

The Impact of Contractor Safety Leadership on Workers Safety Behavior

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Abstract: The importance of safety leadership for effective management of safety behavior has been acknowledged by many researches. However, its development in construction industry is lagging compared to other industry, especially in Indonesia. This research empirically evaluates the impact of contractors' safety leadership on construction workers' safety behavior. It explores three dimensions of safety leadership variable and two dimensions of safety behavior variable, and then examines the relationship between the two variables. Data was gathered through questionnaire survey to eighty-four workers from five on-going construction projects in Surabaya, Indonesia. Multiple regression analysis was performed to examine two models of the impact of safety leadership on safety behavior. The findings suggest that safety concern and safety motivation positively impact safety compliance and safety participation, whilst safety policy only have a significant positive impact on safety participation. The paper discusses these findings and their implications for shaping workers' safety behavior in construction projects.

Keywords: Safety leadership; safety behavior; safety concern; safety motivation; safety policy; safety compliance; safety participation.

Introduction

The construction industry has poor safety records compared to other industries. There are many perceptions indicating that accidents in construction projects, which can range from minor injuries to loss of life, are originated from workers' unsafe acts [1]. Clough and Sears [2] note that statistically 85% of construction accidents are caused by unsafe acts and the rest 15% are caused by unsafe conditions. In short, many argue that the behavior of workers through their unsafe acts (aberrant behaviors) is the main causes of accidents.

From the perspective of the system approach to human errors [3,4], people are fallible and so are construction workers. Such aberrant behaviors (unsafe acts) are to be expected. It is difficult to make workers in such a way that they do not forget, take short cut and so on. Unsafe acts arise directly from the way worker's mind handles information and are not a matter of individual stupidity, carelessness or even lack of training. Therefore, efforts to manage construction safety by focusing only on unsafe acts tend to concentrate on remedial efforts upon preventing the recurrence of specific behaviors.

There is an increasing recognition within the industry and by researchers of the need to manage safety on a more proactive basis to improve safety behavior of construction workers at work.

One proactive management approach to decrease unsafe act is effective safety leadership [5]. Safety leadership that motivates workers to work harder, to work efficiently, and to take ownership of responsibility for safety performance is encouraged. Effective leadership plays an important role in ensuring the success of temporary organizations facing a high degree of uncertainty, which resembles the characteristics of construction projects [6]. It is therefore important to develop and sustain effective safety leadership in construction projects to promote safety behavior among construction workers, which may result in reducing accidents and increasing good safety performance. In Indonesia, this is the contractors' duty as the employer of the workers to lead their workers to behave safely.

Many empirical studies have demonstrated the importance of leadership to safety [6-8]. Safety leadership is a significant antecedent of worker safety behavior [6,7,9]. However, safety leadership researches within the construction industry are scarce compared to other industries, especially in Indonesia. For an example, research by Indryana and Suraji [10] only considered the construction stakeholders' awareness of safety leadership as part of construction safety management system. The research did not specifically analyze how contractors performed safety leadership on site, and more importantly it did not examine how safety leadership might have effects on workers' safety behavior.

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This paper is intended to fill in this gap. It will first gauge safety behavior of the construction workers. Next, it will assess the style of the contractors in leading safety in construction projects. The final objective is to analyze the impact of the contractor safety leadership on the worker safety behavior.

Literature Review

Safety Behavior

There are several definitions of safety behavior. Basically, safety behavior refers to a series of activities carried out by workers on site when they perform safety-related tasks or responsibilities [11]. Marchand, et al. [12] define safety behavior as the level of compliance with safety rules. In other words, safety behavior is individual behavior that supports the health and safety of the work environment [13]. The behavior in question is reflected in a good attitude and becomes a characteristic that distinguishes workers with high or low injury rates [14].

In line with these definitions, safety behavior aims to reduce incidents triggered by unsafe or risky behavior [15]. This is because safety behavior can create a safe work environment [16]. To achieve this goal, safety behavior issues need to be identified with a focus on incidents caused by interactions between people and their work environment. These interactions include the quality of the management system, the quality of leadership, available resources (financial and non-financial), and the overall safety culture [15].

Other studies also confirm that poor safety behavior results in work errors, near misses, or bad events in the work environment [17]. In addition, non-compliance with applicable safety procedures or unwillingness to participate in activities that enhance the safety can create the possibility of harm to others in the future [16]. In short, improving the quality of safety behavior leads to a reduction in injuries, unsafe incidents, and stress at work [18].

Safety Behavior Dimensions

Andriessen [19] noted that the dimensions of safety behavior include carefulness and initiative. Carefulness means that workers are careful to comply with safety rules, while initiative means workers' actions to improve the safety of the work environment.

Similarly, Neal and Griffin [16,20] also consider two dimensions of safety behavior, namely safety compliance and safety participation. These two dimensions form the basis for this research.

Safety compliance focuses on the core activities that individuals need to perform to maintain workplace

safety. It is defined as compliance with safety procedures that aims to reduce the risk of accidents associated with unsafe practices and rule violations [21]. To achieve quality safety compliance, good safety knowledge and skills are required.

According to Neal, et al. [20], safety compliance is in the form of compliance with safety procedures and carrying out work in a safe manner. Neal and Griffin [16] also add complying with standard work procedures and using personal protective equipment as the components of this dimension.

Li, et al. [22] reveal that safety compliance refers to workers who obey the rules, regulations, company implementation procedures in a disciplined manner, and use safe methods to complete their construction tasks. Meanwhile, Clarke [21] remarks that safety compliance involves complying with rules and regulations, following safety procedures carefully, avoiding risky operations and taking precautions against hazards, such as wearing personal protective equipment.

On the other hand, safety participation is behavior that indirectly helps develop a safe work environment [16]. Several studies also state that safety participation not only improves individual safety, but also the safety of the work environment [8, 21]. Safety participation involves a greater voluntary element outside of the worker's formal duties [21].

Li, et al. [13] reveal that safety participation refers to the behavior in which workers participate in their organization's safety issues, help co-workers solve safety problems, improve precautions, and implement safety policies. Neal, et al. [20] note that behaviors that are classified as safety participation include helping coworkers, voicing safety programs at work, showing initiative, and trying to improve safety in the workplace. In addition, Neal and Griffin [16] mention that participating in voluntary safety activities, helping colleagues with safety-related issues, and attending safety meetings are part of safety participation. Table 1 lists the two dimensions of the safety behavior and their components as summarized from several sources [5,16,21].

Table 1. Safety Behavior Dimensions

Dimensions	Components
Safety Compliance	Complying with safety procedures Using safety personal protective equipment Not neglecting safe procedures even though in difficult situation
Safety Participation	Helping co-workers with safety related issues Voicing safety programs in the workplace Attending safety meetings

Safety Leadership

Several studies [6,8,9] have determined that an important element in reducing accident rates in a high-hazard environment such as the construction industry is safety leadership. Safety leadership can motivate a team or group of workers to be able to work harder, work efficiently, and make everyone feel responsible for safety in the workplace. It may have an impact on the behavior of workers which will then reduce the work accidents.

According to Wu et al. [6], safety leadership is a sub-system of leadership. Safety leadership is defined as a process of interaction between leaders and followers, in which leaders can use their influence on followers to achieve organizational security goals under the circumstances of organizational and individual factors [5]. Meanwhile, Skeepers and Mbohwa [23] state that safety leadership is much more important than policy, because leaders improve safety through their actions or decisions, sending clear messages to organizations about which policies are important and which are not. The leaders' behavior that embraces employees' participation allows them to discuss safety problems that occur in the work environment and find solutions.

Safety Leadership Dimensions

Lu and Yang [5] and Wu et al. [9] propose a safety leadership model, which comprises of transactional and transformational leadership, to represent safety leadership dimensions. To summarize, transactional leadership is a leadership style that implements a reciprocal relationship based on the principle of a transaction or exchange between two parties, in this case the employer and the recipient of the job. On the other hand, transformational leaders are leaders who provide individualized and charismatic intellectual stimulation and consideration. Transformational leadership includes organizational change efforts that will lead to superior performance in organizations that are facing the demands of renewal and change [24].

This research adopts the safety leadership model recommended by Lu and Yang [5] and Wu et al. [9] that has three dimensions, i.e. safety motivation, safety concern and safety policy. The first two dimensions signify the characteristics of transformational leadership style; whilst the last is for transactional leadership. Table 2 displays of the safety leadership dimensions and their components.

The safety motivation dimension shows how leader (contractor in this research) can create a motivational system to encourage workers' safety behavior in the workplace. Such systems may include reward-ing safety behavior, praising work safety behavior,

setting up a safety incentive system, reporting poten-tial accidents and advice on safety, and encouraging workers to participate in safety-related decision-making [5]. Wu et al. [6] point out that this dimen-sion resembles the characteristics of inspirational under the transformational leadership.

Table 2. Safety Leadership Dimensions

Dimensions	Components
Safety Motivation	Contractor reward workers who set an example in safety behavior Contractor praise workers' safety behaviors Contractor encourages workers to report potential incidents Contractor encourages workers to provide safety suggestions Contractor encourages workers' participation in safety decision-making
Safety Concern	Contractor stresses the importance of wearing personal protective equipment Contractor is concerned about safety improvement Contractor coordinates with all parties to solve safety issues Contractor shows consideration for workers
Safety Policy	Contractor explains the safety mission clearly Contractor has established a safety responsibility system Contractor establishes clear safety goals

The second dimension, i.e. safety concern, refers to the extent to which a contractor is a role model to workers; stresses the importance of the use of safety equipment; emphasizes its interests in acting on safety policies, is concerned about safety improve-ment; and coordinates with all parties to solve safety issues [5].

For the safety policy dimension, Lu and Yang [5] suggest that contractor creates a clear mission, responsibility, and goal to set standards of behavior for workers; and sets up a safety system to assess workers' safety behaviors. Wu et al. [6] perceive this dimension is closely related to the characteristics of contingent reward and management by exception in the transactional leadership.

Research Method

To collect the required data, the research employed questionnaire survey method. The respondents were construction workers (skilled and unskilled workers) on several ongoing projects at the time of the survey.

The Questionnaire

The questionnaire was divided into three parts, in which the first part asked the respondents' personal data, such as age, education, and experience in

construction. The second part contained questions about the safety behavior dimensions in Table 1. The respondents were asked to rate how often workers (including themselves) conducted such behavior (shown as components in Table 1) using a scale of one (never) to five (always).

The final part of the questionnaire listed the components of three safety leadership dimensions in Table 2. The workers were required to assess the safety leadership of the contractor they were working to using a five Likert scale, from one (very disagree) to five (very agree)

Research Models

To evaluate the impact of contractors’ safety leadership upon workers’ safety behavior, this research proposed two models, which represented the two safety behavior dimensions. Figure 1 shows the two models.

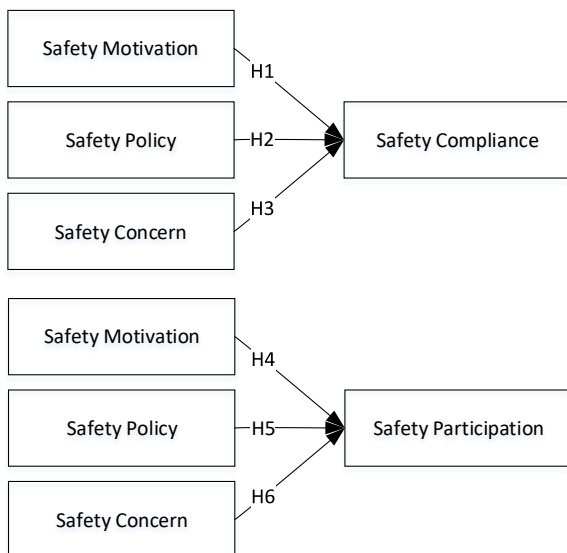


Figure 1. Models of The Impact Safety Leadership to Safety Behavior

As displayed in Figure 1, there were six hypotheses that would be tested. They were: H1 = safety motivation influences safety compliance; H2 = safety concern influences safety compliance; H3 = safety policy influences safety compliance; H4 = safety motivation influences safety participation; H5 = safety concern influences safety participation; and H6 = safety policy influences safety participation.

Multiple linear regression technique would then be employed to perform the two models and to test the six hypotheses. Within each model, there were one dependent variable (Y), which indicated the safety behavior dimension (i.e. the safety compliance and safety participation); and three independent variables (X), which referred to the safety behavior

dimensions (safety motivation, safety policy and safety concern). The general mathematical equation representing the models in Figure 1 would be:

$$Y = b_1X_1 + b_2X_2 + b_3X_3$$

Coefficients b_i indicated the impact of each safety leadership dimension on safety behavior. One step of the statistical analyses’ series conducted in multiple linear regression technique would be the tests of the significance of the coefficient b_i (the impact), which signified the tests of the six hypotheses. If the *p-value* resulted from the test was less than or equal to 0.05 then it would be concluded that the impact was significant. Only safety leadership dimensions that had significant impact would be included in the final model.

Results and Discussions

Eighty-four construction workers were successfully approached by the researchers to participate in the questionnaire survey. They were gathered from six ongoing projects, which were all high-rise building projects in Surabaya. Table 3 summarizes the general information of the respondents.

Table 3. General Information of the Respondents

Items	Categories	Proportion (%)
Age (years)	<20	19.0
	20-30	38.1
	30-40	11.9
	>40	31.0
Experience (years)	<1	15.5
	1-5	31.0
	>5	53.5
Education	Elementary	32.1
	Junior High	39.3
	Senior High	28.6

Before proceeding with subsequent analyses, validity and reliability tests were conducted. The results of validity test indicate that all components shown in Tables 1 and 2 are valid, with the *p-values* below 0.05. Meanwhile since the values of Cronbach’s alpha resulted from the reliability tests are all above 0.4, it can be gauged that all questions (components) are also reliable to measure the five dimensions under consideration [25]. Thus, all questions (components) in Tables 1 and 2 are valid and reliable and can be used for this study.

Safety Behavior Dimensions

Tables 4 and 5 display the mean values of the dimension of safety compliance and safety participation respectively. Overall the results show a good indicator that construction workers have been behaving safely

in the workplace, by complying to the prevailing safety procedures (with a mean value of 4.09) and by actively participating in safety activities (with a mean value of 4.03).

Table 4. Mean Values of Safety Compliance Dimension

Items	Mean
Complying with safety procedures	4.08
Using safety personal protective equipment	4.08
Not neglecting safe procedures even though in difficult situation	4.01
Safety Compliance	4.09

Table 5. Mean Values of Safety Participation Dimension

Items	Mean
Helping co-workers with safety related issues	3.99
Voicing safety programs in the workplace	4.04
Attending safety meetings	4.06
Safety participation	4.03

Safety Leadership Dimensions

With an overall mean value of 4.06 (Table 6), it can be explained that the contractors have carried out the safety policy well. Most the contractors in the survey are required by the owner to submit company’s safety procedures and job safety analyses, which may clarify the company safety mission and goals. The contractors usually then communicate and explain the safety policy and procedures through weekly tool box meeting to ensure that the workers understand them.

Table 6. Mean Values of Safety Policy Dimension

Items	Mean
Contractor explains the safety mission clearly	4,17
Contractor has established a safety responsibility system	3,94
Contractor establishes clear safety goals	4,06
Safety Policy	4,06

Table 7 shows that the contractors also make a good effort in motivating the workers to behave safely. The overall mean value of 3.91 indicates this effort. One way for the contractors to motivate the workers to behave safely was by conducting safety contest among groups of workers. Incentives, such as money or goods, were given to the group who was best exercising safety practices on site.

Table 7. Mean Values of Safety Motivation Dimension

Items	Mean
Contractor reward workers who set an example in safety behavior	3.36
Contractor praise workers’ safety behaviors	4.18
Contractor encourages workers to report potential incidents	4.17
Contractor encourages workers to provide safety suggestions	3.96
Contractor encourages workers’ participation in safety decision-making	3.89
Safety Motivation	3.91

In addition, it is imperative for the contractors to encourage workers to speak up and report about safety issues on construction sites. Currently safety communication mostly only works one way from the contractors to the workers. With an active two-ways communication, the contractors may get more valuable information or suggestion for improving safety practice. An honest safety reporting culture by workers [26] should be promoted in construction projects.

The last dimension of safety leadership, i.e. safety concern, also has a high mean value (4.03). It determines that the contractors put the safety related issues as high priority, especially for the use of basic personal protective equipment, such as helmet, life vest, and safety shoes. The contractors provide and then stress to the workers the importance of their use on construction site.

The safety concern and coordination were shown by giving safety induction to new workers. And to maintain the concern, the contractors communicated the safety issues through weekly toolbox meeting. Safety information was also socialized by placing safety information board.

Table 8. Mean Values of Safety Concern Dimension

Items	Mean
Contractor stresses the importance of wearing personal protective equipment	4.13
Contractor is concerned about safety improvement	4.04
Contractor coordinates with all parties to solve safety issues	3.88
Contractor shows consideration for workers	4.07
Safety Concern	4.03

Another form of contractors’ concern for their workers was providing insurance (*jamsostek*), even though the workers were not having direct contract with the contractors. It was noted that commonly in most projects the workers were supplied by *mandor* (foreman). The insurance was intended to cover the workers in case accident happened on site.

The Impact of Safety Leadership on Safety Compliance

The results of regression analysis for the impact of contractors’ safety leadership on workers’ safety compliance are represented in Table 9. The value of adjusted R² (0,572) indicates that safety leadership, with its three dimensions, has an impact of 57.2%. Additional tests confirmed the fitness of the analysis results. The first was normality test, using Kolmogorov Smirnov test, with a significant value of 0.777 (above 0.05). Next text revealed that there was no multicollinearity among the three independent

variables, in which all collinearity tolerance values were above 0.1 and all VIF values were below 10. Finally, the glejser test did not find any heteroscedasticity (at $\alpha = 5\%$) between independent and dependent variables.

However, only two variables (dimensions) that statistically have significant impact (with a p-value < 5%); they are safety motivation and safety concern. This result thus validates the support of hypotheses 1 and 3 (H1 and H3) and rejection of hypothesis 2 (H2) in Figure 1. The final model can be written as:

$$\text{Safety compliance} = -0.097 + 2.984 \text{ safety motivation} + 4.883 \text{ safety concern.}$$

The model suggests that contractors' safety leadership of safety motivation and safety concern have significant positive impact on workers' compliance on safety. In other words, the workers will comply more to safety rules, procedures and good safety practices when the contractors lead safety on site by giving more motivation (such as rewards and incentives) and showing more concern to the safety of the workers. As Lu and Yang [5] propose, these two leadership dimensions are representation of the characteristics attached to transformational leadership behavior.

Table 9. Regression Analysis Results of Safety Leadership on Safety Compliance

Variables	β	Adj R ²
(constant)	-0.097	0.572
Safety Motivation	2.894*	
Safety Policy	1.503	
Safety Concern	4.503*	

*sig. at $\alpha = 5\%$

The Impact of Safety Leadership on Safety Participation

As exhibited in Table 10, contractors' safety leadership has a relatively strong impact (adj R² = 57.90%) on workers' safety participation. The model also passed the fitness tests (Kolmogorov Smirnov test, with a significant value of 0.14; collinearity tolerance values were above 0.1 and all VIF values were below 10; and heteroscedasticity test at $\alpha = 5\%$).

In this model, the three hypotheses (H4, H5, H6) in Figure 1 are all supported, which signify that the three safety leadership dimensions have positive significant impact on safety participation (at $\alpha = 5\%$). The contractors can increase workers' participation in safety by promoting more motivation and concern of their good safety practices (representing transformational leadership) and by making sure that the workers understand and carry out the company's safety policy, rules and procedures (representing transactional leadership). The positive impacts of transformational leadership characteristics are seen

to more superior than that of the transactional one (see the coefficients β in Table 10). The final model is:

$$\text{Safety participation} = 1.627 + 3.928 \text{ safety motivation} + 2.215 \text{ safety policy} + 3.685 \text{ safety concern.}$$

Table 10. Regression Analysis Results of Safety Leadership on Safety Participation

Variables	β	Adj R ²
(constant)	1.627	0.579
Safety Motivation	3.928*	
Safety Policy	2.125*	
Safety Concern	3.685*	

*sig. at $\alpha = 5\%$

Discussions and Conclusions

Construction is one of the riskiest industries for accidents to happen. Many attempts to reduce the number accidents have been directed to study workers' behavior and the factors behind them. One of the critical driving factors that has long been recognized by many [5,6,9] is safety leadership. This paper has answered several important questions, namely do construction workers comply and participate in construction safety; how the safety leadership of the contractors; and does the leadership have an impact on workers' behavior in complying and participating in construction safety. The followings will discuss and conclude the key findings.

Workers in the study are showing that they have complied and participated in construction safety. They comply and do not violate the available safety rules and procedures, and regularly wear personal protective equipment. In addition, the workers also actively participate in safety by attending safety meeting and voicing and helping other workers with safety related issues.

In leading safety, the contractors have exercised the three safety leadership dimensions quite satisfactorily. They have established safety goals, policy and procedures, and stressed their implementation in construction projects. Safety assessments are conducted regularly to make sure that workers follow the standard behaviors set in the safety procedures. This finding confirms that the contractors apply transformational leadership style in leading safety.

More importantly the contractors not only emphasize on rules and procedures but also present their concern and support to the workers for the success of their implementation, which reinforce the adoption of transformational leadership style. Informal training and education are regularly conducted to ensure that the workers understand the safety policy and procedures. The contractors also employ several motivational systems (such as incentives or praise) to encourage workers to behave safely as necessitated.

The most important finding of this study is the support of the hypothesis that contractors' safety leadership impacts the workers' behavior. The findings advocate that effective safety leadership will lead to better safety behavior, which is ultimately targeted to reduce accident occurrences. Safety concern and safety motivation were found to significantly impact the safety compliance. Meanwhile workers' safety participation was impacted significantly by all three safety leadership dimensions.

These findings address that both transactional and transformational leadership have positive impact on safety behavior. It is consistent with those reported in other studies [3,27], in which workers' behavior can be controlled by prescriptive and discretionary approaches. The first approach resembles the transactional leadership characteristics, where the presence and implementation of safety policy, rules and procedures to regulate workers are prominence. On the other hand, the second approach is closely related to the transformational leadership. It is dedicated to fuel more on workers' self-awareness of the safe behavior, which can be boosted by the contractors through training, two-way communication, and motivation programs.

The contractors should maintain these two safety leaderships, notably the transformational leadership. The transformational leadership is perceived by the workers to be more superior in increasing their compliance and participation in safety. This suggests that contractors should provide more concern and motivation in shaping workers behavior toward the safety standard. It may raise workers' awareness and help them achieve extraordinary high-performance safety behavior [28].

This study, however, is not without limitations. It only concentrates on leadership and does not consider other factors that may have impact on workers' safety behavior, such as the safety climate. Further researches may take this factor into account. Second, while contractor is the main actor to lead safety on construction, the role of others, such as owner's safety leadership [6,9], should not be overlooked. The safety leaderships of all parties and their interaction should get attention for more comprehensive picture.

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