

Article

Organizational Safety Climate Factor Model in the Urban Rail Transport Industry through CFA Analysis

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Abstract: Occupational Safety and Health (OSH) issues in the urban rail transport industry need to be given full attention due to the factors of the instability of declining occupational accident rate, increasing number of passengers each year, and the pressure of technological development; in addition, the day-to-day operations also involve the public and various interested communities. Organization is one of the factors that influence worker safety and health status. This study aimed to propose a factor model of the organizational safety climate towards a better safety and health status for Malaysian urban rail industry. This quantitative study used a questionnaire randomly distributed to Malaysian rail system workers. A total of 441 workers in the operation and maintenance division were involved in this study. Confirmatory factor analysis (CFA) using IBM SEM-AMOS was conducted to determine the reliability and validity of the observed variables and the latent variables. This study proved that all four dimensions identified as safety communication, safety training, safety support system, and safety value represents the organizational safety climate. Following the analysis, an organizational safety climate model is successfully developed. This factor model aims to be used in the context of rail management studies to measure the safety climate of their organization, thereby improving the safety level of the workers within the organization.

Keywords: safety climate; organization; factor model; urban rail industry; workers; confirmatory factor analysis (CFA)



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1. Introduction

The rail transport system is a public transport system that facilitates easy movement of communities from one location to another. However, the issue of worker Occupational Safety and Health (OSH) needs to be taken care of by the organization. Incidents and accidents occurring in the rail transport system have affected workers negatively. These include an increase in worker turnover, lower productivity, and negative emotion [1]. Workers' alertness and focus increase when they feel safe and comfortable at work [2,3]. Therefore, it is important for the management to know the true cause of each incidents and accidents. As such, the introduction of the concept of safety climate is seen as a new alternative to improve the safety and health management systems in urban rail transport and reduce the number of incidents and accidents [4].

Safety climate is a reflection of the assumptions of safety culture within an organization and can influence workers' safety performance [5,6]. Zohar [7] described the term climate in this context as a summary of the molar perceptions that workers share about their

environment. According to Zohar [7], the term climate in this context was based on the individual's perception of the practices, procedures, and rewards of an organization.

In Malaysia, the occupational accident rate for the rail transport industry was recorded at 2.69 accidents per 1000 workers for 2015, 2.43 for 2016, and 2.52 for 2017 [8]. The fatal accident rate was recorded at 6.51 per 100,000 workers for 2015, 5.48 for 2016, and 3.99 for 2017 [8]. Occupational safety and health management in the rail transport industry needs to be given attention; this is because even though the fatal accident rate has shown a decrease, the occupational accident rate still shows a declining instability. More worryingly, the total of daily users of the Greater KL/Klang Valley rail transport system reached 842,666 in 2019 compared to 657,736 in 2017, and the number of users of this service is expected to increase every year [9]. The pressures of technological development, namely the replacement of common mechanical methods into sensor and electronic technology methods through computers also complicate the situation [10]. For example, the replacement of train driver functions to special train control units in some train services in Malaysia. The absence of train drivers to report any incidents or emergencies at the focus site presents a major challenge in this regard. Rail transport system operators need to increase safety through this control technology and at the same time consider any possible failure of the automated system used [10,11]. In addition, the day-to-day operations of the rail transport industry involve not only workers but also the general public and various communities of interest [12,13].

The safety and health management in the urban rail transport system in Malaysia is subject to the Occupational Safety and Health Act (OSHA, Act 514) 1994 and Railways Act (Act 463) 1991. OSHA 1994 aims to ensure safety, health and welfare for the workers and the community around the workplace [8]. This OSHA 1994 combines legal provisions and supervision by the government. This Act is also self-regulating, which means that its main responsibility is to ensure that the safety and health in the workplace lies with the employer and the worker himself. In line with the concept of self-regulation, this act does not have a technical provision, instead it generally outlines the responsibilities of employers and workers in creating safe and healthy working conditions [14]. The safety and health management system in the rail transport industry, especially in Malaysia, is also based on the concept of a plan-do-check-act model developed by Shewart and Deming [15]. Thus, the urban rail transport systems operator organization in Malaysia is working to improve the quality of the organization's safety policy (policy statement, setting the commitment of employers and workers and mission); operations (role of Occupational Safety and Health Committee, safety training, documentation, and communication); planning and implementation (Hazard Identification, Risk Assessment, And Risk Control (HIRARC), the establishment of an Emergency Response Team (ERT) and the existence of an Emergency Procedure (ERP)); assessment (monitoring and inspection of work environment, accident investigation, and safety related audit); and improvement actions (planning, implementation, and evaluation review).

Safety climate refers to the real things that workers feel about the safety aspects found in the workplace [6]. Workplace safety and health conditions are more meaningful if assessed by the workers themselves. Rationally only they themselves are more aware of any weaknesses and constraints of a given task in their daily work routine [7]. This way, issues related to safety and health that affect the discomfort of workers in the workplace will be easier to detect [7]. The concept of organizational safety climate allows the management to predict various possible incidents and accidents in the workplace [7,11]. Hence, the introduction to the concept of safety climate is seen as a new alternative to identify the strengths and weaknesses of urban rail transport organizations especially in Malaysia.

Efforts to develop a positive safety climate in the rail transport system are necessary to reduce incidents and accidents. Through a literature review, issues related to safety climate in international rail transport systems have long been studied. However, most of the previous studies are not comprehensive; often, factors affecting them are discussed separately, inconsistently, and largely depending on the significance of each study. Malaysia

is a developing country; therefore, the workers' beliefs, attitudes and perceptions are different than those of other developed countries [3,16]. Hence, this study fills the gap of previous studies by identifying organizational safety climate dimensions to be used as continuous safety measurement tools in order to enhance the safety and quality of the urban rail management system.

Organizational Safety Climate

Organizational safety climate refers to workers' perceptions of the policies and procedures set by the top management [4,12]. This section was termed as management's attitude towards safety in Zohar [7], management's attention to workers' well-being in Brondino et al. [17], as well as management's commitment to safety in Fernández-Muñoz et al. [1]. The management should demonstrate an ongoing concern and positive action on the issue of safety and health [18]. According to Hofmann and Stetzer [19], the management should show their commitment not only to the safety of the activities undertaken, but also to the behaviors, and even daily conversations.

O'Dea and Flin [20] showed that the commitment shown by the management can also be evaluated in terms of leadership style that can build workers' trust and support. In addition, organizational safety climate also affects workers' safety performance [7,18,21]. Arifin et al. [5] proved that the management's ignorance of the safety and welfare of workers is a cause of major loss to an organization. It causes lesser obedience and respect for instructions from the management as well as uncomfortable and unsafe feelings at work [18]. Glendon and Evans [12] measured railways safety climate according to two factors, which are "Management & Staff Safety" and "Safety Training and Rules". Meanwhile, Cheng [4] identified railways organizational safety climate dimensions, namely safety communication, safety training, and safety management. Zohar [22] in his safety climate conceptual model emphasized that organizations should strive to improve the safety of workers both physically and procedurally, while ensuring the consistency between policy and reality and having positive leadership values.

Jiang et al. [21] in his multi-level safety climate conceptual model further divided organizational safety climate into three sections, namely, safety training, management commitment and communication for safety, and safety equipment and maintenance. Griffin and Neal's [23] safety climate conceptual model divided organizational safety climate into safety climate dimensions of management values (attention to workers' welfare, safety priorities, achievement, and attitude toward safety), safety communication (communication related to safety issues), safety practices (proficiency and permission to practice safety practices), safety training (safety training adequacy), and safety equipment. This research divided organizational safety climate into four main aspects, which are safety communication, safety training, safety support system, and safety value [4,17,21–23].

The dimensions of communication, safety training, safety support systems and safety values are among the key dimensions that influence the safety climate of an organization [17,21,24]. This is because effective communication and safety training is a priority for an organization so that workers are clear with safety demands in the workplace and strive to engage in any safety program [12,23,25,26]. The organization also needs to have the best safety support system and safety values to ensure the level of occupational safety and health for each worker is guaranteed. It also helps the worker to be comfortable and confident while completing tasks [1,17,21,23,27]. These four dimensions need to be taken seriously, especially for high-risk industries such as rail transport systems [4,12]. For example, misunderstandings of verbal messages and written instructions caused by poor communication and lack of safety training especially in emergencies can worsen the incidence of train accidents. Studies on worker perceptions in this dimension is also more aimed at finding out the extent to which workers believe in safety systems and not aimed at knowing how safety systems are implemented [12].

According to Brondino's et al. [17] safety climate model, communication refers to how well safety issues are communicated; it is important for improving workers' confidence and

the quality of safety climate among workers. The Griffin and Neal's [23] model also cited communication as an important aspect of shaping positive safety climate. Communication as described by Vecchio-Sadus [25] is the process of exchanging information between two or more individuals. Workers who have a positive communicative relationship with their employers tend to feel comfortable and secure while on the job [28]. According to Vecchio-Sadus [25] and Miller et al. [26], the importance of communication is to advise, inform, assist, train, direct, warn, seek assistance, obtain respect, knowledge, reassure, motivate, question, and complain. Brondino et al. [17], Jiang et al. [21] and Zohar [7] have touched on open communication; one of them was by creating a space to discuss and exchange ideas on safety issues with top management. Employers need to be open-minded in providing opportunities to discuss any opinions on safety and health [19]. The top management needs to carefully listen to the safety ideas proposed by workers [17]. The management also needs to involve all workers, especially during the decision-making process [7,29].

Jiang et al. [21] also touched on the issue of space given to workers to complain about any problems involving safety experienced by the workers. Workers tend not to cooperate in explaining any incidents, if the communication used in the organization is not open and fair [19,30]. Palali and van Ours [31] in their study showed that most workers are anxious and will not report any injuries and incidents due to fear of getting fired. According to Palali and van Ours [31], this situation is exacerbated if there are limited employment opportunities in the area. Griffin and Neal [23] emphasized the aspect of channelling latest information so that workers receive information as soon as possible, especially in terms of technicalities related to safety. In this context, the management needs to be skilled in conveying information related to occupational safety and health through various efforts, so that the workers have a clear picture of the occupational safety and health objectives and encourage their involvement in safety and health programs in their respective workplaces [32]. Brondino et al. [17] stated that the management should strive to provide workers with safety consultations and take note of any ideas that workers have in improving the workplace safety. The management should also be active in promoting safety [29,33]. Often, the factors which have become the focus in safety communication are the absence of a safe space for discussion, complaint, and exchange of ideas, poor workers' involvement in safety decision-making process, lack of proficient ways to convey safety information; provide safety consultations to workers and poor communication of most up-to-date information [17,19,31,33].

Safety training refers to the quality and quantity of knowledge and skills provided to the workers so that they can perform tasks safely and effectively. Safety training is important for changing the workers' attitudes and behaviors [34]. Griffin and Neal's [23] safety climate model identified safety training as the most important safety management practice that predicts safety knowledge, safety motivation, safety compliance, and worker safety inclusion. Additionally, Jiang et al. [21] in his safety climate model stated that workers have the space to share ideas and insights in safety training sessions, which in turn contributes to an increase in the percentage of workers' safety and health level at work. Workers' perceptions on issues related to safety training allow for an in-depth investigation into whether they are in line with the safety policies set out by the organization [22]. According to Brondino et al. [17] and Kines et al. [29], workers need to receive comprehensive training about health and safety issues at the workplace. This issue is in line with the study of Jiang et al. [21] and Arifin et al. [35], which emphasized that the training provided should include efforts to sharpen workers' skills and enhance workers' knowledge and experience in order to complete tasks safely. Adequate training should also be received by workers when new procedures and equipment are introduced [21]. Zohar [22] states that training needs to be done continuously and periodically so that workers can update their knowledge. Griffin and Neal [23] and Arifin et al. [35] noted that it is important to rationally increase the number of training sessions to enable workers to systematically understand the factors that impact the safety performance. This is important to ensure an increase in the overall safety of the organization. Factors affecting safety training are

quality of training content whether it includes up-to-date procedures, frequency of training provided for each of workers, and worker involvement [17,22,23,29,34,35].

A good safety support system including the occupational hazard protection effort can reduce the number of accidents by improving the understanding, motivation, and commitment among workers [1,27]. Krieger et al. [36] divided hazards in the workspace into two types, namely, occupational hazards (dust, chemicals, noise, electricity, ergonomic threats, and work stress) and social hazards (racial discrimination, sexual harassment, and bullying). The management needs to be aware of any problems of occupational and social hazards that exist in the organization [17,37]. The management also needs to provide workspaces that are protected from high heat and provide all necessary personal protective equipment (such as safety boots and safety helmet) to complete tasks safely [17,21,23]. High heat will cause skin inflammation and increase stress on workers [10]. Uncomfortable workspace designs will increase injury potential worker and reduce worker productivity and job satisfaction [38]. A well-ventilated workspace is needed to reduce hazard exposure, bad odor, and shortness of breath. Factors of cleanliness and tidiness of the workspace should also be taken into account [39]. Among the factors that are widely discussed are poor workplace design that does not focus on ventilation issues and safety risks, occupational and social hazards, and workplace cleanliness and tidiness [17,20,36,39,40].

Griffin and Neal [23] in their model stated that the safety value dimension is the key dimension of safety climate. This dimension is also known as the management's attitude toward safety in Zohar [7], management's attention to the welfare of workers in Brown et al. [41], perceptions that shows the importance of safety in Dejoy et al. [42] and the management's priorities, commitments, and compliance in the study by Kines et al. [29]. Dimensions of management values in the model of Jiang et al. [21] is known as the management's commitment. Factors for safety value in this study are productivity scheduling and leadership style. Griffin and Neal [23] and Jiang et al. [21] stated that safety value refers to the extent to which management prioritizes safety in the workplace. The management needs to demonstrate sincerity in ensuring workers' safety [23]. The management should consider safety as an important part of operations [21]. Brondino et al. [17] in their model stated that the value of safety is measured in terms of the top management's concern on safety issues in production scheduling, worker transfer, and promotion, and during delayed productivity schedule. Unstable productivity scheduling can cause stress to workers [17,42]. Stress usually occurs due to limited time allotted by the employer in completing a task. Large number of tasks to be finished in too little time puts pressure on workers [37]. The management should not allow workers to take risks during a tight productivity schedule [24]. The management also needs to be concerned about the issue of insufficient number of manpower that should be assigned in a productivity group [43]. Large number of tasks to be finished in limited time puts pressure on workers [44]. Employers who are smart in utilizing the workforce without stress will enhance the comfort and productivity of workers [45]. For Nordlöf et al. [46], employers who do not directly empathize with the pressures faced by workers and overestimate the product target and quality would cause the workers to feel unappreciated and unable to focus fully on their work. The management should not allow workers to take risks during a tight productivity schedule [29]. Common factors that affect safety value are lack of safety concern in productivity schedule, worker promotion during delayed productivity schedule; lack of safety risk concern during tight production schedules; and insufficient labor force [21,23,29,41,47].

Referring to the number of occurrences of organizational safety climate dimensions with similar semantic meanings discussed, a hypothetical model (Figure 1) was developed. The latent variables consist of the most common organizational safety climate dimensions, which are safety communication, safety training, safety support system, and safety value. Meanwhile, the observed variables consist of 24 items for all four organizational safety climate dimensions. Hence, these dimensions are believed to be the main dimensions which can be used to evaluate the level of organizational safety climate in urban rail management system (Table 1).

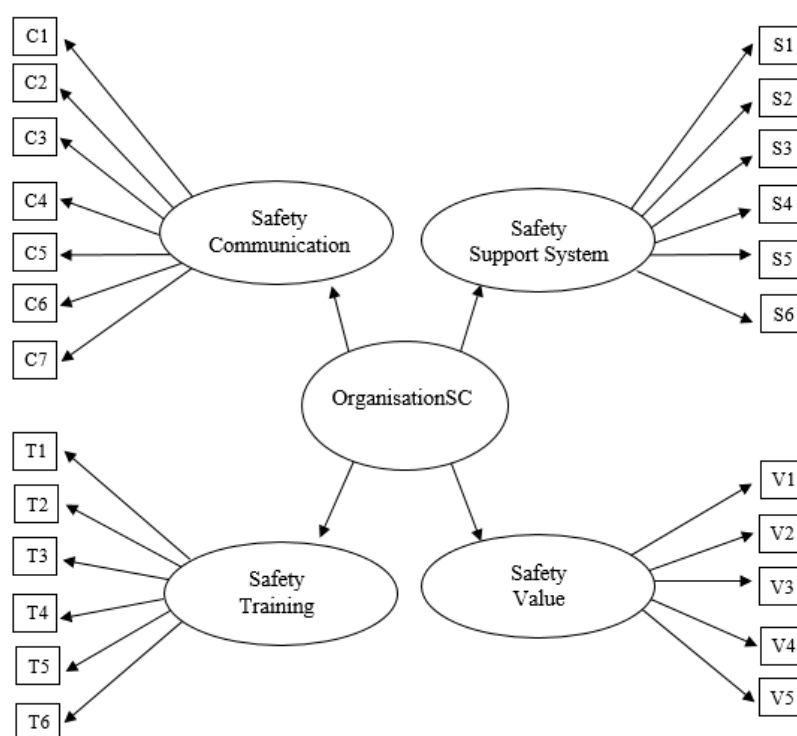


Figure 1. Organizational safety climate measurement model.

Table 1. Organizational safety climate dimensions.

F1: Safety Communication	
C1:	Creating a space for discussion and exchange ideas
C2:	Listen carefully to safety ideas suggested by workers
C3:	Involves workers in making decisions related to safety
C4:	Creating a space to complain about any concerns related to safety issues among workers
C5:	Channelling the most up-to-date safety-related information especially technically
C6:	Proficient in communicating information in various ways
C7:	Provide safety consultations to workers
F2: Safety Training	
T1:	Targeted to all workers involved in a project
T2:	Adequate training is recommended when new safety procedures are introduced
T3:	Adequate training is organized when any new equipment is introduced
T4:	Provided periodically to each worker
T5:	Provided continuously to each worker
T6:	The number of training sessions is rational
F3: Safety Support System	
S1:	Concerned about any occupational hazard issues (dust, chemicals, noise, electricity, ergonomics and work stress)
S2:	Concerned about any social hazard issues (racial discrimination, sexual harassment and bullying)
S3:	Provides all self-protection equipment
S4:	Emphasize workspace that is away from high heat
S5:	Perfectly ventilated workspace
S6:	The top management is concerned about cleanliness in the workplace
F4: Safety Value	
V1:	Take into account safety issues in each productivity schedule
V2:	Take into account safety issues with regards to worker promotion
V3:	Take into account safety issues while productivity schedule is delayed
V4:	Do not allow workers to take safety risks during tight production schedules
V5:	Ensure a sufficient labor force for any operation

Efforts to develop a positive safety climate in the rail transport system are necessary to reduce the risk of incidents and accidents. Issues related to safety climate in international rail transport systems such as the study by Glendon and Evans [12], Morrow et al. [48], Etheridge [13] as well as Curcuruto et al. [49] have been reviewed. It can be identified that the majority of studies are not comprehensive; often, the dimensions of safety climate discussed separately and are inconsistent, and most of them depend on their own respective importance. For example, a study by Glendon and Evans [12] in the Australian transport system articulated the dimensions of “communication and safety information”, “work scheduling”, “maintenance tools”, and “management commitment to safety”. Etheridge [13] linked safety climate with working period and job satisfaction and had highlighted 11 safety climate items without specific dimensions. The study conducted is also unique in nature that is not focused on organizational constructs as the basis for the selection of safety climate dimensions. Malaysia is a developing country and of course the beliefs, attitudes, and perceptions of workers are different from other developed countries [50,51]. Although there is already an index of safety climate assessment been proposed in Malaysia by Rahlin et al. [52], however, the main dimensions of safety climate that adapted to the work culture of an organization need to be studied and developed [53].

This study aims to propose a factor model of the organizational safety climate towards a better safety and health status for Malaysian urban rail industry. This study is the first study conducted to fill the constraints of previous studies by identifying the dimensions of organizational safety climate in urban rail transport systems in developing countries such as Malaysia. This effort is important as one of the methods to assess the level of organizational safety climate in the workplace and identify the real cause of the increase in the number of accidents in an organization thereby improving the safety level of workers within the organization [7,54].

2. Materials and Methods

2.1. Samples

The population and sample for this study is focused on the rail organizations' workers in areas of Greater KL/Klang Valley, Malaysia. The operation and maintenance divisions workers were selected randomly and a total of 441 workers were involved in this study. The sample size determination table by Krejcie and Morgan [55] were used because it is focused on large populations and their numbers are known at 95% confidence level, or $\alpha = 0.05$. In order to meet the need to build the SEM model (AMOS), the sample size decided in a study should represent the population and consider the number of study parameters. Wolf et al. [56] in their study found that the minimum requirement of 30 samples for simple CFA models, and up to 450 samples for mediator models.

This study uses a simple random sampling method based on the inclusion/exclusion criteria that has been decided before the study. The inclusion criteria for this study were gender and working hours. The number of men exceeds the number of women due to the number of female workers in the maintenance division is lower than the number of male workers, as the organizations offer low quotas for women in the maintenance section. This is because most maintenance activities are carried out at night and highly risky for female workers. In line with the study of Islam et al. [57], female workers experience a higher incidence than men in places of high risk, especially when assigned to work at night. The majority of workers work for a period of 8 or 9 h a day. This fact is not considered to affect the results of the study because the difference between the two is only one hour. The exclusion criteria for this study were workers who had had an accident. This is to avoid excessive emotional aspects that will later affect the results of the study. The simple random sampling method was chosen because the population of the organization is homogeneous. This method was chosen to ensure that each unit in the population had an equal chance of being selected as a sample [58]. This method also helps prevent inaccurate sample selection. This method is also one of the efforts to reduce the percentage of sampling errors as well as increase the validity of the sample because the distribution of sample size is made in a

balanced manner [56]. Therefore, this method is considered as the most suitable option to provide an overview to represent workers in the operations and maintenance division.

Sekaran [59] suggests that the number of samples for pilot study is 10% of the actual sample. A total of 100 people is needed to implement the minimum size EFA for a pilot study [58]. For this study, a total of 100 pilot study respondents is sufficient to represent a total of 441 actual sample sizes. A pilot study was distributed to workers in the operations and maintenance division of other transportation system operating organizations. According to Castello and Osborne [60], respondents for the pilot study should be selected from a population that has criteria that are not much different from the study respondents. The sample for this pilot study was selected based on the same characteristics as the population, but not taken into account in the actual sample volume.

The response rate for this study was 98%. Questionnaires were distributed to 450 with a return of 441 completed questionnaires. In order to obtain a perfect and unbiased study results, the distribution of questionnaires was done in collaboration with respective occupational safety and health officers by opening fair and equal opportunities to all workers in the operations and maintenance division who meet the requirements of inclusion/exclusion. To obtain a high response rate, the questionnaires were also distributed by the respective occupational safety and health officers to the workers during time break for a series of seminars organized by the organization. The questionnaire distributed is also equipped with a description of the research direction and a statement that all information and data obtained from the questionnaire would be personal and confidential. The names or identity card numbers of the respondents were not collected in the set of questionnaires.

The respondents of this study were 226 workers in the operation division (41.5% of the 544 staff population) and 215 maintenance division staff (43.3% of the 496 staff population). Based on Table 2, a total of 333 respondents are male and a total of 108 respondents are female. For the age of the respondents, 101 respondents were between 18 and 30 years old, 245 were 31–43 years old, 87 were 44–56 years old, and 8 were 57 years old and above. Therefore, a majority of the respondents are aged between 31 and 43 years.

Table 2. Demography of the respondents.

Demography Criteria	Demography Groups	Operation Division	Maintenance Division	Frequency (f)	Percentage (%)
Gender	Male	118	215	333	75.5
	Female	108	0	108	24.5
Age	18–30 years	51	50	101	22.9
	31–43 years	112	133	245	55.6
	44–56 years	57	30	87	19.7
	57 years and above	6	2	8	1.8
Job tenure	1–10 years	121	101	222	50.3
	11–20 years	114	105	219	49.7
Position status	Permanent	224	214	438	99.3
	Contractual	2	1	3	0.7
Working hours	8 h	41	11	52	11.8
	9 h and above	185	203	389	88.2

More than half of the respondents (50.3%) have served for 1 to 10 years and the others (49.7%) have served a period 11 to 20 years. A majority of the respondents (99.3%) have a permanent work status. The total number of working hours for most respondents (88.2%) was 9 h and above, compared to a few (11.8%) of the respondents working 8 h a day.

2.2. Measures

This study uses quantitative methods using questionnaire as the data collection instrument. The questionnaire is divided into two sections. Section A collects the demographic data of the respondents, whereas Section B consists of 24 items involving four dimensions of organizational safety climate, namely, safety communication, safety training, safety system, and safety value. The questionnaire measurement scales were developed based on literature

review. As shown in Table 1, 7 items represented safety communication, 6 items represented safety training, 6 items represented safety support system, and 5 items represented safety value. The questionnaire items were adapted from several sources and modified according to the suitability of the study. A literature review was conducted, and items were identified from the set of questionnaires from the published articles [4,17,21,23,29,48,49]. The total number of these items has been reduced to 24 following the redundancy screening process and coordinated with the objectives of the study. The 24 items have been translated to the Malay language (national language). The content and the face validity of the questionnaire items for this study were then evaluated by experts (faculty lecturers and OSH officers).

Interviews with experts about the items resulted in a minor wording modification. Likert scale from “1 = strongly disagree” to “5 = strongly agree” was used for each of the organizational safety climate items. A pilot study was conducted before the ground study and analyzed via Cronbach’s Alpha to ensure the reliability of each item. In principle, the Cronbach’s Alpha value ranges from 0.6 to 1, therefore the closer the coefficient to 1, thus the higher the reliability coefficient of the data [61–63]. In addition, the items referenced for this study were also evaluated with a value of >0.6 for Cronbach’s Alpha such as Cheng [4]. The test shows that the reliability value ranges from 0.745 to 0.844. The study showed an acceptable level of reliability (0.6 to 1.0) to continue the actual study.

2.3. Data Analysis

All reversed items were recoded before the analysis procedure. Exploratory Factor Analysis (EFA) by IBM SPSS Version 22 software was used in this study to identify the manageable sets of dimensions. Confirmatory Factor Analysis (CFA) by IBM SEM-AMOS Version 21 was then used to confirm the organizational safety climate dimensions derived from EFA.

3. Results

3.1. Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) aims at forming a non-linear combination that are uncorrelated with the latent variables [64]. This approach eliminates items that are not correlated and thus allows single constructs to be formed. The 24 items of the organizational safety climate were subjected to EFA using the PCA extraction method. EFA with varimax rotation was employed to identify the underlying factor structure [65]. Data validation was assessed by the skewness and kurtosis for each of the variables studied. According to Kline [66], the skewness value of each variable with a normal distribution should be between -1 and $+1$, whereas according to Hair et al. [67], the kurtosis value of each variable must be between -3 and $+3$. Positive values for skewness indicate positive divergence and vice versa. Positive values for kurtosis indicate high distribution curvature (leptokurtic form), while negative values indicate low distribution curvature (platykurtic form).

This study found that each variable has a normal distribution of data, with skewness values ranging from 1.00 to -0.01 and kurtosis values range from 1.25 to -0.04 . The skewness and kurtosis values in the range from $+3$ to -3 show normal scattering data that allow parametric tests to be performed [67]. Boxplot results for all variables also show that the data is normally distributed. Items are considered to measure the same aspect if the test results show similar correlation values between items. Thus, the Kaiser-Meyer-Olkin KMO test helps to identify the suitability of the items for factor analysis. The value of a KMO must be between the range of 0 to 1, whereby the recommended minimum value is 0.6 [67]. Items must be removed if the item has a KMO value below the 0.6 limit. Whereas the Bartlett of Sphericity test allows this study to determine whether the correlation values between items qualify for factor analysis, whereby the variable value for the Bartlett of Sphericity test was significant ($\chi^2 = 0.000, p < 0.05$). Eigenvalue greater than 1.0 was used in this research to determine the number of dimensions [64].

Table 3 shows the factor loadings, eigenvalues for each factors and percentage of factors’ variance. The factor loading cut off was fixed at 0.5. In total, 3 items (C5, S3, V2)

were removed and 21 items loaded on each of the factors at 0.5 or higher were selected. Four main dimensions, namely safety communication, safety training, safety system, and safety value with the total of 21 items were found to underlie organizational safety climate sets in the rail management system based on workers' responses. Factor 1, safety communication dimension, included 6 items with factor loading 0.752 to 0.671. Factor 2, safety training dimension, included 6 items with factor loading 0.822 to 0.640. Factor 3, safety support system, included 5 items with factor loading 0.714 to 0.610. While Factor 4, safety value, included 4 items with factor loading 0.835 to 0.617. The eigenvalues for each factor was greater than 1.0.

Table 3. Results of EFA for organizational safety climate dimensions.

Item	Factor				KMO	Bartlett's Test of Sphericity		
	F1	F2	F3	F4		Approx. Chi-Square	Df	p-Value
F1: Safety Communication								
C3	0.752	0.002	0.213	0.124	0.870	1613.637	55	0.000
C2	0.741	0.382	0.349	0.324				
C6	0.731	0.149	0.112	0.332				
C4	0.728	−0.338	−0.231	0.321				
C1	0.712	0.212	0.228	−0.221				
C7	0.671	0.112	0.115	0.421				
F2: Safety Training								
T1	0.378	0.882	0.435	0.212	0.877	1993.139	55	0.000
T2	0.452	0.732	−0.212	0.112				
T6	0.002	0.701	0.332	0.456				
T4	−0.134	0.675	0.112	0.278				
T3	0.321	0.671	0.367	0.289				
T5	0.223	0.640	−0.112	0.008				
F3: Safety Support System								
S4	−0.211	0.490	0.714	−0.123	0.818	2218.493	66	0.000
S2	0.004	0.210	0.631	0.213				
S5	0.112	−0.212	0.613	0.128				
S1	0.342	0.223	0.612	−0.321				
S6	−0.213	0.012	0.610	0.336				
F4: Safety Value								
V5	0.212	0.234	−0.042	0.835	0.807	1701.506	55	0.000
V4	0.432	0.114	0.115	0.742				
V1	−0.345	0.223	0.223	0.681				
V3	0.213	0.432	0.112	0.617				
Eigenvalues	6.245	1.858	2.156	1.672				
Total	3.211	2.823	2.712	2.433				
Percentage variance	31.876	9.764	8.783	7.439				
Cumulative variance	31.876	41.640	50.423	57.862				
Cronbach's alpha coefficient	0.801	0.912	0.812	0.876				

3.2. Empirically Tested CFA Model (Measurement Model)

Confirmatory factor analysis (CFA) was performed to verify the validity of the data collected with the hypothesized model in predicting the composition of the formed factors. CFA was employed for three major purpose, which are to test for model fit, convergent validity and construct reliability. The level of model fit for this study depends on the Absolute Fit (Root Mean Square of Error Approximation—RMSEA, <0.08, GFI/AGFI > 0.90), Incremental Fit (CFI/TLI/NFI > 0.90), and Parsimonious Fit (ChiSquare/Degrees of Freedom—ChiSq/df, <5.0) [46–48]. The model's convergent validity was tested by factor loading (positive, >0.50, not more than 1.0) and Average Variance Extracted (AVE) ≥ 0.5 [67–70]. Instrument with Construct Reliability (CR) > 0.70 is considered reliable [70].

Items that do not meet the factor loading requirement had been firstly terminated. In addition, Modification Indices (MI) values was referred to identify the potential item to be deleted or correlated as support in the process of determining model compatibility [70]. In this study, two items (C6 and T6) that are lower than 0.50 factor loading has been deleted. Table 4 shows the comparison between CFA base and fitted model of this study. CFI, TLI and NFI are each in the Incremental Fit category. This study further takes into account the CFI value for the Incremental Fit category. This is based on the recommendations of Hair et al. [67] who stated that CFI is not very sensitive to model composition. The value of the CFI index received is above 0.90.

Table 4. Confirmatory factor analysis (CFA) base and fitted model.

Categories	Fit Index	Recommended Value	Base Model	Fitted Model
Absolute Fit	RMSEA (Root Mean Square of Error Approximation)	<0.08	0.09	0.07
	GFI (Goodness of Fit Index)	>0.90	0.85	0.92
	AGFI (Adjusted Goodness of Fit)	>0.90	0.89	0.91
Incremental Fit	CFI (Comparative Fit Index)	>0.90	0.90	0.98
	TLI (Tucker–Lewis Index)	>0.90	0.81	0.88
	NFI (Normed Fit Index)	>0.90	0.81	0.89
Parsimonious Fit	ChiSq/df (ChiSquare/Degrees of Freedom)	<5.0	5.10	3.25

Referring to Figure 2, the standardized factor loading is between 0.80 to 0.94. Average Variance Extracted (AVE) represents the strength of items' relationship that are predicted to represent a single latent construct [67,69]. Table 5 shows that the AVE values exceeds 0.50 (0.63–0.86), meaning that this CFA model reached the convergent validity requirement. Meanwhile, the Composite Reliability (CR)'s result is between 0.93 to 0.97. Hence, all of the dimensions' considered reliability (CR > 0.70) are as recommended by Hair [70].



Figure 2. Organizational safety climate final model.

Table 5. Model fit validity and reliability.

Item	Standardized Factor Loading (λ)	Squared Factor Loading (λ^2)	Measurement Error (δ)	Average Variance Extracted (AVE)	Composite Reliability (CR)
Safety Communication					
C1	0.92	0.85	0.15	0.63	0.95
C2	0.90	0.82	0.18		
C3	0.91	0.82	0.18		
C4	0.90	0.80	0.20		
C7	0.82	0.67	0.33		
Safety Training					
T1	0.94	0.88	0.12	0.80	0.95
T2	0.94	0.89	0.11		
T3	0.80	0.65	0.35		
T4	0.89	0.79	0.21		
T5	0.89	0.79	0.21		
Safety Support System					
S1	0.93	0.87	0.13	0.86	0.97
S2	0.92	0.85	0.15		
S4	0.94	0.88	0.12		
S5	0.93	0.87	0.13		
S6	0.92	0.85	0.15		
Safety Value					
V1	0.91	0.82	0.18	0.78	0.93
V3	0.85	0.72	0.28		
V4	0.89	0.79	0.21		
V5	0.88	0.78	0.22		

Through the measurement model, the discriminant validity value had been tested. Discriminant validity refers to the extent in which a construct is truly distinct from other constructs [69]. Discriminant validity had been assessed thru two methods, which are correlation coefficient condition and comparison between AVE for two constructs against their squared correlation (r^2). The analysis result (Table 6) shows that correlation coefficient is between (0.47 and 0.52), which shows adequate discriminant validity ($r \leq 0.90$) according to Fornell and Larcker [71] and Hair [70]. In addition, each of construct AVE of this research is greater than their squared correlation ($AVE > r^2$), which meets the requirement of discriminant validity [72].

Table 6. Average Variance Extracted (on the diagonal) and squared correlation (on the off-diagonal) between constructs.

Latent Variable	(1)	(2)	(3)	(4)
Safety Communication (1)	0.63			
Safety Training (2)	0.52	0.80		
Safety Support System (3)	0.49	0.42	0.86	
Safety Value (4)	0.50	0.51	0.47	0.78

4. Discussion

Figure 2 shows that all dimensions, which are safety communication ($\beta = 0.85$), safety training ($\beta = 0.73$), safety support systems ($\beta = 0.81$), and safety values ($\beta = 0.84$) significantly positively shaped the organizational safety climate construct. Meanwhile, the values for the standardized regression coefficient ranged from 0.57 to 0.96, proving that all observed variables are significant representing each dimension.

An organization that cares for the safety and welfare of the workers enables the workers to obey and respect every direction of the organization [22]. The findings from the

model development proved that “safety communication” is the most important dimension. Aspects of safety communication that need to be focused on are the existence of space to discuss, complain and exchange ideas; worker involvement in the decision-making process; attention to every safety idea from workers; and efficiency in conveying the latest information to workers. Positive communication is important for minimizing potential conflicts of workers by encouraging the sharing of ideas and goals [25,26,31]. In addition, positive communication will increase worker confidence [17] and encourage cooperation between workers and employers [31]. This in turn can maximize the level of compliance and participation of workers, especially in the issue of occupational safety and health, as suggested by Griffin and Neal [23] and Jiang et al. [21].

The second most important dimension was safety value. The findings of this study are in line with Brondino et al. [17], which demonstrates the importance of organizational concern over safety issues in production scheduling. Kines et al. [29] in their study also demonstrated the importance of exhibiting the best safety value to enhance the safety awareness of individual workers. Aspects of safety values that need to be considered are the responsibility of the organization towards safety issues in the productivity scheduling process and during productivity delays; consideration over workers’ safety risks during tight productivity schedule; and ensure a sufficient labor force for any operation. Productivity scheduling that does not address worker safety issues will increase accidents risk [14,35,36]. Nordlöf et al. [46] and Wu et al. 2019 [37] stated that the management needs workers who work safely as well as productively. Therefore, it is important for the organization to balance between workforce capacity, time allocation, and productivity targets.

This study found that safety support system also effects the organizational safety climate. In line with the study of Fernández-Muñiz et al. [1] and Antonsen et al. [27], a well-designed workspace enhances the understanding, motivation, and commitment among workers, which in turn helps to reduce the number of accidents. The study of Mearns et al. [24], Sjöberg et al. [73] as well as Juhari and Arifin [74] proved that workers who feel a high risk of hazards in the workplace are prone to accidents, incidents and near-fatal accidents. The organization of the urban rail transport system needs to be aware of safety and social risks in each workspace; concern with lighting, ventilation issues and away from high heat; and improve the cleanliness and tidiness of each workspace. Safety training is another dimension affecting the organizational safety climate quality. The findings of the study support the theoretical model of Griffin and Neal [23] and Brondino et al. [17], which proved that safety training has an impact on workers’ safety performance. More precisely, safety training is able to change workers’ attitudes and behaviors [34]. Brondino et al. [17], Jiang et al. [21] and Vinodkumar and Bhasi [18] recommended that safety training need to be comprehensive, complete and repeatable. This study proved that among the aspects that need to be considered is to increase the involvement of all workers in safety training; organize it especially in the presence of new procedures and equipment; provide periodically and continuously safety training to each worker.

The CFA measurement results confirm that all dimensions, namely safety communication, safety training, safety support system, and safety value affect the organizational safety climate for the urban rail transport industry in Malaysia. In line with the Occupational Safety and Health Act (Act 514) 1994 and the Railways Act (Act 463) 1991, the increase in OSH levels in this industry can be achieved by paying close attention to the level of “OSH operation” on the “F2: Safety Training” dimension with five important aspects, which are “T1: Targeted to all workers involved in a project; T2: adequate training is recommended when new safety procedures are introduced; T3: adequate training is organised when any new equipment is introduced; T4: Provided periodically to each worker; and T5: Provided continuously to each worker”. However, the focus should also be on the other three dimensions namely safety support system, safety value and safety communication.

The findings of this study contribute to the literature, especially for the development of the concept of safety climate. The results of the study examine the multi-level theory of safety climate focused on organizational figures. The dimensions of communication,

safety training, safety support systems, and safety values are proven in this study to affect the safety climate of the organization, especially in the urban rail transport system in Malaysia. The findings of this study are very helpful to future researchers not only in terms of conceptual theory, but also in terms of study design, questionnaire, and research methodology for further studies.

The findings of this study also help urban rail transport organizations to be more focused in evaluating and improving the management of occupational safety and health in the workplace. This study is also able to increase the knowledge and understanding of the management of rail transport systems related to the importance of efforts to improve the safety climate among workers. The organization's concern in improving the quality of occupational safety and health management through the aspects of the findings of this study will later benefit the workers. Workers will feel more valued and more motivated to complete each task. The findings of this study are also beneficial for workers to increase awareness related to the importance of the concept of safety climate in occupational safety and health management for an organization. The findings of the study can also provide insights and ideas to the national rail transport management to strengthen occupational safety and health legislation, especially in the urban rail transport system. Workers well-being through a better occupational safety and health practice will improve national sustainability.

This study has several strengths. Firstly, this study used quantitative techniques using questionnaires. According to Marican [75], this method is suitable to be used to obtain information related to the perception, behavior, and awareness of individuals widely from a large group. Therefore, this method can be used to get an accurate explanation of the characteristics of the aspects to be studied in a community. Second, this study focuses on the perspectives of the most vulnerable workers at workplace, namely workers in the operations department (control center, train operations and station operations sub-division) and workers in the maintenance department (network management, power supply, communications and signals, as well as rolling stock sub-division). The three applications of the concept of safety climate in this context help in assessing the strengths and weaknesses of the focused figure of the organization. However, this study also has a few shortcomings. First, the study respondents consisted of only the workers in the operations and maintenance divisions, which were randomly selected from the operating organization of selected urban rail transport systems. In addition, the organization of the selected city rail transport system operators must meet a number of criteria and were not randomly selected. The results of this study are also entirely dependent on the perception of workers on the handling of safety and occupational health aspects in their organization only, and not comprehensive on all operating organizations. The study does not take into account the criteria of specific workplace conditions as well as the tasks variation of each individual. Third, this study only applies to urban rail transport systems excluding rural transport systems.

5. Conclusions

The rail transport industry contributes to the country's economic development and sustainability, whereby the rail transport system connects the distances between cities and rural areas. However, safety and health issues especially for workers need to be taken care of. This is to reduce the risk of accidents among workers and thus increase the confidence of workers and the public in the operation and the quality of service of the organization. Positive organizational safety climate enables an improvement in the worker safety performance.

The findings of this study prove that the organizational safety climate factor model developed is validated using CFA test, whereby it involves the dimensions of safety communication, safety training, safety support system, and safety value. The findings of this study can be used as a checklist of safety management practices in an organization to evaluate the organizational safety climate in the workplace. The findings can also

be used by organizations interested in comparing each organization, especially those involved in rail transport system operations and identifying deficiencies in safety and health management.

This research however has limitations. The questionnaire was only distributed randomly among workers in the operations division and workers in the maintenance division of the Malaysian rail transport industry. The results of this research therefore are depending on the respondents' views on occupational safety and health management in the organization. The results of this study are specific to the urban rail transport system organization. However, this model can be used as a guide to other organizations in identifying the quality of organizational safety climate aimed to improve the safety performance of rail transport industry.

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