Pak. j. life soc. Sci. (2024), 22(2): 11754-11766 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences

www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2024-22.2.00885

RESEARCH ARTICLE

Effect of Behavior-Based Safety and Bow Tie Program on Safety Culture Maturity of LV Drivers at PT BJU, Indonesia

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ARTICLE INFO

Received: Sep 11, 2024

Accepted: Nov 3, 2024

Keywords

Behavior-Based Safety

Bow tie program

Safety Culture Maturity

LV Driver

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ABSTRACT

This study examines how behavioral safety practices and the Bow Tie Program affect the maturity of safety culture among Light Vehicle (LV) drivers at PT Bumi Jasa Utama (BJU) in 2024. The study arises from ongoing concerns about workplace accidents in high-risk sectors, highlighting the need for stronger safety measures. To analyze the influence of behavioral safety practices and the Bow Tie Program on the maturity of safety culture among LV drivers at PT BJU. A total of 127 LV drivers were included as research subjects. Statistical analysis was conducted using path modeling techniques through AMOS software to test the relationships between variables. The results of the study, obtained through completed surveys and structured interviews, showed that behavioral safety significantly and positively influenced the maturity of the safety culture at PT BJU ($t = 0.527$, $p < 0.001$). Additionally, the results of the multivariate test indicated that the indirect effect of work safety behavior on safety culture maturity, mediated by the implementation of the Bow Tie Program, had a positive value of 0.068. These results suggest that as driver work safety behavior improves, the effectiveness of the Bow Tie Program also increases, leading to higher safety culture maturity. Furthermore, with a p-value of 0.017 (<0.05), the indirect effect is significant, thus supporting the hypothesis (Ha).

INTRODUCTION

Human resources are vital to enhancing productivity within organizations. Their performance is influenced by a combination of genetic factors and the work environment, which affects how employees act and adhere to safety protocols. When productivity dips, it is essential for management to intervene swiftly to uncover the underlying causes (Wahyuni, 2017)

The International Labour Organization (ILO) summarized that occupational disorders and work-related accidents account for around 278 million deaths worldwide each year. More than 350,000

are associated to industrial accidents, while 24 million are linked to occupational disorders (International. Labour Organization., 2018). Employers usually provide compensation to employees suffering from these types of circumstances. According to the Workers Compensation Center of Finland, over 80% of the 126,000 work-related accidents that occurred in workplace (Räsänen et al., 2022)

Research have indicated that companies possessing a robust safety culture tend to have fewer incidents and higher employee satisfaction (Shirali, Afshin, Angali, & Kalhori, 2022). There are two key strategies for enhancing safety culture. The first is the Bow Tie Program, a program that visually represent possible risks and the required preventive measures. The last is behavior-based safety (BBS) which focuses on modifying employee behavior to encourage a safer workplace (CCPS & Energy Institute, 2018)

Research conducted by Shope (2006), a public health professional with a background in health behavior education and an interest in preventing driving-related accidents and fatalities, outlines a paradigm in which driving behavior is influenced by personal factors, demographic characteristics, and perceptions of the surrounding environment. In the process of behavior formation, these factors are seen as primary motivators because they originate within the individual driver. Other factors, such as driving skills, can develop over time if adequately supported by progress in these motivational factors (Shope, 2006)

This study investigates the effectiveness of the Bow Tie Program and BBS among LV drivers at PT Bumi Jasa Utama, specifically examining how these programs contribute to strengthening the company's safety culture. Building on previous research, this work emphasizes the necessity for organizations to adopt proactive safety measures and continuously improve their practices to reduce workplace accidents (Geller, 2001)

The Safety Culture Maturity Level assessed for each driver is also expected to assist the company in reflecting on its Occupational Health and Safety (OHS) practices. This study aims to evaluate how effectively and efficiently OHS is implemented by each driver through Behavior-Based Safety practices, with the goal of continuously improving the safety culture through applied risk analysis.

MATERIALS AND METHODS

This study employed a mixed-methods approach, combining both quantitative and qualitative techniques. The quantitative design utilized an observational analytic cross-sectional study, which examined the relationships between safety behavior, the Bow Tie Program, and safety culture maturity at a single point in time. Qualitative data were collected through in-depth interviews to gain deeper insights into the drivers' perceptions of safety culture maturity (SCM).

Research Duration and Location

The research was conducted at PT Bumi Jasa Utama, a transportation company providing Light Vehicle (LV) services in the Sorowako region, Indonesia. Data were collected over two months, from September to October 2024

Population and Sample

The study's population consisted of 127 LV drivers employed by PT Bumi Jasa Utama. Due to the manageable size of the population, a total sampling technique was used, meaning all drivers were included in the study. The drivers were categorized based on the departments they served; Mining Department: 49 drivers, Process Plant Department: 24 drivers, Maintenance Department: 20 drivers, General Facilities Department: 10 drivers, External Relations Department: 8 drivers, and Medical Services Department: 16 drivers.

A. Data Collection Instruments

1. Safety Behavior Questionnaire

This 54-item questionnaire included categories such as ethics (15 items), driving skills (10 items), adherence to traffic rules (10 items), awareness of collective safety (5 items), joint safety efforts (9 items), and responsibility (5 items).

2. Bow Tie Program Evaluation

A 20-item evaluation focused on preventive efforts (10 items) and mitigation strategies (10 items).

3. Safety Culture Maturity (SCM) Questionnaire

A 10-item instrument measured various aspects of safety culture maturity. This was supplemented with in-depth interviews to validate respondents' answers and explore their perceptions of the company's safety culture.

B. Data Collection Procedures

1. Primary Data

Gathered directly from the 127 respondents using structured questionnaires and follow-up interviews. Before data collection, all participants were briefed about the research objectives and assured of their confidentiality. Informed consent was obtained, after which the questionnaires were distributed. Interviews were conducted to explore deeper insights regarding safety practices within the organization.

2. Secondary Data

Included the company's internal reports, records, and literature relevant to the study.

3. Data Processing and Analysis

1) **Screening**

   The data were reviewed for completeness during and after collection to ensure accuracy.

2) **Coding and Data Entry**

   All questionnaire responses were coded and entered the SPSS software for further analysis.

3) **Data Cleaning**

   Errors or inconsistencies in the data entry were identified and corrected before conducting statistical analyses.

4. Statistical Analysis

a) **Univariate Analysis**

   Descriptive statistics, including frequencies and percentages, were used to describe the characteristics of the study sample and the distribution of key variables.

b) **Bivariate Analysis**

   Cross-tabulation and chi-square tests were performed to examine the relationships between two variables, such as the correlation between safety behavior and SCM

c) **Multivariate Analysis**

Path analysis was conducted using AMOS software to explore both the direct and indirect effects of safety behavior and the Bow Tie Program on safety culture maturity. Path analysis allowed for the modeling of complex relationships between these variables, providing insight into how safety behavior affects SCM, both directly and through the implementation of the Bow Tie Program.

RESULTS

Respondent Characteristics

The study involved 127 Light Vehicle (LV) drivers from PT Bumi Jasa Utama. Based on the table 1, most of the respondents fell within the 32-43 age group (49.6%), while the majority were male drivers (97.6%). Regarding education, 83.5% of the drivers had completed senior high school (SMA) as their highest level of education. In terms of work experience, 38.6% of the respondents had worked for over three years, and 33.9% had between three to four years of work experience.

Table 1. Respondent Characteristics

Age Group (year)	Frequency (n)	Percentage (%)
20 – 31	49	38.6
32 – 43	63	49.6
44 – 55	15	11.8
Sex		
Male	124	97.6
Female	3	2.4
Education		
Bachelor	18	14.2
Senior High School	106	83.5
Junior High School	3	2.4
Work Experience		
≥ 4 years	43	33.9
3 < 4 years	49	38.6
2 < 3 years	9	7.1
1 < 2 years	26	20.5
Total	**127**	**100**

Of the 127 respondents surveyed, the demographic characteristics include age, gender, education level, and length of service. The dominant age group is 32-43 years old, representing 63 people (49.6%). Regarding gender distribution, male drivers constitute the majority at 124 people (97.6%). In terms of education, most respondents are high school graduates or equivalent, accounting for 106 people (83.5%).

Univariate Analysis

Table 2. Investigated Variables

Safety Behavior	Frequency (n)	Percentage (%)
Adequate	61	48
Good	66	52
Bow Tie Program Implementation		
Less Effective	80	63
Effective	47	37

Safety Behavior	Frequency (n)	Percentage (%)
Safety Culture Maturity		
Continually Improving	64	50.4
Cooperating	45	35.4
Involving	11	8.7
Managing	7	5.5
Emerging	0	0
Total	**127**	**100**

Safety Behavior

52% of drivers demonstrated "good" safety behavior, while 48% exhibited "adequate" safety behavior.

Bow Tie Program Implementation

63% of drivers rated the program as "less effective," while 37% considered it "effective."

Safety Culture Maturity:

Most drivers (50.4%) reached the "continually improving" stage of safety culture maturity, followed by 35.4% in the "cooperating" stage.

Bivariate Analysis

Safety Behavior and Bow Tie Program

Analysis of responses from 127 participants revealed that among drivers with sufficient work safety behavior, 51 drivers perceived the Bow Tie Program as ineffective, while only 10 drivers considered the program effective (Table 3).

Table 3. Safety Behavior and Bow Tie Implementation

Safety Behavior	Bow Tie Program					Statistical Test Result
	Less Effective		Effective		Total	
	(n)	(%)	(n)	(%)	(%)	*P value*
Adequate	51	83,6	10	16,4	100	*0.001*
Good	29	43,9	37	56,1	100	

In the list of words shown in table 2 that out of 127 drivers, a majority of drivers with sufficient work safety behavior (51 drivers, 83.6%) perceived the Bow Tie Program as ineffective, compared to only 10 drivers (16.4%) who found the program effective. The relationship analysis using the Chi-Squared test revealed a significant correlation between work safety behavior and the implementation of the Bow Tie Program among drivers, with a p-value of 0.001 (<0.05).

Safety Behavior and Safety Culture Maturity

Drivers with good safety behavior were more likely to achieve higher levels of safety culture maturity (table.4).

Table 4. Safety Culture Maturity and Safety Behavior

Safety Behavior	Managing		Involving		Cooperating		Continually Improving		Total		Statistical Test Result
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	*P value*
Adequate	5	8,2	12	19,7	33	54,1	11	18	61	100	0.001
Good	1	1,5	2	3	10	15,2	53	80,3	66	100	

Based on the table above, among the total 127 drivers, those with good work safety behavior were more likely to achieve the 'continually improving' level of safety culture maturity, accounting for 53 drivers (80.3%), compared to only 11 drivers (18%) with sufficient work safety behavior at the same maturity level. A significant correlation was found between work safety behavior and safety culture maturity, with a p-value of 0.001 (<0.05).

Bow Tie Program and Safety Culture Maturity

The implementation of the Bow Tie Program and its impact on Safety Culture Maturity among 127 participants was assessed across four stages: Managing, Involving, Cooperating, and Continually Improving. The analysis showed that 39 participants effectively reached the Continually Improving stage, while 37 participants were less effective, remaining at the Cooperating stage of the Bow Tie Program implementation (Table 5)

Table 5. Bow Tie Implementation and Safety Culture Maturity

Bow Tie Implementation	Managing		Involving		Cooperating		Continually Improving		Total		Statistical Test Result
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	*P value*
Adequate	5	6,3	13	16,3	37	46,3	25	31,3	80	100	0.001
Good	1	2,1	1	2,1	6	12,8	39	83	47	100	

Among 127 drivers, those with less effective Bow Tie Program implementation predominantly showed a 'cooperating' level of safety culture maturity (37 drivers, 46.3%), while only 6 drivers (12.8%) with effective program implementation were at this level. Conversely, drivers with effective program implementation mostly achieved the 'continually improving' level (39 drivers, 83%). Statistical analysis revealed a significant correlation between Bow Tie Program implementation and safety culture maturity (p-value = 0.001, <0.05).

Multivariate Analysis

This research employs hypothesis testing through a multivariate analysis method, specifically path analysis, to examine the direct and indirect effects between independent and dependent variables, as illustrated in the following figure:

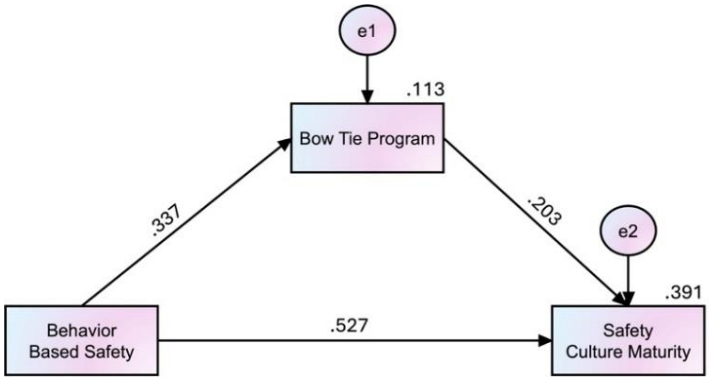

Figure 1. The result of path analysis

Direct Effects

Safety behavior had a significant direct positive effect on Bow Tie Program implementation (estimate = 0.337, p < 0.001) and safety culture maturity (estimate = 0.527, p < 0.001). The Bow Tie Program also had a significant direct effect on safety culture maturity (estimate = 0.203, p = 0.006).

Table 6. Analysis of Direct Effects on Drivers

No	Inter-Variable Effects	*Estimate*	*Critical Ratio*	*P Value*	Result
1	Safety Behavior → Bow Tie Program Implementation	0,337	4,012	0,000	Positive Significant
2	Safety Behavior → Safety Culture Maturity	0,527	7,132	0,000	Positive Significant
3	Bow Tie Program Implementation → Safety Culture Maturity	0,203	2,746	0,006	Positive Significant

Based on the table, the results are as follows:

1. The variable of work safety behavior has a positive influence on the implementation of the bow tie program with a coefficient of 0.337, indicating that improved driver safety behavior enhances the effectiveness of the bow tie program by 0.337, or 33.7%. Thus, the hypothesis (Ha) stating that there is a direct influence of work safety behavior on the bow tie program's implementation is accepted. The critical ratio of 4.012 (> 1.96) and a p-value of 0.000 (< 0.05) indicate that the influence of safety behavior on the program's implementation is significant.

2. The variable of work safety behavior also has a direct positive influence on safety culture maturity with a coefficient of 0.527, meaning that improved driver safety behavior increases safety culture maturity by 0.527, or 52.7%. This result supports the hypothesis (Ha), as the critical ratio is 7.132 (> 1.96) and the p-value is 0.000 (< 0.05), showing that the influence of safety behavior on safety culture maturity is significant.

3. The influence of the bow tie program's implementation on safety culture maturity has a coefficient of 0.203, indicating that more effective implementation of the program improves safety culture maturity by 20.3%. The hypothesis (Ha) is accepted, with a critical ratio of 2.746 (> 1.96) and a p-value of 0.006 (< 0.05), confirming a significant influence of safety behavior on safety culture maturity.

Indirect Effects

Safety behavior had a minimal and non-significant indirect effect on safety culture maturity through the Bow Tie Program (estimate = 0.068, p = 0.017) (table 8)

Tabel 7. Analysis of Indirect Effects on Drivers

Inter-Variable Effects	*Indirect Effect*	*Two Tailed Significance*	Result
Safety Behavior → Bow Tie Program Implementation → Safety Culture Maturity	0,068	0,017	Significant

The table above shows that the indirect influence of work safety behavior on safety culture maturity through the implementation of the bow tie program has a positive value of 0.068. This result indicates that as drivers' work safety behavior improves, the effectiveness of the bow tie program also increases, leading to higher safety culture maturity. Additionally, with a p-value of 0.017 (< 0.05), the indirect influence is significant, thus supporting the hypothesis (Ha).

DISCUSSION

The findings of this study highlight the significant impact of safety behavior and the Bow Tie Program on the maturity of safety culture among LV drivers at PT Bumi Jasa Utama. The results are consistent with the theory that improved safety behaviors, such as compliance with safety procedures and proactive participation in safety activities, positively contribute to safety culture maturity.

The Impact of Safety Behavior on the Bow Tie Program

The results showed that drivers with "good" safety behavior were more likely to perceive the Bow Tie Program as effective (57.6%), compared to drivers with "adequate" safety behavior (14.8%). This aligns with the theory proposed by Griffin and Neal (2006), which describes safety behavior as comprising two key components: safety compliance and safety participation. Compliance with safety procedures is essential for achieving a higher level of safety performance, while safety participation encourages employees to actively engage in creating a safer work environment (Neal & Griffin, 2006).

As noted by Kaplan.,et al (2015), Safety behavior, especially among drivers, plays a vital role in preventing and minimizing road accidents, further supported by an emphasis on safe driving practices. Driver drowsiness and distraction are two major causes of road accidents and the associated financial losses. Several techniques for minimizing road accidents can be implemented using smartphones to detect distracted driving (Kaplan, Guvensan, Yavuz, & Karalurt, 2015)

However, 85% of the drivers in this study rated the Bow Tie Program as "less effective." This suggests that while safety behavior is a key factor in the perceived success of safety programs, additional training and clearer implementation of the Bow Tie Program may be necessary. This finding echoes Hunter and Wolf (2016), who emphasized the importance of continuous feedback and training to reinforce safety behavior (Hunter & Wolf, 2016)

This study aligns with the research conducted by Andrijanto et al. (2022), which identifies six aspects for assessing driver safety behavior: ethics, driving skills, traffic rule compliance, safety awareness, mutual safety, and responsibility. The results of Andrijanto et al. (2022) indicate that all six variables of driver safety behavior have a significant impact on the safety program, with a p-value of 0.00 (< 0.05) (Andrijanto, Itoh, & Sianipar, 2022)

The research conducted by Stephan et al. (2024) shows that the implementation of safety behaviors, such as maintaining speed, keeping a safe distance, and handling early hazard detection, has a positive impact on behavioral change expectations, with a result of 0.0005 (< 0.05) (Stephan, Stephens, Scully, Mitsopoulos-Rubens, & Newstead, 2024)

The Impact of Safety Behavior on Safety Culture Maturity

Drivers exhibiting good safety behavior were more likely to be in the "continually improving" stage of safety culture maturity (80,3%), compared to drivers with "adequate" safety behavior (18%). This confirms Reason and Hobbs (2017), who asserted that to achieve a high level of safety culture maturity, organizations must engage all employees and commit to improving safety practices (Hobbs, 2017). The role of management is also crucial, as highlighted by Mekhlafi et al. (2022), who found that strong safety behavior directly contributes to organizational safety performance (Al-Mekhlafi, Isha, Abdulrab, Ajmal, & Kanwal, 2022).

Path analysis testing shows that work safety behavior has a positive influence on safety culture maturity at 52.7% (0.527 > 1.96). This indicates that the better the drivers' safety behavior, the higher the company's safety culture maturity. Interviews with drivers also concluded that motivation to maintain consistent safe behavior stems from the company's continuous efforts to foster a stronger safety culture. This commitment is evidenced by the company's regular qualification in kaizen improvement competitions in the safety performance category, consistently ranking among participating contractors

The findings of this study are consistent with those of B. Öz (2008), who investigated the relationship between driver behavior and company safety culture, concluding that improved safety behavior positively influences overall performance (Lajunen, 2008). This supports the conclusion that reinforcing good safety behavior is essential for fostering a mature safety culture.

The research conducted by Moreira et al, 2021 Safety culture maturity is critical to the prevention of unsafe behaviors, especially in industries such as civil construction, with its high rates of injuries and fatalities. This concept is even more important when studying the academic environments in which professionals who will work in those industries are trained. The results indicated that the laboratories are in "reactive" maturity stage. The main organizational factors directly affecting the maturity of that safety culture were "information", "involvement" and "commitment" (Moreira, Ramos, & Fonseca, 2021)

The Impact of the Bow Tie Program on Safety Culture Maturity

Although the Bow Tie Program is designed to enhance safety practices by identifying risks and implementing preventive measures, its effectiveness in this study was rated as low. Drivers who found the Bow Tie Program less effective were mostly in the "cooperating" stage of safety culture maturity (46.3%), compared to those who rated the program as effective (17%). This suggests that while the Bow Tie Program has potential, its implementation may not fully align with drivers' expectations, as indicated by the in-depth interviews.

The bivariate test results show a p-value of 0.001 (< 0.05), indicating a significant relationship between the bow tie program implementation and safety culture maturity among drivers at PT Bumi Jasa Utama Sorowako. This suggests that most drivers at PT Bumi Jasa Utama have reached the highest level of safety culture maturity, "continually improving," despite the bow tie program's less effective implementation.

The multivariate analysis shows that the bow tie program has a direct, significant positive impact on safety culture maturity, with an influence of 0.203 (> 1.96) and a p-value of 0.006 (< 0.05), indicating that more effective implementation increases safety culture maturity by 20.3%. However, in-depth interviews reveal that most respondents feel the program has not fully met their expectations, though they still consciously comply with company rules.

The study by Firdaus et al. (2024) similarly found that the Behavior-Based Safety (BBS) Program positively influenced employee compliance, but did not address the level of safety culture maturity achieved (Firdaus et al., 2024). This suggests that structured safety programs like the Bow Tie need

to be reinforced with clear communication and practical application to meet the needs of the workforce.

This research is also supported by Vinicios M et al. (2017) on the Bow Tie program, which demonstrates that this method can provide a clear and useful approach to risk management for safety and risk practitioners. The study explains that the Bow Tie program can contribute to improved risk perception and understanding within companies, encouraging them to use elements such as root causes, preventive barriers, mitigation barriers, deficiencies, recommended actions, degradation factors, and protections as guidelines in developing a Bow Tie program for their safety management processes. Additionally, the implementation of the Bow Tie program can enhance the maturity of the company's safety culture (Muniz, Lima, Caiado, & Quelhas, 2018)

The research by Yiling Li et al. (2020) developed a Safety Management System (SMS) program designed to reduce the impact of workplace accidents. This model-based system informs SMS through two components: (1) an accident-related model, and (2) an organizational model, both of which influence Work Safety Behavior and contribute to the Maturity of Safety Culture. Safety management centers on three core issues: safety, management, and systems, where "safety" specifically relates to accidents, losses, and risks. The implementation of this Safety Management System program aims to enhance work safety behavior and, consequently, the maturity of safety culture (Li & Guldenmund, 2018)

The Combined Effect of Safety Behavior and the Bow Tie Program on Safety Culture Maturity

Work Safety Behavior has demonstrated a significant direct positive impact on both the implementation of the bow tie program and the maturity of safety culture. However, path analysis testing on the effect of Work Safety Behavior on Safety Culture Maturity through the bow tie program yielded a p-value of 0.017 (< 0.05). This result indicates that Work Safety Behavior significantly influences Safety Culture Maturity when mediated by the bow tie program.

The analysis shows that implementing the bow tie program contributes 6% to the relationship between Work Safety Behavior and Safety Culture among drivers. While the bow tie program plays a role in enhancing safety culture maturity through improved safety behaviors, its impact is relatively small at 6%. This suggests that other factors may also play a significant or more diverse role in driving improvements in the safety culture maturity of drivers.

The results of this study align with research related to risk assessment, which found that the Bow Tie diagram program may only be proposed for specific objectives, including risk management and assessment. Furthermore, the Bow Tie programs developed by the company are qualitative techniques that still need to be combined with quantitative risk assessment methods to enhance the company's objectives (Moniri-Morad, Shishvan, Aguilar, Goli, & Sattarvand, 2024)

The study by Rashmi et al. (2023) highlighted that driver safety behavior is influenced by multiple factors, including age, gender, driving experience, education level, and income. In addition, vehicle type, road conditions, and the surrounding environment also play a role in shaping safety behavior (Shandhana Rashmi & Marisamynathan, 2023). In the context of this study, safety behavior and the Bow Tie Program were found to contribute to the maturity of safety culture, although the Bow Tie Program alone did not significantly amplify the effect of safety behavior. This finding suggests that while behavior-based safety practices are crucial, integrating them with comprehensive safety programs like the Bow Tie Program requires a more tailored approach to address the specific needs of the workforce.

The implementation of the bow tie program can be concluded to have met the company's expectations in supporting workplace safety; however, it has not comprehensively contributed to maximum effectiveness. These findings align with studies related to risk assessment, which suggest

that the bow tie diagram program should be proposed for specific objectives, including risk management and assessment. Furthermore, the programs outlined in the bow tie diagram developed by the company are qualitative techniques that still need to be combined with quantitative risk assessment methods to enhance the company's objectives (Moniri-Morad et al., 2024)

Limitations of the Study

The limitations of this study are as follows:

1. This research does not specifically discuss the characteristics of the respondents, such as age, length of service, gender, and educational background.
2. There were difficulties during the interview process with the target informants, as their schedules for passenger deliveries sometimes changed, leading to urgent calls that interrupted the completion of the interviews.
3. Some respondents faced challenges while filling out the questionnaire, requiring the researcher to provide further explanations and guidance on the answer options.
4. There are limitations associated with using a questionnaire, as the responses given by the samples may not always reflect the actual situation.
5. Some respondents felt anxious and concerned during the interview process

Implications of the study

The implications of this research highlight the importance of Safety Behavior. By enhancing their safety behaviors, drivers can better adhere to the Bow Tie program, ultimately reducing the risks associated with their roles. Companies should prioritize initiatives that promote positive safety behaviors, as they directly contribute to the overall maturity of the safety culture. Organizations should adopt a holistic approach, integrating safety behavior training with the Bow Tie program to develop a comprehensive safety management strategy.

CONCLUSION

Based on the results of the study, it can be concluded that work safety behavior has a positive and significant effect on the implementation of the Bow Tie Program for LV drivers at PT Bumi Jasa Utama Sorowako, with a p-value of 0.000. Additionally, work safety behavior positively and significantly affects the maturity of work safety culture among LV drivers at PT Bumi Jasa Utama Sorowako, also with a p-value of 0.000. Furthermore, the implementation of the Bow Tie Program has a positive and significant effect on the maturity of work safety culture among LV drivers at PT Bumi Jasa Utama, with a p-value of 0.006. Moreover, work safety behavior positively and significantly influences the maturity of work safety culture through the implementation of the Bow Tie Program for LV drivers at PT Bumi Jasa Utama, with a p-value of 0.017.

Thus, the Bow Tie Program can be considered to play a role in enhancing the maturity of work safety culture through the promotion of better work safety behavior. While the implementation of the Bow Tie Program has met the company’s expectations in supporting work safety, it has not yet contributed optimally in a comprehensive manner.

Recommendations from this Study:

The recommendations based on the findings of this study are as follows:

1. For Drivers, they must consistently maintain safety behavior in the workplace to improve the maturity of the company's safety culture and actively participate in the company's risk prevention and mitigation program.

2. For Companies, it is recommended to evaluate the Bow Tie program to monitor its effectiveness in improving the maturity of the safety culture in accordance with the company's goals. In addition, conducting periodic surveys to all employees regarding their participation in the safety program can provide valuable feedback to evaluate the Bow Tie program.
3. For Future Researchers, they can confirm the results of this study using other methods, such as experimental methods, case-control studies, or other methodologies that have not been discussed. They are also encouraged to expand this study by exploring variables that have not been studied.Declarations

Ethics approval and consent to participate: No. 872/UN4.14.1/TP.01.02/2024 by faculty of public health hasanudin university

Availability of data and material: Data sharing not applicable - no data shared, or the article describes entrirely theoretical research.

Competing interest: The authors declare that there are no conflicts of interest.

Consent for publication: The article has not been published in any other journal and is not currently under consideration by another journal.

Supplementary Material: There is no other data to be shared regarding the study.

Funding: This work was not supported

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