministry of Manpower reported 157.313 work accident cases throughout 2018, from 2015 to 2018, data recorded nationally by the Social Security Agency for Employment (BPJS) showed 252 cases in 2015, 243 cases in 2016, and 241 cases in 2017. Although there was a decrease in the number of work accidents compared to the previous year, it was still relatively high. Occupational health and safety are important issues in operational processes in the industrial sector. Every year, the number of work-related accidents in Indonesia is still relatively high (Hasanuddin, 2018).

PT. XY Tarjun unit, is one of the largest companies in Indonesia engaged in agribusiness and food. The process of producing cooking oil has risk and hazard factors that can interfere with the safety and health of PT. XY Tarjun's workforce. As a product maker, the company is expected to maintain and improve product quality, providing a strong reason to increase worker productivity (Rauf *et al*., 2023). However, poor conditions in the work environment, worker negligence, operational errors, and not using PPE are causes of workplace accidents. Implementing daily OHS inspections to ensure the use of complete PPE and strengthening management supervision of workers who do not wear PPE are risk control measures that can be implemented to mitigate workplace accidents (Waruwu and Yuamita, 2016). This issue is further emphasized by the high frequency and severity of accidents in the work environment. Data show that the average Frequency Rate (FR) is 4.68 accidents per one million working hours, and the Severity Rate (SR) reaches 336.16 lost working days per one million working hours. Over 56.469.736 working hours in one year, 264 accidents occurred with 18.983 lost working days (ILO, 2023). Therefore, it is necessary to apply situational awareness as a strategy to reduce the risk of accidents and increase work safety. Situational awareness is key to workers' responses to potential hazards and to preventing accidents in the work environment. This study aims to determine the level of situational alertness among workers and analyze their behavior in carrying out tasks at the PT. XY using the BARS method.

MATERIAL AND METHOD

This research has been ethically tested and received an ethical certificate from the Ethics Commission of the Faculty of Industrial Technology, Universitas Muslim Indonesia on June 23th, 2021 No: 017/B.06/TI/FTI-UMI/XII/2022. This research focused on workers in the KCP factory section, specifically those in the position of office, process, and maintenance sections. The main variables of interest were the workers themselves, the equipment used, and the conditions of the work environment or work area where their activities were conducted, to ensure the representativeness of the

sample, this research used a purposive sampling technique, meaning that the selection of respondents was carried out deliberately and based on certain criteria in accordance with the research objectives.

A total of 44 questionnaires were distributed to the selected respondents, with the hope that the data obtained could provide a fairly representative picture of the perceptions and experiences of workers at the KCP factory. The assessment model used was the Behaviorally Anchored Rating Scale (BARS) method, which included 10 indicators: discipline, responsibility, planning skills, compliance, use of PPE, compliance with danger signs, equipment condition, equipment cleanliness, work safety, and inspection of production results. Indicators rated as 'very good' were assigned a score of 5.

This research was carried out for approximately one month by conducting direct observations and interviews at the research site and distributing questionnaires to workers at the PT. XY. The number of respondents was determined, and the data were tested for validity using Microsoft Excel and SPSS. The variable studied was the situational awareness of workers in the PT. XY.

Situational Awareness (SA)

According to Fang *et al*. (2018), *Situational Awareness* (SA) is defined as the perception of elements in the environment in volume of time and space, understanding their meaning, and projecting their status in the near future. Theoretically, the onset of this condition is characterized by increased anxiety, memory loss, weakened work efficiency and alertness, poor motivation, high performance variability, and negligence (Saleh *et al*., 2022). Additionally, converging and intersecting conflicts lead to lower situational awareness (Trapsilawati *et al*., 2020). This process can be explained by the sequential stage model created by Fang *et al*. (2018).

Situational awareness is defined as the perception of entities in the environment, understanding their meaning, and projecting their status in the near future (Munir *et al*., 2022). The behavior and awareness of each employee regarding the importance of work safety can increase the implementation of safety measures, with the hope that each employee will behave positively, including maintaining safety (for example, workers always wear PPE and comply with signs and regulations) (Machfudiyanto *et al*., 2019).

The calibration curve or accuracy control is represented by a linear regression graph analysis Y = AX+B, with a positive correlation, which describes the value where the vertical (Y) axis and horizontal (X) axis intersect (Lusiana, 2012). The calibration curve consists of actual accuracy (%) on the Y axis and perceived accuracy (%) on the X axis (Prawito *et al*., 2014). The actual accuracy level was calculated by dividing the number of respondents' correct answers by the total score and multiplying the result by 100%, while the perceived accuracy was determined by dividing the total respondents' confidence score by the total confidence level score and multiplying the result by 100%.

High workloads can be stressors that negatively impact situational awareness. If the excessive amount of information is accompanied by a very large amount of workload, situational awareness will decrease. For example, a driver may only pay attention to limited information. SA impacts how an individual's internal response factors understand the situation, forming the basis for decision-making in emergency and disaster management (Laurila-Pant *et al*., 2023). Figure 1 is the scale used to determine the score on the level of confidence in perceived accuracy.

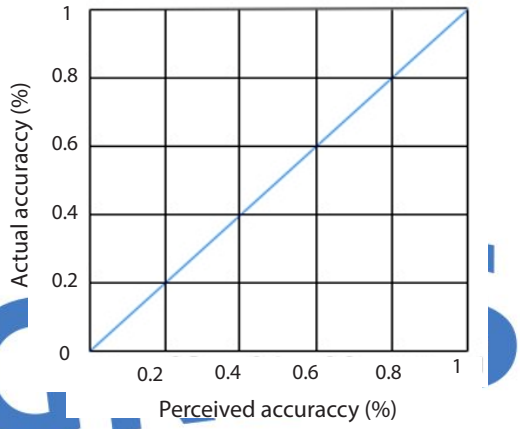

Figure 1. The calibration curve

Data will be calculated for the confidence score for each statement using the Equation (1) (Febriyanti and Faslah, 2013), where the alertness level score is calculated by multiplying the total confidence level score by the correct answer score for each statement in the questionnaire.

$$(k5 \times 100\%) + (k4 \times 75\%) + (k3 \times 50\%) + (k2 \times 25\%) + (k1 \times 10\%) \quad \text{.....(1)}$$

Occupational accidents

The potential for work accidents depends on various factors, including the type of production, the technology used, the materials used, the layout and environment of the building, and the quality of its management. Work accidents can result from unsafe actions (including personal characteristics and behavior) and unsafe conditions (including equipment, machines, tools, etc.). Unsafe actions are the main cause of work accidents (Paskarini *et al*., 2019). It is important to carry out an inventory of work accidents and contribute to its development because today's complex dynamics and working conditions can cause more work accidents (Ivascu *et al*., 2021).

Kernel Crushing Plant (KCP)

In the KCP process, oil is extracted from the palm kernel in three stages. The first stage is called crushing/ first press, the second stage is called crushing/second press, and the third stage is called filtration.

The Behaviorally Anchored Rating Scale (BARS) method

The BARS is a method for evaluating job performance based on the emergence of important behaviors that can influence the success or failure of a job from an individual's position (Klieger *et al*., 2018). Unlike methods that focus on personality traits, BARS emphasizes employee behavior. It effectively identifies the strengths and weaknesses of the employees being evaluated, highlighting areas where they can exceed and fall short. In this research, the BARS method was applied to assess workers in the KCP factory section. While the technical aspects of using BARS present challenges, such as the difficulty assessors face in observing situational awareness in workers, it minimizes subjective bias.

This is achieved through the use of clear metrics and standardized work performance criteria, ensuring assessments are fair and acceptable to all parties, particularly the employees being evaluated. BARS generally has a scoring scale from 1 to 7, where 7 represents the highest value with the assessment score. Scores are categorized as follows: (1) Scores 1 and 2 (do not meet the acceptable performance level), (2) Scores 3, 4, and 5 (meet the acceptable performance level); and (3) Scores 6 and 7 (exceed the acceptable performance level). The BARS method is developed using data collected through the critical incident technique. This development process involves five key steps: (1) Critical incident technique, (2) Performance dimension identification, (3) Retranslation, (4) Scaling incidents, and (5) Final instruments (Taufik *et al*., 2016; Evita *et al*., 2017; Kustiadi, 2018). These steps ensure the BARS method provides a structured, objective, and reliable framework for performance evaluation.

Time and place of the research

The research lasted for approximately one month, from February 23th to March 23th, 2021. It was conducted at PT. XY Tbk, Tarjun Unit KCP. The data collection methods used in this study included company data and direct field research in the form of observation. The types of data used are qualitative and quantitative. Data collection involved questionnaire responses and direct interviews with respondents. Data processing in this study was conducted using the BARS method.

RESULT

Characteristics of respondents based on work position

The first stage of this research was to determine the characteristics of respondents who came from the office, process, and maintenance workers. These respondents were grouped based on the observational situations conducted earlier. The respondents' assessment scores ranged on a 5-point scale, where scale 1 represented "very lacking" (10%), scale 2 "lacking" (25%), scale 3 "sufficient" (50%), scale 4 "good" (75%), and scale 5 "very good" (100%). In this study, the majority of respondents scored only at levels 3, 4, and 5. The grouping of these characteristics is presented in Table 1.

Table 1. Characteristics of respondents based on work position

Job position	Number of respondents	Percentage (%)	Average answer		
			5	4	3
Office	3	7	17.5	20	0
Process	14	32	75	90	10
Maintenance	27	61	151.25	168.75	17.5
Total	44	100	243.75	278.75	27.5

Table 2. Confidence level score

No	Confidence score	Value	Description
1	Very Less (10%)	1	Number of respondents who answered very less sure
2	Less (25%)	2	Number of respondents who answered less sure
3	Enough (50%)	3	Total respondents who answered quite confident
4	Good (75%)	4	Number of respondents who answered confident
5	Very Good (100%)	5	Number of respondents who answered very confident

Table 3. Confidence score results

No	Section workers	Actual accuracy (%)	Perceived accuracy (%)
1	Office	46.67	86.67
2	Process	42.85	84.28
3	Maintenance	44.81	84.90

Table 1 shows the number of employees based on work position, namely 3 office employees (7%), 14 process employees (32%), and 27 maintenance employees (61%). This study observes situational awareness among workers, focusing on the behavior of: (1) People who do the work (workers), (2) Machines, equipment, and work tools, and (3) Conditions or the work area environment. Table 2 is the scale used to determine the score for the level of confidence in perceived accuracy. Confidence scores play an important role in assessing performance and the success of a task. The level of worker self-confidence can influence motivation, productivity, and work quality by understanding and measuring confidence scores, organizations can identify areas that require special attention to improve employee success and well-being. Table 3 provides a clear visual representation of workers' confidence scores in each section, making it easier to interpret and identify areas that may require further attention.

Based Table 3, it was found that workers in the office section of the PT. XY Factory obtained an actual accuracy score of 46.67%, which reflects a relatively high level of task success. Meanwhile, workers' perceived accuracy in this section reached 86.67%, indicating a fairly high level of confidence in their abilities. Workers in the process section obtained an actual accuracy value of 42.85%, while perceived accuracy reached 84.28%. In the maintenance section, the actual accuracy value was 44.81%, with perceived accuracy reaching 84.90%.

These findings provide an overview of the level of workers' confidence in their abilities to carry out tasks in each section. Office workers showed the highest alertness level (65.00%), followed by maintenance workers (63.67%), while workers in the process section showed the lowest alertness level (63.00%). The comparison value will be presented in a curve to compare the two values in percentage form. Below is the curve for each section, along with the results of the analysis can be seen in Figure 2 until Figure 4.

Office

Based on Figure 2, the value of actual accuracy for workers in the office section is 46.67%, and the perceived accuracy is 86.67%. Workers in the PT. XY factory section have characteristics of overconfidence, where the calibration point is below the line. This indicates that workers feel confident in doing their work, but in fact their work methods and behavior are still not appropriate.

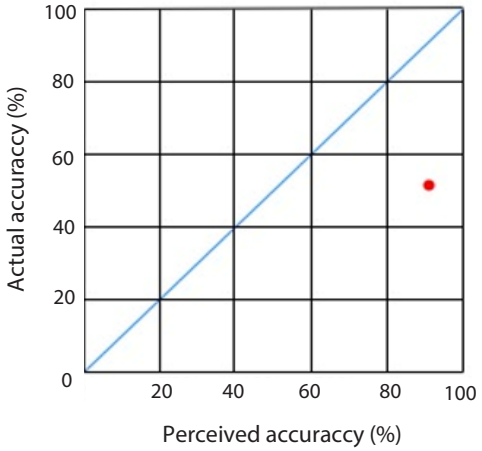

Figure 2. Calibration curve of situational awareness for workers in the office division

Data will be calculated for the confidence score for each statement using the Equation (1) (Febriyanti and Faslah, 2013), where the alertness level score is calculated.

Process

Based on Figure 3, the value of actual accuracy for workers in the process division is 42.85%, and the perceived accuracy is 84.28%. Workers in the PT. XY factory section have the characteristics of overconfidence, where the calibration point is below the line. This indicates that workers feel confident in doing their work, but in fact their work methods and behavior are still not appropriate.

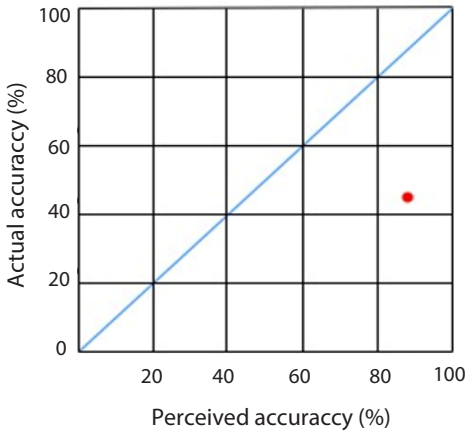

Figure 3. Calibration curve of situational awareness for workers in process division

Maintenance

Based on Figure 4, the value of actual accuracy for workers in the maintenance division is 44.81%, and the perceived accuracy is 84.90%. Workers in the PT. XY factory section have characteristics of overconfidence, where the calibration point is below the line. This indicates that workers feel confident in doing their work, but in fact their work methods and behavior are still not appropriate.

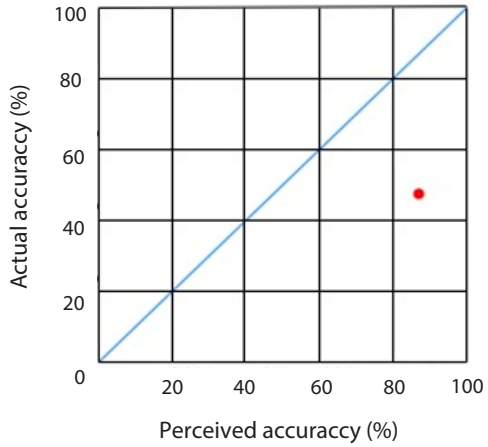

Figure 4. Calibration curve of situational awareness for workers in process division

DISCUSSION

In the research analysis, it can be seen that situational awareness of workers in the PT. XY factory section focuses on worker behavior, machines/equipment and work equipment, and environmental conditions in the work area. The calibration of situational awareness against the three criteria of respondents in the company, especially in the PT. XY factory section, namely in the office, process, and maintenance sections, reveals that each respondent exhibits overconfidence. This means that workers feel good and confident in their work, but in reality their driving style is not yet appropriate. This contrasts with underconfidence, where workers feel insecure and do not feel good at work, but in fact their behavior and working methods are good. Prasetya *et al*. (2022) found that informal employment, constituting 60% of the global workforce, shows limited external impact on job performance. Their study indicates that job security positively influences performance, and less motivated workers tend to exhibit a strong safety culture, with motivation being a significant factor (30.2%). The research suggests a robust safety culture correlates with higher employee performance, while a one-year age increase may significantly impact lower performance.

Based on the results comparing actual accuracy and perceived accuracy values, the highest difference between these two values is for workers in the process section, at 41.43%. Referring to Figure 3, it can be explained that the situational awareness calibration for workers in the process section is still far from the well-calibrated line, where their self-confidence is much higher compared to their actual behavior and working methods, which are not yet appropriate. Furthermore, in Figure 4, workers in the maintenance section have a comparison value difference of 40.09%. This calibration is better than that of workers in the process section, even though their confidence in working is higher, the behavior or working methods in the maintenance section are better, even though it is not completely appropriate. The lowest difference, based on Figure 2, is for workers in the office section, at 40.00%. This calibration is closer to the well-calibrated line, where the working methods in this section are better than those of workers in other sections, and the comparison with self-confidence is more balanced, so it is close to synchrony. The best comparison between actual accuracy and perceived accuracy is when the two values are balanced to form a well-calibrated curve.

Based on these three comparison differences, it can be seen that workers in the office section have the smallest or lowest comparison differences when compared with workers in other sections. The comparison is close to well-calibrated, with a difference in the actual accuracy value of 40.00%, which is close to the perceived accuracy value. Therefore, workers in the office section have better work characteristics, working better than workers in the process and maintenance sections.

CONCLUSION

Employees in the office department showed an alertness level of 65.00%, while those in the process division showed an alertness level of 63.00%. In the maintenance section of the PT. XY factory, workers had an alertness level of 63.67%. As a result, employees in the office department showed superior work characteristics, outperforming their counterparts in the process, and maintenance sections.

The behavior of workers in doing work in the KCP factory section can be assessed using the BARS method, which consists of 10 behavioral assessment indicators. The company should consider the results of research on situational awareness so that workers pay more attention to the conditions or environment of the work area before starting work, making it safer to perform their tasks.

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