International Journal of Advanced Culture Technology Vol.10 No.4 444-452 (2022)
DOI https://doi.org/10.17703/IJACT.2022.10.4.444

IJACT 22-12-53

Decomposing Relationship between Safety Climate, Safety Perception, and Safety Behavior in Airline Industry

[1]Gyulee Kim

[1]Ph.D student, Department of Tourism Management, Kyonggi University, Korea
gyulee87@gmail.com

Abstract

This research aims to investigate the relationship between safety climate and safety perception and safety behavior. Safety perception of the relationship is considered to have a mediating effect. Previous literature has tended to regard safety perception as an independent variable at the same level as the safety climate, which can be said to depend on behavioralism to approach the causal relationship to an one-way perspective. The survey was administrated through full- service carries in Korea such as Korean Air and Asiana Airlines, and low-cost carriers such as JeJu air, Jin air, and Air Pusan. It can identify a mediator of safety perception between safety climate and safety behavior. There are significant indirect effects of each value, which means mediators values of safety perception of safety climate variables and safety behavior. The study highlights that airlines should focus on the importance of their psychological aspects to strengthen the safety behavior of flight attendants and the value of organizational efforts to mature safety perceptions, suggesting some implications of theoretical and practical aspects.

Keywords: *Safety Climate, Safety perception, Safety Behavior, Airline Industry*

1. INTRODUCTION

There have been 14 aircraft accidents, with deaths, across the world in the past five years since 2017. The Federal Aviation Administration and the European Union, including the International Civil Aviation Organization, announced that there are 37 countries with higher-level aviation accidents in which there are six airlines from Korea. In addition, Korean airlines have 47 aircraft with an aircraft lifespan of over 20 years, accounting for 12.9% of the total number of domestic airplanes. By airlines, Korean Air has 25, Asiana 16, and Jin Air and Air Incheon 3 each [1]. As the number of national airlines has increased significantly, with the successive launch of domestic LCCs, it is estimated that the possibility of safety accidents has got early 80 percent of air accidents occur right just before, immediately after, or during landing and takeoff. For the period from the 1950s to early 2006, 1,843 aviation accidents occurred due to the following causes: 53 percent of pilot negligence, 21 percent of mechanical defects, 11 percent of bad weather, 8 percent of other human errors (such as aircraft control mistakes, overloading of aircraft, fuel contamination, communication problems), 6 percent of intentional accident (such as hijacking, explosives accident, shooting down), and 1 percent of other reasons [2]. It can say that about 61% are related to human factors, including pilot mistakes as vital factors involved in accidents.

Manuscript received: October 31, 2022 / revised: November 25, 2022 / accepted: December 3, 2022
Corresponding Author: gyulee87@gmail.com
Tel: +82-53-850-1263, Fax: +82-53-850-1400
Ph D student, Department of Tourism Management, Kyonggi University, Korea

Aircraft accidents can cause a disaster with the deaths of all passengers. For this fact, all airlines in the world must establish and improve steadily strict security. Domestic airlines are positively taking action to build trust in airline safety operations for their passengers, performing special training programs for safety periodically. Airlines expect that these programs will let airlines' risks associated with the safe operation of aircraft be lower and even be zero. Most importantly, airlines should build a climate of safety within their organizations to encourage employees, such as aviators and crews, to take action against risks or dangers related to aircraft through a well-organized perception of safety. In addition, employees such as flight attendants should take voluntary and active behaviors for safety. It will be hard to prevent aircraft accidents with a passive attitude to safety. To constantly to perform safety and security tasks, employees must have a belief in safety.

Despite the importance of aircraft safety, few empirical researches on employees' perception and behavior toward aircraft safety has been. There is little empirical research on how airline's safety climate encourages their employees' perception and behavior about safety toward the right direction, ultimately concentrating on voluntary behavior for safety, with their own-confirmed belief in safety. What does research reveal about the relationship between safety climate, safety perception, and safety behavior?

This research aims to investigate the relationship between safety climate and safety perception and safety behavior. Safety perception of the relationship is considered mediating effect. Previous literature has tended to regard safety perception as an independent variable at the same level as the safety climate, which can be said to depend on behavioralism to approach the causal relationship to an one-way perspective. This study tries to discuss the association with a psychological perspective, with a different approach that can present new findings to take a well-explained understanding of it. In other words, it is to verify the research hypothesis that safety perception has a mediating effect on the causal structure of the safety climate and safety behavior. This hypothesis is grounded in the proposition that the actor's psychological factors can influence human behavior. From the research results, this study aims to emphasize the importance of their psychological aspects to strengthen the safety behavior of flight attendants and the value of organizational efforts to mature safety perception.

2. THEORETICAL BACKGROUND

2.1 Safety Climate

Safety climate refers to a consensus among employees on safety-related management policies, implementation procedures, and business practices, which makes safety culture a fundamental value or expectation level in management, getting more visually predictable inside the organization [3]. Safety climate is a description of a particular type of organizational climate, referring to the climate for the safety of an industrial organization [4]. The safety climate is critical because it allows a consistent grasp of the nature of organizational management, either directly or indirectly, for large-scale accidents [5]. In addition, the safety climate of organizational aspects affecting safety outcomes is broadly defined in the organization as "a shared awareness of safety policies, procedures, and practices" [6]. There are a variety of perceptions that can constitute a safety climate. Three general areas of safety management include universal policy, formal procedure system, and work practices to promote safety in the workplace [7]. Many works come up with propensity, belief, risk perception, and work stressors as safety climate factors [8].

2.2 Safety Perception

Given the meaning of safety perception from a dictionary, safety perception is defined as pre-conscious state for objective behavior of people in an organization to maintain or secure being safe with the first interest in safety. To stay safe from danger begins awareness of a dangerous state, followed by taking actions to avoid it.

From the concept that perception is the process of being conscious of external objects or stimuli through the senses, safety perception means a prior perception of the possibility of danger or accident, stressing the distinction between perception and behavior of safety. Since the 1900s, the systematic approach to safety has begun with the perspective of behavioralist. The perception, value, and attitude of safety inherent in human instinct cause behavior to avoid risks or dangers, with the behavior affecting the individual's safety [9]. This approach came from one of the perspectives of realizing the truth that behaviorists focused on empirical analysis, not on internal consciousness or emotion, but on objective behavior found in the relationship between stimulation and reaction. Given the perspective of the psychological causes of accidents, however, the perception of safety can be distinguished from behavior. The fact that the primary cause of accidents is almost the absence of safety consciousness shows that perception is a leading factor, and behavior is a trailing factor in the circulation of accident occurrence and processing.

2.3 Safety Behavior

Safety Behavior is positive actions not to be harmed by risk factors, such as following safety procedures or participating in activities to prevent risks to their jobs. Safety behavior is classified into safety compliance and safety participation behaviors. First, safety compliance behavior means passive safety activities that comply with regulations and procedures within an organization to prevent accidents in advance. Safety participation behavior presents actions that are active to precaution safety accidents, with voluntary participation in various meetings or educational programs relating to safety [10]. Safety behavior is efforts to reduce safety accidents as much as possible by carrying out various preventive activities and establishing safety regulations or preparing various safety facilities. There are many elements that consist of and promote those efforts, including physical ones such as equipment and workplaces, legal ones such as procedures and regulations, human ones such as communication and preventive activities, and task performance ones such as workload and situational awareness [11,12]. There is an agreement that the frequency of safety accidents can be the most appropriate index to measure the performance of safety action. However, we face a limit on having to use a subjective awareness-based scale instead of quantitative indicators such as accident frequency because accident frequency is so lower that it should depend on only exponential distribution, and it is not sensitive to the treatment effect of independent variables [13]. It means that we have something hard in causal analysis on the determinants of safety behavior.

2.4 Previous Literature

It is not difficult to find the research results that there is a correlation between a safety climate and safety behavior [14, 15]. It can be said that the relationship between the safety climate and safety behavior is the most basic causal structure. Whatever the research area, building a desirable safety climate for industries has been suggested as the most common alternative, with the purpose of enhancing safety behavior. On the other hand, the relationship between the safety climate and safety perception has also been empirically verified in various industrial sites [16, 17], which emphasizes that the level of safety perception of employees depends on the safety climate promoted by industries, not specifically showing how safety perception affects safety behavior. After the studies on the relationship between safety perception and safety behavior [18, 19], it is generally said that employees' safety perception affects concern and attitude toward safety. Previous studies have explained the relationship between each variable in the approach of a one-way causal relationship between safety climate, safety perception, and safety behavior. Out of this perspective, research to investigate the existence of a mediating variable between the safety atmosphere and safety behavior can bring a new perspective on the relationship between them. Although Neal et al. (2000)'s study is out of the order of the relationship between

safety climate, safety perception, and safety behavior, it has enough value to investigate the relationship between safety climate and safety behavior with safety knowledge and motivation as mediating variables [20]. Based on the causal mechanism of previous studies discussed above, it can be said that the ground for investigating the mediating effect of safety perception in the causal structure between the safety climate and safety behavior is sufficient.

3. DATA AND STATISTICA METHOD

3.1 Data

The survey was administrated through full service carries in Korea such as Korean Air and Asiana Airlines, and low-cost carriers such as JeJu air, Jin Air, and Air Pusan. The survey measured the demographic characteristics of the respondents by questioning gender, age, educational achievement, service period, and position which is used as control variables in the research.

Table 1. Description of Survey Sample (N=239)

Gender	
Male	17.6%
Female	82.4%
Age	
20-29	51.3%
30-39	42.1%
40-49	5.6%
50-59	1.0%
Educational achievement	
Associate degree	42.7%
Bachelor's degree	47.4%
Postgraduate diploma	5.3%
Master's degree	4.6%
Position	
Flight attendant(AP, SS , SD)	68.9%
Purser(CP, SP, PS)	31.1%

3.2 Measures

Safety Climate. This study employs a mixed scale from two scales to measure safety climate, defining it as a consensus among flight crews on safety policy, procedures, and practices. Based on Bhavara et al. [16] and Mohamed et al. [17], this study modified the measurement items to make them appropriate for the conceptual definition, dividing the safety climate into empathy in safety policy, education for safety procedures, and safety practice. The items of empathy in safety policy are as follows: (1) taking an active interest in the causes of safety accidents, (2) making the whole effort to prevent safety accidents, (3) participating in safety-related tasks or activities, and (4) having a positive mind to safety-first principle. The items of education for safety procedures are as follows: (1) understanding something learned by safety training, (2) taking part in safety training, (3) applying principles from safety training to jobs, and (4) memorizing rules or principles of safety. The items of safety practice are as follows: (1) communicating with co-workers about safety in the whole process of flight, (2) confirming rules or principles of safety regularly, (3) keeping right behaviors by rules or

principles of safety, and (4) solving problems relating to safety by regulations. These items were measured on the same 5-point Likert-type scale.

Safety Perception. This study measures safety perception by using a mixed version of Carla et al. [21] and Gregory et al. [14], with the definition that safety perception means pre-conscious state for objective behavior of flight crews to maintain or secure being safe with the first interest in safety. The items of empathy in safety perception are as follows. (1) trying to be awaking of something dangerous in flight, (2) recalling how to prepare danger in case, (3) confirming safety compliance of fellow crews, (4) trying not to forget the importance of safety. These items were measured on the same 5-point Likert-type scale.

Safety Behavior. This study measures safety behavior by using the scales of Qinggui et al. [18], with a little bit of revision for validity of measurement, defining it as positive actions of flight crews not to be harmed by risk factors. The items of empathy in safety perception are as follows. (1) encouraging other crews to perform rules or principles of safety by regulations, (2) finding and solving the risk factors, (3) checking safety devices and equipment in flight regularly, (4) checking that all people in the cabin are following safety procedures constantly. These items were measured on the same 5-point Likert-type scale.

4. Analytical Results

4.1 Analyses of Factor and Reliability

A factor analysis was conducted to test for the assumed conceptual differentiation between the individual variables used to construct each scale (see Table 2). Many of the items used to construct these scales were based on previous work. As can be seen from Table 2, no overlap between the constructed scales is detected. Table 2 also shows Cronbach alpha reliability coefficients of all factors. As can be seen, the Cronbach alpha coefficients of each scale are reasonably reliable scales, with over 0.8.

Table 2. Results of Factor Analysis and Reliability Analysis

Items	Factors 1	2	3	4	5	Cronbach alpha
Safety Climate						
Empathy in Safety Policy						
Taking an active interest in the causes of safety accidents	.876					.858
Making the whole effort to prevent safety accidents	.890					
Participating in safety-related tasks or activities	.843					
Having a positive mind to safety-first principle	.839					
Education for Safety Procedures						
Understanding something learned by safety training		.798				.811
Taking part in safety training		.803				
Applying principles from safety training to jobs		.784				
Memorizing rules or principles of safety		.824				
Safety Practice						
Communicating with co-workers about safety in the whole process of flight			.799			.806
Confirming rules or principles of safety regularly			.801			
Keeping right behaviors by rules or principles of safety			.812			
Solving problems relating to safety by regulations			.797			

Safety Perception						
Trying to be awaking of something dangerous in flight				.899		
Recalling how to prepare danger in case				.875		
Confirming safety compliance of fellow crews				.877		.829
Trying not to forget the importance of safety				.802		
Safety Behavior						
Encouraging other crews to perform rules or principles of safety by regulations					.846	
Finding and solving the risk factors					.854	.886
Checking safety devices and equipment in flight regularly					.829	
Checking that all people in the cabin are following safety procedures constantly					.801	
Eigenvalues	4.65	1.57	1.12	7.95	3.13	
Explained Variance (%)	16.41	9.78	8.12	39.54	13.13	

4.2 Analysis of Structural Model

This work, first, employed a path analysis of structural model using ML (Maximum Likelihood) estimation to verify the structural equation model. Table 3 shows the analysis of the structural model. x^2 is sensitive to sample size and multivariate normality, so the work evaluates the fitness of model through various fit indices, like GFI (Good-Fit Index), RMSEA (Root Mean Square Error of Approximation), Absolute fit index, TLI (Tucker-Lewis Index) and CFI (Comparative Fit Index), as well as incremental fit index. As seen from Table 3, CFI value is determined for the representation of the parameters and distribution of the population, .981. GFI is unaffected by sample size and violations of multivariate normal, .981. NFI resulted in a better fit for structural equation modeling compared to the basic model, .975. TLI is .973, and RMSEA is .040. All values shows that the model is suited well to the data.

Table 3. Fitness of the Model

x^2	d.f.	CFI	GFI	NFI	TLI	RMSEA
199.465*	34	.981	.984	.975	.970	.040

*p<0.01

The study investigated the relationship between safety climate, safety perception and safety behavior in the context of airline industry by using structural model equation. From Figure 1, we can look at the statistical results of the relationship between them. First, empathy in safety policy, education for safety procedures, and safety practice as sub-constructs of safety climate are significantly related to safety behavior, with values of .167 ($p < .01$), .299 ($p < .01$), and .356 ($p < .01$), respectively. Second, empathy in safety policy, education for safety procedures, and safety practice significantly affect safety perception, with values of .334 ($p < .01$), .136 ($p < .01$), and .208 ($p < .01$), respectively. Last, safety perception has a positive influence on safety behavior, with a value of .216 ($p < .01$).

As seen from Table 4, we can identify a mediator of safety perception between safety climate and safety behavior. There were significant indirect effects with each value: .072, .029, and .044, mediator values of safety perception among safety climate variables and safety behavior. This means that empathy in safety policy, education for safety procedures, and safety practice have the indirect effects of a mediating variable, rather than direct effects on safety behavior.

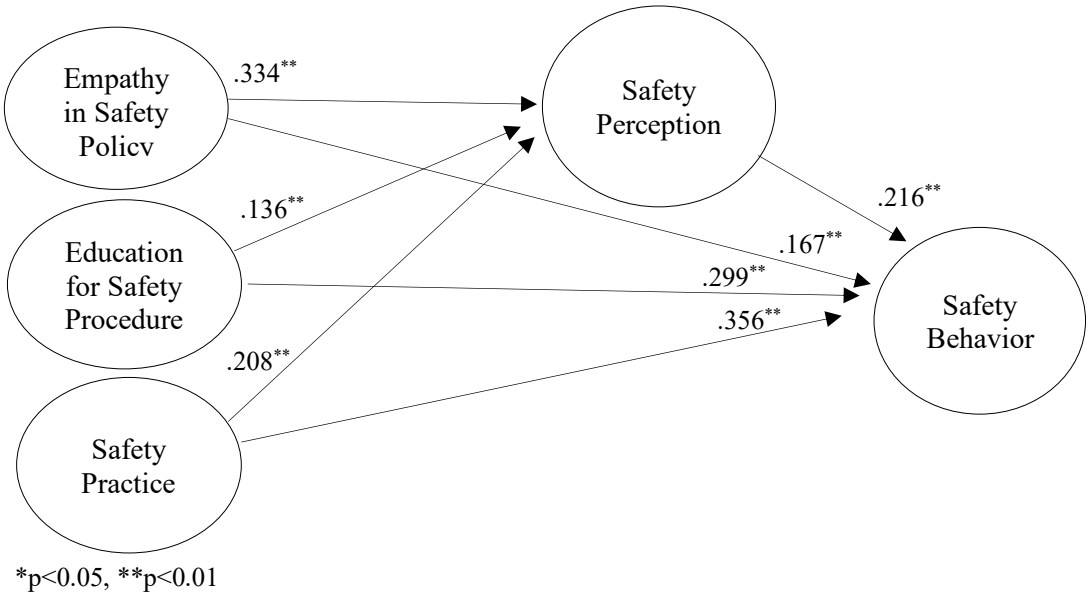

Figure 1. Standard Regression Weight between Latent Variable

Table 4. Total, Direct, and Indirect Effects of Structural Model

Latent Variables			Direct Effects	Indirect Effects	Total Effects
Empathy in Safety Policy			.334		.334
Education for Safety Procedures	→ Safety Perception		.136		.136
Safety Practice			.208		.208
Empathy in Safety Policy			.167		.167
Education for Safety Procedures	→ Safety Behavior		.299		.299
Safety Practice			.356		.356
Safety Perception	→ Safety Behavior		.216		.216
Empathy in Safety Policy				.072	
Education for Safety Procedures	→ Safety Perception	→ Safety Behavior		.029	
Safety Practice				.044	

Table 5. Analysis of Mediator of Safety Perception

Path	Parameter Model	x^2 (d.f.)	$\Delta x^2(\Delta d.f.)$
Empathy in Safety Policy → Safety perception → Safety Behavior	Full	41.538(7)	5.348(1)
	Partial	36.190(6)	
Education for Safety Procedures → Safety perception → Safety Behavior	Full	76.345(12)	2.122(1)
	Partial	74.223(11)	
Safety Practice → Safety perception → Safety Behavior	Full	43.439(7)	4.472(1)
	Partial	38.967(6)	

From Table 5, we can see that safety perception shows the influence of partial mediators among empathy in safety policy, education for safety procedures, and safety practice as sub-constructs of safety climate and safety behavior. By modeling the indirect mediating effect of safety perception, this work gains a better description of the phenomena, more so than with the model of direct influence.

5. CONCLUSION

The study is to empirically examine the relationship between safety climate and safety perception as a mediating effect and safety behavior in the airline industry and emphasize the importance of the safety perception of crews to strengthen safety behavior by verifying the mediating effect of safety perception.

As a result of the analysis, it is found that safety perception has a mediating effect. The work can identify a mediator of safety perception between safety climate and safety behavior. There are significant indirect effects with each value which means mediator values of safety perception among safety climate variables and safety behavior. In the study, safety climate consists of three factors: empathy in safety policy, education for safety procedures, and safety practice. These have the indirect effects of a mediating variable, rather than direct effects on safety behavior. From the analytical results, the work highlights that airlines should focus on the importance of their psychological aspects to strengthen the safety behavior of flight attendants and the value of organizational efforts to mature safety perception.

The implications of this study have theoretical and practical aspects. For theoretical implication, the work contributes to expanding the applicability of safety climate as a concept. Previous studies on safety climate have mainly focused on industrial sites such as construction and machinery. There may be errors in the discrimination and composition validity in applying the concept of safety climate directly to the airline industry. To enhance its applicability to the airline industry, safety climate consists of three factors: safety in safety policy, education for safety procedures, and safety practice by redefining the concept of safety climate. As a result of empirical verification through factor analysis and reliability analysis, safety climate can be composed of empathy in safety policy, education for safety procedures, and safety practice with high validity. In addition, a psychological factor such as safety perception can mediate the relationship between a physical factor such as safety climate and a behavioral factor such as safety behavior, which means that we should first stimulate the actor's psychological motivation and satisfaction to induce behavior in a certain direction. In terms of practical implications, this study emphasizes that airlines should take measures to strengthen the safety perception of the crews to prevent safety accidents in the airline industry. Airlines should provide both psychological needs and physical incentives such as rewards to encourage cabin crews to voluntarily recognize the risk situation on board, developing a working system for stimulating and enhancing safety perception in the overall jobs of the flight attendants.

This study made up for previous works related to safety in the airline industry and redefined these concepts with the characteristics of the airline industry. However, this study is still exploratory research like existing literature, reiterating follow-up work to accurately define the concepts of safety climate, safety perception, and safety behavior through understanding the characteristics of the airline industry.

REFERENCES

[1] https://www.ktv.go.kr/content/view?content_id=645774
[2] https://ko.wikipedia.org/wiki/%ED%95%AD%EA%B3%B5_%EC%82%AC%EA%B3%A0
[3] H. J. Rue, *A Study on the Effects of Safety Climate and Safety Consciousness level in Construction site on Workers' Safety Behaviors*, Seoul National University of Science and Technology University Graduate School, Master's thesis, 2016.
[4] D. Zohar, Safety Climate in Industrial Organizations: Theoretical and Applied Implications, *Journal of Applied Psychology*, Vol. 65, No. 1, pp. 96-102, 1980. doi:org/10.1037/0021-9010.65.1.96

[5] M. A. Griffin and M. M. Curcuruto, Safety Climate in Organizations, *Annual Review of Organizational Psychology and Organizational Behavior*, Vol. 3, No. 3, pp. 191-212, 2016. doi:org/10.1146/annurev-orgpsych-041015-062414
[6] D. Zohar, *Safety Climate: Conceptual and Measurement Issues*, In D. Hofmann and L. Tetrick (Eds.), The Handbook of Occupational Health Psychology, Washington, DC: American Psychological Association, 2011.
[7] M. A. Griffin and A. Neal, Perceptions of Safety at Work: A Framework for Linking Safety Climate to Safety Performance, Knowledge, and Motivation, *Journal of Occupational Health Psychology*, Vol. 5, No. 3, pp. 347-358, 2000. doi:10.1037//1076-8998.5.3.347
[8] F. W. Guldenmund, The Nature of Safety Culture: A Review of Theory and Research, *Safety Science*, Vol. 34, No. 1, pp. 215-257, 2000. doi:10.1016/S0925-7535(00)00014-X
[9] M. Guarnieri, Landmarks in History of Safety, *Journal of Safety Research*, Vol. 23, No. 2, pp. 151-158, 1992. doi.org/10.1016/0022-4375(92)90018-5
[10] A. Neal & M. Griffin, Safety Climate and Safety Behaviour, *Australian Journal of Management*, Vol. 27, No. 1, pp. 67-75, 2002. doi:10.1177/031289620202701S08
[11] T. N. Garavan and F. O′Brien, An Investigation into The Relationship Between Safety Climate and Safety Behaviors in Irish Organizations, *Irish Journal of Management*, Vol. 22, No. 1, pp. 141-170, 2001.
[12] P. O′Connor, A. O′Dea, Q. Kennedy, & S. E. Buttrey, Measuring Safety Climate in *Aviation*: A Review and Recommendations for the Future, *Safety Science*, Vol. 49, No. 2, pp. 128-138, 2011. doi:10.1016/j.ssci.2010.10.001
[13] D. Zohar, A Group-level Model of Safety Climate: Testing the Effect of Group Climate on Micro-Accidents in Manufacturing Job, *Journal of Applied Psychology*, Vol. 85, No. 4, pp. 587-596, 2000. doi:10.1037/0021-9010.85.4.587
[14] E. P. Gregory, P. W. Geoffrey, and R. E. Madhu, Influences on Safety Consciousness in a Utility Company: A Sequential Mediation Model, Journal of Safety Research, Vol. 68, No. 11, pp. 119-129, 2019. doi:10.1016/j.jsr.2018.12.002
[15] O. K. Haji, B. M. Seyyed, M. M. Eesa, and S. T. Mahmood, The Relationship between Safety Culture and Safety Climate and Safety Performance: A Systematic Review*, Journal of Occupational Safety and Ergonomics*, Vol. 10, No. 12, pp. 24-49, 2019. doi:org/10.1080/10803548.2018.1556976
[16] P. E. Bhavana, A. E. Albert, Y. T. Patil and A. J. Bayati, Impact of Safety Climate on Hazard Recognition and Safety Risk Perception, *Journal of Safety Science*, Vol. 113, No. 2, pp. 44-53, 2019. doi:10.1016/j.ssci.2018.11.020
[17] A. A. Mohamed, M. O. Khalid, R. D. Icon, and S. R. Balan, Modeling the Impact of Safety Climate on Process Safety in a Modern Process Industry: The Case of the UAE's Oil-refining Industry"*, Journal of Cogent Business & Management*, Vol. 6, No. 1, pp. 164-189, 2019. doi:org/10.1080/23311975.2019.1647591
[18] C. A. Qinggui, Y. E. KAi, Z. T. Lujie, W. C. Linlin, and L. Chunai, In-depth Research on Qualitative Simulation of Coal Miners' Group Safety Behaviors, *Journal of Safety Science*, Vol. 113, No. 1, pp. 210-232, 2019. doi:org/10.1016/j.ssci.2018.11.012
[19] C. M. Xiang, H. Y. Zhai and H. S. Alan, Development of Scales to Measure and Analyse the Relationship of Safety Consciousness and Safety Citizenship Behaviour of Construction Workers: An Empirical Study in China, *Journal of Environmental Research and Public Health*, Vol. 16, No. 8, pp. 1141-1165, 2019. doi:10.3390/ijerph16081411
[20] A. Neal, M. A. Griffin, and P. M. Hart, The Impact of Organizational Climate on Safety Climate and Individual Behavior, *Safety Science*, Vol. 34, No. 1-3, pp. 99-109, 2000. doi:org/10.1016/S0925-7535(00)00008-4
[21] S. F. Carla, A. S. Silvia, and L. M. Jose, Another Look at Safety Climate and Safety Behavior: Deepening the Cognitive and Social Mediator Mechanisms, *Journal of Accident Analysis & Prevention*, Vol. 45, No. 8, pp. 468-477, 2012. doi:10.1016/j.aap.2011.08.013