Konya Mühendislik Bilimleri Dergisi, c. 12, s. 2, 561-585, 2024
Konya Journal of Engineering Sciences, v. 12, n. 2, 561-585, 2024
ISSN: 2667-8055 (Electronic)
DOI: 10.36306/konjes.1458193

SITE SUPERVISOR SELECTION WITH ANALYTIC HIERARCHY PROCESS (AHP) AND CASE STUDY

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Highlights

- Site supervisor is the most important technical personnel in construction work.
- Selection of the site supervisor is vitally important for construction work.
- This study aims to develop a methodology for site supervisor selection.
- Case study was conducted with 3 companies to comfirm the method developed in study.

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(Received: 25.03.2024; Accepted in Revised Form: 06.05.2024)

ABSTRACT: The purpose of this study is to develop a methodology for the selection of site supervisors for construction companies carrying out medium-sized building construction works. For this purpose, 3 construction companies were interviewed and the developed method was used for the site supervisor selection of these companies. In this context, 4 candidates who applied to Company A were given scores by the company official according to the selection criteria used in this study and analyses were made with AHP. Candidate 3 ranked first with a priority value of 26.57%. This result was compared with the results of the simultaneous selection by the company using its own method and it was seen that the company selected the same candidate. Same procedure was used for companies B and C. Three different candidates had applied to each company. According to the results, Candidate 3 was selected by Company B with a priority value of 37.52% and Candidate 1 was selected by Company C with a priority value of 35.87%. It was observed that the selection results of both companies carried out simultaneously with their own methods were the same with the candidates found in the study.

Keywords: *AHP, Building Construction Companies, Construction Industry, Field Work, Site Supervisor Selection*

1. INTRODUCTION

1.1. Importance of the Subject

The site supervisor is the most important technical personnel in charge of the execution of a construction work. Pursuant to the Regulation on Construction Site Supervisors, the construction site supervisor refers to the technical personnel who manages and implements the construction / demolition works on behalf of the building contractor. The duty of the construction site supervisor regarding the construction work starts from the receipt of the building license and ends with the receipt of the occupancy permit. The site supervisor is responsible for ensuring the construction and work organization necessary for the realization of the construction / demolition work on behalf of the building contractor in accordance with the license and the surveys and projects attached to the license, taking, implementing and enforcing all kinds of measures stipulated by the legislation [1]. According to the 3194 Zoning Law, it is not possible to continue the construction work without a construction site supervisor. Although the responsibility of technical personnel is limited to their own technical field, according to the law, the responsibility of the site supervisor is at the same level with the building contractor. This responsibility includes the construction of the building in accordance with the legislation, technical documents, standards and technical specifications [2].

The selection of the site supervisor, who has such important duties and responsibilities and who is expected to manage resources (time, money, labor, authority, talent, etc.) in the best way, is vitally important for the completion of the construction work as desired. Making this selection with a data-based scientific method will be beneficial for both the contractor company and the person/institution that demands the construction. This study aims to develop such a scientific method.

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1.2. Analytic Hierarchy Process (AHP)

It can be difficult to choose between alternatives when there are multiple criteria for decision making. Multi-criteria decision-making (MCDM) methods are analytical methods used in the evaluation of alternatives. There are many types of MCDM methods such as ELECTRE, TOPSIS, PROMETHEE, VIKOR, ANP, AHP and many others [4].

AHP, one of the most popular MCDM methods, was developed by Thomas L. Saaty to find solutions to complex multi-criteria problems [3]. It is based on the principle of determining the relative importance of decision criteria according to each other by subjecting them to pairwise comparisons. For this, the decision maker (expert) opinion is used. The alternatives are prioritized on the basis of the criteria and the selection is made. The most important advantages of AHP among other MCDM methods are its ease of use and the fact that it can be successfully applied in complex decision problems that include subjective judgments as well as objective judgments.

The problem of selecting the best site supervisor involves both quantitative and qualitative criteria. The quantitative criteria (such as having a certificate, experience by years, English level, etc.) can be analyzed numerically while the qualitative criteria (such as self-confidence, general experience, reliability, etc.) should be evaluated personally with expert knowledge of the decision maker. AHP supplies an easily applicable method for both of these two types of criteria. In addition, there is a need to classify and handle many criteria related to different fields, thus the problem can be detailed and decomposed. When evaluated in terms of suitability for the purpose in this study, it was decided that it would be appropriate to use AHP in this study because of the advantages and superiority of it compared with other MCDM methods.

The solution stages of the AHP method consist of 5 steps [5].

Step 1 (Creating the Hierarchical Structure): A top-down structure is created. The objective is written at the top. In the middle are the criteria and sub-criteria, and at the bottom are the alternatives.

Step 2 (Pairwise Comparison Matrices and Determination of Superiorities): After the hierarchical structure is established, the (nxn) pairwise comparison matrix shown in equation (2.1) is created.

$$A=\begin{bmatrix} 1 & a_{21} & a_{31} & \dots & a_{n1} \\ 1/a_{21} & 1 & a_{32} & \dots & a_{n2} \\ 1/a_{31} & 1/a_{32} & 1 & \dots & a_{n3} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 1/a_{n1} & 1/a_{n2} & 1/a_{n3} & \dots & 1 \end{bmatrix} \quad (2.1)$$

Each criterion given in equation (2.1) is scored according to their importance. Here, the 9-digit importance scale developed by Saaty should be used to determine the superiority [4].

Step 3 (Determination of the Eigen Vector (Relative Importance Vector)): After the pairwise comparison matrices are created, the eigenvector showing the importance of each value in the matrix relative to the other values is calculated. The eigenvector of the matrix in nx1 dimension is given in equation (2.2).

where i =1,2,3…..,n and j=1,2,3,….n

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}) \quad \text{and} \quad w_i = \frac{\sum_{j=1}^{n} b_{ij}}{n} \quad (2.2)$$

The column vector W is obtained from the arithmetic mean of the row elements of the matrix formed by the b_{ij} values specified in equation (2.2).

Step 4 (Calculating the Consistency of the Eigenvector): The inconsistency ratio (CR) is calculated for each pairwise comparison matrix. The inconsistency ratio should be below 0.10 [4]. If it is above this value, the scoring should be redone. To calculate the inconsistency ratio, the largest eigenvector of matrix A, i.e. λmax is calculated (equation 2.3).

where i =1,2,3…..,n and j=1,2,3,….n

D =$[aij]_{mxn}$ x $[w_i]_{nx1}$ = $[d_i]_{nx1}$

$$\lambda_{max}=\frac{\sum_{i=1}^{n}\frac{d_i}{wi}}{n} \quad (2.3)$$

In order to calculate the inconsistency ratio, the randomness index (RI) value is needed. This value is taken from the random value index table [4].

In accordance with this information, the calculation of the inconsistency ratio CR is given in equation (2.4). In order to obtain a reliable result, the CR inconsistency ratio should not exceed 0.10 [4].

$$CR=\frac{\lambda_{max}-n}{(n-1).RI} \quad (\textbf{Hata! Belgede belirtilen stilde metne rastlanmadı.}.4)$$

Step 5: The first four steps for obtaining the priority values are calculated for the entire hierarchical structure. At this stage, the superiority column vectors of mx1 dimension generated by each of the n criteria in the hierarchical structure are combined to form the DW decision matrix of mxn dimension with equation (2.5). The result vector R is obtained by multiplying the matrix with the superiority vector

where i =1,2,3…..,n and j=1,2,3,….n

DW =$[w_i]_{mxn}$ (**Hata! Belgede belirtilen stilde metne rastlanmadı.**.5)

W by equation (2.6) [5].

1.3. Literature Review

There are many studies in the literature on selection with MCDM methods, here especially studies with AHP are focused. In these studies, selection problems have been evaluated in different areas such as recruitment of personnel for workplaces belonging to various sectors, priority/performance evaluation for the purpose of assigning personnel within the organization to a position, selection of the most suitable contractor/bid.

Özyürek et al. [6-8] utilized AHP in their studies on the evaluation of tender bids within the scope of 4734 Public Procurement Law. In this framework, solutions were proposed for the selection of the most suitable bidder by using AHP in the areas of; evaluating quality and bid price together [6], evaluating the quality of bidders [7], evaluating the qualification criteria of bidders in the law [8].

Yılmaz [9] addressed the problem of selecting a research assistant for a private university in Germany by using AHP. It was revealed that if the personnel who is prioritized at result of the study is selected, the research assistant with the most important characteristics of the decision makers will be recruited and the highest efficiency can be achieved.

In the study conducted by Şener [10], the problem of selecting one of the existing personnel as quality control personnel for a new production line to be established in an integrated textile enterprise was solved with AHP. As a result of the study, it was revealed that the classical performance evaluation

applied by the organization is based only on quantitative criteria while ignoring qualitative criteria; however, by taking qualitative criteria into consideration in AHP analysis, the selection results can be based on a more comprehensive study.

In the study conducted by Çoban [11], it was aimed to realize the personnel selection process by applying AHP in the recruitment of engineers for a drip irrigation manufacturing company. As a result of the study; it was concluded that subjective criteria (creative thinking and research skills) had a high impact on the selection and that AHP can be used not only in personnel selection but also in solving all decision problems.

Erdemir et al. [12] conducted a performance evaluation of one hundred personnel working in a municipality by considering public performance requirements. As a result of the findings, it was revealed that the AHP integrated fuzzy TOPSIS model can achieve different and effective results in performance evaluation than the existing evaluation.

Koyuncu et al. [13] aimed to compare the effectiveness of AHP and TOPSIS methods in personnel selection process. In this context, a personnel selection study was conducted in a manufacturing company operating in the automotive sector. Six engineers who started to work in the company within the last year were evaluated with the two methods, and the ranking results obtained were compared with the performance scores of these employees. According to the comparison, it was determined that the method showing the least deviation was AHP.

Turan et al. [14] focused on personnel selection in the health sector and examined the use of AHP in nurse selection for hospitals. As a result of the study, AHP method was applied for the criteria and the importance level of the criteria was quantified.

Vural et al. [15] addressed the personnel selection problem of a medium-sized enterprise located in the Organized Industrial Zone of Kayseri province. Candidates who applied for a job were ranked according to their level of having the specified criteria. The results showed that AHP and VIKOR methods can be used effectively in an integrated manner in personnel selection.

Supçiller et al. [16] used AHP method to find the weights of the criteria in the optimal supplier selection problem for a company, and 7 different MCDM methods together with AHP in the selection of the supplier. As a result of the study, it was observed that AHP gave results compatible with other methods.

Önel [17] studied personnel selection with fuzzy AHP for a concrete plant. With this method, it was revealed that linguistic variables can be processed mathematically and the selection process can be realized.

In the study by Hankılıç [18], a fuzzy AHP decision making model was developed and applied for personnel selection with job/position and organizational requirements criteria. While individuals cannot compare more than seven objects at the same time, it is shown that it is possible to compare the data of a large number of candidates with this method.

In the study conducted by Keser [19] on bank personnel selection, AHP and fuzzy AHP methods were used. The data of the interviews conducted with 250 candidates by the human resources department of a bank were reinterpreted with AHP and fuzzy AHP. It was seen that AHP and fuzzy AHP are very effective methods in deciding which of the alternatives to select from the data sets with high sample size.

In the study by Özbek [20], the personnel selection problem was solved with AHP, one of the MCDM techniques that is frequently used in solving such problems, and the AHP solution algorithm was turned into a web-based application.

In the study conducted by Uğur [21], the selection of a project manager who will take part in the management of a large construction project to be carried out in a foreign country (Russia) was made with MOORA, one of the MCDM methods.

Anbarcı et al. [22] developed a fuzzy logic evaluation model for technical personnel selection, which is usually based on the subjective evaluations of the people responsible for personnel selection in the company. The model was applied to site supervisor selection and the results showed that the proposed

method can be effective and useful for the site supervisor selection problem.

Acer et al. [23] evaluated the field operation personnel selection process in Trabzon Port, one of the most important ports of Türkiye, by using AHP and MOORA methods. With the findings obtained, it was shown that post-application criteria (interview, exam results and references) were the most important factors in the personnel selection process and a prioritized candidate was determined for selection.

Karabayır et al. [24] used multi-criteria decision-making methods for selecting the most convenient supplier for construction companies. Fuzzy AHP was used for the calculation of decision criteria weights, and then Fuzzy TOPSIS was applied for ranking the alternatives. The approach was tested for two construction companies and selection decisions of two different sized companies having the same supplier pool was compared.

In the study by Uluskan et al. [25] suppliers of a public institution operating in the railway industry were evaluated using MCDM methods. The criteria were weighted through AHP, Fuzzy AHP and Level Based Weight Assessment (LBWA) methods, whereas, the alternatives were ranked via Complex Proportional Evaluation (COPRAS) method. The AHP method was utilized due to its effectiveness in criterion weighting and its usability with other methods. As there is a large number of subjective criteria in the study, the uncertainties were decided to be eliminated through FAHP method.

Kantoğlu et al. [26] studied the supplier selection problem in a chocolate production company. Factors such as quality, price, delivery, performance, interaction and a large number of sub-criteria create a complex structure in evaluating supplier selection. In this study, the Fuzzy AHP Method was used to determine the important criteria for supplier selection.

Akkaya [27] analyzed determining the sludge dewatering process in a wastewater treatment plant using the analytical hierarchy process (AHP), as it is necessary to choose low-cost methods that are suitable for the plant and provide high solids content. The criteria were created for the selection of sludge dewatering equipment, these criteria were compared and analyzed in the SuperDecision software and the best sludge dewatering equipment was determined.

Paçacı et al. [28] focused on logistics center selection problem. AHP was used for evaluation of the order of importance of the main and sub-criteria determined for the logistics center location.

In the study conducted by Aykan et al. [29], choosing the right candidate for the position of assistant human resources specialist in a production enterprise operating in the Kayseri Free Zone was studied with the help of AHP and TOPSIS methods. With the help of the results obtained from the AHP method, the TOPSIS method was applied and the most suitable candidate was selected among 8 candidates.

Gümüşhan et al. [30] studied selection of a suitable e-learning system, which is being actively used more and more in normal life starting from the Pandemic period. The criteria for selection were listed using the fuzzy AHP method. The most effective criterion in the study was found to be interaction, which is followed by ease of use, content and reliability criteria.

In the study by Şahintürk et al. [31], appropriate Enterprise Architecture (EA) selection problem was analyzed. EA is a methodology that aims to ensure continuous harmony between the institution's strategy, goals, organizational structure, business processes and information technology infrastructure. In the study, the selection of a EA framework suitable for the business processes of an institution that will start a digital transformation project is explained. AHP and ELECTRE I techniques were used and the TOGAF framework was determined to be the most appropriate one.

Çetin et al. [32] studied company performance with AHP based Balanced Scorecard (BSC) method. AHP was used to determine the weight of performance measurement criteria. The performance of a company operating in the metal plating sector in Izmir was evaluated with BSC. The importance levels of BSC's financial dimension, customer dimension, internal processes dimension and learning and development dimensions in performance evaluation were measured with AHP. The performance evaluation of the company for the determined years was obtained.

Aslan's study [33] was carried out in order to model and evaluate the groundwater potential and quality of Van (Türkiye). In order to evaluate the groundwater potential of Van, remote sensing data

with AHP and Fuzzy AHP methods were used. The evidence obtained by validating the results is consistent with the flow calculation values.

Özen et al. [34] studied supplier selection in automotive sub-industry sector using AHP, fuzzy AHP and fuzzy TOPSIS approaches. In the study, the impact of Covid-19 epidemic on supplier selection in the automotive industry is emphasized. Selection of the most suitable supplier was evaluated among the 4 candidate suppliers with three different expert decision makers. Finally, by conducting sensitivity analysis, suppliers were examined and interpreted under different circumstances.

2. MATERIAL AND METHODS

2.1. Material

The aim of this study is to develop a scientific method that construction companies can use for the selection of personnel to be employed as site supervisors. For this purpose, the study was initiated by researching and obtaining the material that can be used in the analysis.

First of all, the decision criteria that can be used in site supervisor selection were investigated. For this purpose, a literature review on personnel selection and interviews were conducted with the relevant people within the scope of the study. The relevant people whose information and opinions were obtained in the field study were company owners, board members and company managers. In addition to these, missing criteria were produced through research (recruitment advertisements, etc.) and personal experience. The decision criteria obtained were shown on a table and a Personnel Selection Criteria Matrix was created (Table 1).

The criteria were categorized in a logical and consistent manner and a questionnaire was created with 66 sub-criteria under 10 criteria. The purpose of the questionnaire is to determine the importance levels of the criteria and sub-criteria. In order to test the comprehensibility, the questionnaire was sent to a limited number of related people through a Pilot Research Application. As a result of this application, it was realized that the target group of the questionnaire should be more specific. When the questionnaire was first created, it was aimed to be applied to all construction companies. However, it was found that this target caused difficulties in the design of the survey questions (decision criteria).

The construction sector consists of many sub-areas. For example; building construction, soil mechanics applications, steel structures, paved field manufacturing, etc. If the questions are designed to address companies operating in all areas, there is a need to make generalizations, and if the questions are detailed according to different construction areas, the number of questions increases exponentially.

It was evaluated that the survey questions related to a specific construction area, rather than all of these areas, would increase comprehensibility, validity and reliability, and thus the universe for application of the questionnaire was limited. It was decided that applying the questionnaire in the field of "building construction" would provide the opportunity to reach the largest number of participants. Thus, the scope of the study was determined as construction companies operating in the construction sector and carrying out medium-sized building construction works. As a result of the study, it was evaluated that studies addressing different construction areas could be conducted by changing the decision criteria after the method for the selection of the construction site supervisor was established.

Finally, the Site Supervisor Selection Decision Criteria Survey was finalized to consist of 51 sub-criteria under 8 criteria (Table 2). The purpose of the survey is to determine the level of importance of the decision criteria and sub-criteria in the selection of a site supervisor. The survey was prepared in such a way that one of the 5 levels, namely "Very High", "High", "Medium", "Low", "Very Low", could be preferred for the importance levels of the sub-criteria. Participants were not asked to determine the level of importance for the criteria, it was aimed to obtain the importance levels of the criteria from the average of their sub-criteria for internal consistency.

Table 1. Personnel Selection Criteria Matrix (a part of it is shown because it is voluminous)

			Pre-Selection Criteria						Experience		
			Gender	To have done military service	Diploma	Other Legislative Obligations	Experience period (years)	Age	Experience in the Construction Industry	Experience as Site Supervisor	Similar Project Experience
USED IN ACADEMIC STUDIES	1	Personnel Selection with Anp and Dematel - E.Aksakal, ... (Industrial Engineer for an international company)								√√	
	2	Personnel Selection with Fuzzy Ahp - E.Özgörmüş, ... (Supply Planning Engineering for the food industry)								√√	
	3	Site Supervisors Qualifications - L.O.Uğur, ... (leader qualified Site Supervisor)									
	4	(PhD) Fuzzy Logic in Human Resources Selection - B.Doğanalp (Mechanical Maintenance Engineer for a business organization in the manufacturing sector)							√		
	5	Salesperson Candidates with F.Topsis - Z.Başkaya, ... (Salesperson to work in top level store)								√√	
	6	Integrated Fuzzy For Architect - V.Keršulienė, ... (Architect to work as project manager)									
	7	(PhD) F.Topsis F.AHP - B.Öztürk (Salesperson for chain of stores)								√√	
	8	(Master's degree) Nurse Selection with F.Topsis - M.K.Bingöllü (Nurse selection from internal sources)									
	9	Group Decision in Fuzzy Environment with F.Topsis - F.Ecer (Salesperson in national retail stores)								√√	
	10	Topsis for group decision under F.Environment - C.T.Chen *(System Analysis Engineer for software company)*								√√	
FROM CONTRACTORS		BÜLENT SAVAŞ KILINÇ / EYLÜL BİLİŞİM MÜH.İNŞ.TİC.LTD.ŞTİ. (Company owner, Civil Engineer)	√	√						√√	
		MUSTAFA KAYA / YAPTEK İNŞ.TUR.TAAH.TİC.LTD.ŞTİ. (Company partner, Civil Engineer)								√√	
		ALİ ILGAR / A YAPI TAAH.SAN.TİC.LTD.ŞTİ. (Company partner, Civil Engineer)								√√	
		ALAATTİN AKCİN / ÖZ ARGE İNŞAAT SAN.VE TİC.LTD.ŞTİ. (Company owner, Civil Engineer)	√	√					√		√

Contractor Reported Criteria
Self Generated Criteria
√ sub-criteria used
√√ criteria used

Table 2. Site Supervisor Selection Decision Criteria Survey

At what level are the following criteria important for the selection of a site supervisor?					
Criteria / Sub Criteria	**Importance for Selection***				
1. EDUCATION / CERTIFICATE	**VH**	**H**	**M**	**L**	**VL**
1.1 Undergraduate Education (candidate's university of graduation)					
1.2 Master's Degree (university candidate graduated/continues)					
1.3 Having "Class A Occupational Safety Specialist Certificate"					
1.4 Having a "First Aid Certificate"					
1.5 Having a "Driver's License"					
1.6 Vocational Trainings Received (certified)					
2. EXPERIENCE	**VH**	**H**	**M**	**L**	**VL**
2.1 Total Experience as a Site Supervisor in All Construction Areas					
2.2 Experience as a Site Supervisor in Building Construction					
2.3 Experience of Managing a Construction Site from Start to Finish					
2.4 Number of Works Completed as Site Supervisor					
2.5 Size of the Work(s) Completed as Site Supervisor (area, cost)					
2.6 Total Number of Years of Employment in the Construction Sector					
2.7 Total Number of Years Worked in the Field of Building Construction					
2.8 Previous Companies and Duration of Employment (stability)					
3. BUSINESS KNOWLEDGE	**VH**	**H**	**M**	**L**	**VL**
3.1 Planning Knowledge (to be able to prepare and follow the work program)					
3.2 Quantity Survey, Progress Payment, Final Account Information					
3.3 Equipment and Technology Knowledge (construction machinery, etc.)					
3.4 Construction Materials Knowledge (concrete, admixtures, paint, etc.)					
3.5 Knowledge of Records to be kept at the construction site					
3.6 Knowledge of Construction Legislation					
3.7 Knowledge of Labor Law (Labor Law and related legislation)					
3.8 Knowledge of Occupational Health and Safety					
3.9 Knowledge of Resource Management (material, labor, money, time, etc.)					
3.10 Knowledge of Cost Management (cost of construction works)					
3.11 Environmental Management Knowledge					
3.12 Knowledge of General Economics and Construction Economics					
3.13 Knowledge of Productivity Management (optimum resources)					
4. COMPUTER KNOWLEDGE	**VH**	**H**	**M**	**L**	**VL**
4.1 Using MS Office Programs					
4.2 Using Autocad Program					
4.3 Using Planning Program (Primavera, MS Project etc.)					
5. FOREIGN LANGUAGE KNOWLEDGE	**VH**	**H**	**M**	**L**	**VL**
5.1 General English Level					
5.2 Vocational English Level (mastery of technical terminology)					
6. CANDIDATE'S DEMANDS	**VH**	**H**	**M**	**L**	**VL**
6.1 Fee Requested by the Candidate					
6.2 Whether the candidate needs accommodation, whether the company should provide it, and if so, the cost to the company					
6.3 Whether the candidate needs a vehicle, whether the company should provide it, and if so, the cost to the company					
7. SKILLS AND PERSONAL CHARACTERISTICS	**VH**	**H**	**M**	**L**	**VL**
7.1 Desire to succeed (enthusiasm for work, ownership of work)					
7.2 Reliability (to be supported by previous workplaces, references, etc.)					
7.3 Self-confidence					
7.4 Activity and Dynamism (practicality, quick thinking and acting)					
7.5 Tidiness and Orderliness					
7.6 Ability to Represent (appearance and speaking style)					
7.7 Coordination Skills (providing information flow up, down and horizontally)					
7.8 Team Management Skills					
7.9 Ability to take initiative when faced with a problem					
7.10 Predisposition to Personal Career Development					
7.11 Whether he/she has harmful/bad habits (gambling, smoking, alcohol)					
8. OTHER	**VH**	**H**	**M**	**L**	**VL**
8.1 References					
8.2 The size of the construction site that the candidate will manage if hired					
8.3 If he/she knows the location of the construction site he/she will manage					
8.4 Whether the construction site is located in the candidate's hometown					
8.5 The status of the candidate's spouse and children (whether the family can come to the location of the construction site, etc.)					
*** VH: Very High / H: High / M: Medium / L: Low / VL: Very Low**					

2.2. Method

AHP was used for data analysis. For the AHP analysis, data was collected from construction companies by conducting a field study. The data was entered into Super Decisions software and AHP analysis was performed. The flow chart of the processes carried out in accordance with the method from the beginning to the end of the study is given in Figure 1.

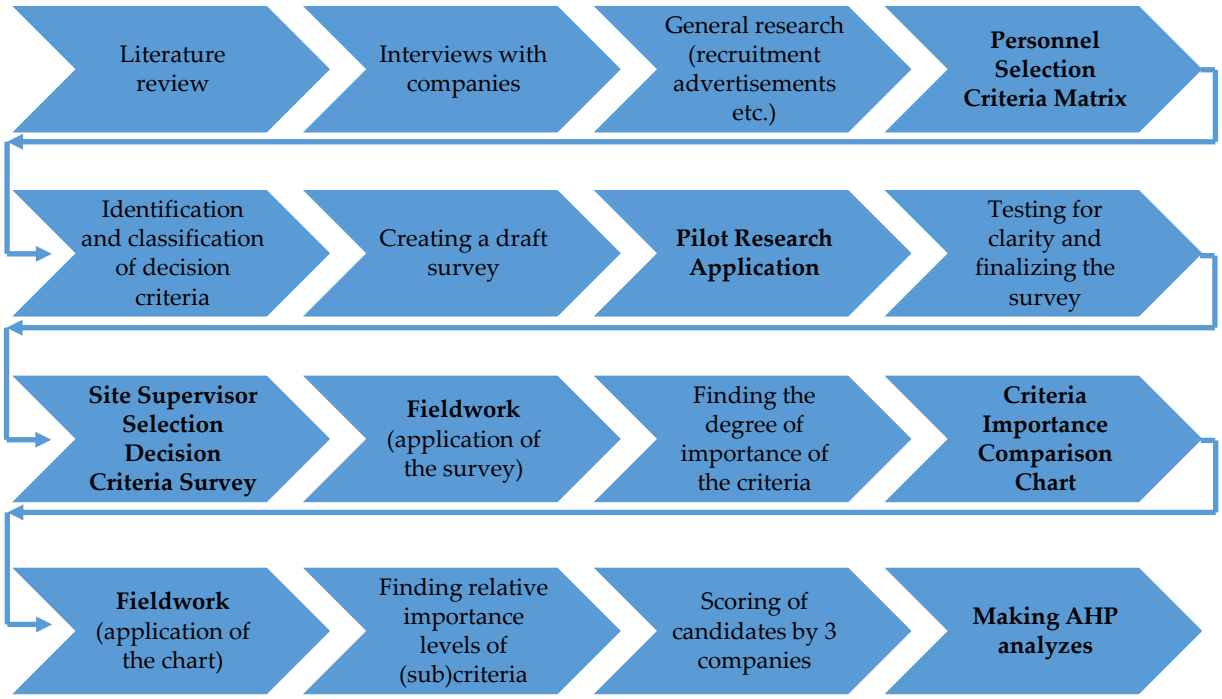


Figure 1. Flow Chart of Processes Conducted in Study (each line is continuation of the previous one)

2.2.1. Fieldwork for AHP

Site Supervisor Selection Decision Criteria Survey was applied to the relevant people and the answers were received. For this purpose, the Ministry of National Defense Construction Real Estate organization, which is responsible for the construction works of the Ministry of National Defense, was worked with. The target group of the survey is the construction companies that carry out medium-sized building construction works participating in the construction tenders of the organization throughout the country. Of these, 48 construction companies were selected to represent the country. The survey was administered through face-to-face interviews where possible, and when this was not possible, it was sent to the companies via the official e-mail address of the organization. As a result, 32 companies were interviewed or returned the questionnaire. Due to the July 15 treacherous coup attempt and Covid-19 pandemic events, this number of interested people could be reached due to the shock, stagnation and contraction in military units and the construction sector. Thus, the importance levels of the sub-criteria were determined. The importance level of each criterion was calculated by taking the average of its sub-criteria (Table 3). In this calculation, it is accepted that the answer "Very High" in the survey is 5 points and the answer "Very Low" is 1 point. These numbers were used in the next stage to find the relative importance levels of the criteria in comparison with each other.

In order to determine the comparative (relative) importance levels of the sub-criteria with each other, the "Decision Criteria Importance Comparison Chart" was created. A score of 1 indicates that the

importance levels of the sub-criteria are equal, and a score between 2 and 9 indicates the level of importance compared to the other sub-criteria (2 being the lowest and 9 being the highest relative importance level). To obtain expert opinion for the chart, face-to-face interviews were conducted with the company managers/board members of 3 construction companies. The scores of the experts were averaged to obtain the comparative (relative) importance levels of the sub-criteria (Table 4).

Table 3. Importance Levels of Decision Criteria (Scores Calculated Using Sub-Criteria)

Decision Criteria	Average Score
1. EDUCATION / CERTIFICATE	3,89
2. EXPERIENCE	4,46
3. BUSINESS KNOWLEDGE	4,13
4. COMPUTER KNOWLEDGE	4,55
5. FOREIGN LANGUAGE KNOWLEDGE	3,00
6. CANDIDATE'S DEMANDS	3,00
7. SKILLS AND PERSONAL CHARACTERISTICS	4,12
8. OTHER	3,40

Table 4. Comparative (Relative) Importance Levels of The Sub-Criteria (a part of it is shown)

1. EDUCATION / CERTIFICATE	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
1.1 Undergraduate Education (candidate's university of graduation)								X										1.2
1.1												X						1.3
1.1			X															1.4
1.1														X				1.5
1.1											X							1.6
1.2 Master's Degree (university candidate graduated/continues)												X						1.3
1.2										X								1.4
1.2																	X	1.5
1.2										X								1.6
1.3 Having "Class A Occupational Safety Specialist Certificate"		X																1.4
1.3																	X	1.5
1.3								X										1.6
1.4 Having a "First Aid Certificate"																	X	1.5
1.4													X					1.6
1.5 Having a "Driver's License"				X														1.6

In order to obtain the comparative (relative) importance levels of the criteria, the importance level scores given in Table 3 were used. These were mathematically compared with each other to obtain the comparative (relative) importance levels of the criteria according to the comparison chart (Table 5).

Three construction companies were contacted, and the developed method was used for the selection of site supervisors for these companies. These selection results were then compared with the results of the simultaneous selection process conducted by the companies using their own methods. Candidates who wanted to work as a construction site supervisor applied to companies A, B and C. The candidates who applied to the companies are different people. After pre-selecting the applicants, the companies assigned scores to the best remaining candidates (alternatives) to apply this method.

The method developed in this study was applied in the selection of the best 4 candidates among the

candidates (alternatives) who applied to Company A for the position of construction site supervisor. The candidates were given scores by the company official according to the sub-criteria (Appendix A). This method was applied in the selection of the best 3 candidates among the candidates (from the alternatives) who applied for the position of construction site supervisor in Company B. The scores given to the candidates by the company official are given in Appendix B. Similarly, the scores given by the company official to the top 3 candidates who applied for the position of construction site supervisor at Company C are shown in Appendix C. The data obtained from the field studies and the scores given to the candidates were used in the AHP analyses. The voluminous score tables are given in appendices for the sake of orderliness of main text.

Table 5. Comparative (Relative) Importance Levels of Decision Criteria

	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
1. EDUCATION / CERTIFICATE										X								2.
1									X									3.
1										X								4.
1							X											5.
1							X											6.
1									X									7.
1								X										8.
2. EXPERIENCE								X										3.
2									X									4.
2						X												5.
2						X												6.
2								X										7.
2							X											8.
3. BUSINESS KNOWLEDGE										X								4.
3							X											5.
3							X											6.
3									X									7.
3							X											8.
4. COMPUTER KNOWLEDGE						X												5.
4						X												6.
4								X										7.
4							X											8.
5. FOREIGN LANGUAGE KNOW.									X									6.
5											X							7.
5										X								8.
6. CANDIDATE'S DEMANDS											X							7.
6										X								8.
7. SKILLS AND PERSONAL CH.								X										8. OTHER

2.2.2. AHP Analyses

Super Decisions software was used for AHP analyses. In the software, firstly the decision problem was defined and the objective was determined as "Best site supervisor selection". The decision criteria and sub-criteria created to realize the objective were entered into the software. The criteria are linked to the objective and each sub-criteria is linked to its own criterion. Three different hierarchical structures were created for three different companies (companies A, B, C). The hierarchical structure for Company A is given in Figure 2.

First, the comparison results of the decision criteria shown in Table 5 were entered into the software (Table 6). The comparison matrix of the criteria is given in Table 7 and the priority values according to the comparison results are given in Table 8. Accordingly, 'K2 Experience' and 'K4 Computer Knowledge' criteria were determined as the most prioritized criteria with 22.34%. Table 8 shows that the inconsistency rate is 0.00893. The fact that this ratio is less than 0.10 indicates that the relevant data are consistent [4].

For the comparison of the importance levels of sub-criteria, the expert opinion results presented in Table 4 were entered into the software. Here, as an example, the comparison results of the sub-criteria of the "K1 Education / Certificate" criterion are shown as entered the software (Table 9). The comparison matrix of the same sub-criteria is given in Table 10 and the priority values according to the comparison results are given in Table 11. Accordingly, among the sub-criteria of criterion K1, sub-criterion 'K1.5 Having a "Driver's License"' is the most prioritized sub-criterion with 52.34% priority value. The

inconsistency rate is 0.09848.

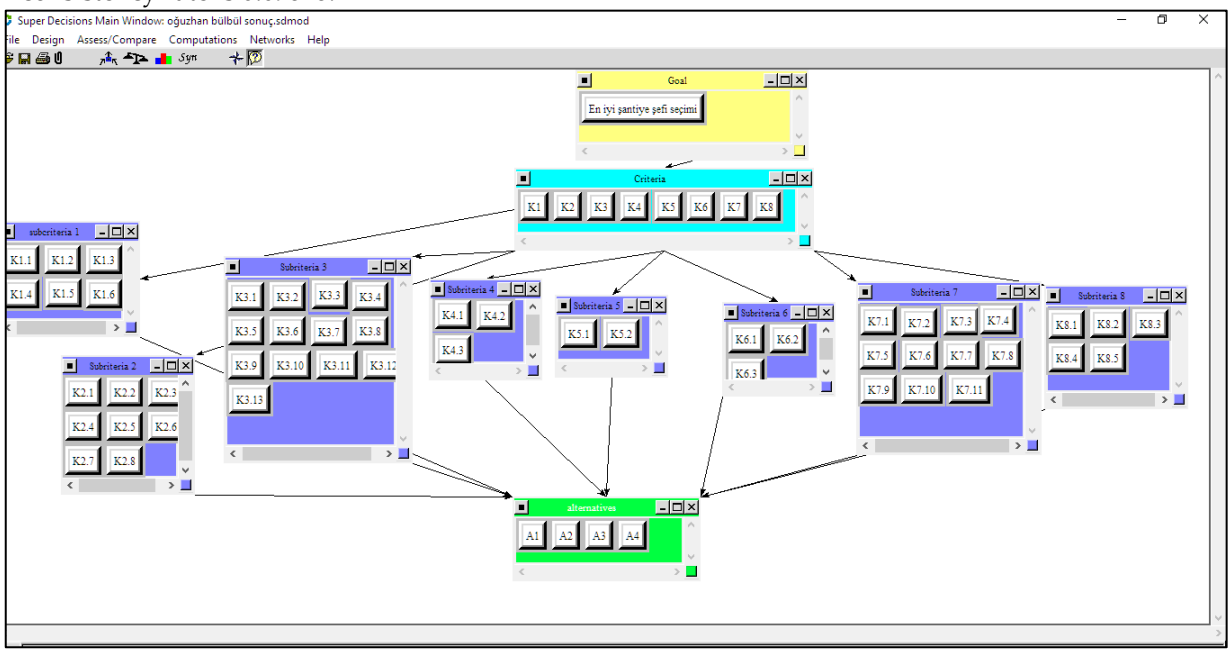


Figure 2. Hierarchical Structure for Company A

Table 6. Entering the comparison results of the criteria into the software (a part of it is shown)

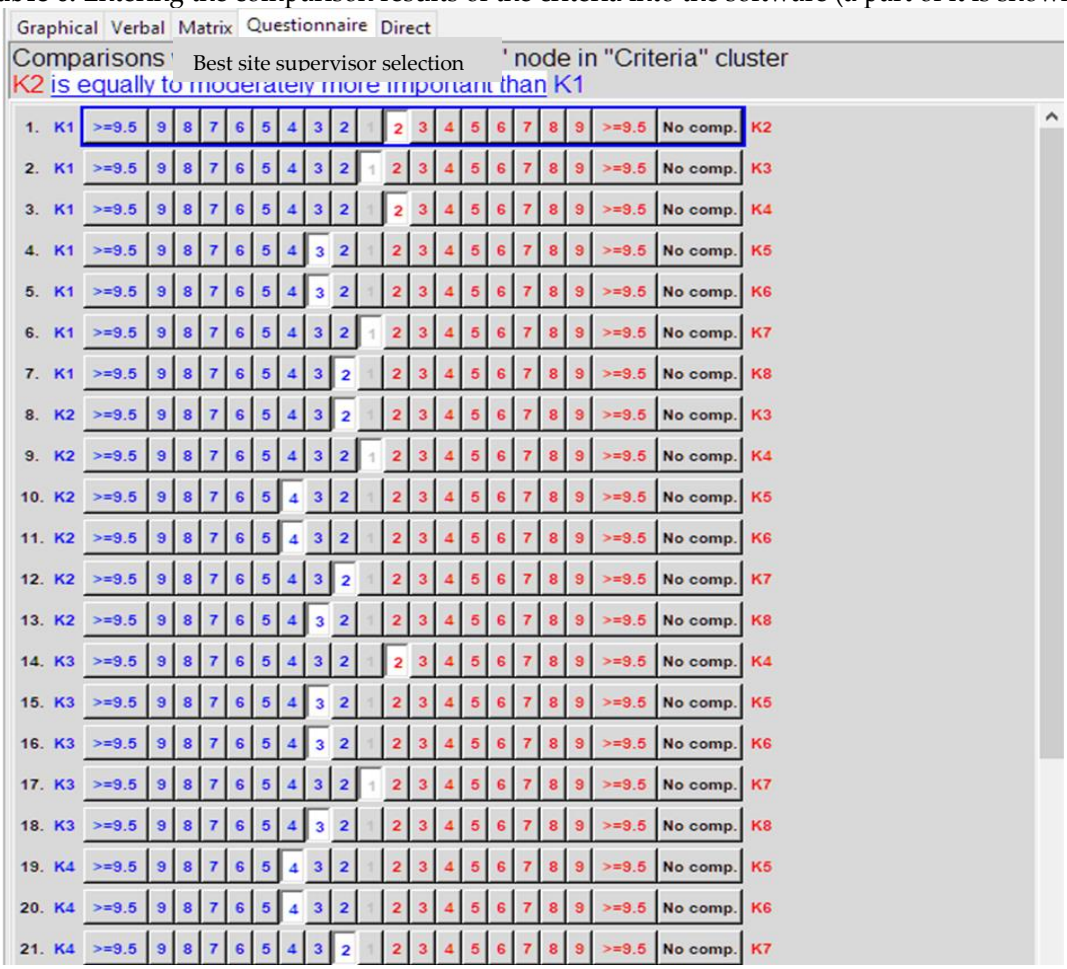


Table 7. Comparison matrix of criteria (a part of it is shown)

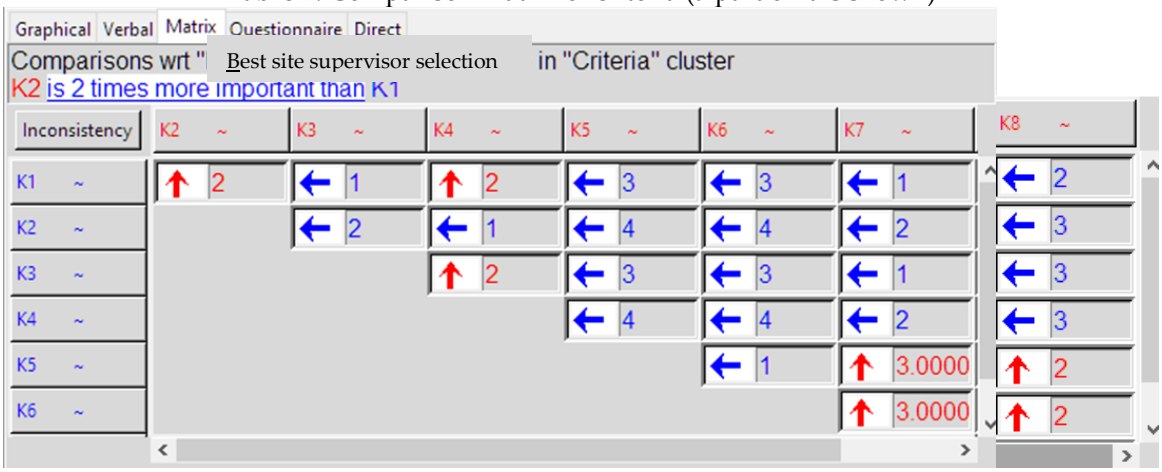


Table 8. Priority values of the criteria according to the comparison results

Inconsistency: 0.00893	
K1	0.12737
K2	0.22339
K3	0.13616
K4	0.22339
K5	0.04559
K6	0.04559
K7	0.12737
K8	0.07112

Table 9. Entering comparison results of K1 criterion's sub-criteria into the software (a part of it is shown)

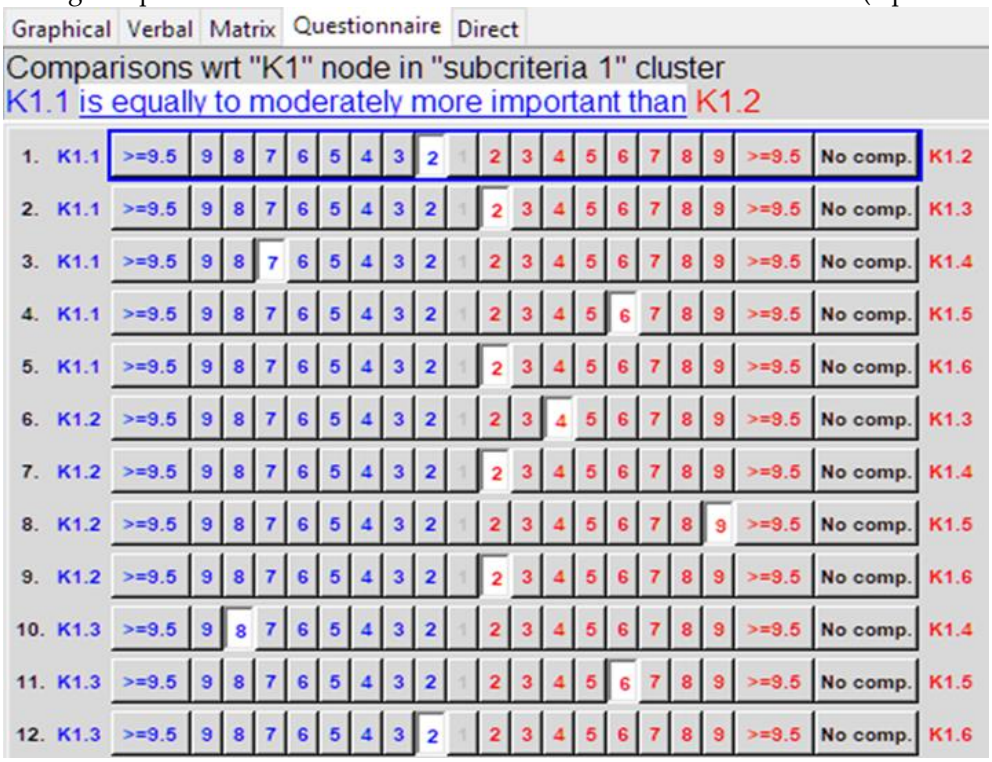


Table 10. Comparison matrix of K1 criterion's sub-criteria

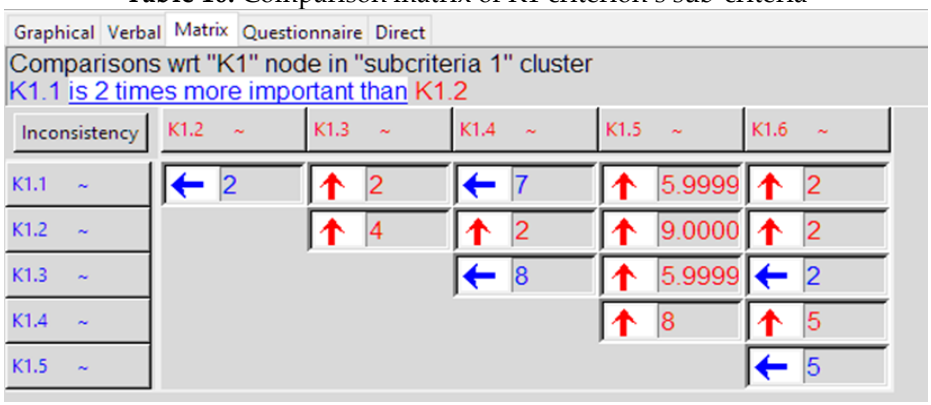
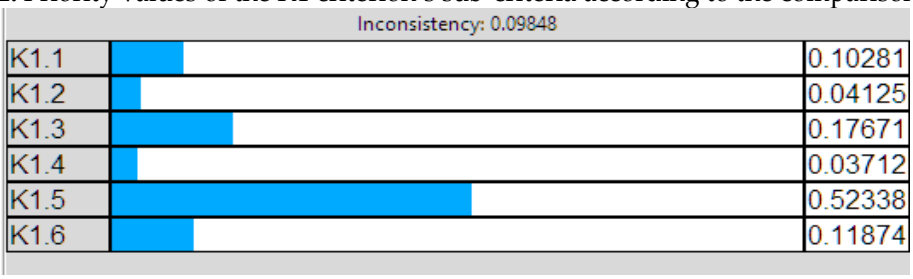


Table 11. Priority values of the K1 criterion's sub-criteria according to the comparison results



Likewise, the comparison results of the sub-criteria of K2, K3, K4, K5, K6, K7 and K8 criteria within their groups were entered into the software and comparison matrices and priority values were obtained. In all cases, the inconsistency rate is below 0.10. Up to this point, hierarchical structures are common to the three companies A, B and C. From this point on, the structures change as candidates are entered into the software as data.

For Company A, hierarchical structure given in Figure 2 is used. The 4 candidates (alternatives A1, A2, A3, A4) who applied to Company A were compared according to each sub-criteria, based on their scores given in Appendix A. For example, comparison of alternatives according to the 'K1.1 Undergraduate Education (candidate's university of graduation)' sub-criterion is in Table 12. The comparison matrix of this process is given in Table 13, and the priority values are given in Table 14. According to the K1.1 sub-criterion, Candidate 3 is the highest priority candidate with 51.58% priority value. The inconsistency rate is 0.00772.

Table 12. Comparison of Company A's candidates according to the K1.1 sub-criterion

Table 13. Comparison matrix of Company A's candidates according to the K1.1 sub-criterion

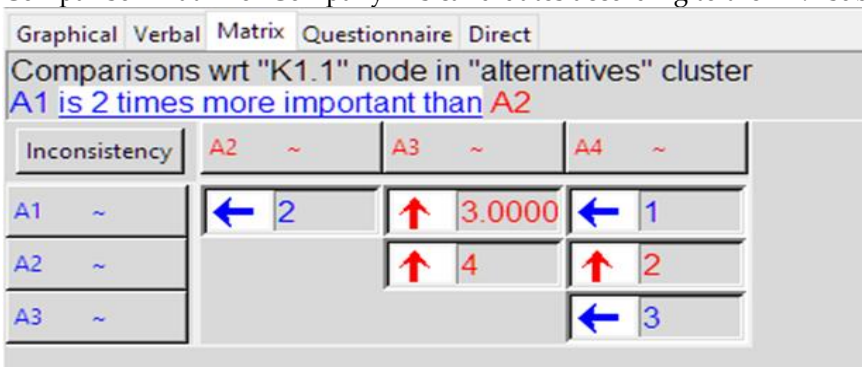
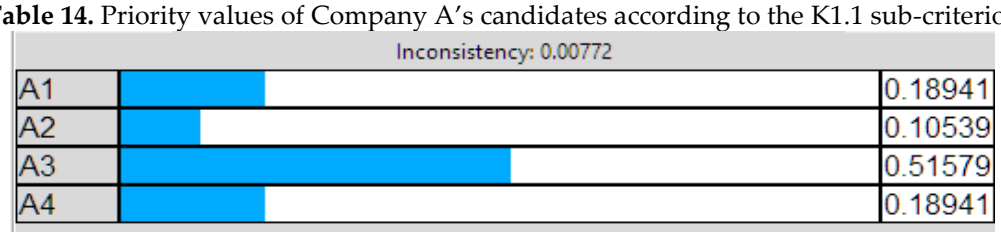


Table 14. Priority values of Company A's candidates according to the K1.1 sub-criterion



Candidates of Company A were compared with each other according to each of the 51 sub-criteria. As explained above, each comparison was entered into Super Decisions software and comparison matrices and priority values were obtained. Other results are not shown here to save space. The inconsistency rate is less than 0.10 in all comparisons.

Finally, an Unweighted Super Matrix of 64x64 size was created by combining all the data (objective, criteria, sub-criteria, candidates) of Company A and normalized to obtain the Weighted Super Matrix (Table 15). The Limit Matrix, which reveals the priorities of the objective, criteria, sub-criteria and alternatives, is in Table 16. The selection results of Company A obtained as a result of these procedures are presented in the "3. Results and Discussion" section.

Table 15. Weighted Super Matrix of Company A (a part of it is shown)

Super Decisions Main Window: oğuzhan bülbül sonuç.sdmod: Weighted Su...

Cluster Node Labels		Goal: Best site supervisor selection	subcriteria 1						Subriteria 2
			K1.1	K1.2	K1.3	K1.4	K1.5	K1.6	K2.1
alternatives	A1	0.000000	0.189406	0.510316	0.087847	0.290339	0.315789	0.225719	0.469434
	A2	0.000000	0.105394	0.086097	0.055322	0.496616	0.315789	0.123501	0.078875
	A3	0.000000	0.515793	0.325741	0.713340	0.127957	0.315789	0.516638	0.137110
	A4	0.000000	0.189407	0.077846	0.143491	0.085089	0.052632	0.134142	0.314582
Criteria	K1	0.127369	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	K2	0.223394	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	K3	0.136163	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	K4	0.223394	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Done

Table 16. Limit Matrix of Company A (a part of it is shown)

Super Decisions Main Window: oğuzhan bülbül sonuç.sdmod: Lim...

Cluster Node Labels		Criteria							
		K1	K2	K3	K4	K5	K6	K7	K8
alternatives	A1	0.129452	0.131938	0.106073	0.149494	0.078960	0.150363	0.150396	0.097583
	A2	0.111269	0.089047	0.120766	0.070995	0.208396	0.161996	0.116059	0.162956
	A3	0.211944	0.142702	0.128351	0.126043	0.125222	0.089152	0.096018	0.089346
	A4	0.047336	0.136313	0.144811	0.153468	0.087422	0.098489	0.137527	0.150115
Criteria	K1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	K2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	K3	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	K4	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Done

Similar to Company A, the candidates of Companies B and C were also compared according to 51 sub-criteria. The comparison of the 3 candidates who applied to company B was made according to the sub-criteria based on the scores given in Appendix B. For example, the comparison data for the sub-criterion 'K1.1 Undergraduate Education (candidate's university of graduation)' is given in Table 17. The comparison matrix of this process is given in Table 18 and the priority values are given in Table 19. According to sub-criterion K1.1, Candidate 2 and Candidate 3 have equal priority with 42.86%. The inconsistency rate is 0.00000.

Based on the scores given in Appendix C, 3 candidates who applied to Company C were compared according to the sub-criteria. For example, the comparison data according to the sub-criterion 'K1.1 Undergraduate Education (candidate's university of graduation)' is in Table 20. The comparison matrix of this process is given in Table 21 and the priority values are given in Table 22. According to sub-criterion K1.1, Candidate 3 is the most prioritized candidate with 64.42%. The inconsistency rate is 0.05156.

Other results for companies B and C are not shown here to save space. The inconsistency rate is less than 0.10 in all comparisons. The selection results of companies B and C are presented in the "3. Results and Discussion" section.

Table 17. Comparison of Company B's candidates according to the K1.1 sub-criterion

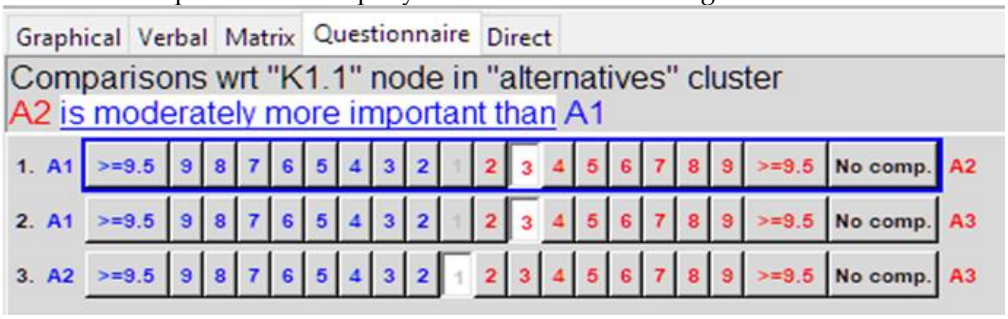


Table 18. Comparison matrix of Company B's candidates according to the K1.1 sub-criterion

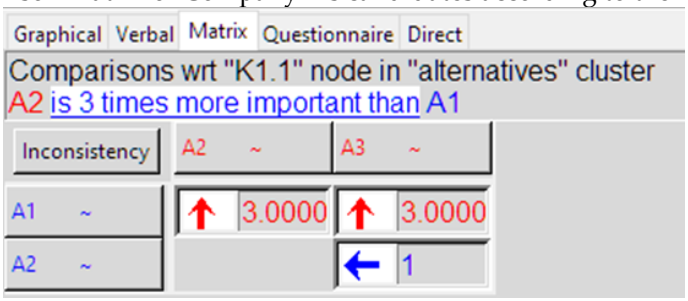


Table 19. Priority values of Company B's candidates according to the K1.1 sub-criterion

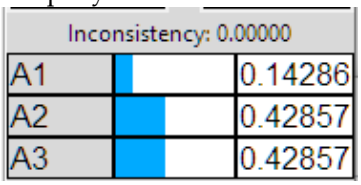


Table 20. Comparison of Company C's candidates according to the K1.1 sub-criterion

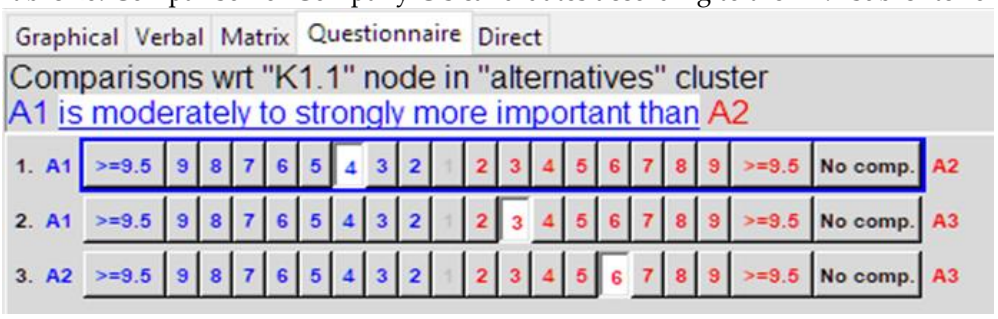


Table 21. Comparison matrix of Company C's candidates according to the K1.1 sub-criterion

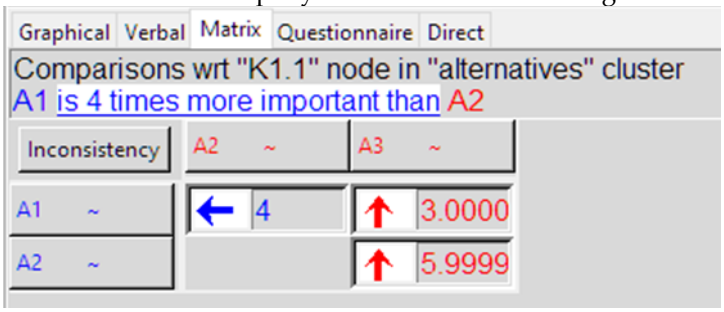
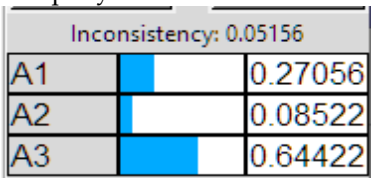


Table 22. Priority values of Company C's candidates according to the K1.1 sub-criterion



3. RESULTS AND DISCUSSION

The outcome, which is the objective of this study, is the final priority values of the candidates (alternatives). The candidate with the highest priority value will be preferred.

This result for Company A is given in Table 23. Accordingly, the priority values (from highest to

lowest) are 26.57% for Candidate 3, 26.07% for Candidate 1, 25.43% for Candidate 4 and 21.93% for Candidate 2. According to these results, Candidate 3 ranked first with a priority value of 26.57% and was selected as the site supervisor.

An important detail is that the priority values of Candidate 3 and Candidate 1 are very close to each other. There is only a 0.5% difference between them. There is a difference of 1.14% between Candidate 3 and Candidate 4 and a difference of 4.64% between Candidate 3 and Candidate 2. These results show that with the method developed in this study, it is possible to make a choice even between alternatives with very close selection values. With this method, it is possible to scientifically determine the priorities that may not be realized in subjective choices and to select the best site supervisor.

Table 23. Final Priority Values for Company A's Candidates

Name	Graphic	Ideals	Normals	Raw
A1		0.981088	0.260707	0.086902
A2		0.825102	0.219257	0.073085
A3		1.000000	0.265733	0.088578
A4		0.956991	0.254304	0.084768

The total priority values for Company B's candidates are given in Table 24. Accordingly, the priority values (from highest to lowest) are 37.52% for Candidate 3, 33.61% for Candidate 1 and 28.87% for Candidate 2. According to these results, Candidate 3 ranks first with a priority value of 37.52% and is selected as the site supervisor.

Table 24. Final Priority Values for Company B's Candidates

Name	Graphic	Ideals	Normals	Raw
A1		0.895894	0.336107	0.112036
A2		0.769606	0.288728	0.096243
A3		1.000000	0.375164	0.125055

The total priority values for Company C's candidates are given in Table 25. Accordingly, the priority values (from highest to lowest) are 35.87% for Candidate 1, 35.17% for Candidate 3 and 28.95% for Candidate 2. According to these results, Candidate 1 ranks first with a priority value of 35.87% and is selected as the site supervisor.

Similar to Company A, the priority values of the top two candidates of Company C are very close to each other. There is only a 0.70% difference between Candidate 1 and Candidate 3. It is seen that the selection method developed in the study allows the selection between candidates with very close priority values in the three-candidate selection.

Table 25. Final Priority Values for Company C's Candidates

Name	Graphic	Ideals	Normals	Raw
A1		1.000000	0.358738	0.119579
A2		0.807126	0.289547	0.096516
A3		0.980422	0.351715	0.117238

An important part of the study is that the construction companies, with which this study was carried out, conducted the selection of the construction site supervisor with their own selection methods simultaneously with the study and the results of this study were compared with the results of the

companies' own selection. Firms A, B and C conducted the selection process with their own methods simultaneously. It was seen that the candidates selected by the companies with their own methods were the same as the candidates selected as a result of the AHP analysis applied according to the method developed in this study (Table 26).

Table 26. The Candidates Selected with AHP Analyses Applied According to the Methodology Developed in this Study and the Candidates Selected by the Companies' Own Methods

Companies	Candidates and Priority Values	Candidates Selected with AHP Analyses	Candidates Selected by the Companies' Own Methods
A	Aday 3 (%26,57) Aday 1 (%26,07) Aday 4 (%25,43) Aday 2 (%21,93)	A3	A3
B	Aday 3 (%37,52) Aday 1 (%33,61) Aday 2 (%28,87)	A3	A3
C	Aday 1 (%35,87) Aday 3 (%35,17) Aday 2 (%28,95)	A1	A1

In the literature review of personnel selection studies conducted with AHP, it has been revealed that AHP generally gives successful results for priority assessment.

Yılmaz [9] used AHP in the selection of research assistants for a university. Şener [10] studied a quality control personnel selection problem in a textile company. Çoban [11] utilized AHP for the selection of engineers for a drip irrigation manufacturing company. Erdemir et al. [12] used AHP integrated fuzzy TOPSIS model to identify and prioritize criteria for the personnel working in a public institution (municipality) and evaluated their performance. Koyuncu et al. [13] compared the effectiveness of AHP and TOPSIS methods in personnel selection in a manufacturing company operating in the automotive sector. Turan et al. [14] examined the use of AHP in nurse selection for hospitals. Vural et al. [15] examined the integrated use of AHP and VIKOR methods in the personnel selection problem of a medium-sized enterprise located in Kayseri Organized Industrial Zone. Önel [17] studied personnel selection with fuzzy AHP for a concrete factory. In the study by Hankılıç [18], a fuzzy AHP decision making model for personnel selection was developed and applied. AHP and fuzzy AHP methods were used in the study conducted by Keser [19] on bank personnel selection. In the study by Özbek [20], AHP solution algorithm for personnel selection problem was turned into a web-based application. In the study conducted by Uğur [21], the selection of the project manager for a construction project was made with MOORA, one of the MCDM methods. Anbarcı et al. [22] developed a fuzzy logic evaluation model for site supervisor selection. Acer et al. [23] studied the selection of field operation personnel for a port by using AHP and MOORA, two MCDM methods. Karabayır et al. [24] used Fuzzy AHP and Fuzzy TOPSIS for selecting the most convenient supplier for construction companies. Uluskan et al. [25] studied supplier selection of a public institution operating in the railway industry with the help of fuzzy AHP. Kantoğlu et al. [26] studied the supplier selection problem in a chocolate production company with fuzzy AHP. Akkaya [27] analyzed determining the sludge dewatering process in a wastewater treatment plant using SuperDecision software for AHP analyzes. Paçacı et al. [28] focused on logistics centers selection problem using AHP. Aykan et al. [29] studied selection of assistant human resources specialist in a production enterprise with the help of AHP and TOPSIS methods. Gümüşhan et al. [30] studied selection of a suitable e-learning system using the fuzzy AHP method. Çetin et al. [32]

studied company performance with AHP based Balanced Scorecard (BSC) method. Özen et al. [34] studied supplier selection in automotive sub-industry sector using AHP, fuzzy AHP and fuzzy TOPSIS approaches, emphasizing the impact of Covid-19 epidemic.

Many types of selection and priority determination problems were studied using AHP method. In these studies, AHP was used both alone to analyze the problem as well as an accompanying method besides other MCDM methods successfully. To be easily combined with other methods is another powerful property of AHP.

In this study, the problem of site supervisor selection with AHP for construction companies is analyzed. As a result, findings confirming the results of similar studies on selection problems were obtained.

4. CONCLUSIONS

Site supervisor selection problem was studied and the criteria for selection were analyzed using AHP method. The priorities for both criteria and site supervisor candidates were evaluated successfully with the help of Super Decisions software. The candidates with highest priorities were determined for three companies. It was observed that the selection results of all three companies with their own methods coincided with the results of the method developed in this study and the success of the method was 100% according to the available data.

Even if a different candidate had been selected by the companies with their own methods among the candidates with very close values, it would not have reduced the value of this study, but it was considered that the study was confirmed by seeing that the same alternatives were selected.

This study has been conducted to benefit the selection of site supervisors for contractor construction companies carrying out medium-sized building construction works. Similar studies can be developed for companies operating in different fields in the construction industry by using criteria specific to the relevant field.

Declaration of Ethical Standards

Authors declare that all ethical guidelines including authorship, citation, data reporting, and publishing original research are followed.

Credit Authorship Contribution Statement

O.Bülbül and R.Kanıt both contributed to all stages of study and composing the article. Besides, O.Bülbül performed writing of article while R.Kanıt performed editing and supervision.

Declaration of Competing Interest

Authors declare that there is no competing interest that influence this study.

Funding / Acknowledgements

The authors received no financial support for the research.

Data Availability

The data related to this study is available from O.Bülbül upon reasonable request.

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APPENDICES

Appendix A. Scores of Site Supervisor Candidates of Company A

Criteria / Sub Criteria	Scores of Candidates			
1. EDUCATION / CERTIFICATE	**A1**	**A2**	**A3**	**A4**
1.1 Undergraduate Education (candidate's university of graduation)	8	7	10	8
1.2 Master's Degree (university candidate graduated/continues)	10	2	9	2
1.3 Having "Class A Occupational Safety Specialist Certificate"	3	2	10	4
1.4 Having a "First Aid Certificate"	8	10	5	3
1.5 Having a "Driver's License"	10	10	10	4
1.6 Vocational Trainings Received (certified)	8	7	10	7
2. EXPERIENCE	**A1**	**A2**	**A3**	**A4**
2.1 Total Experience as a Site Supervisor in All Construction Areas	10	4	6	8
2.2 Experience as a Site Supervisor in Building Construction	10	4	8	6
2.3 Experience of Managing a Construction Site from Start to Finish	6	8	10	4
2.4 Number of Works Completed as Site Supervisor	6	8	10	4
2.5 Size of the Work(s) Completed as Site Supervisor (area, cost)	6	7	8	10
2.6 Total Number of Years of Employment in the Construction Sector	10	4	6	8
2.7 Total Number of Years Worked in the Field of Building Construction	10	4	8	6
2.8 Previous Companies and Duration of Employment (stability)	4	6	4	10
3. BUSINESS KNOWLEDGE	**A1**	**A2**	**A3**	**A4**
3.1 Planning Knowledge (to be able to prepare and follow the work program)	4	8	10	3
3.2 Quantity Survey, Progress Payment, Final Account Information	8	5	7	10
3.3 Equipment and Technology Knowledge (construction machinery, etc.)	8	6	7	8
3.4 Construction Materials Knowledge (concrete, admixtures, paint, etc.)	7	8	6	9
3.5 Knowledge of Records to be kept at the construction site	6	8	10	7
3.6 Knowledge of Construction Legislation	10	8	6	9
3.7 Knowledge of Labor Law (Labor Law and related legislation)	9	8	10	7
3.8 Knowledge of Occupational Health and Safety	8	9	7	7
3.9 Knowledge of Resource Management (material, labor, money, time, etc.)	8	7	9	10
3.10 Knowledge of Cost Management (cost of construction works)	8	9	9	8
3.11 Environmental Management Knowledge	10	8	9	7
3.12 Knowledge of General Economics and Construction Economics	8	8	9	10
3.13 Knowledge of Productivity Management (optimum resources)	8	9	8	7
4. COMPUTER KNOWLEDGE	**A1**	**A2**	**A3**	**A4**
4.1 Using MS Office Programs	7	8	10	10
4.2 Using Autocad Program	10	8	10	9
4.3 Using Planning Program (Primavera, MS Project etc.)	10	9	8	10
5. FOREIGN LANGUAGE KNOWLEDGE	**A1**	**A2**	**A3**	**A4**
5.1 General English Level	9	6	7	8
5.2 Vocational English Level (mastery of technical terminology)	5	10	8	7
6. CANDIDATE'S DEMANDS	**A1**	**A2**	**A3**	**A4**
6.1 Fee Requested by the Candidate	10	8	9	10
6.2 Whether the candidate needs accommodation, whether the company should provide it, and if so, the cost to the company	4	5	3	2
6.3 Whether the candidate needs a vehicle, whether the company should provide it, and if so, the cost to the company	8	7	6	10
7. SKILLS AND PERSONAL CHARACTERISTICS	**A1**	**A2**	**A3**	**A4**
7.1 Desire to succeed (enthusiasm for work, ownership of work)	6	8	10	8
7.2 Reliability (to be supported by previous workplaces, references, etc.)	10	7	8	10
7.3 Self-confidence	10	9	10	8
7.4 Activity and Dynamism (practicality, quick thinking and acting)	9	10	7	6
7.5 Tidiness and Orderliness	6	7	9	8
7.6 Ability to Represent (appearance and speaking style)	10	8	9	7
7.7 Coordination Skills (providing information flow up, down and horizontally)	10	9	8	9
7.8 Team Management Skills	10	8	9	10
7.9 Ability to take initiative when faced with a problem	10	8	7	9
7.10 Predisposition to Personal Career Development	6	9	8	7
7.11 Whether he/she has harmful/bad habits (gambling, smoking, alcohol)	6	10	7	8
8. OTHER	**A1**	**A2**	**A3**	**A4**
8.1 References	10	9	8	10
8.2 The size of the construction site that the candidate will manage if hired	8	9	9	10
8.3 If he/she knows the location of the construction site he/she will manage	5	9	6	4
8.4 Whether the construction site is located in the candidate's hometown	6	7	9	8
8.5 The status of the candidate's spouse and children (whether the family can come to the location of the construction site, etc.)	7	6	5	10

Appendix B. Scores of Site Supervisor Candidates of Company B

Criteria / Sub Criteria	Scores of Candidates		
1. EDUCATION / CERTIFICATE	**A1**	**A2**	**A3**
1.1 Undergraduate Education (candidate's university of graduation)	6	8	8
1.2 Master's Degree (university candidate graduated/continues)	9	5	3
1.3 Having "Class A Occupational Safety Specialist Certificate"	2	10	2
1.4 Having a "First Aid Certificate"	10	2	2
1.5 Having a "Driver's License"	9	6	10
1.6 Vocational Trainings Received (certified)	3	6	2
2. EXPERIENCE	**A1**	**A2**	**A3**
2.1 Total Experience as a Site Supervisor in All Construction Areas	5	9	9
2.2 Experience as a Site Supervisor in Building Construction	6	7	8
2.3 Experience of Managing a Construction Site from Start to Finish	7	9	10
2.4 Number of Works Completed as Site Supervisor	6	8	9
2.5 Size of the Work(s) Completed as Site Supervisor (area, cost)	10	6	9
2.6 Total Number of Years of Employment in the Construction Sector	5	10	10
2.7 Total Number of Years Worked in the Field of Building Construction	7	8	8
2.8 Previous Companies and Duration of Employment (stability)	10	5	7
3. BUSINESS KNOWLEDGE	**A1**	**A2**	**A3**
3.1 Planning Knowledge (to be able to prepare and follow the work program)	8	10	10
3.2 Quantity Survey, Progress Payment, Final Account Information	7	9	8
3.3 Equipment and Technology Knowledge (construction machinery, etc.)	10	6	8
3.4 Construction Materials Knowledge (concrete, admixtures, paint, etc.)	6	9	10
3.5 Knowledge of Records to be kept at the construction site	8	10	9
3.6 Knowledge of Construction Legislation	7	10	8
3.7 Knowledge of Labor Law (Labor Law and related legislation)	5	7	7
3.8 Knowledge of Occupational Health and Safety	4	10	3
3.9 Knowledge of Resource Management (material, labor, money, time, etc.)	8	7	8
3.10 Knowledge of Cost Management (cost of construction works)	6	8	6
3.11 Environmental Management Knowledge	6	3	4
3.12 Knowledge of General Economics and Construction Economics	7	8	6
3.13 Knowledge of Productivity Management (optimum resources)	9	6	8
4. COMPUTER KNOWLEDGE	**A1**	**A2**	**A3**
4.1 Using MS Office Programs	10	8	5
4.2 Using Autocad Program	8	4	9
4.3 Using Planning Program (Primavera, MS Project etc.)	5	8	5
5. FOREIGN LANGUAGE KNOWLEDGE	**A1**	**A2**	**A3**
5.1 General English Level	9	5	10
5.2 Vocational English Level (mastery of technical terminology)	8	2	6
6. CANDIDATE'S DEMANDS	**A1**	**A2**	**A3**
6.1 Fee Requested by the Candidate	10	8	6
6.2 Whether the candidate needs accommodation, whether the company should provide it, and if so, the cost to the company	8	5	4
6.3 Whether the candidate needs a vehicle, whether the company should provide it, and if so, the cost to the company	3	10	6
7. SKILLS AND PERSONAL CHARACTERISTICS	**A1**	**A2**	**A3**
7.1 Desire to succeed (enthusiasm for work, ownership of work)	9	7	8
7.2 Reliability (to be supported by previous workplaces, references, etc.)	8	9	6
7.3 Self-confidence	10	7	7
7.4 Activity and Dynamism (practicality, quick thinking and acting)	9	7	8
7.5 Tidiness and Orderliness	6	5	9
7.6 Ability to Represent (appearance and speaking style)	7	5	9
7.7 Coordination Skills (providing information flow up, down and horizontally)	8	9	6
7.8 Team Management Skills	7	8	10
7.9 Ability to take initiative when faced with a problem	9	7	9
7.10 Predisposition to Personal Career Development	7	6	3
7.11 Whether he/she has harmful/bad habits (gambling, smoking, alcohol)	4	9	7
8. OTHER	**A1**	**A2**	**A3**
8.1 References	6	8	10
8.2 The size of the construction site that the candidate will manage if hired	10	6	9
8.3 If he/she knows the location of the construction site he/she will manage	5	10	3
8.4 Whether the construction site is located in the candidate's hometown	4	10	2
8.5 The status of the candidate's spouse and children (whether the family can come to the location of the construction site, etc.)	8	7	3

Appendix C. Scores of Site Supervisor Candidates of Company C

Criteria / Sub Criteria	Scores of Candidates		
1. EDUCATION / CERTIFICATE	**A1**	**A2**	**A3**
1.1 Undergraduate Education (candidate's university of graduation)	8	5	10
1.2 Master's Degree (university candidate graduated/continues)	10	2	2
1.3 Having "Class A Occupational Safety Specialist Certificate"	2	10	10
1.4 Having a "First Aid Certificate"	2	10	2
1.5 Having a "Driver's License"	10	8	5
1.6 Vocational Trainings Received (certified)	3	5	9
2. EXPERIENCE	**A1**	**A2**	**A3**
2.1 Total Experience as a Site Supervisor in All Construction Areas	8	7	5
2.2 Experience as a Site Supervisor in Building Construction	6	5	4
2.3 Experience of Managing a Construction Site from Start to Finish	8	7	5
2.4 Number of Works Completed as Site Supervisor	5	4	3
2.5 Size of the Work(s) Completed as Site Supervisor (area, cost)	7	10	9
2.6 Total Number of Years of Employment in the Construction Sector	8	7	5
2.7 Total Number of Years Worked in the Field of Building Construction	6	5	4
2.8 Previous Companies and Duration of Employment (stability)	5	9	10
3. BUSINESS KNOWLEDGE	**A1**	**A2**	**A3**
3.1 Planning Knowledge (to be able to prepare and follow the work program)	10	8	9
3.2 Quantity Survey, Progress Payment, Final Account Information	8	9	6
3.3 Equipment and Technology Knowledge (construction machinery, etc.)	6	9	5
3.4 Construction Materials Knowledge (concrete, admixtures, paint, etc.)	6	9	4
3.5 Knowledge of Records to be kept at the construction site	8	6	9
3.6 Knowledge of Construction Legislation	7	5	6
3.7 Knowledge of Labor Law (Labor Law and related legislation)	6	5	6
3.8 Knowledge of Occupational Health and Safety	4	8	10
3.9 Knowledge of Resource Management (material, labor, money, time, etc.)	7	8	9
3.10 Knowledge of Cost Management (cost of construction works)	5	8	9
3.11 Environmental Management Knowledge	3	2	5
3.12 Knowledge of General Economics and Construction Economics	5	7	7
3.13 Knowledge of Productivity Management (optimum resources)	7	6	8
4. COMPUTER KNOWLEDGE	**A1**	**A2**	**A3**
4.1 Using MS Office Programs	10	7	9
4.2 Using Autocad Program	8	6	9
4.3 Using Planning Program (Primavera, MS Project etc.)	10	3	5
5. FOREIGN LANGUAGE KNOWLEDGE	**A1**	**A2**	**A3**
5.1 General English Level	8	5	10
5.2 Vocational English Level (mastery of technical terminology)	6	2	5
6. CANDIDATE'S DEMANDS	**A1**	**A2**	**A3**
6.1 Fee Requested by the Candidate	6	10	8
6.2 Whether the candidate needs accommodation, whether the company should provide it, and if so, the cost to the company	6	7	9
6.3 Whether the candidate needs a vehicle, whether the company should provide it, and if so, the cost to the company	5	6	9
7. SKILLS AND PERSONAL CHARACTERISTICS	**A1**	**A2**	**A3**
7.1 Desire to succeed (enthusiasm for work, ownership of work)	7	8	9
7.2 Reliability (to be supported by previous workplaces, references, etc.)	9	6	7
7.3 Self-confidence	7	8	6
7.4 Activity and Dynamism (practicality, quick thinking and acting)	7	8	9
7.5 Tidiness and Orderliness	10	6	7
7.6 Ability to Represent (appearance and speaking style)	9	5	7
7.7 Coordination Skills (providing information flow up, down and horizontally)	5	9	8
7.8 Team Management Skills	8	10	7
7.9 Ability to take initiative when faced with a problem	7	8	6
7.10 Predisposition to Personal Career Development	8	4	10
7.11 Whether he/she has harmful/bad habits (gambling, smoking, alcohol)	5	9	7
8. OTHER	**A1**	**A2**	**A3**
8.1 References	8	9	6
8.2 The size of the construction site that the candidate will manage if hired	7	10	9
8.3 If he/she knows the location of the construction site he/she will manage	8	5	9
8.4 Whether the construction site is located in the candidate's hometown	5	2	9
8.5 The status of the candidate's spouse and children (whether the family can come to the location of the construction site, etc.)	6	9	5