An Investigation of Relationships between Employees' Safety and Productivity

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Abstract

Safety culture is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to and organization's health and safety management. It varies from one country to another. Employees may behave differently due to their background differences in race, nation, religion, and community. To achieve a positive safety culture, employee involvement and satisfaction must be considered, as it drives continuous improvement, which may lead to better productivity. This paper utilizes the exploratory factor analysis and structural equation modeling method to examine the relationships between People, People Results, and Productivity in the textile industry in Thailand. It is expected that the results give better understanding on how employees' involvement in safety leads to higher productivity in the organization.

Keyword: Employees' involvement, exploratory factor analysis, productivity, safety culture, structural equation modeling

Introduction

Safety culture is being interested in many organizations as a means of reduce the potential for disasters, accident and injuries (Choudhry et al., 2007). A positive safety culture can be an effective tool for improving safety in an organization and creating good atmosphere in the workplace (Fernández-Muñiz et al., 2009). This will help organizations to benefit financially through reduced lost work hours and accident related compensation cost, increased employees' motivation, higher quality product, and reduced turnover; all of which lead to improved productivity (Ali et al., 2009).

A number of quality models can be used as a basic model for safety improvement. Chinda and Mohamed (2008) claimed that the EFQM Excellence model is a suitable model for safety improvement. Oger and Platt (2002) also mentioned that the EFQM Excellence model places more emphasis on tactical issues relating to implementation of strategy and the monitoring of customer, employee and people results. Based on this, the EFQM Excellence model is utilized as a basic model of developing a conceptual model, as shown in Figure 1.

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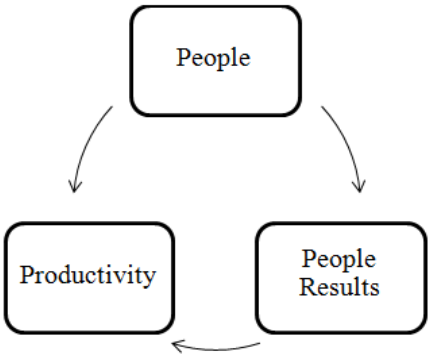

Figure 1. The Conceptual Model between People and Productivity

The Conceptual Model

The conceptual model consists of three constructs, which are People, People Results, and Productivity. It is hypothesized that better safety implementation leads to better results and productivity. A number of items associated with each construct are extracted from safety- and productivity-related literature. Details are as described below.

People

People construct consists of 13 items, which are explained below:

1. Participation: Wu et al. (2010) stated that employee's safety involvement creates a safe environment. This includes participations in setting safety policy and decision making to improve safety, attending safety training etc.
2. Emergency preparedness: Emergency plan should be set up to avoid accidents, and react quickly in case of emergency (Fernández-Muñiz et al., 2007).
3. Perceived risk: Workers' perception of risk and construal of danger is crucial in creating a positive safety culture (Perez-Floriano, 2007).
4. Safety observation: The observation in physical and mental fatigue offers reasoned suggestions for improving health, safety, and ergonomics (Ahasan, 2002).
5. Employee empowerment: Employees have unique abilities, skills, and knowledge that can be used to empower them to create a safe work environment (Sawacha et al., 1999).
6. Training: Safety training is an important factor in creating a strong safety culture in the workplace (Wu et al., 2010).
7. Peer review: Naevestad (2010) suggested that a safety culture campaign should involve workmate interventions.
8. Accident experience: Goncalves et al. (2008) claimed that an accident experience has a positive correlation with unsafe behavior.
9. Employee commitment: Wu et al. (2010) stated that successful safety programs depend largely on employees' commitment in safety.
10. Safety compliance: Fernández-Muñiz et al. (2007) suggested that employees should comply with regulations designed to promote improvements in their workplace.
11. Stress: Workers who report more anxiety report more injuries, and take fewer safety precautions (Perez-Floriano, 2007).
12. Teamwork: Safety performance is significantly influenced by organization team members and on-site safety communication (Sawacha et al., 1999).
13. Reporting accident: A good safety culture would generate a substantial number of high quality incidents and accident reports (Ariss, 2003).

People Results

Seven items are associated with this construct, which are:

1. Job tenure: The reduction of workplace injuries may reduce employee turnover (Ali et al., 2009).
2. Better attitudes: Ariss (2003) defined safety culture is the recognition that attitudes and behaviors of employees are crucial to safe behavior at work.
3. Job satisfaction: High level of job satisfaction assists in reducing work injuries (Mitropoulos and Cupido, 2009).
4. Higher motivation: Ali et al. (2009) stated that the reduction of workplace injuries may increase the motivation of employees.
5. Workforce morale: An effective safety program helps improve employees' morale (Chinda and Mohamed, 2008).
6. Communication enhancement: Two-way communication can be enhanced through employees' involvement in safety (Ariss, 2003).
7. Absenteeism: The improvement of safety culture helps reduce the lost time through accidents (Pasman, 2000).

Productivity

Productivity construct is composed of eight items, including:

1. Good working environment: Mitropoulos and Cupido (2009) suggested that a good safe behavior results in a good working environment.
2. Material damage: The improvement of safety culture will reduce the material damage (Fernández-Muñiz et al., 2007).
3. Quality of product: Quality improvement is influenced by a positive health and safety implementation (Riedel et al., 2001).
4. Compensation cost: Pasman (2000) stated that a positive safety culture leads to the reduction of costs of accidents borne by the organization, such as compensation cost and plant damage.
5. Reputation: Ali et al. (2009) stated that high rates of severe injuries in organizations can have detrimental effects on the reputation as well as performance of an organization.
6. Increased working speed: Mitropoulos and Cupido (2009) stated that the enhancement of safety culture leads to increased working speed.
7. Customer perception: A global concern for safety is related to an ever-increasing consumer expectation of service excellence. (Appelbaum and Fewster, 2003).
8. Accident rate: The frequency of accident occurrences may be reduced with good safety program (Pasman, 2000).

The above three factors, together with their 28 associated attributes are used in developing the questionnaire survey to gather data for the analyses.

Questionnaire Survey and Preliminary Analyses

The questionnaire survey was developed based on the 28 extracted items. Targeted respondents were both management and workers positions in the textile companies to gain mixed perception of safety implementation. A total of 300 questionnaires were launched to 60 textile firms located mainly in the central part of Thailand, with 130 responses returned. This represented the response rate of 43.33%. Among the responses, three were unusable

due to data incompleteness, resulting in a total of 128 questionnaires for further analyses. More than half of the respondents were employees, working in their current position, as well as in the textile industry, of more than five years. Majority of the respondents also participated in safety training program. These indicated the reasonably high working experience of the respondents.

Preliminary analyses were, then, performed to confirm the suitability of the data for the exploratory factor analysis. The normality, outlier, and reliability tests were conducted. The normality test is a statistical process used to determine if a sample or any group of data fits a standard normal distribution. The results showed that there are no skewness and kurtosis values that exceed the stated limits, thus concluding the normal distribution of all the 28 attributes. The outlier test is the test that detects an observation which deviates so much from other observations as to arouse suspicious that it is generated by a different mechanism. The results led to the deletion of one data, resulting in the 127 data for the reliability test. The three factors, including People, People Results, and Productivity were proved reliable with the reliability test, thus, confirming the suitability of the data for the exploratory factor analysis.

Exploratory Factor Analysis

Exploratory factor analysis (EFA) is used to examine how underlying constructs influence the responses on a number of measured variables (Newcastle University, 2007). In this paper, the generalized least square method was used as factor extraction. Factor loading of 0.4, together with the varimax rotation, were used to perform factor analysis. The first run resulted in the deletion of the 'safety observation' and 'compensation cost' items. The remaining 26 items were, then, reanalyzed, and were extracted into three factors, in which, each factor represented the characteristics of its factor (see Table 1). These three extracted factors were reconfirmed with the reliability test. The Cronbach's alpha values of the factors were founded in the acceptable range, as shown in Table 2. It was worth pointing out that the above analysis led four items (reputation, accident rate, employee empowerment, and good working environment) initially assumed to be associated with a certain factor, to strongly correlate with another factor. To illustrate, the 'employee empowerment' item was relocated from People and People Results factors. This is partly supported by McClay (1995) that employee empowerment is achieved by a good teamwork.

In summary, the three factors, with their associated items, formed the baseline model for the structural equation modeling to investigate the inter-relationships between the confirmed factors, as shown in Figure 2.

Structural Equation Modeling

Structural equation modeling (SEM) consists of an integration of two models, including the measurement model, which explains the relationships between latent variables and observed variables, and the structural model, which defines causal relationships among those latent factors (Jitlung, 2009).

Modification indices (MI) are often used to assess the overall model fit (Moss, 2009). Common fit indices are RMSEA, CMIN/DF, CFI, and IFI (Kohn et al., 2011). The value of RMSEA of 0.1 or less, CMIN/DF of less than two, and CFI and IFI of 0.80 or more represent the model as a good fit (Browne and Cudeck, 1993; Garson, 2006).

Table 1. Three Factors Extracted from the EFA.

Item	Factor		
	People	People Results	Productivity
Emergency preparedness	0.72		
Participation	0.72		
Safety compliance	0.65		
Reputation*	0.60		
Training	0.59		
Peer review	0.59		
Perceived risk	0.58		
Employee commitment	0.56		
Accident experience	0.52		
Accident rate*	0.48		
Teamwork	0.45		
Reporting accident	0.41		
Stress	0.41		
Absenteeism		0.77	
Higher motivation		0.72	
Communication enhancement		0.71	
Job tenure		0.69	
Job satisfaction		0.69	
Better attitudes		0.61	
Workforce morale		0.60	
Employee empowerment*		0.49	
Good working environment*		0.47	
Quality of product			0.93
Material damage			0.58
Customer perception			0.45
Increased working speed			0.41

Table 2. Cronbach's Alpha Values of the Three Factors Extracted from the EFA

Factor	Cronbach's Alpha
People	0.87
People Results	0.88
Productivity	0.81

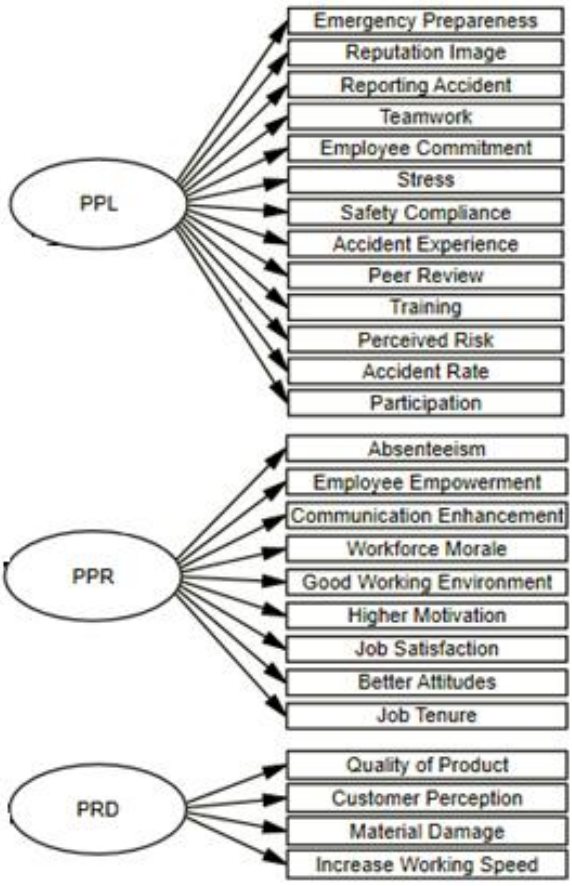

Figure 2. The Baseline Model

The baseline model was analyzed with SEM. The fit indices, as shown in Table 3, revealed the best-fit measurement model, as shown in Figure 3.

Table 3. Fit Indices Results

Fit Index	Acceptable Level	Baseline Model	Best-Fit Measurement Model	Best-Fit Structural Model
RMSEA	≤ 0.10	0.09	0.09	0.08
CMIN/DF	< 2.00	2.03	1.92	1.89
CFI	≥ 0.80	0.80	0.83	0.83
IFI	≥ 0.80	0.80	0.83	0.83

Having established the confidence in the measurement model, a structural model was performed to examine the direction of relationships between the three factors. A number of model runs, with different arrow directions connecting the three factors, were carried out. Any links with low correlations are deleted. For each run, the fit indices were computed and compared. The model with the best fit proved the directional influences (Clissold, 2004).

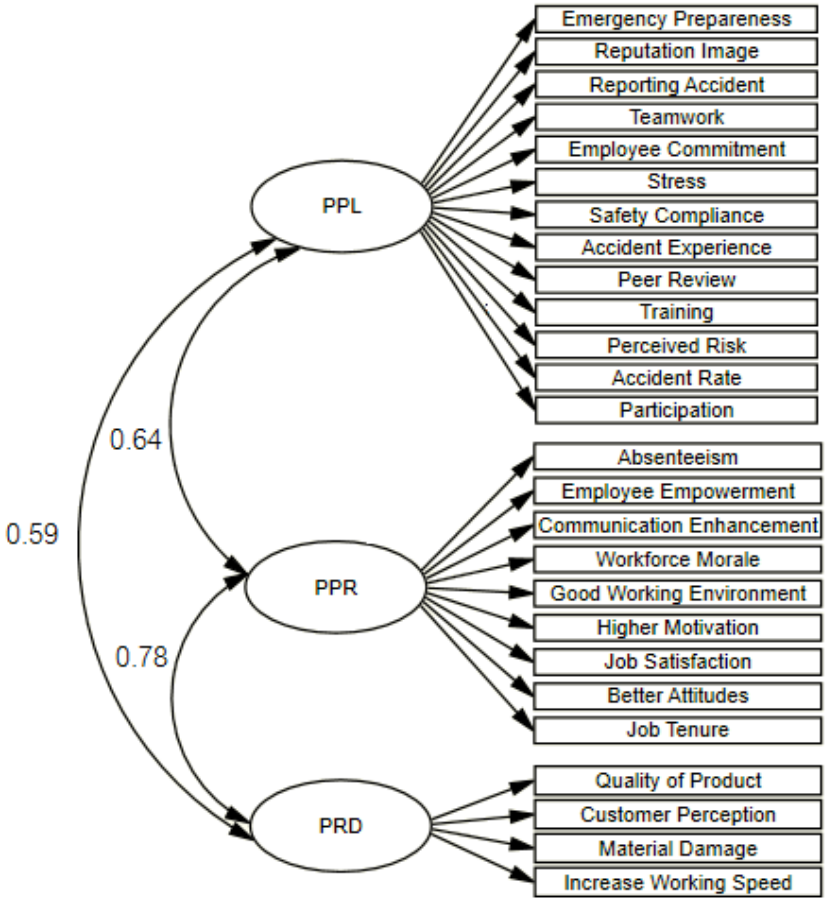

Figure 3. The Bet Fit Measurement Model

The fitted structural model (see Figure 4) showed better fit indices (see Table 3), leading to the final model, as shown in Figure 5. The final model showed that People Results had a significant direct relationship with the Productivity (with path coefficient = 0.79) at 0.05 probability level, and that it explained 62.1% of the variance in the People Results factor. This is supported by, for example, Pasman (2000) that the improvement of safety culture helps reduce the lost time through accidents, thus increases productivity.

No statistically significant relationships, however, were found between People and Productivity factors, as were previously hypothesized. Indirect effect, though, was found through People Results. For example, employees' involvement in safety leads to higher job satisfaction. This assists in reducing work injuries (Mitropoulos and Cupido, 2009).

The summary of direct and indirect path coefficients of the three factors is illustrated in Table 4.

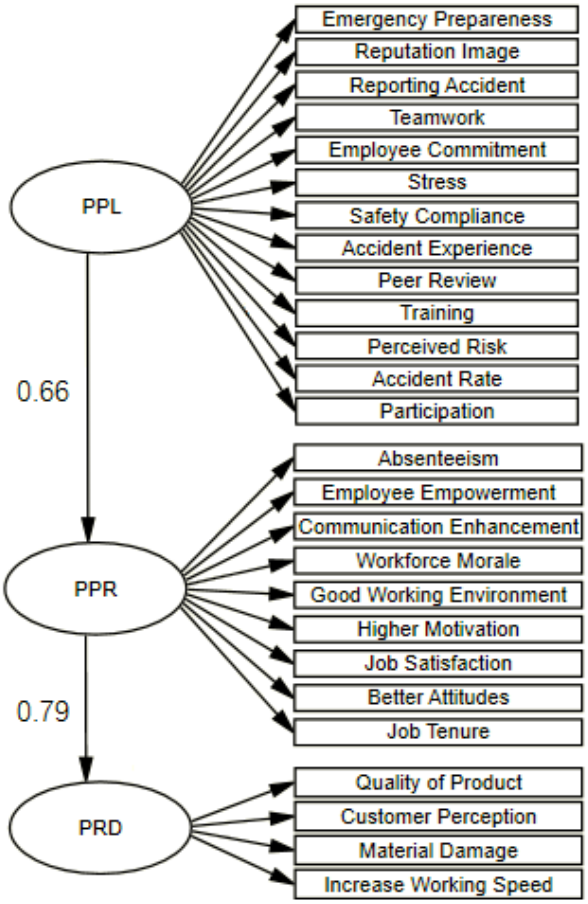

Figure 4. The Best-fit Structural Model

Figure 5. Final Model of the Three Factors

Table 4. Direct and Indirect Path Coefficients

Factor	Path Coefficient	Path
People → People Results	0.66	Direct
People Results → Productivity	0.79	Direct
People → Productivity	0.52	Indirect

Conclusion

This study uses the structural equation modeling technique to better understand the relationships between People, People Results, and Productivity factors. It is found that People Results has direct effect to Productivity, explaining that productivity tends to be higher when employees, for example, have high job satisfaction, are accounted for proper safety responsibilities, work as a team, and have adequate safety training. The results also

show that productivity can be higher with a good safety implementation, as seen by an indirect effect from People to Productivity through People Results. Textile companies can use the analyses results in planning its safety program to enhance productivity.

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