

Safety culture maturity and related risk factors among automotive workers in Malaysia

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ABSTRACT

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Introduction: The automotive industry in Malaysia has a high rate of workplace accidents, highlighting concerns about the effectiveness of safety culture. Safety culture reflects workers' attitudes and behaviors toward safety and can influence accident outcomes. Therefore, this study aims to assess the safety culture maturity level and its associated sociodemographic and occupational factors among automotive workers in Malaysia.

Methods: This cross-sectional study was conducted at one of the largest automotive factories in Malaysia. Survey data were collected for over one month, from early August to September 2022, from 387 workers in the manufacturing division using a non-probability sampling method. A standardized 28-item SASTO questionnaire was administered.

Results: Most respondents were between eighteen and thirty years old (32.3%), male (63.3%), with an education level of Sijil Pelajaran Malaysia (49.1%), working as operators (76.0%), with one to ten years of work tenure (52.7%), and no history of occupational accidents (79.3%). The results indicated that the average level of safety culture maturity among the respondents was 3.46 (SD = 0.94), indicating a proactive stage. Among the aspects of safety culture, the organizational aspect had the highest mean level (M = 3.48, SD = 1.05), followed by the psychological aspect (M = 3.46, SD = 0.82), and the behavioral aspect (M = 3.42, SD = 0.98). In multivariate analysis, significant associations were found between gender ($\beta = 0.145$), educational level ($\beta = 0.156$), had history of occupational accidents ($\beta = 0.346$), and departments ($\beta = 0.171$) with the level of safety culture maturity. The most dominant factor was the history of occupational accidents.

Conclusion: The safety culture among workers is generally positive, even with areas identified for improvement. This safety culture is influenced by their sociodemographic and working backgrounds, as well as their history of occupational accidents. Therefore, it is recommended that future intervention strategies to prevent occupational accidents consider these factors to ensure effectiveness.

Keywords: Automotive Industry, Occupational Health, Safety Culture, Cross-Sectional Studies, Risk Factors

Introduction

The automotive industry, a sub-sector of manufacturing industry, plays a pivotal role in manufacturing also known as the car Malaysia. The Institute of Labor Market

Information and Analysis (ILMIA) reported over 10,000 cases of occupational accidents in the manufacturing sector in both 2019 and 2020, including nearly 100 fatalities.¹ This highlights the high incidence of workplace injuries in the industry. In 2021, the Department of Occupational Safety and Health (DOSH) recorded approximately 4,200 occupational accidents in manufacturing, resulting in over 4,000 cases of non-permanent disabilities, 206 cases of permanent disability, and 48 fatalities.² However, DOSH emphasized that these figures represent only reported incidents, suggesting a significant number of unreported cases. This underreporting indicates potential gaps in safety management and reporting practices within the sector.

The increasing rate of occupational accidents and illnesses among manufacturing workers has raised concerns about the effectiveness of organizational safety culture. Safety culture encompasses workers' behaviors, perceptions, and beliefs about risk management and safety engagement.³ This concept gained prominence after the Chernobyl nuclear disaster, where both organizational and individual errors were identified as root causes.⁴ Research underscores a strong correlation between safety culture and occupational accident rates.⁵ This is further supported by recent occupational safety and health studies highlighting the critical role of workplace safety systems in preventing injuries and improving worker well-being. For instance, a study found that workers actively engaged in safety culture were less likely to cause accidents than those disengaged.⁵ Safety culture is closely tied to human beliefs, attitudes, and behaviors toward risk, where individuals unaware of this culture are more prone to unsafe acts.⁶ Various accident causation models further highlight the role of human actions in workplace incidents, identifying fundamental patterns leading to accidents.⁷ According to the Health and Safety Executive, safety culture comprises psychological, behavioral, and organizational aspects.⁸ These dimensions focus on attitudes, actions, and institutional practices, respectively, with the

safety culture maturity model serving as a tool to assess organizational safety commitment.

The Hudson Safety Culture Maturity Model conceptualizes safety culture as a progressive ladder with five stages: pathological, reactive, calculative, proactive, and generative.⁹ In the pathological stage, safety is viewed as a worker-caused issue addressed only to avoid detection. The reactive phase marks a response-driven focus on safety after accidents. The calculative phase involves management-led safety practices, often without worker involvement. A shift occurs during the proactive phase, in which workers actively participate in safety initiatives. The highest stage, the generative phase, integrates safety as a core organizational value, with all levels actively engaged.⁹ Understanding the factors influencing safety culture maturity is essential to establishing a safe work system, particularly in high-risk industries like automotive manufacturing. Recent evidence also indicates that occupational safety and health has become an increasingly important research area globally due to its direct impact on worker productivity and well-being.

Worker demographics significantly influence workplace safety culture. Studies show that factors such as age, education, and cultural background affect safety perception and behavior.¹⁰ Older workers often exhibit higher safety compliance than younger workers, emphasizing the role of age in fostering a strong safety culture.¹¹ Additionally, education levels and work experience impact safety awareness and the ability to address hazardous situations.¹² Language barriers and cultural differences among foreign workers further complicate safety training and communication.¹³ Recognizing these sociodemographic factors is crucial for developing effective safety strategies

The automotive industry remains a cornerstone of Malaysia's manufacturing sector, contributing 4% to GDP and ranking as ASEAN's third-largest automotive market.¹⁴ This high production demand often results in long working hours and

diverse tasks, increasing the risk of accidents and reduced performance.¹⁵ While a robust safety culture is widely recognized as key to mitigating these risks, data on safety culture in Malaysian industries, particularly in manufacturing, remain scarce.² Addressing this gap, this study aims to assess the safety culture maturity level and identify risk factors, including sociodemographic and occupational backgrounds, among automotive industry workers in Malaysia.

Methods

This cross-sectional study was conducted among automotive workers in the manufacturing division of an automotive company located in Perak, Malaysia. Both male and female workers aged 18 and above were included in the study, while those with less than one year of experience were excluded. Data collection was carried out over one month, from early August to September 2022. A minimum sample size of 377 respondents was required, calculated with a 20% allowance for potential missing data. The study successfully obtained responses from 387 participants.

The survey utilized structured questionnaires designed specifically for this study, known as the Safety Culture Assessment Tool for Car Manufacturing Company (SASTO). The survey comprised 28 items, categorized into two distinct sections. Section A contained seven items focusing on demographic information, including age, gender, education level, job role, department, and length of employment. Section B contained 21 questions evaluating safety culture across three aspects: psychological, behavioral, and organizational. These aspects were further categorized into six dimensions: safety priority, organizational learning, involvement, behavior towards risk, procedure adherence, and commitment. Respondents rated their agreement with statements on a Likert scale. The SASTO questionnaire consisted of 28 items measuring three key aspects of safety culture: psychological, behavioral, and organizational. Each item was rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The

overall safety culture maturity level was calculated as the mean of all responses. Scoring was guided by the Hudson Safety Culture Maturity Model (2001), which categorizes organizations into five maturity levels based on average scores. These levels are detailed in Table 1.

A pre-test was conducted with 10% of the target sample to verify clarity and resolve any language-related ambiguities in the Malay-language questionnaire. The questionnaire's internal reliability was validated, yielding a Cronbach's alpha of 0.82. The study employed a purposive sampling method to select the participating automotive company. This company is one of the largest automotive factories producing cars as its main product. Within the company, convenience sampling was used to recruit respondents from six key manufacturing departments: Body Assembly 1, Body Assembly 2, Painting, Trim & Final 1, and Trim & Final 2. Due to restricted access to workers' data, a non-probability sampling approach was deemed suitable. With assistance from the company's Safety, Health, and Environment Department, questionnaires were distributed to employees in these departments. Participants were informed of the study's purpose via the online questionnaire and assured of confidentiality, with the emphasis that their responses would be used solely for research. Ethical approval for the study was obtained from the Ethics Committee for Research Involving Human Subjects at Universiti Putra Malaysia (Reference number: JKEUPM-2022-401). Additionally, permission was granted by the company's Department of Safety, Health, and Environment.

Data analysis was performed using SPSS Version 26.0. Descriptive statistics were used to summarize respondent demographics and safety culture maturity levels. The association between sociodemographic and occupational backgrounds and safety culture maturity was analyzed using the Pearson chi-square test. Multiple Linear Regression analysis was conducted to further

determine these associations. Statistical significance for all hypotheses was set at $p < 0.05$.

Table 1. The scoring method of safety culture maturity level

Scoring	Level of safety culture maturity
0.00 – 1.44	1 (Pathological)
1.45 – 2.44	2 (Reactive)
2.45 – 3.44	3 (Calculative)
3.45 – 4.44	4 (Proactive)
4.45 – 5.00	5 (Generative)

Results

This study successfully recruited 387 respondents from the six main departments within the organization's manufacturing division who completed the questionnaire. This resulted in a 100% response rate. Table 2 presents the respondents' sociodemographic and occupational backgrounds. In terms of sociodemographic characteristics, 125 (32.3%) respondents were aged 18-30 years, 245 (63.3%) were male, and 190 (49.1%) had an educational background of Sijil Pelajaran Malaysia (SPM). The majority of respondents worked in the painting department (42.4%), with most holding operator positions (76.0%). Additionally, most respondents reported 1-10 years of work experience (52.7%), and 79.3% had no record of occupational accidents.

In this research study, safety culture maturity was assessed across three aspects: psychological, behavioral, and organizational. Each aspect was analyzed to determine its contribution to the overall maturity of the safety culture. The mean of the overall safety culture maturity was calculated and rounded off. The scoring method for the safety culture maturity level has been outlined in Table 1, adapted from Hashim (2022). Based on the results, the organizational aspect exhibited the highest mean safety culture score (3.48), followed by the psychological (3.46) and behavioral (3.42) aspects. The overall safety culture maturity among respondents was nearly equivalent across all aspects, with a mean of 3.46. The study referenced the Hudson (2001) Model, in which higher levels indicate greater safety culture maturity within an organization. This suggests that the overall safety culture maturity

among the recruited automotive workers was classified as Level 4 (Proactive) after rounding the value up. Similarly, the psychological and organizational aspects were also categorized as proactive among the respondents, while the behavioral dimension was classified as calculative. Under the psychological aspect, two sub-dimensions were assessed: the safety-priority dimension and the organizational-learning dimension. The results indicated that most respondents agreed that their organization tried to balance financial budgets and safety aspects, although they were uncertain about the profitability of this approach. Respondents also agreed that top management encouraged continuous improvement in safety and health within the organization. However, most respondents reported feeling safe to report accidents only at certain times in their workplace. This fear stemmed from concerns about being blamed, highlighting a lack of trust between management and employees that still exists.

Additionally, the behavioral aspect was divided into two factors: employees' safety involvement and their behavior towards risk. The results indicate that management encourages workers to participate in safety-related activities, but only at certain times. It is also observed that most employees provide their full participation and opinions only when prompted by management after accidents, rather than engaging in frequent discussions. Consequently, the level of safety culture maturity among respondents in the behavioral aspect is the lowest among the three aspects, suggesting a lack of worker participation in safety-related issues within the organization.

Safety procedures and safety commitments were the two sub-dimensions assessed under situational aspects. The results reveal that safety audits are comprehensive in all areas, while risk assessments are conducted only in some working areas by the designated personnel. The company also demonstrates full commitment to training for emergency preparedness, and reports are regularly reviewed daily.

The association between sociodemographic and occupational backgrounds with safety culture maturity among respondents was assessed using a Pearson chi-square test with $\alpha = .05$. Safety culture levels were determined based on the Hudson (2001) Safety Culture Maturity model, which comprises five levels. Levels 1 and 2 were classified as 'Poor,' Level 3 as 'Moderate,' and Levels 4 and 5 as 'Strong.' The analysis considered three aspects of safety culture maturity: psychological, behavioral, and situational aspects. Referring to Table 3 below, three sociodemographic characteristics were considered in this analysis: gender, age groups, and the education level of respondents. The association between two sociodemographic backgrounds and overall safety culture maturity among respondents was found to be statistically significant: gender ($p < .05$) and educational level ($p < .05$). Thus, the null hypothesis is rejected. Regarding gender, it is observed that 58.5% of female workers exhibit a stronger safety culture maturity compared to male workers (43.7%). Furthermore, participants with an educational level of degree and above have the highest percentage of strong safety culture maturity at 62.2%.

Regarding occupational background, four aspects were considered: years of employment, department, position, and history of occupational accidents among automotive workers. The department in which respondents worked was found to be statistically significant in relation to the overall level of safety culture maturity, with $p < .001$. Therefore, the null hypothesis is rejected. Specifically, the Painting department had the highest percentage of respondents (63.4%) with a strong safety culture maturity, while the Trim & Final 2 department had the highest percentage of respondents (40.0%) with a poor level of safety culture maturity. Furthermore, the history of occupational accidents was found to be significantly associated with the overall level of safety culture maturity, with $p < .001$. Hence, the null hypothesis is also rejected. The findings were similar to those for the overall aspect, with age and education level were $p < .05$ significantly associated with it. Furthermore, occupational factors significantly associated with safety culture maturity included department ($p < .05$) and occupational accidents ($p < .05$). Thus, the null hypothesis is rejected.

In terms of the behavioral aspect, gender ($p < .05$) and education ($p < .05$) were found to be significant factors associated with safety culture maturity among the sociodemographic background. Additionally, occupational factors that were found to be statistically significant with safety culture maturity included years of employment ($p < .05$), department ($p < .05$), and history of occupational accidents ($p < .001$). Thus, the null hypothesis is rejected (refer to Table 5).

Table 2. The sociodemographic and occupational background of respondents (N=387)

Characteristics	Frequency, n (%)
Gender	
Male	245 (63.3)
Female	142 (36.7%)
Age Group (in Years)	
18 – 30	125 (32.3)
31 – 40	109 (28.3)
41 – 50	92 (23.8)
51 and above	61 (15.8)
Education Level	
Sijil Pelajaran Malaysia	190 (49.1)
Diploma	93 (24.0)
Degree and above	90 (23.3)
Others	14 (3.6)
Years of Employment (in Years)	
1 – 10	204 (52.7)
11 – 20	120 (31.0)
21 and above	63 (16.3)
Department	
Body Assembly 1	33 (8.5)
Body Assembly 2	38 (9.8)
Painting	164 (42.4)
Stamping	55 (14.2)
Trim & Final 1	42 (10.9)
Trim & Final 2	55 (14.2)
Position	
Operator	294 (76.0)
SG1 – SG4	55 (14.2)
SG5 and above	38 (9.8)
Occupational accident	
Yes	80 (20.7)
No	307 (79.3)

Table 3. The association between sociodemographic and occupational background with overall safety culture maturity (N = 387)

Characteristics	Overall safety culture maturity			X ²	p-value
	Poor n (%)	Moderate n (%)	Strong n (%)		
Gender					
Male	52 (21.2)	86 (35.1)	107 (43.7)	12.973	0.002*
Female	12 (8.5)	47 (33.1)	83 (58.5)		
Age Group (in Years)					
18 – 30	16 (12.8)	37 (29.6)	72 (57.6)	6.597	0.360
31 – 40	19 (17.4)	39 (35.8)	51 (46.8)		
41 – 50	17 (18.5)	32 (34.8)	43 (46.7)		
> 51	12 (19.7)	25 (41.0)	24 (39.3)		
Education Level					
Sijil Pelajaran Malaysia	38 (20.0)	71 (37.4)	81 (42.6)	16.380	0.012*
Diploma	12 (12.9)	38 (40.9)	43 (46.2)		
> Degree	11 (12.2)	23 (25.6)	56 (62.2)		
Others	3 (21.4)	1 (7.1)	10 (71.4)		
Years of Employment (in Years)					
1 – 10	24 (11.8)	71 (34.8)	109 (53.4)	8.234	0.083
11 – 20	26 (21.7)	43 (35.8)	51 (42.5)		
21 and above	14 (22.2)	19 (30.2)	30 (47.6)		

Department					
Body Assembly 1	4 (12.1)	11 (33.3)	18 (54.5)		
Body Assembly 2	9 (23.7)	11 (28.9)	19 (47.4)		
Painting	11 (6.7)	49 (29.9)	104 (63.4)	50.033	<0.001*
Stamping	10 (18.2)	25 (45.5)	20 (36.4)		
Trim & Final 1	8 (19.0)	18 (42.9)	16 (38.1)		
Trim & Final 2	22 (40.0)	19 (34.5)	14 (25.5)		
Position					
Operator	48 (16.3)	101 (34.4)	145 (49.3)		
SG1 - SG4	13 (23.6)	19 (34.5)	23 (41.8)	4.597	0.331
SG5 & above	3 (7.9)	13 (34.2)	22 (57.9)		
Occupational accident					
Yes	34 (42.5)	33 (41.3)	13 (16.3)	64.655	<0.001*
No	30 (9.8)	100 (32.6)	177 (57.7)		

Note: *p*-value is significant when <0.05

Table 4. The association between sociodemographic and occupational background with the psychological safety culture maturity aspect (N = 387)

Characteristics	Psychological safety culture maturity aspect			X ²	p-value
	Poor n (%)	Moderate n (%)	Strong n (%)		
Gender					
Male	27 (11.0)	94 (38.4)	124 (50.6)	7.328	0.026*
Female	11 (7.7)	39 (27.5)	92 (64.8)		
Age Group (in Years)					
18 - 30	12 (9.6)	37 (29.6)	76 (60.8)	3.195	0.784
31 - 40	12 (11.0)	40 (36.7)	57 (52.3)		
41 - 50	9 (9.8)	31 (33.7)	52 (56.6)		
> 51	5 (8.2)	25 (41.0)	31 (50.8)		
Education Level					
Sijil Pelajaran Malaysia	21 (11.1)	81 (42.6)	88 (46.3)	17.782	0.007*
Diploma	12 (12.9)	23 (24.7)	58 (62.4)		
> Degree	4 (4.4)	25 (27.8)	61 (67.8)		
Others	1 (7.1)	4 (28.6)	9 (64.3)		
Years of Employment (in Years)					
1 - 10	21 (10.3)	63 (30.9)	120 (58.8)	4.157	0.385
11 - 20	13 (10.8)	48 (40.0)	59 (49.2)		
21 and above	4 (6.3)	22 (34.9)	37 (58.7)		
Department					
Body Assembly 1	4 (12.1)	8 (24.2)	21 (63.6)	23.335	0.010*
Body Assembly 2	2 (5.3)	14 (36.8)	22 (57.9)		
Painting	9 (5.5)	50 (30.5)	105 (64.0)		
Stamping	6 (10.9)	20 (36.4)	29 (52.7)		
Trim & Final 1	6 (14.3)	15 (35.7)	21 (50.0)		
Trim & Final 2	11 (20.0)	26 (47.3)	18 (32.7)		
Position					
Operator	48 (16.3)	101 (34.4)	157 (53.4)	4.698	0.320
SG1 - SG4	13 (23.6)	19 (34.5)	34 (61.8)		
SG5 & above	3 (7.9)	13 (34.2)	25 (65.8)		
Occupational accident					
Yes	21 (28.3)	36 (45.0)	23 (28.7)	44.280	<0.001*
No	17 (5.5)	97 (31.6)	193 (62.9)		

Note: *p*-value is significant when <0.05

Table 5. The association between sociodemographic and occupational background with behavioral safety culture maturity aspect (N = 387)

Characteristics	Behavioral safety culture maturity aspect			X ²	p-value
	Poor n (%)	Moderate n (%)	Strong n (%)		
Gender					
Male	53 (21.6)	89 (36.3)	103 (42.0)	6.654	0.036*
Female	18 (12.7)	48 (33.8)	76 (53.5)		
Age Group (in Years)					
18 – 30	16 (12.8)	39 (31.2)	70 (56.0)	9.911	0.128
31 – 40	19 (17.4)	44 (40.4)	46 (42.2)		
41 – 50	23 (25.0)	32 (34.8)	37 (40.2)		
> 51	13 (21.3)	22 (36.1)	26 (42.6)		
Education Level					
Sijil Pelajaran Malaysia	44 (23.2)	75 (39.5)	71 (37.4)	21.497	0.001*
Diploma	12 (12.9)	36 (38.7)	45 (48.4)		
> Degree	12 (13.3)	26 (28.9)	52 (57.8)		
Others	3 (21.4)	0 (00.0)	11 (78.6)		
Years of Employment (in Years)					
1 – 10	26 (12.7)	72 (35.3)	106 (52.0)	16.546	0.002*
11 – 20	26 (21.7)	50 (41.7)	44 (36.7)		
21 and above	19 (30.2)	15 (23.8)	29 (46.0)		
Department					
Body Assembly 1	4 (12.1)	12 (36.4)	17 (51.5)	31.176	0.001*
Body Assembly 2	9 (23.7)	11 (28.9)	18 (47.4)		
Painting	16 (9.8)	54 (32.9)	94 (57.3)		
Stamping	15 (27.3)	20 (36.4)	20 (36.4)		
Trim & Final 1	8 (19.0)	19 (45.2)	15 (35.7)		
Trim & Final 2	19 (34.5)	21 (38.2)	15 (27.3)		
Position					
Operator	54 (18.4)	108 (36.7)	132 (44.9)	2.863	0.581
SG1 – SG4	12 (21.8)	18 (32.7)	25 (45.5)		
SG5 & above	5 (13.2)	11 (28.9)	22 (57.9)		
Occupational accident					
Yes	34 (42.5)	32 (40.0)	14 (17.5)	50.697	<0.001*
No	37 (12.1)	105 (34.2)	165 (53.7)		

Note: p-value is significant when <0.05

The association between all sociodemographic backgrounds and situational aspects of safety culture maturity was analyzed in this study, as shown in Table 6. The results indicated significant associations with gender ($p < .05$), age groups ($p < .05$), and education level ($p < .05$). Regarding age groups, most workers in the 18 to 30 years old range (62.4%) exhibited a strong safety culture compared to other age groups. Conversely, most workers aged 51 and above (31.1%) demonstrated poor safety culture maturity. Additionally, occupational information was analyzed to determine its association with the situational aspect of safety culture maturity. The results mirrored those of the overall safety culture aspect, with both department ($p < .001$) and occupational accidents

($p < .001$) significantly associated with safety culture maturity. Hence, the null hypothesis is rejected. Table 7 presents the results of the multiple linear regression used to predict the association between sociodemographic factors and the overall safety culture maturity, adjusting for respondents' occupational background. Only the variables found to be significant in the Pearson chi-square test were included in the regression analysis. Prior to this study, preliminary analyses were conducted to ensure that no violations of the assumptions of normality, linearity, multicollinearity, and homoscedasticity occurred.

In combination, gender, education level, accident experience, and department accounted for a significant 22.3% of the variability in safety

culture maturity, with $R^2 = 0.223$, adjusted $R^2 = 0.215$, $F(4, 382) = 27.462$, $p < 0.001$. Unstandardized (B) and standardized (β) coefficients, standard error (S.E), and t for each predictor in the regression model were reported in Table 7. According to the table, an increase of one level of education will increase safety culture maturity by 0.156, while holding the other significant characteristics constant. For gender, female automotive workers will increase the level of safety culture maturity by 0.145

compared to males, while holding the rest constant. The result for the department shows that workers in Body Assembly 1 and Body Assembly 2 had an increase in safety culture maturity of 0.171. The strongest association between the characteristics tested was the history of occupational accidents among workers, where those who had not experienced any accident accounted for an increase in safety culture maturity level by 0.346 while holding the others constant

Table 6. The association between sociodemographic and occupational background with situational safety culture maturity aspect (N = 387)

Characteristics	Situational safety culture maturity aspect			X ²	p-value
	Poor n (%)	Moderate n (%)	Strong n (%)		
Gender					
Male	63 (25.7)	68 (27.8)	114 (46.5)	9.257	0.010*
Female	19 (13.4)	39 (27.5)	84 (59.2)		
Age Group (in Years)					
18 – 30				14.548	0.024*
31 – 40	17 (13.6)	30 (24.0)	78 (62.4)		
41 – 50	21 (19.3)	36 (33.0)	52 (47.7)		
> 51	25 (27.2)	25 (27.7)	42 (45.7)		
	19 (31.1)	16 (26.2)	26 (42.6)		
Education Level					
Sijil Pelajaran Malaysia					
Diploma	48 (25.3)	57 (30.0)	85 (44.7)	12.755	0.047*
> Degree	16 (19.5)	28 (30.1)	49 (52.7)		
Others	14 (15.6)	22 (24.4)	54 (60.0)		
	4 (28.6)	0 (0.0)	10 (71.4)		
Years of Employment (in Years)					
1 – 10				8.697	0.069
11 – 20	32 (15.7)	57 (53.3)	115 (56.4)		
21 & above	33 (27.5)	34 (28.3)	53 (44.2)		
	17 (27.0)	16 (25.4)	30 (47.6)		
Department					
Body Assembly 1	5 (15.2)	11 (33.3)	17 (51.5)	51.359	<0.001*
Body Assembly 2	13 (34.2)	6 (15.8)	19 (50.0)		
Painting	16 (9.8)	40 (24.4)	108 (65.9)		
Stamping	12 (21.8)	22 (40.0)	21 (38.2)		
Trim & Final 1	11 (26.2)	15 (35.7)	16 (38.1)		
Trim & Final 2	25 (45.5)	13 (23.6)	17 (30.9)		
Position					
Operator	60 (20.4)	80 (27.2)	154 (52.4)	3.462	0.484
SG1 – SG4	16 (29.1)	16 (29.1)	23 (41.8)		
SG5 & above	6 (15.8)	11 (28.9)	21 (55.3)		
Occupational accident					
Yes	35 (43.8)	30 (37.5)	15 (18.8)	48.475	<0.001*
No	47 (15.3)	77 (25.1)	183 (59.6)		

Note: p-value is significant when <0.05

Table 7. The multiple linear regression between predictor variables and overall safety culture maturity aspects (N = 387)

Characteristics	B	β	S.E	t	p
Constant	38.789		5.399	7.185	<0.001*
Gender	5.559	0.145	1.736	3.202	<0.001*
Education Level	3.155	0.156	0.916	3.443	0.001*
History of occupational accident	15.821	0.346	2.098	7.541	0.001*
Department	-2.220	0.171	0.596	3.724	<0.001*

Note: B = Unstandardized B, β = standardized Beta, S.E = Standard Error, p-value is significant when < .05

Discussion

The overall level of safety culture maturity among respondents is almost entirely in the proactive stage (Level 4). This result aligns with findings from a study of steel manufacturers in Malaysia, in which the level of safety culture maturity was similarly classified as a proactive stage. This stage reflects an organizational culture where strong leadership and sustained commitment from top management drive continuous improvements in safety practices. Previous research has also demonstrated that leadership-driven interventions play a critical role in enhancing safety outcomes.¹⁷ These efforts highlight a widespread awareness and prioritization of safety throughout the workplace.¹⁰ Recent studies published in the *International Journal of Occupational Safety and Health* have highlighted the increasing global importance of occupational safety and health in improving worker well-being and productivity.^{24,25}

Under the psychological aspect, two subdimensions have been assessed: the safety-priority dimension and the organizational-learning dimension. The importance of prioritizing occupational safety and health (OSH) within an organization's economic framework has been widely discussed for decades.⁸ Dorman defines the economic role of OSH as a means to provide safe and profitable working conditions, emphasizing the importance of addressing indirect financial losses caused by occupational accidents and diseases.⁸

The behavioral aspect is divided into two factors: employees' safety involvement and their behavior towards risk. Workers' involvement in

the safety management system is essential for improving safety culture maturity and reducing occupational accidents.²⁰ A study found a negative correlation between employees' safety involvement and the Total Recordable Incident (TRC) rate, indicating that limited participation often stems from reactive rather than proactive management practices.²³ Employees may be unaware of their right to participate in safety decisions, and employers often fear that such involvement could lead to unreasonable demands.⁵ Organizational pressure has also been identified as a contributing factor to underreporting of workplace incidents.²¹ This situation highlights the need for inclusive practices, particularly among employees engaged in high-risk tasks requiring adherence to safe procedures.⁵ As a result, the behavioral aspect scored lowest in safety culture maturity, primarily due to limited worker participation in safety-related issues. Moreover, management commitment significantly influences employee perceptions of safety and readiness to adopt safe practices.¹⁹ A strong safety climate has been shown to positively influence overall safety performance in organizations.²²

The results indicate that the organization exhibits a high level of safety culture maturity among workers in the manufacturing division. However, there is room for improvement. It is recommended that organizations adopt a 'Just culture' that fosters an open reporting environment where safety discussions are free from fear of negative repercussions or blame.^{1,3} Employers should encourage a high-trust environment that balances accountability and

tolerance for errors, differentiating between acceptable and unacceptable actions.³ Additionally, implementing Behavior-Based Safety (BBS) programs could enhance employees' safety involvement.² Such programs aim to transform unsafe behaviors into safe practices through systematic training and fostering individual responsibility for accident-prone behaviors.³

This study contrasts with a previous study in an academic setting, which found no significant association between gender factors, education level, and safety culture. However, it aligns with another study in academic settings, in which both gender and education level were found to be associated with safety culture.¹² Research on safety culture maturity among manufacturing workers in Kuantan also found a high correlation between the educational level of workers and their safety perceptions. Over 50% of women among respondents possessed a strong level of safety culture compared to men (43.7%). Earlier studies have concluded that gender plays a significant role in safety perceptions. Hitchcock claimed that women are more detail-oriented when evaluating moderate-to-high risks than men.¹⁵ As women tend to associate with feminine traits, including sensitivity, they may have a higher level of safety culture maturity than men. Based on the findings above, workers with tertiary education have the highest safety culture maturity (62.3%).

In several works of literature, education is defined as the process by which an individual obtains knowledge and information and turns it into value through their cognitive capabilities. While reasoning a task, a person is believed to use their cognitive capabilities from a cognitive-behavioral perspective.³¹ Hence, it is believed that a high level of education can increase workers' rationale for their occupational safety judgment and behavior.¹¹ Furthermore, there was no significant association between age groups and overall safety culture maturity, which obtained similar results as a previous study.¹⁹ Approximately 60% of younger

respondents have a high safety culture maturity level, compared with older workers. Older workers may experience declines in physiological systems, including cognitive skills, such as response time to near-miss accidents.¹⁹ Occupational stress and job-related factors may also influence workers' health and safety outcomes.¹⁸ This aligns with findings where the higher age group was found to have poor safety culture maturity among workers.¹⁶ However, Crawford et al.⁴ suggested that some older workers may perform comparably to their younger colleagues, depending on individual factors. Thus, safety culture is unlikely to be affected solely by age groups within an organization.

Additionally, 57.7% of respondents with strong safety culture maturity reported no history of occupational accidents in their workplace. The history of occupational accidents showed the strongest association with the safety culture maturity aspect. As there is still a lack of recent studies correlating occupational accidents with safety culture maturity, few comparisons can be made. However, the findings align with a previous study on the relationship between workers' safety culture and accidents in Poland in 2004, which found that safety culture is linked to positive behaviors, such as protecting one's life from danger.³ Hence, it is reasonable to assume that organizations with good safety culture tend to have lower accident rates than those with poor safety culture.¹⁶ Furthermore, literature suggests that workers' history of occupational accidents tends to increase predictive risky behaviors for those who have witnessed such incidents.

Conclusion

In conclusion, the findings indicate that respondents' overall safety culture maturity falls within the proactive stage. The psychological and situational aspects of safety culture maturity are similarly classified as proactive, while the behavioral aspect remains slightly lower in maturity. The study also found significant

associations between safety culture maturity and sociodemographic factors, particularly gender and educational level. Occupational backgrounds, such as the department in which workers are placed and whether they have experienced workplace accidents, also influence the maturity of safety culture. Among these, the history of occupational accidents emerged as the most influential factor associated with safety culture maturity. Future research on safety culture maturity should focus more on the automotive industry, given its significant contribution to the country's economy. Highlighting the occupational safety and health aspects in this industry is crucial to providing workers with a safe and comfortable working environment. Additionally, based on the findings of this study, further research should focus on selected sociodemographic and occupational backgrounds that are significantly associated with safety culture maturity. This could help policymakers develop more effective

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intervention programs. Finally, since this study only focuses on one specific automotive company, future research could include automotive workers from various companies in Malaysia to provide a more representative sample and determine the average level of safety culture maturity in the country.

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