

Decision Tree Analysis of Job Stress and Satisfaction of Foreign Construction Laborers in Korea

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Abstract—With the aging of the existing construction workforce and the reluctance of young manpower to enter the construction field due to it being one of the so-called “3D” (Dirty, Dangerous and Difficult) industries, the number of foreign laborers employed in Korean construction industry has been on the rise. As construction jobs involve high job intensity and the risk of safety accidents, they can trigger a high level of stress among workers. Based on this logic, we can expect that foreign construction laborers in Korea will experience even more job stress due to language barriers and cultural differences. As job stress can have a negative impact on job performance, a plan to manage the job stress of foreign construction workers in Korea should be prepared to ensure successful construction projects. Thus, this study aims to probe the relationship between job stress and job satisfaction of foreign construction laborers in Korea using a decision tree. A survey was conducted after selecting factors of job stress, and an effect of each factor was analyzed using the decision tree. As a result of that, it was found that two factors, i.e. lack of reward and organizational system, were the main influential factors that affect the job satisfaction of foreign laborers. The findings of this research are expected to serve as fundamental data to improve job performance through job stress management of foreign workers in the future.

Keywords—Foreign laborer; Decision tree; Job stress; Job satisfaction

I. INTRODUCTION

As of 2012, there were 1,114,000 foreign workers in Korea. In particular, the construction industry employs 85,000 foreign laborers, which is almost 10 percent of the total population of foreign workers [1]. With the aging of Korean construction workers and the avoidance of “3D” jobs by young job-seekers, the number of foreign workers in Korea has been on the rise. Moreover, an increase in foreign laborers employed in the Korean construction industry is seen by many as a good way to address the shortage of Korean construction laborers due to their relatively lower wage and easier employment.

The construction industry is labor-intensive, and to complete a project successfully, it is essential to provide a working environment that enables the construction laborers to concentrate fully on their jobs. But unlike other industries, construction laborers are more likely to get stressed due to high job intensity, the need to work on holidays, and the risk of safety accidents related with construction work [2]. Moreover, the foreign construction laborers in Korea may experience a different level of stress from Korean workers

since the unfamiliar work setting, including the culture and the language, is greatly different from theirs.

The higher the job stress level, the lower the job satisfaction [3, 4, 5]. When job satisfaction is low, it turns out to have a negative impact on job performance [6]. Therefore, to improve the job performance of construction workers, it is important to understand the relationship between job stress and job satisfaction. In particular, with the number of foreign workers gradually increasing in the construction industry, it is especially important now to understand the relationship between job stress and job satisfaction of foreign construction workers. Studies have been conducted in the past on the relationship between stress and job satisfaction of foreign laborers [7, 8, 9, 10]. However, few studies have been conducted on foreign construction workers.

Therefore, this study aims to clarify the relationship between job stress and job satisfaction of foreign construction workers in Korea. To do this, we first identified factors of job stress and job satisfaction, and then conducted a survey on foreign construction workers. A decision tree analysis was then performed based on the survey results. Since the decision tree is expressed as a tree structure, it is easy to understand and interpret the results. Moreover, it is easy to understand the interaction between variables, because it shows how two or more variables are combined and affect the target variable, and is a nonparametric method that requires no assumption for linearity, normality or equal variance [11].

II. THEORETICAL REVIEW

A. Foreign Laborers in Korea

According to the ‘2012 Foreigner Labor Force Survey’ reported by Statistics Korea in November 2012, a total of 1,114,000 foreign laborers were found to be employed in all industries, accounting for 3.13 percent of all employees in Korea. Of the foreign workers, 85,000 or 7.63 percent were employed in the construction industry, indicating that a relatively high population of foreign workers is employed in the construction sector.

Table I indicates the “current state of foreign laborers by nationality.” Ethnic Korean in China and Chinese people were counted as 600,000 accounting for more than half of the entire population of foreign laborers. There are no official statistics for the construction industry, but the composition is expected to be similar.

TABLE I. CURRENT STATE OF FOREIGN LABORERS BY NATIONALITY

Nationality	Number of laborers (thousand person)	Composition (%)
Total	1,114	100
Ethnic Korean in China	457	41.0
China	143	12.8
Vietnam	114	10.2
Uzbekistan	31	2.8
Philippines	34	3.0
Indonesia	31	2.8
Japan	22	1.9
Thailand	24	2.1
Mongolia	21	1.8
other Asian countries	120	10.8
North America (USA, Canada)	81	7.3
Europe	22	2.0
Oceania	8	0.7
Etc.	8	0.7

B. Job Stress and Satisfaction

Job stress is a harmful physical and emotional reaction in the body arising out of a disagreement between the capabilities or resources and needs [12]. Stress has both positive and negative effects on the worker's behaviors and attitudes. That is, an appropriate level of stress serves as an invigorator for mental and physical activities, and facilitates job performance; however, stress is shown to reduce job satisfaction in most laborers [13]. Job satisfaction refers to a

work, and triggers voluntary initiatives, participation and creativity [15].

An excessive level of stress has negative effects such as anxiety and exhaustion, leading to a sharp decline in job performance [16]. Therefore, efforts should be made for a successful project. In other words, job stress factors of laborers should be studied to release the laborers' stress, increase job satisfaction and finally improve job performance [17].

III. FACTORS OF JOB STRESS

A. Selecting factors of job stress

To clarify the relationship between job stress and job satisfaction of foreign construction laborers, we selected factors of job stress first. Most of the job stress factors were adopted from Occupational Stress Scale for Korean Employees (KOSHA CODE H-42 2006) of the Korean Occupational Safety & Health Agency, but some of the factors were added in consideration of the characteristics of foreign construction laborers. That is, of the seven major factors of job stress in the measurement instrument ((1) job demand, (2) insufficient job control, (3) interpersonal conflict, (4) job insecurity, (5) organization system, (6) lack of reward, (7) occupational climate), factors (1) through (6) were included, and 'cooperation with foreign worker' was added (see Table II).

The factors of job satisfaction were not subdivided like

TABLE II. DETAIL OF THE QUESTIONNAIRE IN THIS STUDY

Categories	Item	KOSHA (Original)	KOSHA (Revised)	New one
Job demand	Due to many things to do, I always feel time pressure.	○		
	My job has become increasingly overloading.	○		
	Sufficient rest is provided during working hours.	○		
	I have to do various jobs simultaneously.	○		
Insufficient job control	My work requires creativity.	○		
	My work requires a high level of skill or knowledge.	○		
	I can make my own decision in my job and give influence over the work.	○		
	I can control my work pace and time schedule.	○		
Interpersonal conflict	My site-manager is helpful in getting the job done.		○	
	My coworker is helpful in getting the job done.	○		
	I have a co-worker(s) to share my problems at work.	○		
Job insecurity	My future is uncertain because the current situation of my company is unstable.	○		
	Undesirable changes (i.e. downsizing) will come to my job.	○		
Organizational system	The organizational policy of my company is fair and reasonable for both Korean and foreigner.		○	
	My company provides me with sufficient organizational supports .	○		
	Work-crews cooperate each other without conflicts.		○	
Lack of reward	I have opportunities and channels to talk about my ideas.	○		
	I acquire respect and confidence from my company.	○		
	I believe that I will be given more rewards from my company if I work hard.	○		
	I am provided with opportunity of developing my capacity.	○		
Cooperation with foreign worker	I have difficulty cooperating with foreign laborers due to the language barrier and cultural differences.			○
	I cooperate well with foreign laborers.			○

worker's attitude toward his/her own job [14]. That is, the individuals who have a high level of job satisfaction tend to have a positive attitude toward their job, while the individuals who have a low level of job satisfaction tend to have a negative attitude toward their job. A high level of job satisfaction has positive impacts such as inspiration or will to

the factors of job stress, and only 'satisfaction level' was measured. The results were used as dependent variables to divide job satisfaction into yes or no in the decision tree analysis.

B. Summary of Questionnaire

A questionnaire survey of Korean and foreign construction laborers was conducted at 10 different construction sites in Gyeonggi region, and the survey was self-administered. The questionnaire was composed of 23 sub-items (22 job stress factors and 1 job satisfaction factor) and the sub-items were assessed using a 4-point Likert's scale (Never, Not very much, Moderately, Very much).

A total of 400 questionnaires were collected, and of them 375 questionnaires (183 from Koreans, 192 from foreigners) were used for the analysis. The summary of the respondents' information is shown as below in Table III.

TABLE III. SUMMARY OF QUESTIONNAIRE RESPONDENTS

Categories		Number of laborers (person)	percentage (%)
Nationality	Korean	183	48.8
	Ethnic Korean in China	96	25.6
	Chinese	96	25.6
Age	20s	32	8.5
	30s	59	15.7
	40s	148	39.5
	50s	113	30.1
	60s	23	6.1
	More than 20years	36	9.6
Work experience	Under 5 years	133	35.5
	6-10years	89	23.7
	11-15 years	87	23.2
	15-20 years	29	7.7

C. Result of Questionnaire

The response values of the survey conducted for this study were scored using Equation (1) as suggested in the Occupational Stress Scale for Korean Employees of Korean Occupational Safety and Healthy Agency. A higher score indicates a higher level of stress.

$$\frac{(\text{sum of score} - \text{number of question})}{(\text{highest score} - \text{number of question})} \times 100 \quad (1)$$

Table IV indicates the descriptive statistics of Korean and foreign laborers, difference in averages between the two groups, and the t-test results. First, the difference in averages

'lack of reward,' 'organizational system,' and 'insufficient job control.' In the t-test results, there was no significantly statistical difference between the two groups in the stress scores in two categories (job demand, and interpersonal conflict) ($p < 0.05$).

IV. DECISION TREE ANALYSIS OF JOB STRESS AND SATISFACTION

A decision tree analysis was performed to investigate the relationship between job satisfaction and job stress. For the analysis, seven job stress factors were set as independent variables, while job satisfaction was set as a dependent variable. As the algorithm of the decision tree analysis, CART (Classification And Regression Test) was selected. 'Gini Index' was used as the splitting criterion because the dependent variable in this study is discrete. The maximum depth of the tree was set as '5'. The stopping criteria was set as the minimum number of cases to be either top node '20' or bottom node '5' and the minimum variation of 'improvement' was set to be less than '0.0001'.

Through the decision tree analysis, Fig. 1 shows the decision trees of Korean and foreign construction workers. Risk estimate of the two models was '0.088' and '0.077' indicating that the accuracy of the two models is very high, and that the two models give a good explanation for the relationship between the job stress factors and job satisfaction.

The model for Korean workers was shown to be more complicated than the model for foreign workers, and more factors were used in the analysis, which means that the stress factors that affect the job satisfaction of foreign workers are simpler. To be more specific, five factors were found to affect job satisfaction of Korean workers, and from most important to least important these were 'interpersonal conflict,' 'organizational system,' 'lack of reward,' 'insufficient control,' and 'job insecurity.' On the other hand, two factors were found to affect job satisfaction of foreign workers, and in order of importance these were 'lack of reward,' and 'organizational system.' That is, if these factors are managed intensively, it is expected that the job satisfaction of foreign workers can be improved greatly.

TABLE IV. RESULT OF T-TEST FOR JOB STRESS AND SATISFACTION

Categories	Korean laborer (N=183)		Foreign laborer (N=192)		Mean difference (A-B)	t value	p value
	Mean (A)	SD	Mean (B)	SD			
Job demand	55.00	11.252	55.07	16.509	-0.06	-0.047	0.963
Insufficient job control	50.31	13.085	56.81	17.648	-6.49	-4.033	0.000
Interpersonal conflict	61.08	12.321	62.79	15.246	-1.70	-1.190	0.235
Job insecurity	51.63	17.914	57.63	20.455	-5.99	-3.016	0.003
Organizational system	56.01	13.202	63.54	16.721	-7.53	-4.826	0.000
Lack of reward	53.37	14.618	60.93	17.206	-7.56	-4.580	0.000
Cooperation with foreign worker	52.09	11.058	61.28	17.054	-9.19	-6.159	0.000

between the two indicated that job stress level of foreign laborers is higher than that of Korean laborers in the overall categories. In particular, the difference was found to be highest for 'cooperation with foreign worker,' followed by

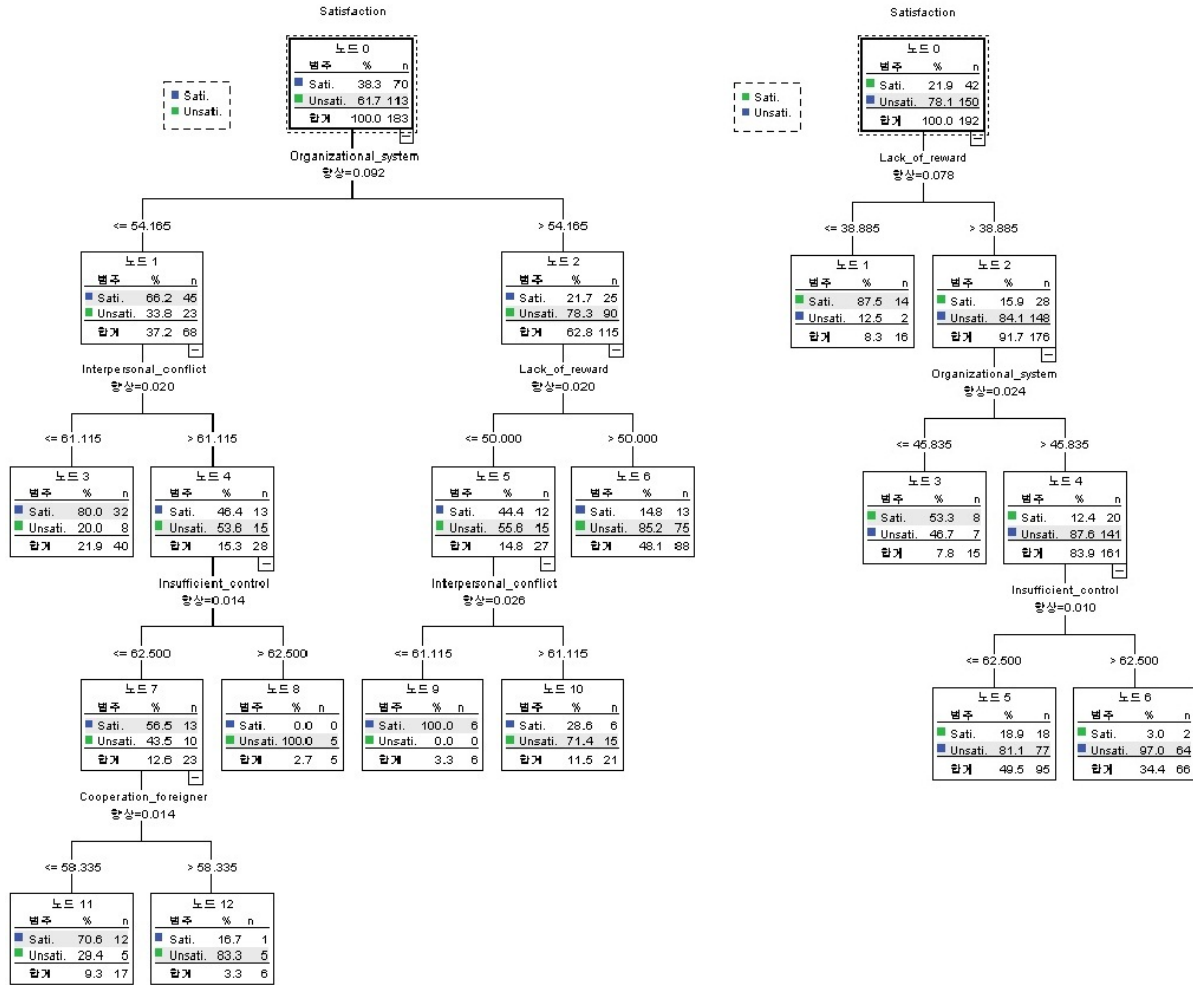


Figure 1. Decision tree model of Korean(left) and Foreign(right) laborer

V. CONCLUSION

The aging of Korean construction workers and the avoidance of the construction sector by young job-seekers have led to a shortage of construction workers, which is being addressed through the use of foreign laborers. Unlike other industrial sectors, the construction sector can trigger a high level of stress due to high job intensity and the risk of safety accidents, and it is expected that foreign workers will experience more stress because of the additional stress related to the language barrier and cultural differences. Job stress has been known to have a negative impact on job performance, and studies have been done to elucidate the relationship between the two. Despite this research, few studies have been conducted on job stress in foreign laborers working at construction sites in Korea. For this reason, this study aims to elucidate the relationship between job stress and job satisfaction of foreign construction laborers using a decision tree analysis. To do this, a questionnaire survey was conducted after factors of job stress and satisfaction were selected, based on which a decision tree analysis was

performed. Through the analysis it was found that there were fewer factors that affected the job satisfaction of foreign laborers compared with the factors that affect the job satisfaction of Korean laborers, but the importance of the factors was shown to be higher. The findings of this study can be utilized in approaches to managing the job stress of foreign construction laborers in Korea.

The foreign laborers studied in this study were ethnic Koreans in China and Chinese people. While these two groups account for half of the foreign laborers in Korea, to get more general results a future study should consider foreign laborers with various nationalities, including laborers from the Philippines, Vietnam, and so on.

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