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Instrument to Measure Safety Climate: An Application to a Tyre Manufacturing Plant

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ABSTRACT

Occupational health and safety is a key feature in good governance. It depends on the safety culture of each and every person relevant to a work place. Culture means people think or act according to their opinions and beliefs by themselves without any external force. Positive safety culture gives benefits to both employee and employer. Therefore, measure the current status of safety culture is important to identify the areas which already improved and areas need to be improved. Safety climate is a descriptive measure that implies the status of the safety culture. Safety climate in a work place can be measured through the employees' attitudes regarding the work place. A self-administrative questionnaire can be used to collect the data as a productive method. The objective of the study was to develop a questionnaire as an instrument to measure safety climate in a work place through employees' attitudes and validate the theoretical structure of safety climate with five dimensions. The questionnaire was designed based on literature survey under five dimensions. 30 Likert item questions were used to measure the 5 dimensions and Likert scaling technique was used to measure those five dimensions. Data were collected based on a tire manufacturing plant. Since these dimensions are highly correlated a pilot survey was conducted to identify ambiguities and difficult questions. A representative sample was selected using stratified sampling technique. The reliability of the questionnaire was measured using Chonbach's Alpha statistic and Split –half Test. Confirmatory factor analysis was used to validate the theoretical structure. According to its results common factor was explained more than 80% of variance in each variables and model diagnostic tests showed that errors were satisfied the assumptions. The goodness of fit statistics showed that fitted model was acceptable. It can be concluded that the theoretically assumed structure to measure the safety climate with five dimensions is acceptable. This study provides a complete guidance on how to measure safety climate through a questionnaire and any interested parties may able to make their own measuring system based on the study.

Keywords: Confirmatory factor analysis, Likert scale, questionnaire, Safety climate.

Mathematics Subject Classification: 62-07,62D05, 62H25, 62P30

Journal of Economic Literature (JEL) Classification: C38

1. INTRODUCTION

Occupational health and safety (OHS) is a key result area of human resource management. Implementing a healthy working environment is a responsibility of employer & working according to

given procedures, rules & regulations is responsibility of employees. OHS depends on the safety culture. If people think or act based on own opinions and beliefs without any external force then it can be introduced as a culture. Guldenmund (2000) mentioned that Safety culture is defined as a combination of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organization's health and safety management.

Work related injuries and diseases are increased due to the failure of existing regulatory controls to meet the evolution of workplace hazards. Alli (2008) expressed that if a work place has positive safety culture, on the employer side it affected in economically and legally. Positive safety culture gives benefits to both employee and employer. Therefore, whatever the industry, identifying the current status of safety culture is important to implement a new one or to improve it. Safety culture cannot be measured directly. Safety climate is a descriptive measure of safety culture. As concluded by Guldenmund (2000), safety climate (SC) is defined as a summary concept describing the safety ethic in a workplace which is reflected in employees' beliefs about safety.

Although safety climate researches were done related to steel, food processing, chemical and textile industry, construction sites, limited researches were done relevant to tire manufacturing industries. Further, few number of researches in the field of safety climate were done in Sri Lankan context. A questionnaire developed for investigations in one country (or region) would not be adequate for collecting data in another country. The performances related to OHS are different according to the country, economy and size of the enterprises. It is beneficial that design a concept to measure safety climate.

Safety climate is an attitude object & if a single question is used to measure it then it may not reliable. Therefore several questions should be used to measure an attitude object. Carifio and Perla (2007) emphasize that if the "attitude object" was believed to have some sub-dimensions of importance, this methodology was repeated for each of the sub dimension or sub variable again balanced by positive and negative statements.

Safety climate survey can be conducted based on self-administrative questionnaire or interview. Since whole data collection via personal interviews is a time consuming method as well as it is inefficient when employees are busy. Self-administrative questionnaire is the most productive method to measure safety climate when consider the limited time and cost. Therefore, the questionnaire was selected as the instrument of this research to collect data from independent sample units.

Confirmatory factor analysis (CFA) allows testing the hypothesis that a relationship between the observed variables and their underlying latent construct(s) exists. Schreiber et al (2006) expressed that CFA is a confirmatory technique and it is theory driven. CFA can be used to confirm the theoretical relationships among the observed and unobserved variables. In this research a structure was pre-defined through a literature review and it was validate using CFA.

Although there are many models and scales for assessing safety climate, there is no universally accepted set of component dimensions. Flin et al (2000) mentioned that these dimensions can be reduced to a limited number of themes. To design a questionnaire to measure safety climate, a pool of dimensions was selected through literature review and five dimensions were identified to measure safety climate which highly correlated each other. These are briefly explained below:

- Management commitment towards safety (Dimension 1 (D1))

Management should engage to identify workplace hazards and take actions to eliminate or reduce the risk. Sharing the safe work procedures with knowledge and information is essential responsibility of management.

- Safety system (Dimension 2 (D2))

A health and safety system is designed to minimize the risk of injury and illness of workers and to verify the occupational health and safety at the workplace.

- Rules/ Procedures (Dimension 3 (D3))

Rules are general standards and should apply according to the situation. Rules should be clearly defined in a positive way. Work procedure helps to avoid the worker exposure to hazards, maintain the quality of the output, define production plan (daily, weekly, monthly) and define target that can be achieved.

- Training/Competency (Dimension 4 (D4))

Mathis and Jackson (2003) stated that training is a process of people, acquires capabilities to aid in the achievement of organizational goals. According to the company side, it is needed to provide effective trainings to the employees to improve their knowledge and skills.

- Reactions towards work pressure/stress (Dimension 5 (D5))

Pressure is a feeling of tension occurred by a potentially stressful situation. Work-related stress occurs when the demands of the job and the available resources and capabilities of the individual worker are not matched to catch the demand. Organization should hire persons for jobs according to their skill and willingness. Otherwise, it is a waste for both parties.

To address how to design a questionnaire to identify the current level of the safety climate, 'Ekala Tyre Division 02' which is one of the main plants of Camso Loadstar (Pvt) Ltd. was selected. It is a solid tire manufacturing plant which is started on 2008. It has 4 manufacturing processes. It applies lean manufacturing basic with lean tools such as 5S concept and Team Leader Based Organization (TLBO) concept. Thus production employees are the main important resource in the system and every other people give their service to them to do their jobs easily. Based on that condition, employees can be categorized into two groups as direct and indirect carder.

Research problem was how to develop an instrument to measure the safety climate. Following research questions were addressed under this study.

1. Design a questionnaire to measure safety climate
2. Check the reliability and validity of the theoretical dimensions of safety climate

The purpose of this research was to develop a reliable and valid instrument to measure the safety climate. In methodology, it is mentioned the methods that used to design the questionnaire, data collection method and statistical methods used to analyse further. The findings were included in the results and discussion section.

2. METHODOLOGY

The objective of the study was to design a questionnaire to measure safety climate using attitudes of employees. The first research problem was to design a questionnaire to measure the safety climate. The general knowledge about safety culture was obtained from secondary data sources. Verbal communications were done with both senior executive officer in Safety health and environment and human resource manager to identify current health and safety legislations. The details about training programs, Team Leader Based Organization (TLBO) concept were obtained via lean managers. The details of the workplace health and safety together with issues of safety system were discussed with the leading fireman, medical officers, team leaders, workers of the work place.

2.1. Questionnaire design

A multi-dimensional concept can't be measured through a single question or variable. When a single question is used, the information may not be very reliable because people may have different responses to a particular word or idea in the question. Therefore to measure the safety climate, several variables should be selected and composited into one or few latent variable using suitable method. Initially a pool of variables was collected through literature survey and 30 variables (factors) were selected among them. Finally, 30 variables were categorized under selected 5 dimensions according to a logical order. Figure 1 shows the conceptual frame work of the study. The selected statements were verified from a human resource manager in a reputed company. Those statements were translated into Sinhala and some words were replaced words with that the company used. The self-administrative questionnaire was designed according to understand and complete easily. Most of the questions were closed ended questions.

Second research question was check the reliability and validity of the questionnaire. Each selected variable was measured using Likert item response format. In general, Likert item is a statement or question which measured attitudes or belief with ordered response. Normally ordered response levels vary from 3 to 7. Rhemtulla (2014) conducted a research regarding how many categories are enough to be treated as continuous data. The results of that research shows that when number of categories reaches to five then ordinal data produce acceptable results. In this research, 5 point Likert item response option is used which numerically weighted, 1= Strongly Disagree to 5= Strongly Agree. This converts the ordinal categories to interval level data from which mean and standard deviation can be computed.

2.2. Measure the dimensions

In social science researches, several methods were used to composite variables. Scaling and index are two methods that used to convert the several dimensions into one dimension. Scaling method was used to measure pre-defined five dimensions using selected 30 items and index method was used to check the validity of 5 dimensions to measure safety climate.

Scale is defined as a cluster of statements that composite into single domain. When participant gives responses to a set of items, researcher often want to assign a single number that represents the person's overall attitude or belief. Likert scaling technique is one of those methods used in safety climate survey. Likert scale data is a composite score (sum or mean) of the set of Likert item data. Since different number of items were selected to measure dimensions mean of relevant items was used to measure each dimensions. Then the scale of each dimension is same and it is in 1-5 range. The range of the scale can be changed as easily interpret. Then all dimensions can be considered as in same scale. Boone et al (2012) stated that Likert scale data are analysed at the interval measurement scale. In index method, it composites of different variables together. It is a method of convergent content, and face validity. CFA was used to check whether selected five dimensions can be used the measure safety climate.

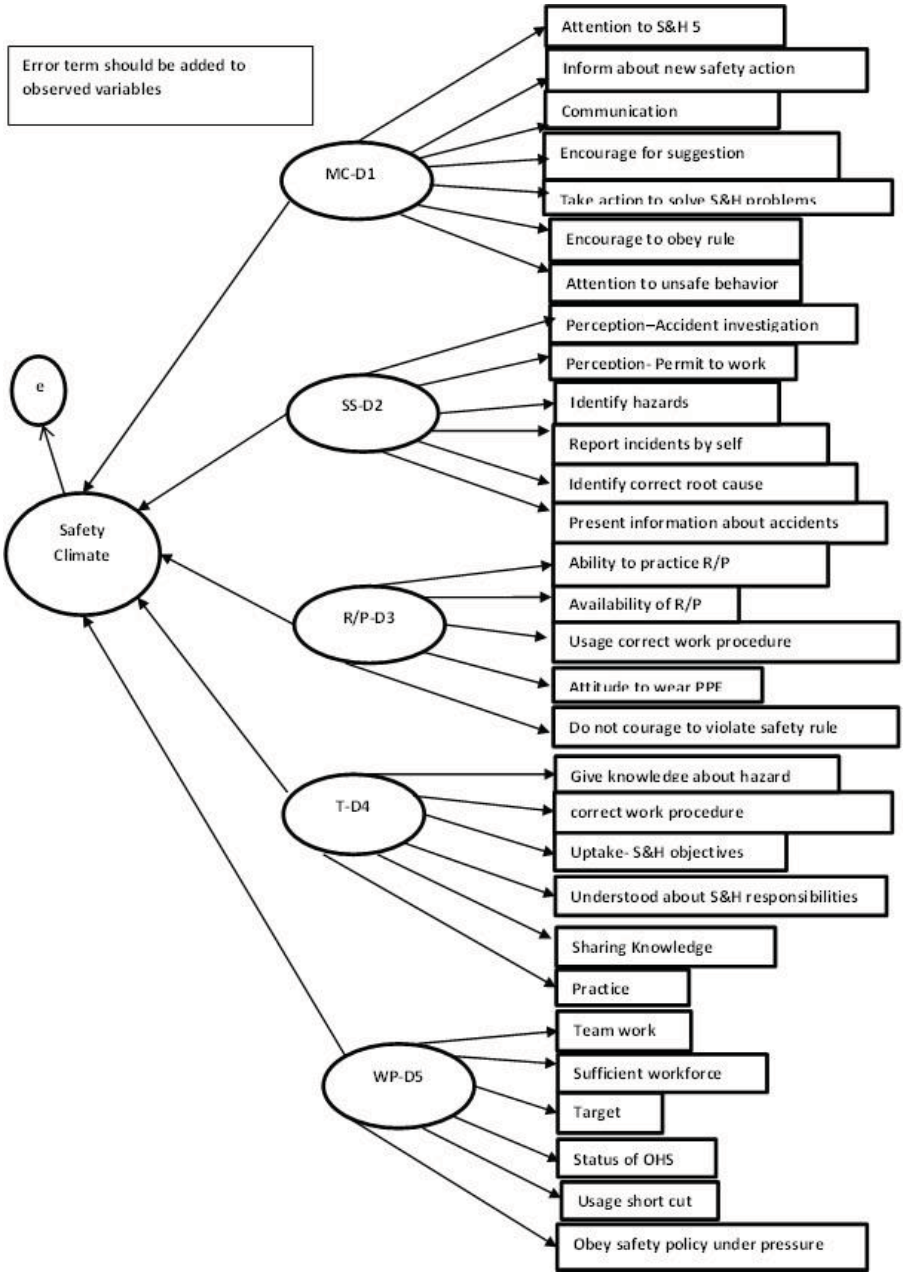

Figure 1. Conceptual frame work of measuring safety climate

2.3. Pilot Survey

Doing a pilot survey is important before the full survey. In this research pilot survey was conducted to check the validity of the questionnaire and to assess the feasibility of the survey.

2.4. Population, sample size and sampling method

This study considered employees who work in a tyre manufacturing plant. Target population of the study was all the shop floor employees of the plant. They can be categorized as direct carder and indirect carder. Under these two stratums, sample was selected according to stratified random sampling technique. Sampling frame was obtained from HR division and 323 employees were included in the sampling frame.

Bartlett et al (2001) discussed appropriate sample size in survey research. He mentioned that Cochran's (1977) sample size formula can be applied for continuous data (Likert scale data).

$$no = \frac{a^2 * s^2}{t^2}$$

Where a is the selected value for the alpha level, and s is the estimate of standard deviation in the population while t represents the acceptable margin of error. Then sample size (n) is given by

$$n = \frac{no}{1 + {}^{no}/_{Population}}$$

Sample size was calculated at 5% alpha level and 5% margin of error. According to sample size calculations, required maximum sample size was 146. To cover the lack of responses, 200 units were selected to sample. As above mentioned, the population was divided into two stratums. Sample size was allocated according to the proportional allocation. All selected participants were requested to be answered for all questions. To ensure accuracy of responses, it is ensured that no person affiliated with their organization was involved in any way. Participants were also assured that all responses were completely confidential and their organizations/management would have no access to any data that they have provided.

2.5. Methods for data analysis

- Cronbach's Alpha

Cronbach's Alpha is often considered a measure of item homogeneity; that is large alpha values indicate that the items are tapping a common domain. If alpha value is 0.7 then measure of adequacy is acceptable without other considerations. If a group of items has an alpha value of .6, it may be acceptable because the group is comprised of three items, therefore it would be expected. At this study minimum 5 items were used to measure a dimension. Therefore, alpha value greater than 0.6 criteria was used to access the acceptance of the reliable scale.

- Spearman– Brown coefficient

Spearman– Brown coefficient represents the reliability coefficients that can be attained from all possible combinations of dividing the questions into two sets (split-half). An estimate of the reliability of the test scores is given as the results. In theory, reliability ranges from 0 to 1 and higher values reflecting better reliability.

- Checking Outlies

By using Box-plot univariate outliers were identified. By using the scatterplot for pair of variables, bivariate outliers can be detected. A scatter departure from the elliptical pattern shows bivariate outliers. After removing univariate and bivariate outliers it should be considered about multivariate outliers in multivariate analysis such as factor analysis. Mahalanobis distance was used to identify the multivariate outliers. It is a measure of how much a case's values on the independent variables differ from the average of all cases.

- Test for multi-collinearity

Variables which just simple derivations of another variable in the analysis should excluded from the analysis. If the determinant of correlation matrix is greater than 0.00001 there is no multi-collinearity effect.

- Bartlett's test

This test provides a minimum standard which should be passed before a factor analysis. The hypothesis tested in the test is,
H_0: The correlation matrix is an identity matrix
H_1: The correlation matrix is not an identity matrix
This test should be used before done the confirmatory factor analysis.

- Confirmatory Factor Analysis (CFA)

To check the association of the observed variables together with their underlying latent construct(s) exists, CFA can be applied. The study applies knowledge of the theory and experimental research, to tests the hypothesis statistically. Following assumptions were considered.

1. Observations are independence
2. Adequate amount of covariance or correlation
3. Variables are continuous/ interval level data
4. Variables are multivariate normally distributed
5. The relationship between the coefficients and the error term must be linear
6. Error follow a normal distribution with mean zero and constant variance

Li, Y (2014) defined the CFA model as follows. Given a set of observed variables $z_1, z_2, \dots, z_q$ there is assumed to exist some underlying factors $\xi_1, \xi_2, \dots, \xi_m$ where m<q, which account for the inner correlation of observed variables. Written as an equation, it will become:

$$\mathrm{z} = \Lambda\xi + \delta$$

where $\mathrm{z}_{q\times 1}$ is a vector of observed variables, $\Lambda_{q\times m}$ is the matrix for factor loadings, $\xi_{m\times 1}$ is a vector of factors (latent variables), while δ is a vector of $q \times 1$, represents the measurement errors corresponding to each observed variables in q. Elements in δ are assumed to be uncorrelated. Based on the basic settings, relationships between the covariance matrices can be formulated. Let Φ, $m \times m$ and Θ, $q \times q$ be the covariance matrices of ξ and δ. $\Theta_{q\times q}$ is a diagonal matrix due to assume that elements of δ uncorrelated. Then covariance matrix (Σ) of z is defined as:

$$\Sigma(\theta) = \Lambda\Phi\Lambda + \Theta$$

where θ is a set of free parameters in Λ and Φ. Model was estimated using Maximum Likelihood (ML) estimation method. The ML is an estimation technique referred to Linear Structural Equation Model (LISREL). Approach defined on Covariance-based method, whose objective is to reproduce the $\sum$ of the manifest variables by means the model parameters. This is the initial model that comes directly out of the estimation.

Scaling information of variables is retained by unstandardized parameter estimates. It can only be understood with reference to the scales of the variables. Estimators of standardized parameters which remove scaling are transformations of estimated unstandardized parameters. It can be used for unceremonious evaluations of parameters throughout the model. Using the standardized model, interpretation can be done with more effective manner.

- Model adequacy checking

Model adequacy was checking using residuals according to criteria mentioned by Montgomery (1997). Shapiro-Wilks normality test was used to test the univariate normality. If residuals have constant variance, Residual Verses Fitted values plot should be structure less. If residuals are independently distributed, there should be no pattern in Residual Verses Order plot.

- Indices of goodness of fit

Some goodness of fit indexes is used to provide an additional basis for the acceptance or rejection of a model. Several goodness of fit indexes can be used to test the fit of the model. Among them suggestions have been made regarding their critical cut-off values.

1. Chi-square test

Basic thoughts of estimation of CFA are that $\sum$ is a function of θ. Sample covariance matrix can be reproduced through a correct model. This leads to the main idea of estimating CFA model: minimizing the differences between the sample covariance matrix and the model implied covariance matrix.

In this test below hypothesis is tested.

H_0: There is no significant different between observed and expected covariance matrixes

H_1: There is a significant different between observed and expected covariance matrixes

The difference between the two matrices is expressed in chi square, with degrees of freedom (df) and df is the number of covariance in the matrix. If chi-square value of the test is closed to zero then it indicates slight difference between the expected and observed covariance matrices.

2. Root Mean Square Error of Approximation (RMSEA)

RMSEA based on χ^2, df and N. This penalizes free parameters. If a model is perfectly fit, RMSEA value will be 0 and cut off value for a good fit is suggested as less than or equal to 0.06.

3. Standardized Root Mean Square Residual (SRMR)

SRMR is calculated by squaring the residuals in the residual correlation matrix and then summed and this sum is divided by the $q\,(q+1)/2$, where q is the number of variables, including the diagonal with communalities and then square root of this mean. If model is perfectly fit, SRMR value will be 0 and cut off value for a good fit is suggested as less than or equal to 0.08.

4. Non-Normed Fit Index (NNFI)

NNFI belongs to the class of comparative fit indices. If model is perfectly fit, NNFI value will be 1 and cut off value for a good fit is suggested as greater than or equal to 0.95.This is also known as Tucker-Lewis Index (TLI).

5. Comparative Fit Index (CFI)

CFI provides some penalty for free parameters. Values > 1 are truncated to 1, and values < 0 are raised to 0. CFI ≥ .95 suggested as a cut-off value for a good fit.

SPSS and LISREL software were used to analyse the data. Conclusions were taken with 90% confidence.

3. RESULTS

3.1. Results of pilot survey

To improve the validity of questionnaire design pilot survey was conducted. The questionnaire was administered to pilot subjects in exactly the same way as it will be administered in the main study and recorded the time taken to complete the questionnaire and decide whether it is reasonable. Pilot survey was conducted using 11 sample units. Average time taken to fill the questionnaire was around 10 minutes with deviation of 2.3 minutes. Respondents were asked the subjects for feedback to identify ambiguities and difficult questions. Assessed whether each question gives an adequate range of responses, checked that replies can be interpreted in terms of the information that is required, checked that all questions are answered.

Reliability of the questionnaire was measured using Chonbach's Alpha statistic. The alpha coefficient for the 30 items was 0.941 suggesting that the items have relatively high internal consistency. 30 questions were divided into odd and even numbered questions and correlate them. Each part had 15 items. Therefore equal length Spearman-Brown Coefficient was measured. The estimation of Spearman-Brown Coefficient 0.887 >0.7 provided some support for quality of the test scores. Since the reliability of the questionnaire was enough, survey was conducted using that questionnaire.

3.2. Results of the final survey

200 questionnaires were distributed and 177 questionnaires were collected. Overall response rate was 88.5%. Selected five dimensions were created with respect to responses of 30 Likert items by using Likert scaling technique. As per results in Table 1, all Cronbach's Alpha statistics were greater than 0.60. It indicated that the items are tapping a common domain.

Table 1: Results of Cronbach's Alpha statistics

Category	No of Items	Cronbach's Alpha	Rule of thumb
Over all reliability	30	0.927	> .9 – Excellent
D1	7	0.799	> .7 – Acceptable
D2	6	0.723	> .7 – Acceptable
D3	5	0.634	> .6 – Sufficient
D4	6	0.735	> .7 – Acceptable
D5	6	0.663	> .6 – Sufficient

The univariate and multivariate outliers were checked and removed before analysis. According to Shapiro-Wilk test, it was concluded that all 5 dimensions were normally distributed. Bivariate normality was checked using scatter plots. The multivariate normality of the variables and test for adequate amount of correlation among variables were checked before CFA. According to Bartlett's test results, there was enough evidence to reject that the correlation matrix is an identity matrix since significance value is 0.000.

According to the correlation matrix in table 2, Pearson correlation coefficients were greater than 0.66 in between each pair of dimensions. Every pair of dimensions was correlated each other. It was implied that variables were suitable for doing factor analysis. Determinant of the correlation matrix is 0.03 and since it is greater than 0.00001 there is no multi-collinearity effect.

Table 2: Correlation Matrix

		D1	D2	D3	D4	D5
Correlation	D1	1.000	.702	.709	.715	.688
	D2	.702	1.000	.661	.695	.666
	D3	.709	.661	1.000	.705	.747
	D4	.715	.695	.705	1.000	.694
	D5	.688	.666	.747	.694	1.000

All endogenous variables are measured using the same scale. Model was estimated using maximum likelihood estimation technique and by using covariance matric with 10% level of significance. The figure 2 shows the estimated model and test statistics for confirmatory factor analysis.

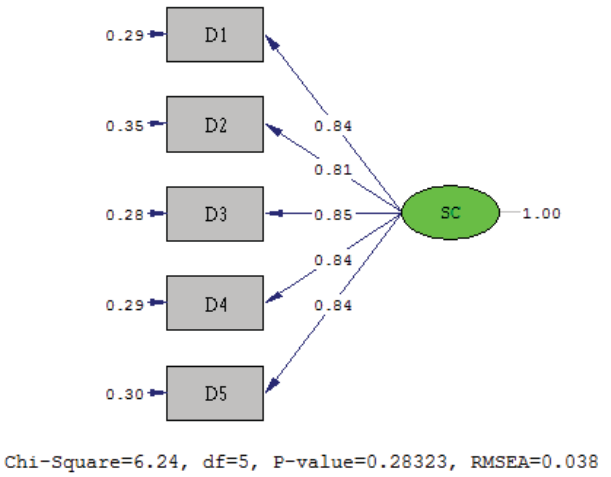

Figure 2. Structure of standardized model

According to the results of confirmatory factor analysis common factor was explained more than 80% of the variance in each of the variables and model diagnostic test showed that errors were satisfied the assumptions.

The goodness of fit statistic implies how well the model fit to a set of observations. Table 3 summarized some goodness of fit indexes according to the above fitted model and conclusions were derived based on cut off values. This goodness of fit indexes implies that fitted model can be acceptable.

There were so many models that can be used to measure safety climate. Confirmatory factor analysis results suggested that the theoretically assumed structure to measure the safety climate was acceptable at 90% confidence level.

Table 3: Results of Goodness of fit statistics

Statistic and Value	Conclusion
Chi-square=6.24,df=5 p-value=0.28323	p-value (0.283) >0.1=> There was no significant diffèrent between observed covariance matrix and expected covariance matrix.
CFI=1.00	>0.95=> Good fit
RMSEA=0.033	<0.06=> Good fit
SRMR=0.015	<0.08=> Good fit
NNFI=1.00	>0.95=> Good fit

4. DISCUSSION AND CONCLUSION

Any insurance can never cover the damage happen to a person totally. Therefore, good safety practices give advantages to all parties. Measuring the current status of safety culture is important to identify the areas that should be improved further. Safety climate is a technique that can be used to measure safety culture and it is a multi-dimensional concept. Although so many factors were identified to discuss the safety climate there is no universal concept. Therefore, this study was conducted to develop a reliable questionnaire as an instrument to measure safety climate. Five dimensions were selected to measure the safety climate with sufficient internal consistency. Then again if a single statement is used to measure those dimensions, it is less reliable. As a solution Likert scaling technique was used to measure each dimension. To measure one dimension, set of variables were selected using literature survey under operationalization. Initially a pool of questions was collected and categorized them under dimensions according to a logical order. Finally, 30 variables were selected and they were randomly ordered in the questionnaire. Likert scaling technique was used to composite dimensions. Sample was selected under stratified sampling technique by considering two stratums such as direct and indirect carder.

Factor analysis is a technique that can be used to identify the hidden relationship among variables by considering their correlation. CFA was done to verify that theoretically assumed structure is acceptable to discuss the safety culture by removing univariate and multivariate outliers. The results

of the study shows that the standardized loading in each dimensions have nearly equal value and it indicated that common factor (SC) explains more than 80% of variance in each variable. If any variable having a factor loading less than 0.6 and R^2 less than 0.4, that variable should be deleted from the fitted model and needed to re test the model. Ambiguous statements, double meaning statements, biased statements may be reasons for low factor loading. If the factor loading of a variable is low then that variable should be removed from selected construct. But in this model none of the variables were removed and all 5 variables are essential to discuss the safety climate. According to model diagnostic tests, assumptions were not violated. Chi square test and other goodness of fit indexes were indicated that model was fitted well. it proved that the theoretical model is acceptable to measure the safety climate.

As a summary, by measuring status of management commitment towards safety, safety system, rules/procedures, training/competency and reactions towards work pressure/stress relevant to organization, safety climate of the organization can be taken as a productive method to measure safety climate. The developed questionnaire can be used to measure above mentioned variables as a valid method. Therefore, this developed questionnaire can be used as an instrument to measure the safety climate.

The developed instrument (questionnaire) can be used to measure the current level of the safety climate in the tyre manufacturing plant and check whether there is a significant difference in safety climate among demographic sub groups in the plant. Although this questionnaire was developed based on the one specific production plant of the organization, it can be used to measure the safety climate of other plants also. Further management will be able to define key performance indicators based on that. Also then it can be used to compare the safety climate among production plants.

Further this instrument can be generalized to use in any working place via small modifications and then it will help to identify current level of safety climate. Then corrective actions can be taken based on that and it will help to increase job satisfaction of employees. Meanwhile it helps to improve the organization's growth.

4. REFERENCES

Alli,B.O., 2008, *Fundamental principles of occupational health and safety* (2nd ed.).Geneva: International Labor office. ISBN 978-92-2-120454-1.

Bartlett, J.E. ,Kotrlik, J,W., and Higgings.,2001, Organizational Research: Determining Apropriate Sample Size in Survey Research, *Information Technology, Learning, and Performance Journal, 19*(1), 43-50.

Boone, D.A., and Boone, H.B.,2012, Analyzing Likert Data, *Journal of Extension*, 50(2).

Carifio, J., and Perla, R.J.,2007, Ten Common Misunderstandings, Misconceptions, Persistent Myths and Urban Legends about Likert Scales and Likert Response Formats and their Antidotes, *Journal of Social Sciences*, 3 (3), 106-116.

Flin, R., Mearns, K., Connor, P., and Bryden, R.,2000, Measuring safety climate: identifying the common features, *Safety Science*, 34(1), 177-192.

Guldenmund,F.W., 2000,The nature of safety culture: a review of theory and research. *Safety Science*,34,215-257.

Likert,R.,1932, A Technique for the measurement of attitues. *Archives of phychology*, 22(140),5-55.

Mathis, R. L., & Jackson, J. H., 2003, Human Resource Management, United States: South-Western.

Montgomery,D.C.,1997, *Design and analysis of experiments*, John Wiley & Sons, New York, ISBN-0471-31649-0.

Rhemtulla, M.,2012, When Can Categorical Variables Be Treated as Continuous? A Comparison of Robust Continuous and Categorical SEM Estimation Methods Under Suboptimal Conditions. *Psychological Methods*,17(3), 354–373.

Schreiber,j.B., Nora,A.,Stage, F.K.,Barlow,E.A., and King,J.,2010, Reporting Structural Equation Modeling and Confirmatory Factor Analysis Results: A Review, *The Journal of Educational Research*, 99(6), 323-338, DOI: 10.3200.