An Empirical Study on the Impact of Leadership Style on Miners' Safety Performance

Li Song*, Jian Sun
Economics and management school, Anhui university of science and technology
Huainan City, Anhui Province, 232100, China
*Corresponding author’s e-mail: lilysong23@163.com

Abstract. Based on the survey results of 168 miners from a state-owned coal mine, the impact of leadership style on employee safety performance was analyzed. Pearson correlation and regression analysis results show that leadership style has a significant impact on miners' safety performance. Person-oriented leadership style and management safety commitment have significant roles both on accidents and injuries.

1. Introduction
Human unsafe behaviour is one of the main causes of accidents [1]. Many studies proved that majority of accidents are caused by human factors [2], few accidents are caused by an unsafe environment, and many accidents can be prevented by efficient safety management. Accidents usually imply that some defects occurred in the process of safety management [3].

Based on the causal model of "event chain" represented by Heinrich, "in-depth defence" system that consists of technical and unsafe behaviour control is emphasized [4]. By building "in-depth defence" systems, both technical system and social system can be improved and accident rate can be reduced. However, many accidents show that the causal chains are not caused by isolated decision-making errors or human factors, but occur in the process of resonance between human, machine, environment, task and information system units [5]. Production system is an open system that consists of human beings with three-dimensional and multi-layered network structure. Many environmental factors such as market competition, financial pressure, technological changes and laws will influence organizational safety management and employees’ safety attitude and behaviour. In order to survive and develop, enterprises must constantly adapt to the environment. That is to say, enterprises must have the ability of showing a certain degree of response to environmental pressure shocks [6].

Accidents are the collapse of the adaptive behaviour process of the system in response to dynamic environment changes. It is important to enhance the flexibility of the organization in dealing with safety risks, and improving adaptability and resilience of enterprise organization. As one of the organizational factors, leadership style is one of the most important factors influencing adaptability of organization. In order to study the influence of leadership style and management safety commitment on employee safety performance, we made a questionnaire survey on employees from a local state-owned coal mine enterprise, and made quantitative analyses on the influence of leadership style on employees’ safety performance by methods of correlation analysis and regression analysis.
2. Theory and hypothesis

Leadership is a kind of behaviour or process in which leaders exert influence on their subordinates by using their rights to achieve organizational goals. Leadership includes four essential elements: leaders, targets (i.e. objective environment), authority and leadership behaviour. Successful leadership depends on appropriate behaviour, skills and actions [7]. Leadership style is the sum of the relatively fixed and frequently used behavioural methods that the leader presents in the process of long-term leadership activities [8]. When leaders influence others, they adopt different behavioural patterns to achieve their goals. Enterprise leadership style is the characteristics of customized leadership style. The customized leadership style is gradually formed in the long-term personal experience and leadership practice, and plays a role consciously or unconsciously in the leadership practice, which has a strong personalized colour. Every leader has his / her own style, different from other leaders in terms of working environment, experience and personality.

Leadership behaviour sometimes focuses on supervision and control, sometimes on trust and decentralization, sometimes on persuasion and explanation, and sometimes on encouraging and establishing affinity. These behavioural patterns are observable and can be "felt" by the employees. Blake & Mouton [9] divided leadership style into two dimensions: person-oriented and regulation-oriented. Person-oriented leadership style pays attention to the establishment of interpersonal relationships, while regulation-oriented leadership style emphasis achieving the goals of the organization by setting up work process. Person-oriented behaviour is the leader's behaviour to satisfy their psychological needs, including expressing trust, enhancing the sense of participation, establishing affinity and belonging, etc. Two-way or multi-way communication between leaders and employees are the main features of Person-oriented behaviour. Regulation-oriented leader clearly states the responsibilities of an individual or organization. This includes telling the other person who you are (role orientation), what to do, when to do it, where to do it, and how to do it. One-way communication from leaders to employees is a typical feature of work behaviour.

Conceptualizing safety leadership is helpful in explaining how and why good organizational safety performance achieved. Interest in how leaders lead and the impact of leadership upon work safety is not new. Safety climates, leadership within the organization are commonly cited as important antecedents of workplace safety. Leadership is a construct that reflects the true priority of safety within an organization. Commitment to safety has been identified as the key dimension of safety climate. Blair (2003) [10] argued that seven issues regarding safety performance needed to be improved; three concerning safety climate and four concerning safety leadership, in order to reveal any correlation among safety leadership, safety climate, and safety performance. Zohar and Luria (2005) [11] promoted a global factor relating to management commitment when measuring safety climate based on theoretical and statistical considerations. Zohar (2008) [12] concluded that the core meaning of safety climate concerns managerial commitment, with all other variables that have been associated with this construct assuming a secondary role both theoretically and empirically. Abdelhamid T. [13] proved that both management commitment to safety and leadership behaviour have significant impact on safety climate. Tsung-Chih Wu [14] found that management commitments had an impact on accident rates, management’s attitudes and behaviour to safety could affect employees’ safety behaviour.

The conceptual definition of safety performance refers to “the overall performance of the university safety management system in safety operation” [15]. Threats to work safety in mining industries include physical, ergonomic and social hazards. Therefore, the purpose of this study was to explore the correlation between leadership style, management safety commitment and safety performance in mining. In keeping with this idea, Probst and Brubaker (2001) [16] proposed that extrinsic safety motivation would be related to employee accidents and injuries at work. Extrinsic safety motivation involves the perceptions of supervisor enforcement of safety policies (i.e., enacted safety policy), including the extent to which supervisors provide praise for safety compliance and punish for non-compliance. They found that employees who had low extrinsic safety motivation (i.e., supervisors who failed to enforce safety policies) had lower levels of safety compliance and were more likely to
experience injuries and accidents at work. Thus, this aspect of enacted safety policy was shown to influence safety outcomes.

The following hypotheses have been put forward:

Hypothesis 1. Management safety commitment mediates the relationship between leadership style and safety performance.

Hypothesis 2. Leadership style is positively related to management safety commitment. This hypothesis means that the more positive the perceived leadership, the more positive the perceived management safety commitment.

Hypothesis 3. Management safety commitment is positively related to safety performance. This hypothesis means that the more positive the perceived management safety commitment, the more positive the perceived safety performance.

Hypothesis 4. Leadership is positively related to safety performance. This hypothesis means that the more positive the perceived safety leadership, the more positive the perceived safety performance.

3. Methodology

3.1. Sample
A total of 200 questionnaires were distributed and 168 valid questionnaires were collected. The recovery rate was 84%. All subjects were male, the age distribution was as following: age distribution were: 62 subjects were 25 years old and below, accounting for 37% of the total; 48 subjects were 26-30 years old, 29% of the total; 41 subjects were 31-35 years old, 24% of the total; 11 subjects were 36-40 years old, 6.5% of the total; 6 subjects were 40 years old and above, 3.5% of the total. The distribution of education level: 2 undergraduates, 1.2% of the total; 32 collegiates, 19% of the total; 45 technical secondary school, 26.8% of the total; 43 high school, 25.6% of the total; and 46 middle school and below, 7.4% of the total.

3.2. Variables
The questionnaire was divided into two parts. The first part requested general information, which was used to measure organizational factors (including size, ownership and location) and individual factors (including gender, age, job tenure, title and work site). The second part is consist of three variables including the leadership scale (LS), management safety commitment (MSC) and safety performance (SP).

Leadership style variable consists of two dimensions including "work -oriented" and "person-oriented" behaviour. Items such as "work -oriented" behaviour such as “supervisors will let subordinates know their importance in the organization” “the director will let the subordinates understand their expectations of the company” are used to describe leadership style. Standardized mean of the answer to the above questions is used to represent leadership style variable. The alpha coefficient of the composite variable is 0.8361, indicating that the reliability of the questionnaire is relatively high.

Management safety commitment variable is composed of 5 items such as “leaders' emphasis on safety objectives” “contradictions in product tasks and safety” “awareness of risks” “safety communication” and “attitude towards violations”. Standardized mean of the answer to the above questions is used to represent management commitment to safety variable. The alpha coefficient of the composite variable is 0.8124, indicating that the reliability of the questionnaire is relatively high.

Safety performance variable consists of three aspects: absenteeism, accident and injury. Standardized mean of the answer to the above questions is used to represent safety performance system. The alpha coefficient of the composite variable is 0.8026, indicating that the reliability of the questionnaire is rather high.

As shown in table 1, the internal consistency analysis has shown good validity and reliability.
All of the above questionnaires were used in the form of the Likert 7-point scale, the positive question score: 1 = very objection, 7 = very agree. Reverse question score: 1 = very agree, 7 = very objection.

Table 1. Validity and relativity of variables

| Variables                  | Eigen-values | Accumulative variance (%) | Cronbach |
|----------------------------|--------------|----------------------------|----------|
| Leadership style           | 8.250        | 23.875                     | .8361    |
| Management safety commitment| 8.124        | 46.275                     | .8124    |
| Safety performance         | 8.137        | 70.684                     | .8026    |

4. Results

4.1. The overall condition of the variables

(1) Leadership style

Subjects feel that the immediate leadership will let them know the importance of their organization (mean 5.51 standard deviation 1.35) Understand the company's expectations (mean 6.75 standard deviation 1.18), Comply with the relevant provisions and requirements (mean 5.21, standard deviation 1.34), Monitor the objectives of work plan and progress (mean 6.35 standard deviation 1.18), Stressed that the work should be completed on schedule (mean 6.88 standard deviation 2.02), Less appreciate subordinates for completing the task (mean 4.08 standard deviation 1.02), Less support for subordinate acts (mean 3.98 standard deviation 2.13), Do not pay much attention to subordinate benefits (mean 4.22 standard deviation 1.92), Less concerned about subordinate life (mean 4.11, standard deviation of 1.92), Differences in treatment to subordinate (mean 5.78 standard deviation of 2.42).

(2) Management safety commitment

Subjects felt that management did not pay much attention to safety objectives (mean 4.56 standard deviation 1.44), In the face of choice on safety and production costs, the management will give priority to financial indicators (mean 4.75 standard deviation 1.38), Management has some knowledge of work risk (mean 5.21, standard deviation of 1.34), less direct discussion with employees on safety issues (mean 4.35 standard deviation 1.18), not pay attention regulation violation(mean 4.88 standard deviation 2.02).

(3) Safety performance

Most subjects had absenteeism experience (mean 5.86 standard deviation of 1.09), some subjects were injured in the accident (mean 4.13 standard deviation 1.55).

4.2. The effect of Leadership Style on Miners' Safety Performance

As shown in table 2, there are significant correlations between leadership style and management safety commitment, and management safety commitments are significantly related to employees' safety performance. Person-oriented leadership behaviour has significant positive effect on management safety commitment, but has obvious negative correlation with absenteeism, accidents and hurts. Work-oriented behaviour has significant positive correlation with accidents and hurts.

The results of the regression analysis are shown in Table 3. Regression analysis models are made by taking absenteeism, accidents and hurts as the dependent variables, leadership style and the management safety commitment as the independent variables. According to the results of the regression analysis, the following conclusions can be drawn.

Table 2. Pearson correlation coefficient of variables

| variable                  | 1   | 2   | 3   | 4   | 5   | 6   |
|---------------------------|-----|-----|-----|-----|-----|-----|
| 1 person-oriented behaviour| 1   |     |     |     |     |     |
| 2 work-oriented behaviour | .208| 1   |     |     |     |     |
** Correlation coefficient significance level 0.01, two-tailed test;  
* Correlation coefficient significance level 0.05, two-tailed test

| variable                       | absenteeism | accidents | hurts  |
|--------------------------------|-------------|-----------|--------|
| Person-oriented behavior (Beta)| -.165       | -.122     | -.101  |
| Work-oriented behavior (Beta)  | -.087       | .202      | .213   |
| Management safety commitment (Beta) | -.103     | -.162     | -.315  |
| Adjusted $R^2$                 | .842        | .811      | .868   |
| F                              | 41.081      | 37.208    | 34.741 |

Leadership style, management safety commitment and absenteeism constitute a significant linear regression. Comparing the Beta values, person-oriented leadership behaviour and management safety commitment have obvious contribution to the regression equation, which means both person-oriented leadership style and management safety commitment are important factors affecting employee absenteeism, accidents and hurts.

5. Conclusion and Discussion

Leadership style, management safety commitment and accidents constitute a significant linear regression. Comparing the Beta values, it can be seen that work-oriented behaviour has the significant influence on accidents, while person-oriented behaviour and management safety commitment can reduce the accident.

Leadership style, management safety commitments and injuries constitute a significant linear regression. Comparing the Beta values, it can be seen that management safety commitment is the significant factor influencing hurts; by improving management safety commitment, hurts could be reduced effectively.

This survey proves that both leadership style and management safety commitment have an important impact on employees’ safety performance. Each leadership style has different impact on safety performance, person-oriented leadership behaviour and management safety commitment are critical factors affecting safety performance. The person-oriented leadership is the most obvious element affecting workers’ safety performance.

Another important result is that managers’ safety commitment has notable effect on workers’ safety outcomes, which is the media variance between leadership style and employees’ performance. Thus it is necessary to improve safety outcomes by adjusting safety-oriented commitment and balance safety management and leadership.

A limitation to this study is that it only captured individual practices, but did not account for factors outside of the organization that may contribute both to leadership style and workers’ safety practices at workplaces. Besides, sample size is small and needs to be expanded in later studies.

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