

Relationship between Employees' Characteristics and Occupational Safety Climate in Phosphoric Acid Industry

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ABSTRACT

Introduction: The Indonesian government has issued, through the Ministry of Manpower, an announcement that occupational health and safety is the creation of a conducive employment climate. This research aims to determine the relationship between characteristics of employees (age, education level, and job title or position) and work safety climate in the Phosphoric Acid Industry. **Method:** This research is an observational study with quantitative method. The population of this research is the employees of the phosphoric acid plant in the Phosphoric Acid Industry, totaling 44 people and total sampling technique as the sampling method. The researchers used the Pearson Spearman correlation test. **Result:** All dimensions of occupational safety have a weak correlation with the age of employees. Several dimensions have negative correlations with age like dimension of employees' occupational safety priority and unacceptable risks, dimension of employees' occupational safety commitment, dimensions of priority and occupational safety management capability. All dimensions of occupational safety climate have a positive correlation with the level of education. Dimension of trust toward the organization, dimensions of priority, and occupational safety management capability; dimension of occupational safety empowerment have moderate correlations with education level. Most dimensions of occupational safety climate have a negative correlation with the job positions. There is one dimension that is positively correlated with the job position, namely the dimension of trust toward the organization. **Conclusion:** The results of the study found that there was no strong relationship between employee characteristics (age, education level, position) with the dimensions of work safety climate.

Keywords: age, education level, job position, safety climate

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INTRODUCTION

Generally, every type of job is always accompanied by the risks of work accidents. According to the report published by International Labor Organization (ILO), 2.78 million cases of work accidents and 380.000 cases of work-accidents-related occupational diseases (13.7%) occur every year (Hämäläinen, Takala and Kia, 2017). Based on the data reported by BPJS Ketenagakerjaan (Indonesian social security provider), 153,044 work accident cases occurred in 2020, which was slightly decreased from the previous year (155,327 cases).

In order to reduce the number of occupational diseases and work accidents, the Indonesian

government issued Medium-Term Development Plan (RPJM) that is stipulated in the Regulation of Indonesian Ministry of Manpower No. 20 of 2020, and one of the policies issued by the Ministry of Manpower concerning occupational health and safety is the creation of a conducive employment climate. This employment climate can be achieved through the improvement of occupational health and safety rules and norms in the workplace. Occupational health and safety norms can be realized through the increase of employees' compliance to these rules and norms. Safety climate has relationships with safety participation (Saedia, Majida and Isa, 2019). A positive safety climate can lead to improvements in hazard recognition performance (Pandit *et al.*, 2019).

The occupational safety climate is the integrated pattern and procedure that should be thoroughly

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implemented by the company in its every work process. According to the theory proposed by Kines *et al.* (2011), the occupational safety climate can be divided into seven dimensions: priority and occupational safety management capability; employees occupational safety commitment; learning processes, communication on occupational safety, and innovation; occupational safety fairness; trust toward the organization; occupational safety priority and unacceptable risks; and occupational safety empowerment.

Neal and Griffin (2006) suggested that the occupational safety climate could be influenced by individual and environmental factors. A correlation between individual characteristics and occupational safety climate had also been conducted (Muslima, 2017). Based on the result of research conducted by Silvia, Ihsan and Rizky (2020), the characteristics of the respondents could affect the value of occupational safety climate in the Phosphoric Acid Industry in Padang Municipality. Research conducted by Baby, Madhu and Renjith (2021) in Kerala, India, involved 3017 electrical employees as the research subjects and showed that age, job role, education, and experience had a significant impact on the electrical workers' safety behavior.

Phosphoric Acid Industry is one of the major inorganic chemical factories in Indonesia. According to reports, the phosphoric acid production capacity reaches 200,000 Metric Tons Per Year (MTPY) annually. However, in 2019-2020, there was a significant gap between production targets and production achievement, which was influenced by the occupational safety climate factor. At the phosphoric acid plant in the Phosphoric Acid Industry, work accidents occur due to unsafe actions such as workers not wearing safety helmets, slippery floors, rusty buildings, etc. Work accidents that occur have an impact on delays in the production process. The supervision process on K3 in the Phosphoric Acid Industry is carried out by three employees of the Environment Health Safety (EHS) division, and this lack of staff is believed to contribute to the lack of supervision of employees. Each worker or employee and plant leader has responsibility for occupational health and safety. Based on this research background, the researchers were interested to determine the relationship between the characteristics of employees and the occupational safety climate at the phosphoric acid plant in the Phosphoric Acid Industry.

METHOD

In May 2021, the Ethics Commission of Faculty of Dentistry, University of Airlangga permitted the researchers to conduct the research with the approval number 240/HRECC.FODM/V/2021. This study is observational research with quantitative methods. Based on the time of sampling, this research can be categorized as cross-sectional research, which is conducted at one time period. This research was conducted at the Phosphoric Acid Industry in May 2021. This research involved 44 employees of phosphoric acid plants in the Phosphoric Acid Industry. And to equate the number of samples with the total number of population ($n = 44$), the researchers used the total population technique as the sampling method. The population of this research consists of 32 operators, eight foremen, and four superintendents.

This research consists of two variables: independent and dependent. This research's dependent variable is occupational safety climate while its independent variable is the characteristics of employees, which include age, education level, and job position. The researchers used a questionnaire as the instrument of this research. The occupational safety climate variable was measured by using the Nordic Safety Climate Questionnaire-50 (NOSACQ-50), which had been tested for its validity and reliability. The occupational climate variable consists of seven dimensions, in which every dimension was measured by four levels of score: namely good (score > 3.30), fairly good (score 3.00-3.30), quite poor (score 2.70-2.99), and poor (score < 2.70). The researchers also used a questionnaire to measure the employees' characteristics variable. Employee's age was categorized into five groups: late adolescence (17-25 years), early adulthood (26-35 years), late adulthood (36-45 years), early elderly (46-55 years), and late elderly (56-55 years). Based on the initial study, the level of education was divided into two: employees with high school and undergraduate diplomas, while job positions were divided into three groups: operator, foreman, and superintendent.

The collected data have been statistically tested by using the Pearson-Spearman correlation test through the utilization of the Statistical Package for the Social Sciences (SPSS) ver. 25.0. The researchers chose the Spearman correlation test to determine the significance level and direction of the relationship between the two variables. The significance level of

correlation would be considered weak if the value of the correlation coefficient is near zero, and if the correlation coefficient is closer to 0.5 and 1, then the significance level of correlation would be considered as moderate and strong, respectively. The direction of the relationship would be considered as unidirectional and controvert if the correlation coefficient is positive and negative, respectively.

RESULT

Characteristics of Employees of Phosphoric Acid Plant in Phosphoric Acid Industry

The employees' characteristics variable includes age, education level, and job position. In Table 1, the researchers show that 25 of 44 phosphoric acid plant employees (56.8%) are 26-35 years old. In terms of education level, 33 of 44 workers (75%) have high school diplomas. The research also shows that 32 of 44 workers have job positions as the operator (72.7%).

Occupational Safety Climate among Phosphoric Acid Plant Employees

Occasional safety climate variable consists of seven dimensions, which are the priority and the occupational safety management capability; commitment to occupational safety of employees; learning processes, occupational safety

Table 1. Frequency Distribution of the Phosphoric Acid Plant Employees' Characteristics in 2021

Variable	Frequency	Percentage
Age		
Late Adolescence (17-25 years old)	4	9.1
Early Adulthood (26-35 years old)	25	56.8
Late Adulthood (36-45 years old)	8	18.2
Early Elderly (56-55 years old)	7	15.9
Level of Education		
High School	33	75
Undergraduate	11	25
Job Position		
Foreman	8	18.2
Operator	32	72.7
Superintendent	4	9.1

communication and innovation; occupational safety fairness; trust toward the organization; workers occupational safety priority and unacceptable risks; and occupational safety empowerment. In the dimension of priority and occupational safety

Table 2. Frequency Distribution of Phosphoric Acid Plant's Employees/ Workers Based on the Dimension of Occupational Safety Climate

Variable	Frequency	Percentage
Dimensions of Priority and Occupational Safety Management Capability		
Poor	3	6.8
Quite Poor	1	2.3
Fairly Good	15	34.1
Good	25	56.8
Dimension of Employees' Occupational Safety Commitment		
Poor	1	2.3
Quite Poor	9	20.5
Fairly Good	19	43.2
Good	15	34.0
Dimensions of Learning Processes, Occupational Safety Communication, and Innovation		
Poor	6	13.7
Quite Poor	2	4.5
Fairly Good	18	40.9
Good	18	40.9
Dimension of Occupational Safety Fairness		
Poor	1	2.3
Quite Poor	7	15.9
Fairly Good	16	36.4
Good	20	45.4
Dimension of Trust toward the Organization		
Poor	1	2.3
Quite Poor	6	13.6
Fairly Good	15	34.1
Good	22	50.0
Dimensions of Employees' Occupational Safety Priority and Unacceptable Risks		
Poor	8	18.2
Quite Poor	16	36.4
Fairly Good	18	40.9
Good	2	4.5
Dimension of Occupational Safety Empowerment		
Poor	2	4.5
Quite Poor	7	15.9
Fairly Good	16	36.4
Good	19	43.2

management capability, 25 of 44 employees (56.8%) can be considered as in a good category. In the dimension of employees' occupational safety commitment, 19 of 44 employees (43.2%) can be considered in a fairly good category. In the dimension of learning processes and occupational safety communication, 18 of 44 employees (40.9%) can be considered to be a fairly good and good category, respectively. In the dimension of occupational safety fairness, 20 of 44 employees (45.5%) can be considered in the good category. In the dimension of trust toward the organization, 22 of 44 employees (50%) can be considered in the good category. In the dimension of employees' occupational safety priority and unacceptable risks, 18 of 44 employees (40.9%) can be considered as in the fairly good category. And in the dimension of occupational safety empowerment, 19 of 44 employees (43.2%) can be considered in the good category.

The Relationship between Employee's Age and Occupational Safety Climate among the Phosphoric Acid Plant Employees in the Phosphoric Acid Industry

Table 3 shows the relationship between the age of employees and every dimension of occupational safety climate at the phosphoric acid plant in the Phosphoric Acid Industry. The significance level of correlation between the age of employees and

Table 3. Analysis of Correlation between the Age of Employees and Occupational Safety Climate at Phosphoric Acid Plants in the Phosphoric Acid Industry

Dimension of Occupational Safety x Age of Employees	Correlation Coefficient (r)
Priority and capability of occupational safety management	-0.132
Employees' occupational safety commitment	-0.082
Learning processes, occupational safety communication, and innovation	0.154
Occupational safety fairness	0.051
Trust toward the organization	0.152
Priority of employees' occupational safety and unacceptable risks	-0.205
Occupational safety empowerment	0.033

dimension of priority and occupational safety management capability is -0.132, which indicates that such relationship is at a weak negative level. In the dimension of employees' occupational safety commitment, the table shows that its significance value of a relationship with age is -0.082, and it means that such correlation or relationship is in the very weak negative level. In the dimension of learning processes, occupational safety communication, and innovation, the correlation coefficient value is 0.154, which means that the correlation between this dimension and employees' age is at a weak positive level. In the dimension of occupational safety fairness, its correlation coefficient value with employees' age is 0.051, and it indicates that this significance level of correlation is in the very weak positive level. In the dimension of trust toward the organization, its correlation coefficient with employees' age is 0.152, which means that the significance level of this relationship is in a very weak positive correlation. In the dimension of occupational safety of employees and unacceptable risk, its correlation coefficient value with the age of employees is only -0.205, which means that its significance level of correlation is at a weak negative level. In the dimension of occupational safety empowerment, the table shows that its correlation coefficient value with employees' age is 0.033, and it means that the significance level of this correlation is at the very weak positive level.

Table 4. Analysis of Correlation between the Level of Education and Occupational Safety Climate at Phosphoric Acid plant in the Phosphoric Acid Industry

Dimension of Occupational Safety x Level of Education	Correlation Coefficient (r)
Priority and occupational safety management capability	0.209
Employees' occupational safety commitment	0.029
Learning processes, occupational safety communication, and innovation	0.156
Occupational safety fairness	0.107
Trust toward the organization	0.380
Priority of employees' occupational safety and unacceptable risks	0.481
Occupational safety empowerment	0.377

The Relationship between Level of Education and Occupational Safety Climate among Phosphoric Acid Plant Employees in the Phosphoric Acid Industry

In Table 4, the researchers show the results of a statistical correlation test for the relationship between the level of education and each dimension of occupational safety climate at the phosphoric acid plant in the Phosphoric Acid Industry. In the dimension of priority and occupational safety management ability, its correlation coefficient value with the level of education is 0.209, which means that this relationship is at a weak positive level. In the dimension of employees' occupational safety commitment, the table shows that its correlation coefficient value is 0.029, and it means that this relationship with the level of education is at a very weak positive level. In the dimension of learning processes, occupational safety communication, and innovation, the table shows that its correlation coefficient value is 0.156, which means that the relationship between this dimension and the level of education is at a weak positive level. In the dimension of occupational safety fairness, the table shows that its correlation coefficient value is 0.107, which means that the relationship between this dimension and the level of education is at a weak positive level. In the dimension of trust toward the organization, the table shows that its correlation coefficient is 0.380, and it means that the correlation

Table 5. Analysis of Correlation Between Job Position and Occupational Safety Climate at Phosphoric Acid Plant in the Phosphoric Acid Industry

Dimension of Occupational Safety x Job Position	Correlation Coefficient (r)
Priority and occupational safety management capability	-0.184
Employees' occupational safety commitment	-0.156
Learning processes, occupational safety communication, and innovation	-0.119
Occupational safety fairness	-0.370
Trust toward the organization	0.023
Priority of employees' occupational safety and unacceptable risks	-0.362
Occupational safety empowerment	-0.413

between this dimension and the level of education is in the moderate positive level. In the dimension of occupational safety of employees and unacceptable risks, the table shows that its correlation coefficient value is 0.481, which means that the relationship between this dimension and the level of education is at a moderate level. In the dimension of occupational safety empowerment, the table shows that its correlation coefficient value is 0.377, and it means that the relationship between this dimension and the level of education is at a moderate positive level.

The Relationship between Job Position and Occupational Safety Climate among Phosphoric Acid Plant Employees in the Phosphoric Acid Industry

Table 5 shows that all dimensions of occupational safety and job position – except for the dimension of trust toward the organization – at a phosphoric acid plants in the phosphoric acid industry have negative or unidirectional relationships. In the dimension of priority and occupational safety management ability, its correlation coefficient level reaches -0.184, which means that its correlation with the job position is at a weak level. In the dimension of occupational safety commitment, its correlation coefficient value with the job position reaches -0.156, which means that this relationship is at a weak level. In the dimension of learning processes, occupational safety communication, and innovation, its correlation coefficient value is -0.119, which means that the relationship between this dimension and job position is at a weak level. In the dimension of occupational safety fairness, its correlation coefficient value with the job position reaches -0.370, which means that the relationship of this dimension with job position is at a fairly moderate level. In the dimension of trust toward the organization, its correlation coefficient value with the job position is 0.023, which means that the relationship between dimension and job position is at a very weak level. In the dimension of occupational safety of employees and unacceptable risks, its correlation coefficient value with the job position is -0.362, which means that the relationship between this dimension and job position is at a moderate level. In the dimension of occupational safety empowerment, its correlation coefficient value with job position reaches -0.413, which means that the relationship between this dimension and job position is at a fairly moderate level.

DISCUSSION

Characteristics of Employees

Based on the data of all respondents ($n = 44$), the researchers found that the majority of employees are in early adulthood (26-35 years old), and the rest of them are in the age range of 17-25 years. The researchers considered age is one of the factors that influence the occupational safety climate, which suggests that older employees tend to have better occupational safety behavior (Vallières *et al.*, 2021).

In terms of the level of education, most of the employees are high school graduates. According to Prasetia and Harianto (2020), the employee's level of education would affect their level of discipline and behavior in compliance with the safety rules in the workplace, which includes compliance with the use of Personal Protective Equipment (PPE).

In terms of job position, the majority of employees have job positions as operators. Susanto, Karisma and Budi (2020) stated that certain job positions determine the habits to conduct the activities, supervise, and taking responsibility in the implementation of OSH in the project area.

Occupational Safety Climate

Based on the result of measurements using the NOSACQ-50 questionnaire, the occupational safety climate consists of seven dimensions. This research shows that most of the dimensions of the occupational safety climate can be considered are in a good category. The occupational safety climate dimensions that are considered in the good category are the dimension of priority and occupational safety management capability; dimension of learning, occupational safety communication and innovation; occupational safety fairness; dimension of trust toward the organization; and the dimension of occupational safety empowerment. The dimensions of occupational safety of employees and unacceptable risks, as well as occupational safety commitment can be considered are in the fairly good category. In order to improve the quality of all dimensions, then the management should give more attention to these two dimensions.

Based on the result of research conducted by Brooks (2017), the best strategy for the companies to improve the quality of occupational safety climate is the improvement of the dimensions of occupational safety commitment and employees' occupational

safety and unacceptable risks. This strategy can be achieved through the implementation of leadership training with the target of leaders in bottom-level positions. Therefore, the leaders that are responsible for their subordinate unit at the phosphoric acid plant should obtain leadership training.

A good occupational safety climate has a strong correlation with the lower level of work accidents within the company. The results of research conducted by Abubakar *et al.* (2018) showed that the occupational safety climate has a significant and negative correlation, and it means that there is a significant correlation between the occupational safety climate and the incidence of work accidents in the workplace. The direction of the correlation between these variables is negative, which means that the higher level of occupational safety climate quality will decrease the risk level of work accidents.

Leaders have an important role to create a safety climate in the working area by promoting safe behavior and reducing accidents (Lefsrud, McLarnon and Gellatly, 2021). Not only leaders, companies must also support the formation of a safety climate in the workplace by providing resources that facilitate professional safety to improve the safety climate (Bunner, Prem and Korunka, 2021). The way that safety professionals ensure the management or company about the importance of workplace safety is to communicate it effectively (Provan, Dekker and Rae, 2017).

The Relationship between Employees' Age and Occupational Safety Climate

Based on the results of statistical tests shown in Table 3, the researchers found that all dimensions of occupational safety climate have a weak or insignificant correlation with the age of employees. However, there are several dimensions that have positive and negative correlations. Dimensions that are positively correlated with employees' age are the dimensions of learning processes; occupational safety communication and innovation; occupational safety fairness; trust toward the organization; and occupational safety empowerment. The dimensions that have a negative correlation with employees' age are the priority and occupational safety management capability, occupational safety commitment, and employees' occupational safety priority and unacceptable risks.

The results of this research are in accordance with the results of previous research conducted by

Listyaningsih and Harianto (2021), which stated that occupational safety climate did not have a relationship with employees' age. The same study was conducted by Hasibuan and Lubis (2018) which showed that of the seven dimensions of safety climate, all of them had an insignificant relationship with age. Widyanti, Octaviana and Yamin (2018) state that age is negatively correlated with worker's safety commitment. Older workers are less likely to engage in workplace safety commitments.

Another research conducted by Silvia, Ihsan and Rizky (2020) showed that the respondents' age had a correlation with occupational climate among the employees at PT X in Padang Municipality. Their research showed that employees' age was correlated with job experience, in which it stated that older employees with longer work experience tended to have a better understanding of occupational safety. Kiani *et al.* (2021) show that age is significantly correlated with work safety climate and the direction of the relationship is positive on employee attitudes regarding work safety. According to research conducted by Sutrisno, Sandora and Rachman (2019), there were differences in occupational safety behavior between respondents aged 17-32 years, 33-48 years, and >49 years.

The Relationship between Level of Education and Occupational Safety Climate

The results of the correlation test shown in Table 4 indicate that all dimensions of occupational safety climate have a positive correlation with the level of education. Several dimensions of the occupational safety climate have a strong and weak correlation with the level of education, including the dimension of priority and occupational safety management capability; occupational safety commitment; learning process, occupational safety communication, and innovation; and occupational safety fairness. Other occupational safety climate dimensions have a moderate level of correlation with the level of education, namely the dimension of trust toward the organization; priority of occupational safety of employees and unacceptable risks; as well as occupational safety empowerment.

Research conducted by Sutrisno, Sandora and Rachman (2019) found that educational level factors could affect employees' perceptions of the occupational safety climate and safety behavior in their workplace. In accordance with the results of previous research conducted by Silvia, Ihsan and Rizky (2020), the level of education had a

similar level of significance in every dimension of occupational safety climate.

In this research, the researchers found that the relationship significance level between employees' education level and occupational safety climate is in the weak category. The researchers also found that the educational level of phosphoric acid plant employees is less diverse, which only consists of two categories of education levels. According to the research conducted by Yang *et al.* (2021), employees with a low level of education could affect the employees' compliance level with the regulation concerning occupational safety in the workplace.

Research conducted by Ameko (2015) showed that the employees' level of education was strongly and positively correlated with occupational safety climate, in which employees with a higher levels of education tended to have a higher occupational safety climates. In contrast, research conducted by Endriastuty, Rabia and Adawia (2018) found that employees' education level had no correlation with occupational safety culture.

Occupational safety fairness is one of the occupational safety climate dimensions that have the weakest level of correlation with the employees' educational level. The best strategy that can be applied by the company to improve safety fairness is the implementation of accidents reports. According to Casey (2017), the implementation accident report could increase employees' awareness to report any errors and near-miss incidents to the company. The improvement of interpersonal relationships among the employees can also be implemented as a method to improve the dimension of occupational safety fairness.

Level of education has a moderate correlation with the work safety climate. Companies cannot change the level of education possessed by employees, but companies can increase workers' knowledge through activities such as training, FGD, safety morning talks, etc. These activities can be carried out periodically organized by the division of safety, health, and environment.

The Relationship between Job Position and Occupational Safety Climate

The results of statistical tests shown in Table 5 indicate that most dimensions of occupational safety climate have a negative correlation with the job positions. Trust toward the organization is the only dimension that is positively correlated with the job position. There is a weak correlation between job

position and several dimensions of the occupational safety climate, which includes learning processes, occupational safety communication, and innovation; priority of occupational safety management capability, trust toward the organization, and occupational safety commitment. There is a correlation with a moderate level of significance between job position, occupational safety fairness, employees' safety priority and unacceptable risks, and occupational safety empowerment.

Past research conducted by Kiani *et al.* (2021) shows that job titles don't have a significant correlation with safety climate. This is in line with the result of research conducted by Hasibuan and Lubis (2018) showing that the position held by workers has no significant correlation with all dimensions of the work safety climate. According Pinion *et al.* (2018), the different perceptions of the work safety climate in each position are influenced by the period of service and work location. Differences in the perception of the work safety climate in each job position can have an impact on increasing personal safety risks, increasing safety incidents and inter-organizational conflicts.

Most of the directions of the relationship between job positions and occupational safety climate are negative and non-unidirectional, and indicates that the lower the job position is highly correlated with better occupational safety climate. Some findings indicate that employees with more technical works and lower job positions will tend to conduct their job in a more careful fashion, which makes these employees have a better occupational safety climate, and this interesting phenomenon may cause the negative and non-unidirectional relationship between job position and occupational safety climate.

The relationship between job position and occupational safety climate has the highest level of significance. Phosphoric Acid Industry provides regular and continuous training activities for each employee at the phosphoric acid plant, and these types of training activities include safety representatives to improve employees' understanding of occupational safety regulations. Employees' awareness and capabilities in occupational safety can be improved through their involvement in every intervention of occupational safety, which can be conducted by the management or the leaders of every workgroup (Brooks, 2017).

Previous research conducted by Silvia, Ihsan and Rizky (2020) showed that employees

with supervision positions will have a different perceptions of occupational safety climate, compared to the employees with technical job positions. The differences in perception can be caused by the differences in workloads and the risks possessed by each job position. Alruqi, Hallowell and Techera (2018) identified that supervisors and employees with occupational safety responsibility could be the predictors of workplace injuries and incidents.

Occupational safety climate can be affected by various factors other than the characteristics of employees. In order to determine other factors that may influence the occupational safety climate, it is therefore necessary to conduct further research.

CONCLUSION

All dimensions of occupational safety climate have a weak level of significance of the relationship with age, and the researchers also found that several dimensions have positive and negative relationships. All dimensions of occupational safety climate have a positive correlation with the employees' level of education. Several dimensions of occupational safety climate have weak and moderate levels of relationship with the employees' level of education. Almost all dimensions of occupational safety climate are known to have a negative correlation with the job position. The researchers found that the dimension of trust toward the organization is positively correlated with the job position.

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