



## Original Article

# Comparison of Safety Perception between Foreign and Local Workers in the Construction Industry in Republic of Korea

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## ABSTRACT

**Background:** Since the Republic of Korea became a labor-force-importing country, the number of foreign workers has increased gradually, especially in the construction industry. The main objective of this study was to examine the differences in safety perception between domestic and foreign workers at Korean construction sites.

**Methods:** A total of 891 Korean and foreign workers were surveyed: 140 foreign and 751 Korean workers. The general characteristics and 25 factors influencing safety perception were considered in the questionnaire. Regression and correlation analyses were conducted to examine the variables of workers' safety perception.

**Results:** Differences of nationality ( $F = 7.379, p < 0.001$ ) and workplace accidents were statistically significant for both domestic ( $F = 1.503, p < 0.05$ ) and foreign workers ( $F = 7.868, p < 0.05$ ). In contrast, age, education, and Korean language level were significant variables only for foreign workers. Correlation coefficients of 0.428\*\* for Korean and 0.148 for foreign workers between two items – namely, “management's commitment to safety” and “blaming staff when they make mistakes” – support the conclusion that foreign workers do not trust management's commitment to safety, while Korean workers have confidence in these commitments.

**Conclusion:** Foreign workers' level of safety perception should rise to the same level as Korean workers, especially in terms of obeying safety rules, safety education performance, and safety beliefs. Therefore, an improvement plan for the Korean construction industry is suggested in order to have a better safety level at construction sites with foreign workers.

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## 1. Introduction

Construction industry is important in terms of contribution to gross domestic product (GDP) of countries, and it has a considerable impact on the safety and health of workers [1]. The Republic of Korea, where construction constitutes a substantial portion of the economy, used to be a source country for migrant workers, and its citizens were willing to emigrate to well-developed countries. However, since 1980, the Republic of Korea has become a labor-force-importing country, and the demand for foreign migrant workers began to increase, fueled by the high-speed growth of domestic companies, an upward trend in wages, and the imbalance between supply and demand in the industrial workforce [2,3].

Korea's decreasing birth rate and growing cost of labor resulted in labor shortages, especially in 3D jobs (Dirty, Dangerous, and Difficult) [4]. In sum, workers migrated to the Republic of Korea due to financial situation, higher level of education and lower birth rate among Korean nationals [4,5].

According to the Korean Occupational Safety and Health Agency report in 2015, in 2014, there were 17,062,308 workers, including 762,930 migrant workers, working in 2,187,391 workplaces subject to the Industrial Accident Compensation Insurance Act. In all Korean industries, 90,909 workers had occupational accidents requiring at least 4 days of medical treatment [6]. Of these workers, 6,044 were foreign, and 19.3% of the foreign workers were employed in the construction industry. More than half of the

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foreigners who were injured in occupational accidents were Chinese of Korean descent, followed by other Chinese, Vietnamese, Uzbek, and Sri Lankan. This shows that 0.5% of domestic Korean workers and 0.8% of foreign workers were in an occupational accident in the workplace [7]. It can be surmised that foreign workers in the construction industry are injured at a higher rate than domestic workers.

Total work-related fatalities in 2014 were 1,850, and 85 of these fatalities were of foreign workers in the Republic of Korea. Thirty-five foreign workers out of the 85 were working at construction sites. A total of 22.3% of occupational accidents occurred in construction, second to the manufacturing industry, with nearly 60% of all accidents. Literature statistics indicate that even though 22.3% of accidents involving foreign workers occurred in the construction industry, almost 50% of fatal accidents were in the construction industry [8].

Son et al. [9] noted that foreign workers have specific characteristics, such as different cultures, background, and language, which separate them from locals. These characteristics cause higher accident rates for foreign workers [10–13]. A lack of proper safety and health training was emphasized by Cheng et al. [14]. In addition, some researchers such as Guldenmund et al. [15], Ceric [16] and Zerjav [17] have mentioned poor communication as one of the safety-related problems with foreign employees. Previous studies mainly identified different culture, background, and language of foreign workers, but little attention has been paid to safety perception.

Therefore, this study compared safety perception between foreign and Korean workers at construction sites in the Republic of Korea to provide a better safety level for foreign workers. A questionnaire survey was conducted at several construction sites to highlight causal factors, with the support of correlation analysis.

## 2. Materials and methods

The questionnaire (Appendix 1) was prepared to analyze Korean and foreign construction workers' reactions and the differences in safety and health in the construction industry. The survey included 25 questions rating participants' level of agreement using a 1–5 Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree. The questionnaire was divided into two sections. The first section was about construction workers' personal information, and the second section was about safety perception in selected construction sites. The survey was designed to analyze the level of safety perception and how successfully safety and health are managed. The survey questionnaire consisted of four groups: the concept of safety and health and its significance in the management of construction industry workers (five questions); the factors that influence the safety-related behavior of construction workers (six questions); methods that could be used to improve the workers' safety and health perception (six questions); and internal and external influences of safety and health on workers (eight questions). The survey questionnaire has been prepared in five different languages – Korean, English, Chinese, Vietnamese and Thai – to reach a variety of foreign construction workers. Questionnaires were disseminated to foreign workers' foremen, safety managers, or the persons in charge of safety and foreign workers. Foreign construction workers are generally managed by a Korean-speaking foreman from the same country as the workers.

The questionnaire survey was conducted during the month of August 2016 at South Korean construction sites in the areas of Seoul, Pyeongtaek, and Gyeonggi. Korean and migrant respondents consisted of contractors, technicians, foreign workers, safety officers, and engineers. The questionnaire survey was given to a total

of 996 construction workers: 148 foreign and 848 Korean. Ultimately, 105 questionnaire survey sheets were not considered for the analysis due to inadequate answers to the questions. Not counting the omitted surveys, a total of 891 Korean and foreign workers were surveyed: 140 foreign workers and 751 Korean workers. An independent sample *t* test, an analysis of regression, and Pearson's correlation coefficient (*r*) analysis were performed to examine the differences in safety perception of domestic and Korean workers. The independent *t* test was an inferential statistical test that determined whether there was a statistically significant difference between the means in two unrelated groups. *F* in regression analysis gave a measure of how much of the variation was explained by the model versus how much of the variation was unexplained. The *p* value was the probability of finding the observed, or more extreme, results when the null hypothesis of a study question was true. A low *p* value (< 0.05) indicated that the null hypothesis could be rejected. Data collected from the questionnaire survey were analyzed using the statistical software package SPSS version 22.0.

## 3. Results

As indicated in Table 1, a total of 751 participants were from the Republic of Korea, and 140 workers were from other countries, including China, Vietnam, Thailand, the Philippines, and some Central Asian countries. The majority of foreign workers surveyed were Chinese (*n* = 104). Fifteen Vietnamese workers comprised the second largest group of foreign workers surveyed. The smallest groups of workers surveyed were from Kyrgyzstan, Pakistan, and India, with one person from each country. In the education level section, 20 foreign workers who had a university degree were mainly from China, the Philippines, and Kazakhstan, and five of them worked as safety supervisors in the workplace. There were 362 domestic workers, which was a considerably higher number than the number of foreigners. The age of foreign and Korean construction workers was collected in order to evaluate the relation between age and workers' history of accidents or injuries. Among foreigners, the forties age group had the largest number of workers: 48 foreigners and 244 domestic workers. The twenties age group was the smallest for both worker groups. Korean language ability of foreign workers varied by ethnic origin. A total of 104 of the participants were Chinese, including Korean Chinese. Therefore, it was not surprising that 34 workers had a good level of Korean language. Construction workers from southeastern countries and other countries did not have a good level of Korean compared to Korean ethnic Chinese. Workplace accident rates of workers during their career at construction sites were 13 (9.3%) for foreigners and 85 (11.32%) for Koreans, which did not show a significant difference between the two worker groups. The average level of safety perception for foreign workers was 3.71 points out of 5 (standard deviation 0.372). This was higher than that of Koreans (average 3.46, standard deviation 0.370). This difference was due to negative and positive questions asked in the questionnaire. The variables of sex and safety training showed an insignificant impact on the safety perception of Koreans and foreigners. Differences of nationality ( $F = 7.379, p < 0.001$ ) and workplace accident experience were significant for both domestic ( $F = 1.503, p < 0.05$ ) and foreign ( $F = 7.868, p < 0.05$ ) workers. In contrast, age ( $F = 7.437, p < 0.001$ ), education level ( $F = 5.589, p < 0.05$ ), and Korean language level ( $F = 7.582, p < 0.001$ ) were significant variables for foreign workers only (Table 1).

The results of regression analysis to determine relative impact of domestic and foreign workers' characteristics on accident rates are shown in Table 2. When the result of the *F* test showed a *p* value < 0.05, it indicated that overall, the regression model was

**Table 1**  
Differences in safety perception for foreign and Korean workers according to general characteristics of responders

Characteristics		n		Mean		SD		t/F <sup>†</sup>		P <sup>*</sup>	
		K	F	K	F	K	F	K	F	K	F
Sex	Male	675	135	3.47	3.70	0.381	0.441	0.937	0.471	0.585	0.494
	Female	76	5	3.39	3.84	0.313	0.141				
Age (y)	20s	64	27	3.47	3.94	0.395	0.235	0.881	7.437	0.684	<0.001
	30s	231	44	3.48	3.78	0.398	0.392				
	40s	244	40	3.44	3.65	0.363	0.439				
	>50s	212	29	3.46	3.45	0.358	0.500				
Education level	<Middle school	120	41	3.43	3.65	0.343	0.455	0.924	5.589	0.609	0.005
	High school	266	80	3.42	3.79	0.378	0.368				
	University	362	20	3.50	3.46	0.381	0.536				
	Graduate school	3	0	3.73	—	0.375	—				
Korean language level	None at all	—	5	—	3.36	—	0.194	—	7.582	—	<0.001
	Poor	—	18	—	3.49	—	0.601				
	Intermediate	—	23	—	3.85	—	0.354				
	Good	—	60	—	3.86	—	0.359				
	Very good	—	34	—	3.50	—	0.381				
Safety training records	Yes	729	136	3.47	3.71	0.373	0.438	1.413	1.575	0.048	0.121
	No	22	4	3.24	3.44	0.370	0.126				
Workplace accident	Yes	85	13	3.34	3.39	0.388	0.371	1.503	7.868	0.024	0.006
	No	666	127	3.48	3.74	0.371	0.429				
Nationality	Korea	751	—	3.46	—	0.375	—	7.379	—	<0.001	
	China	—	104	—	3.76	—	0.400				
	Vietnam	—	15	—	3.49	—	0.609				
	Kazakhstan	—	7	—	3.96	—	0.177				
	The Philippines	—	4	—	3.31	—	0.191				
	Bangladesh	—	4	—	3.43	—	0.693				
	Thailand	—	3	—	3.44	—	0.120				
	Kyrgyzstan	—	1	—	3.72	—	—				
	Pakistan	—	1	—	3.28	—	—				
	India	—	1	—	3.56	—	—				
Total		751	140	3.45	3.71	0.370	0.372				

F, foreigner; K, Korean; SD, standard deviation.

\* Variation between sample means/variation within the sample.

† Probability for the given statistical model when the null hypothesis is true.

statistically significant. Statistically, variables such as age, education, training, and language influenced accident rates significantly ( $F = 44.14$ ,  $p < 0.001$  for foreigners, and  $F = 23.83$ ,  $p < 0.001$  for Koreans).  $R^2$  was 0.64 (64%) for foreigners; this score for domestic workers was 0.11 (11%), which was lower than that for foreigners. Accident rates were significantly influenced by language ( $t = -5.08$ ,  $p < 0.001$ ) and education ( $t = -6.48$ ,  $p < 0.001$ ) for foreign workers. In terms of safety discipline, there was a negative influence, which meant that more accidents occurred when the education and language level decreased. For Koreans, the significant factor influencing accident rates was training ( $t = -4.49$ ,  $p < 0.001$ ). Less safety training caused more accidents.

**Table 2**  
Regression analysis of characteristic variables for accidents

Factors		Unstandardized coefficients		Standardized coefficients	t <sup>†</sup>
		B	SE	$\beta^{\dagger}$	
Foreigner	Age	-0.019	0.009	-0.135	-2.016
	Educations	-0.106	0.016	-0.359	-6.488
	Language	-0.096	0.019	-0.357	-5.086
	Training	0.010	0.197	0.005	0.048
	(Constant)	2.329	0.161		14.509
Korean	Age	-0.008	0.013	-0.023	-0.589
	Education	-0.049	0.017	-0.116	-2.928
	Training	-0.297	0.066	-0.158	-4.499
	(Constant)	1.821	0.124		14.649

$R^2 = 0.64$  (foreigner),  $R^2 = 0.11$  (Korean),  $p < 0.001$ .

SE, standard error.

\* Unstandardized coefficients.

† Standardized regression coefficient.

‡ Ratio of the departure of an estimated parameter from its notional value to its SE.

Pearson's correlation coefficient analysis from the survey questionnaire is presented in Table 3, with the significance values. Questionnaire items such as mistake blaming, accident prevention, and peer pressure were rewritten concisely in the table to avoid confusion for the interpretation of the statistical results. According

**Table 3**  
Correlation values of survey questions

Factors		Foreigner (r)	Korean (r)
Management's interest on safety	Mistake blaming	0.148	0.428 <sup>*</sup>
Prevention of accidents	Mistake blaming	0.476 <sup>*</sup>	-0.123 <sup>*</sup>
Accident prevention	Mistake blaming	0.304 <sup>†</sup>	0.123 <sup>*</sup>
Protecting management	Mistake blaming	0.445 <sup>*</sup>	-0.057
Age	Risk control reasonable	-0.330 <sup>†</sup>	0.054
Knowledge on instruction	Accident	-0.171 <sup>†</sup>	0.047
Education level	Involving in risk assessment	-0.198 <sup>†</sup>	0.027
Management's interest on safety	Adequate safety trainings	0.457 <sup>*</sup>	0.451 <sup>*</sup>
Management's high priority on safety	Adequate safety trainings	0.521 <sup>*</sup>	0.400 <sup>*</sup>
Staff are praised for working safely	Adequate safety trainings	0.418 <sup>*</sup>	0.327 <sup>*</sup>
Protective equipment obligatory	Adequate safety trainings	0.417 <sup>*</sup>	0.124 <sup>†</sup>
Protective equipment wearing	Useful safety briefings	0.273 <sup>*</sup>	0.132 <sup>†</sup>
Knocks and bruises	Knowledge on instruction	-0.304 <sup>†</sup>	-0.163 <sup>†</sup>
Knocks and bruises	Peer pressure	0.407 <sup>*</sup>	0.308 <sup>*</sup>

r, Pearson's correlation coefficient value.

\* Correlation is significant at the 0.01 level (2-tailed).

† Correlation is significant at the 0.05 level (2-tailed).

to the correlation analysis of foreign construction workers, senior management of the company demonstrated full commitment to safety and health, but the correlation coefficient of 0.148 meant that there was a low correlation between blaming staff when they made mistakes and commitment to safety. From the safety point of view, it was interpreted that even though management gave the highest priority to safety and health, they did not tend to blame the staff for the things that the staff made unsafe and unhealthy. A correlation coefficient of 0.428\*\* meant that a positive significant relation showed that Koreans were blamed or warned when they made mistakes in terms of safety. This important finding showed that Korean workers had more opportunities to be aware of their unsafe behavior at work than foreign workers had.

Blaming staff had a correlation factor of 0.476\*\* with the prevention of accidents among foreign workers, and it had a correlation factor of  $-0.123^{**}$  for Korean workers. In contrast, blaming had a correlation factor of 0.445\*\* for foreign workers and  $-0.057$  for Korean workers, with the idea that some safety and health rules were only for protecting management. These correlations may be explained as follows. When staff were blamed for mistakes, it was believed that was not for the safety of staff, but to protect employers from legal prosecution. However, Korean workers' coefficient value of  $-0.057$  showed that their situation was the opposite of that of the foreigners. Another correlation factor of 0.123\*\* determined that Koreans believed that accident prevention was done before an incident. This factor was 0.304\* for foreign workers, so they supported the idea that little action was taken for accident prevention when staff were blamed.

Upon comparing general information of workers with safety perception, it was found that age had multiple effects on several questions associated with safety perception for foreign workers. One of them showed that age had a high negative correlation with the reasonable risk control ( $-0.330^{**}$ ). This meant that older workers were inclined to believe that risk controls got in the way when they performed their jobs. The negative correlation between age and reasonable risk control (0.054) was not as strong among Korean workers as foreign workers.

Foreign workers' knowledge of safety instruction was negatively correlated with accident rates. The significant value of  $-0.171^{*}$  indicated that more accidents resulted from a lack of knowledge about safety instruction. Workers who did not fully understand the safety and health instructions that were related to their job tended to experience more accidents. Correlation of these two items was not significant for domestic workers (0.047).

There was a negative correlation between education level and involvement in risk assessment, with a value of  $-0.198^{*}$ . A low education level is common in the construction industry, especially for foreign construction workers surveyed in this study. Domestic workers' correlation coefficient was 0.027, which showed the differences between foreigners and Koreans. Workers who were familiar with their tasks could help to assess risks in the workplace.

There was a positive correlation between adequate safety training and other statements, including "Senior management is fully committed to safety and health"; "Management prioritizes safety and health"; and "Staff are praised for working safely and the use of personal protective equipment is strictly enforced"; the correlations between these factors were, respectively, 0.457\*\*, 0.521\*\*, 0.418\*\* and 0.417\*\* for foreigners and 0.451\*\*, 0.400\*\*, 0.327\*\*, and 0.124\*\* for Korean workers. Adequate safety training may have resulted in the construction workers being praised for working safely. The given safety subject and the method of safety training showed how effective the training was; moreover, safety training was a topic that workers reflected on during their overall training.

In an industry or a union, the workforce can be affected by peer pressure [18]. The workforce is also important for reaching a good

safety level in a construction work place, especially if the workers share characteristics such as being migrant workers in a foreign country. The correlation factors of 0.407\*\* and 0.308\*\* for foreigner and Korean workers, respectively, showed a positive correlation between the idea of taking risks that colleagues would not take and the idea that accidents always happened no matter how careful people were.

The correlation between wearing safety equipment and useful safety briefings for foreign construction workers was 0.273\*\*, this correlation was positive but not high. This correlation factor meant that daily safety briefings reminded foreign construction workers that using personal protective equipment was salubrious and ensured that they were aware of its importance. The correlation factor of these two items was positive, with a value of 0.132\*\* for Korean workers, but it was not as significant as for foreigners.

Foreign workers' correlation factor of  $-0.304^{**}$  for knowledge of safety instruction indicated that there was a significant negative correlation with the statement that being careful did not mean that there would not be an accident. The correlation factor for these items for domestic workers was not as strong as for foreigners. The value of  $-0.163^{**}$  indicated that there was no strong negative correlation, which meant that being careful at work prevented workers from having accidents.

This study provided a comparison of safety perception for both foreign and domestic workers in the construction industry in the Republic of Korea. First, possible influencing factors related to the general background of workers – factors such as age, education, language ability, nationality, safety training, and workplace accident history – were analyzed for impact on safety perception. Then a regression and Pearson's correlation analyses were conducted. An improvement plan has been suggested for foreign and Korean workers who work in the Korean construction industry. The aim was to introduce a plan for construction companies and organizations where foreigners are employed.

According to the correlation analysis, a positive relation between "blaming staff when they make safety-related mistakes" and "management commitments to safety" was found to be significant only for Korean workers. Foreign workers might have been considered temporary workers, so they were not blamed or warned as much as Koreans were. Management and safety representatives should be aware of safety rules and implement them fairly.

Foreign workers who did not fully understand safety instructions tended to experience workplace accidents. Here, the language ability of foreign workers played an important role. To reach a desired safety level at the workplace, appropriate safety training should be provided for workers who have poor Korean language skills.

In addition, safety training should be provided separately in light of workers' education levels and ages. Foreign workers had a lower education level than their Korean counterparts, so there was a possibility that they had difficulties comprehending the training provided. To be successful with less-educated workers and young workers, safety training should be designed and developed in accordance with the requirements.

Lastly, it is seen from the analysis that foreign workers in the Korean construction industry did not believe that safety rules were meant to protect workers. However, Korean workers did not share the same opinion. Therefore, safety regulations, safety policy, and rules should be clearly identified to foreign workers, and safety policies should be redesigned if necessary. Safety training sessions for the foreign workers should be provided in several languages and it should be placed in the Korean Occupational Safety and Health Act. These trainings should not include only work-related safety information, but also information on employees' rights and employers' responsibilities.

#### 4. Discussion

Increasing the number of foreign workers in the Republic of Korea has resulted in problems related to workplace safety. The purpose of this study was to examine the safety perception of foreign and Korean workers in the construction industry. A questionnaire survey was given to 751 Korean and 140 foreign workers at several Korean construction sites. To compare workers' safety perception, the survey asked about general background information and safety-related attitudes. A plan for improving safety perception has been described; according to the findings of the analysis, such a plan is especially important for foreign workers.

An independent sample *t* test, regression analysis, and Pearson's correlation coefficient analysis demonstrated that language, education, nationality, and age had a significant influence on safety perception of foreign workers. In addition, managerial safety directives were less effective for foreign workers compared to Koreans. Thus, carrying out safety training and instructions might not be enough for workers to be aware of safety at construction sites. Warning or blaming workers when they make mistakes related to safety may help to improve their safety perception. Due to differences of education level as well as language ability, foreign workers need extra attention in order to improve safety perception. The safety act and safety rules for the site should be presented in several languages by a responsible person who is in charge of safety.

The aim of the improvement plan is to have a better safety status by making suggestions for the Korean construction industry for both foreign and Korean workers. However, this may be applied in other countries. Nevertheless, this subject should be studied more for other countries in order to reach a more generalized result.

#### Conflicts of interest

The authors declare that there are no conflicts of interests regarding to the publication of this article.

#### Appendix 1

This questionnaire is only for **academic purposes**. Please fill out this form with the correct information. Please **do not** write down your name.

1. Nationality	
2. Sex	a. Male b. Female
3. Age	a. 20s b. 30s c. 40s d. > 50
4. How long have you been working in the construction industry?	a. less than 1 year b. 1–10 years c. 10–20 years d. 20–30 years e. > 30 years
5. Education level	a. Middle school or lower b. High school c. University d. Graduate school
6. Duty	
7. The city you work in	
8. How long have you been living in the Republic of Korea?	a. < 1 year b. 1–2 years c. 2–5 years d. 5–10 years e. > 10 years
9. Did you have safety education?	a. Yes b. No
10. Have you ever had an accident in a construction site?	a. Yes b. No
11. Korean language ability	a. not at all b. poor c. intermediate d. good e. very good

Please tick the appropriate box to show your level of agreement with each of the following statements.

Question	Strongly disagree	a little	Strongly agree
1. Senior management is fully committed to safety and health.			
2. Staff are blamed when they make mistakes.			
3. The company is interested in my opinions about safety and health.			
4. Management places a high priority on safety and health.			
5. Supervisors turn a blind eye to unsafe behavior.			
6. Safety and health procedures are much too stringent in relation to the risk.			
7. My colleagues would criticize me for breaking the safety and health rules.			
8. I am given adequate safety and health trainings.			
9. Little should be done to prevent accidents until someone gets injured.			
10. Everyone wears their protective equipment when they are supposed to.			
11. Action should be rarely taken when someone breaks the safety and health rules.			
12. I fully understand the safety and health instructions that relate to my job.			
13. Time pressures for completing jobs are reasonable.			
14. I was involved in risk assessments relating to my work.			
15. Staff are praised for working safely.			
16. Action has been taken on the basis of risk assessment findings.			
17. The risk controls do not get in the way of my doing my job.			
18. Knocks and bruises are bound to happen at work no matter how careful you are.			
19. Safety and health briefings are very useful.			
20. I take risks that my colleagues would not take.			
21. Accidents that happen here are always reported.			
22. Some safety and health rules are only there to protect management.			
23. The permit-to-work system leads to unnecessary delays in getting the job done.			
24. I know that if I follow the safety procedures I will not get hurt.			
25. The use of personal protective equipment is strictly enforced.			



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