

## **Job Analysis System for Civil Engineers in Construction Companies**

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### **ABSTRACT**

Job research and analysis studies are the reports that detail the system and environmental conditions and performance of each job for obtaining higher efficiency and reducing the unit cost. In order to do the job analysis properly, information and data regarding the job have to be evaluated accurately and realistically. The originating point of the article is based on this definition and requirement. In the study, the established job analysis model has been built on system approach. Steps of the model consist of input-preliminary preparation, process-analysis and conclusion phases.

In accordance with the model suggested, a job analysis form has been developed to be used in improvement of functions of various human resources and in selection of civil engineers at manager position of construction companies during the study. The form specifies the job profile and personal requirements of civil engineers and gives information about time research studies aimed at efficiency. Form data has been collected by interviewing 50 (fifty) civil engineers at manager position working at large and medium sized construction firms, in order to be used in job analysis discipline. In the study, information and data obtained by job analysis form have been analyzed by statistical methods and the results have been compared to similar literature findings.

### **1. INTRODUCTION**

Job analysis is the group of activities to determine expertise, knowledge, ability, and responsibility requirements for successfully carrying out the business by observation and examination of the work to face the features and environmental conditions of a modern-day organization [1, 2]. The purpose of job analysis can be summarized as researching and developing new methods for the elements that require the job to be undertaken simpler and more efficiently.

Job analysis has been often used to obtain the data related with the job and the job requirements. To determine the performance measure methods, the job analysis arranges the production standards available for increasing the productivity and efficiency of the performer, establishes a balanced remuneration system, develops human resources planning in the future, determines the training requirement, provides the carrier plan to be made properly and soundly, and improves the working conditions [1, 3-11].

Success of job analysis requires the analysis to be made through advanced methods such as sophisticated qualitative and quantitative computer software of information and data obtained from job analysis forms and through various statistical techniques [11].

The re-definition of jobs of businesses in the face of recent changes compels them to discover job-related personal requirements and identify their relationships with each other. This can only be accomplished with the implementation of job analysis discipline across the company. Job analysis is done in the companies in three different cases [12]:

- The job analysis should be done during the establishment of an organization. If an organization bases the works of its personnel to the scientifically conducted job analyses, then the company will own a scientific organization with well and qualified staff from the very beginning.
- The job analysis can be done when the need arises. When there is a new task, the state of works against the environmental factors alters, or transformations in organizational structure occur, the job analysis can be done. In addition, if there are changes in the method, technique, and tools used in doing the works then the job analysis can be done.
- The job analysis can be done at a time pre-determined by the company. Even if there is no a change in the organization and the staff of a company, the works can be analyzed periodically within a certain time frame. Thus, better opportunities to exploit the staff productivity can be developed.

In literature, job analysis discipline is collected under two phases: traditional job analysis and strategic job analysis [1, 3]. Traditional job analysis is an approach based on individuals, jobs and the definite borders of harmony in between and focused on job rather than team-based study. Strategic job analysis is the efforts aimed at determining the mission that shall bring final success and the information and skill necessary for that mission (Singh, 2008). In the studies made, taking these two approaches as a base, efforts have been spent to obtain the information and data to be used by companies for success of various functions of human resources. The job analysis model established in accordance with system approach is also to be benefited when developing job analysis forms from which this information and data are obtained.

## **2. JOB ANALYSIS MODEL RECOMMENDED FOR CONSTRUCTION SECTOR**

Construction companies are now in an effort to reduce the costs and to obtain higher productivity in order to be able to compete under the economic crises suffered. This can only be possible if these companies determine how each job is performed, its details and environmental conditions and therefore through sound and proper job analysis. The structure of job analysis model intended to be applied in construction sector, is the product of results obtained from the previous researches made. In this respect, taking into consideration the purpose and principles of job analysis in the study, a job analysis method has been developed available to be used in construction sector and other sectors. The established job analysis model has been built on scientific system approach where integral and inter-disciplinary approach are handled together [13]. During the study, job analysis model is discussed in three phases as the preliminary preparations stage, analysis stage and conclusion stage.

### **2.1. Preliminary Preparation Studies of Job Analysis**

Preliminary preparation studies for construction firms start with clearly defining the perception of obligations and aims of the organization and the strategic role of each unit within the organization. Before starting the analysis of a job, preliminary information has to be obtained about that job by benefiting from the organizational structure of that firm regarding that job, catalogues related with the job, definitions, job studies and job flow diagrams. Respectfully, the jobs in all the departments of the business place and the working conditions where the job is performed (number of employees, remuneration etc.) are to be analyzed and the notes and information obtained are to be classified and arranged according to jobs. Especially when similar jobs, jobs with similar contents but different titles are required to be

analyzed, then these are to be named with the same title. When job analysis is made, the subjects to be analyzed are to be recorded on a job analysis form.

The second phase of Preliminary preparation stage consists of selection of the analysts to conduct the job analysis. Analysts have to be capable of collecting the data regarding the facts and jobs, and of evaluating and compiling them. In this context, analysts may be selected from inside or outside the corporation or from consultant firms specialized in this type of analysis.

The third phase of Preliminary preparation stage consists of determining the techniques and the data collection methods to be used in job analysis. In literature about the job analysis techniques; methods are specified such as functional job analysis, critical event technique, case analysis inquiry, time research, method research and micro action research. Regarding the data collection methods used during analysis; literature is involved with review of previous job definitions, duty performance of job, benefiting from diary of performer, interviews with employees or superiors, observations and classification as inquiry method or combined job analysis [7, 10, 14, 15].

## **2.2. Analysis Stage**

At this stage, profile and the personal requirements about the job obtained through the job analysis form and information and data obtained with time research studies are analyzed. In this phase, primarily the data necessary for job analysis are to be collected. The assessments should be made with sophisticated qualitative and quantitative computer software, various statistical techniques, and comments and observations [11].

## **2.3. Conclusion Stage**

At the conclusion stage of job analysis process; the information obtained, job/duty definitions, requirements related with job etc. are converted into job standards and used by human resources department in decisions regarding the employees and in efforts spent for correction. With job analysis, development plans of the company for future and the preventive aspects of the organization are put into force. Faults made in the past are to be analyzed realistically and new standards are developed aimed at future or the already available standards are arranged and improved. Therefore it is necessary for corporations to continue their studies regarding job analysis.

## **3. MATERIAL AND METHOD**

During the study, in accordance with the purpose and scope of job analysis, a job analysis form has been developed taking into consideration the job analysis method and data collection techniques [16-21].

Job analysis form consists of two basic activity groups as method research and time research. The method research part of the study is aimed to specify the personal eligibilities and job profiles (job/duty definitions, capabilities/requirements necessary to perform the job, job and performance assessments, remuneration, carrier and training planning, labor health and safety, quality control and the socio-psychological factors) of the civil engineers employed in the sector. In the time research part of the form, questions are included regarding the arrangement of job flows and improvement/redesign of working conditions in accordance with the characteristics of the person, using the principles of job measuring and action economy. In job measurement part, information is sought regarding especially how the

production stage at construction companies is programmed and how it should be programmed.

The form developed in this study has been completed by interviewing 50 (fifty) civil engineers at manager position employed by large- and medium-sized construction firms. In compiling the answers to job analysis form, frequency tables are used for analyzing the distribution and variation of the data measured. Answers to questions regarding their rate of significance are analyzed using “Likert Scale” for grading questions [22].

#### **4. RESEARCH FINDINGS AND EVALUATION**

The findings part of the study has been constituted from evaluation of form results and from observations. Also in this part, points of view of the construction companies towards job analysis are evaluated. The fact that the position and educational status of these persons within the company and that they share their experiences and knowledge during interviews, provided important contributions with regard to the accuracy level and assessment of the answers given in job analysis form during the study. This part consists of the ‘method research’ stage where the personal requirements and job profile are specified and the ‘time research’ stage where the information is included for determining the work flows and working conditions to increase production factors.

##### **5.1. Method Research**

The part of method research consists of analysis of answers given regarding personal requirements and job profile concerning job performance culture of civil engineers. The questions were answered by 50 (fifty) managers who are civil engineers authorized by the companies. The results obtained from these answers are summarized in the following:

###### *5.1.1. Personal Requirements*

The civil engineers who completed the form regarding personal capabilities, pointed out that in order to consider himself as a specialized engineer, s/he has to work in the sector for minimum 7-8 years in the sector to gain experience. In other words, civil engineers emphasized that the range of 31-40 years of age (54%) is the turning point for a civil engineer to reach the personal perfection.

###### *5.1.2. Determination of the Profile for the Job*

In this part of the job analysis, only the selected results that are considered to be the most important are included. The results related to study job descriptions for civil engineers, business requirements and socio-psychological factors affecting job are given.

###### *➤ To Define the Job/Duty*

Regarding the answers given by civil engineers concerning the job/duty definitions, it is observed that civil engineers work 51-60 hours per week (38% answer users), and they stay for a period of one month (66%) outside the region as required by their job/duty and outside the city as required by other activities concerning the job. Civil engineers, concerning the project-study group meetings which require participation due to their job, stated that they join the job progress meetings weekly in general (51%). These points indicate that the leisure time of the civil engineers is insufficient [Table 1].

Table 1. Working conditions of civil engineers

Working Conditions	Variables	Frequency	%
Working Environment Required by Task/Job	Site	32	65
	Office	17	35
	<b>Subtotal</b>	49	100
Working Hours per Week	60 and over	15	31
	51–60 hours	18	38
	40–50 hours	15	31
	<b>Subtotal</b>	48	100
Project-Working Group Meetings Requiring Active Participation	Job Progress Meetings	19	51
Time Spent Outside the Current Region Required by Job/Task	0-1 Month	21	66

The answers given by civil engineers regarding the level of importance they pay for their duties and responsibilities indicate that they give higher significance to the construction phase of the job ( $X_{ao}= 2.14$ ) as shown in Table 2. During face-to-face interviews, they stated that the reason for this is that they feel like civil-engineer when the work appears at the production stage, and feel proud of their profession and be satisfied with the work they have done. This power is also the factor upon which those who answer the job analysis form agree the most ( $\sigma =1.56$ ). Civil engineers also stated that during the preliminary preparation phase, activities such as project preparation and pre-estimation have been another important power for them both regarding duties and responsibilities, and regarding job satisfaction ( $X_{ao}=1.96$ ,  $\sigma=1.46$ ). When taking apart in completion phase ( $X_{ao}=1.86$ ,  $\sigma=1.33$ ) and quotation phase ( $X_{ao}=1.70$ ,  $\sigma=1.55$ ), the duties and responsibilities are important for them but they do not care for them as much as they do for the duties and responsibilities included in the two phases above.

Table 2. The level of importance paid by civil engineers in evaluation stage of duties and responsibilities

Stage of Duties and Responsibilities	Average Rate ( $X_{ao}$ )	Standard Deviation ( $\sigma$ )	Coefficient of Variation (V)
During Construction	2,14	1,56	0,73
Preliminary preparation Phase	1,96	1,46	0,75
Completion Phase	1,86	1,33	0,72
Quotation Phase	1,70	1,55	0,91

When the civil engineers were asked about the duties undertaken in the company, the following data were obtained. During the typical pre-preparation stage, the preparation of projects (47%) and preparation of pre-bid activities (27%) are performed. At the bidding stage, %95 of the civil engineers were doing cost and tender related activities. At the construction-production phase, they work as worksite supervisor (48%) and as coordinator of the project (30%). At the completion phase of a construction project, the civil engineers assume the role of site supervisor (64%) and general responsible person (22%). Therefore, the civil engineers should behave more responsible during the pre-bid and tender stages toward determining the cost of the project. The data also indicate to intensity in the work-loads and responsibilities of civil engineers.

➤ *Requirements for Performing a Job/Duty*

Civil engineers who answered the form, regarding the necessary capabilities to perform a job, pointed out the significance of the 20-30 age range (80%), sex as male (100%), minimum license degree as well as bearing a certificate regarding the job (36%), especially concerning computer and professional training (40%), medium level of foreign language (49%), computer knowledge at least at the level to use especially various package programs such as MS Office (61%) and MS Project and Primavera (32%), bearing a driver's license (99%) and registration to Chamber of Civil Engineers (90%). These points indicate that regarding term, quality, cost and therefore productivity of the job, civil engineers are required to make a progress in any subject.

➤ *Socio-Psychological Factors*

Since the content of questions are long regarding importance rates developed in this part, it is considered as satisfactory to summarize the problems suffered by civil engineers when performing their jobs as follows:

Civil engineers pointed out that the greatest power effective in performing successfully a job or a duty assigned is the current work load (%84). Civil engineers consider that data related with the previous jobs if not held (%80), duties, obligations and responsibilities if not specified clearly (%72) are the other important factors that may impair the effectiveness of the job as different job performance cultures and deficiencies of trade groups included in the organizational structure and other departments (%72). It is understood that the organization members do not trust but afraid of each other, that they have the habit of not telling the faults they see (%52), and weak communication and dialogue (%54), failure of systemizing or operating the information network (%46) are not considered as important factors in performing a job.

## **5.2. Time Research**

Time research is the operations regarding how and which criteria the companies program their work by benefiting from work measurements and action economy principles for the purpose of combining the job and human elements in the most proper way.

➤ *Job Measurement*

Time study activities are concerned with how and to what criteria the companies program their work. As for the civil engineers in the time study activities regard, the answers show that they plan the production phase based on previous works and experience.

When programming the production phase regarding the job measuring operations of companies and civil engineers, it is observed that they generally use the former jobs and experiences as a basis (53%). To program the production phase, however, 44% of civil engineers use the prepared work programs. It is observed that when the engineers plan the production phase, they generally use the bar programming method (26%) and also the network diagrams (25%) within this scope. Again when programming the production phases, it is observed that Excel is used (55%) in general and the use of package programs is getting significantly and widely spread (MS Project: 34% and Primavera: 10%). It is observed that civil engineers, for the sake of timely delivery, arrange the work schedule in accordance with increasing the productivity and work speed of the product phase as well as increasing use of different construction technologies together with the increasing number of employees (55%).

➤ *Action Research*

Concerning the methods increasing the productivity of manufacturing factors, results obtained by Likert scale are summarized as follows:

(1) Civil engineers specified that the greatest power that increases the productivity of production factors is the social assurance, and this can only be made through improvements

both in job, and in the subject of health and social assurances ( $X_{a0}= 4.54$ ). This power is also a factor upon which those who completed the form agreed the most ( $\sigma =0.54$ ;  $V=0.12$ ).

(2) Civil engineers stated that perfect performance of (management functions), planning, organization, coordination, guiding and inspection operations, is the second important factor that increases the productivity of production factors ( $X_{a0}=4.54$ ,  $\sigma=0.64$ ;  $V=0.14$ ).

(3) Civil engineers emphasized that as the third factor, use of trained labor may also increase the productivity of production factors ( $X_{a0}=4.54$ ,  $\sigma=0.73$ ;  $V=0.16$ ).

(4) It is understood that failure to provide satisfactory service from analysis results and failure to be sensitive to internal and external circumstances are not considered as factors that affect the productivity of production factors ( $X_{a0}=3.54$ ;  $X_{a0}=3.46$  ).

## 6. CONCLUSION

Today only the companies that re-structure both their organizational structures and their current jobs in accordance with the system approach under specific principles can survive. Another criterion that enables the companies to survive and maintain their activities is accepted as productivity. Companies may obtain higher productivity only if they analyze how each job is performed, its details, and the environmental conditions of the job, if they make a research to find the ways to perform a job within the shortest possible time by spending the least energy possible and if they determine how to program the production phase. And this can only be possible through flexible and dynamic and systematic job analysis to be developed in accordance with system approach. Companies may provide selection and employment of personnel eligible for job in their organizations, may enable them to be trained and remunerated as required only through using these analyses. Companies need the job analysis also for incorporating the fast modifications in their organizations in accordance with the needs that occur.

Job analyses have always been and will be a valuable means of information in human resources for determining the job/duty profiles of the employee and in specifying the personal requirements and in making the time research studies. This indicates that these analyses are to be made not only in case of necessity but constantly as an integration of operations. Unfortunately it is observed that company managements included within the Turkish construction sector have not perceived the importance of job analysis discipline yet. It is understood from the discussions made that knowledge on this subject is quite blurred and therefore the studies made are not compliant with the systematic approach required by job analysis. It is another conclusion obtained during both completion of forms and face-to-face interviews conducted with the engineers, that Turkish construction firms do not care much about information regarding personal and job-related requirements, job evaluations and remuneration etc. obtained from job analyses. This type of knowledge is generally based on traditions and experiences, and they act with the reflex arising from being aware of the nature of this country. In this context, by determining the deficiencies in practice, studies must be accelerated on how the dynamic and effective job analysis model can be developed to improve the human resources of construction companies. In order to do that the company management should be made aware of the subject primarily. Furthermore, regarding the job analysis, there is no doubt that increase in the number of studies carried out by academicians and consultants whether individuals or firms, shall contribute in awareness in job analysis in Turkey and the countries alike.

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