

WHAT QUALIFICATIONS AND SKILLS ARE IMPORTANT FOR CIVIL ENGINEERS? A JOB ADVERTISEMENT ANALYSIS

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Abstract:

The Turkish construction sector has been developing day by day. According to the sources it has moved into second place in the world after China. Turkish companies have been constructing many buildings all over the world. In light of these developments, Turkish construction companies now require civil engineers to have different and higher level skills than in the past. This paper examines the knowledge, skills and competencies demanded of early career civil engineer graduates through a content analysis of job advertisements. The study focuses particularly on jobs which are appropriate for civil engineers with three or fewer years of working experience. The job advertisement data was gathered from January 2011 to March 2011. Our analysis shows that a wide variety of job titles require a high level of technical knowledge and competency as well as strong communication skills. This paper briefly situates this study in the literature, describes the research method - essentially the collection and content analysis of job ads - and then presents the results. It concludes with a consideration of the issues arising, particularly the role of entry level positions in preparing their incumbents for more senior positions in the future.

Keywords: civil engineers, knowledge and skills, job advertisements, qualifications

1. INTRODUCTION

Because of rapid changes in today's labor market, employees must be able to adapt to new conditions. Adapting to change requires a set of skills and competencies beyond technical skills. Job advertisement analysis studies became widespread in recent years to identify the qualifications needed for different professions. By focusing on information systems jobs and their requirements for IS graduates, Kennan et al.(2007), determined what Australian employers currently require in terms of IS knowledge, skills, competencies and any other traits such as communication skills or personal characteristics. Choi and Rasmussen (2009) examined on qualifications needed for digital library positions in academic libraries by studying job advertisements. They showed that library professionals need qualifications in management, skills in communication, and proficiency in with digital technology. In her paper investigating the knowledge and skills required by employers of recordkeeping professionals, Pember (2003) concluded that employers expect recordkeeping professionals to possess a diverse range of recordkeeping knowledge and experience. She also indicated that recordkeeping positions often require knowledge and experience in several areas of information management. Recordkeeping professionals must have a high level of computer literacy, well developed communication and interpersonal skills, staff management skills and experience, well developed team skills, and a strong customer focus. Personal attributes such as enthusiasm and motivation as well as analytical and problem solving skills were also highly valued. These skills are also sought after in many other professions. Similar studies were conducted for the civil engineering profession (Angelides, 2003).

In this study we aimed to find out skills and competencies required for civil engineers. When engineering history is investigated, it can be seen that civil engineering is the second oldest engineering discipline after military engineering. The focus of civil engineering is site and soil analysis and the design of a building's foundation, structure, and surrounding paved areas, as well as the appropriate, site-condition based design of its underground utilities such as storm, water, sewer, and electrical services (Levy, 2009). Civil Engineering has subdisciplines such as environmental engineering, geotechnical engineering, water resource engineering, coastal engineering, materials engineering, and surveying. An owner will often to require the services of one or more of these engineering specialists on his or her project (Levy, 2009).

A number of studies have tracked the changes in the knowledge, skills and competencies required of civil engineers over time. Baron (2001) indicated in his study outlining a proactive approach for today's civil engineers that those training for the profession today should not only be equipped with knowledge of technical issues but should also be familiar with other areas such as quality management, risk management, new information technologies, as well as environmental, management, social, ethical, political, and legal issues. In his study, Arroyo (2001) essentially proposes the establishment of an academic and a professional path, stressing the importance of developing skills in teamwork, initiative and management ability in civil engineers. The development of personal qualities' necessary for the execution of technical and non-technical duties throughout an engineer's professional life was stated by Economopoulos (2001). He also emphasized the importance of Continuous Professional Development (CPD) of Civil Engineers as a planned acquisition of knowledge, experience and skills.

Through the analysis of job advertisements, this paper aims to identify what construction companies currently require in terms of civil engineering knowledge, skills and competencies as well as any other expressed requirements such as communication skills or personal characteristics.

2. RESEARCH METHOD

To identify what skills and competencies are required by employers, a number of approaches can be used (Liteck et al., 2004). The unobtrusive method of job advertisement analysis was chosen for this study in the belief that a broad sweep could be achieved with quite limited resources. The job advertisement data was gathered from January 2011 to March 2011. Two major Turkish online job lists were used – Kariyer.net (<http://www.secretcv.com>) and Secretcv.com (<http://www.secretcv.com>). 427 job ads were analyzed. Collected data from the two web pages is listed according to date, job title, employer, job setting, location, educational requirements, and years' experience. These qualifications were analyzed and tabulated in five areas: technical skills, computer skills, language skills, and interpersonal skills.

3. RESULTS

Advertised positions have been grouped into a number of categories according to the requirements listed by employers. Table 1 presents these categories. Although advertisements analyzed listed jobs in the field of civil engineering, only 40,98% included the term “civil engineer”. The other 59,02% provided a detailed description of a job suiting a civil engineer (such as Site and Soils Analyst) without actually mentioning the discipline of civil engineering. The description of position titles in detail can be considered a new trend. On the other hand, greater consciousness of health and safety issues as well as legal regulations have created positions such as Health and Safety Engineer. The other significant finding in Table 1 is the percentage of civil engineers working as sales representatives. In recent years the number of civil engineers who have been working as sales engineer has increased due to the preferences of those companies which produce construction materials.

Table 1: Considered position titles in ads

Position Title	N	P (%)
Civil Engineer	175	40,98
Site manager	53	12,41
Sales Engineer	43	10,07
Technical Office Engineer	42	9,84
Site Engineer	30	7,03
Project Manager	30	7,03
Health and Safety Engineer	20	4,68
Others	34	7,96
Total	427	100,00

This study treats experience in a particular field as well as work experience as technical skills. Findings from this content analysis show that the skill set most frequently mentioned by employers in job advertisements is technical skills (78%). The next most often mentioned is computer skills (%55), followed by language skills (%49), and interpersonal skills (%44).

Table 2: Considered experience fields in job ads

Experience Fields	N	P (%)
Cost estimation and bidding	93	21,78
Planning and Inspection	46	10,77
Design	41	9,60
Dam Construction	27	6,32
Building Construction	26	6,09
Industrial Construction	23	5,39
Road and transportation Cons.	21	4,92
Marketing and sales	18	4,22
Quality, Health and Safety	13	3,04
Steel Construction	12	2,81
Infrastructure	5	1,17
Airport Construction	4	0,94
Construction Inspection	4	0,94

Table 2 indicates that experience fields were the most commonly mentioned attribute in advertisements, having been mentioned in 333 out of 427 ads (78,00%). According to this table, experience in cost estimation and bidding is the most highly demanded field (%21.78). One of the reasons for this is the rapid growth projects with large, multi-million dollar budgets. Government investments in different projects need accurate technical and financial estimations. Another significant figure in this table is required marketing and sales experience. In this day and age, most companies in different sectors are focusing on marketing and sales. The same trend is prevalent in the construction

sector. Companies that produce construction materials have been particularly prefer civil engineers as marketing and sales employees.

Table 3: Civil Engineers' work experience in job ads

	N	P (%)
Not Required	172	40,28
Required	255	59,72
No specific years	37	8,67
Less than 3 years	45	10,54
4-5 years	89	20,84
6-10 years	57	13,35
More than 10 years	27	6,32
Total	427	100

In terms of civil engineers' work experience, almost two third of the job ads (59,72%) for civil engineer positions give place to work experience, while 40,28% job ads do not. As Table 3 indicates, one third of job ads (34,19%) ask for work between 4 and 10 years of work experience. This may be a result of the increase in large and costly projects which require experienced civil engineers. Another reason may be the idea that experienced civil engineers make better decisions than inexperienced ones.

Table 4: Considered computer skills in ads

Computer Skills	N	P (%)
MS Office	217	50,82
AutoCAD,	165	38,64
Primavera	46	10,77
MS Project	46	10,77
SAP 2000-STA 4 CAD, X-Steel	31	7,26

Technology use is an important part of civil engineer. Computer software packages can be used for many tasks, such as collecting, storing, analyzing, and displaying data. Table 4 indicates the computer skills required by employers. When all job ads were considered, in more than half (55,03%) proficiency in at least one computer programme was needed. Note that the total is more than 100% because some employers ask for knowledge of more than one computer programme. An ad might, for example, require competency with both MS Office and Primavera. The most frequently mentioned required or preferred programmes were MS Office (50,82%) and AutoCAD (38,64%). For over a decade, the relative importance of the top four skills (spreadsheets, word processors, CAD, electronic communication) has remained unchanged, indicating some stability in these computing skills in civil engineering. A study conducted by the American Society of Civil Engineers' Task Committee on Computing Education found that the use of Computer-aided Design (CAD) and Spreadsheet software were the most important programs to both educators and practitioners, a result which our study corroborates (as shown in Table 4). Because much civil engineering work requires computer knowledge, the ability to use computer programmes is essential today (Abudayyeh, 2004).

Table 5: Considered computer skills in ads

Language Skills	N	P (%)
English	218	51,05
Arabic	13	3,04
Deutch	4	0,94
Total	235	55,03

Among qualifications stated in the ads, more than half (55,03%) stated a preference for foreign language knowledge. As can be seen from Table 5, the demand for knowledge of English is the most significant (51,05%). Recent economic developments in the Turkish economy and the effects of

globalization have enabled Turkish construction companies to do business all over the world. Especially in terms of foreign contracting, the period from 2003 to 2008 has been a brilliant success story. While the annual amount of new contracts for Turkish contractors was only \$1,7 billion in 2002, at the end of 2008 the amount reached \$23,6 billion. In 2009, five thousand projects were been carried out in 70 countries, and the total volume of international business reached \$130 billion (TCA, 2009).

Table 6: Considered interpersonal skills in ads

	N	P (%)
Team oriented	101	23,65
Management skills	64	14,99
Communication skills	58	13,58
Ability to think analytical	39	9,13
Adaptable to flexible working hours	31	7,26
Taking responsibility	27	6,32
Problem solving and decision making	19	4,45
Innovative	6	1,41

Almost half of the ads listed skills which can be considered interpersonal skills or soft skills (194, 45.43%). The most frequently occurring among these is being team oriented, found in 101 (23.65%) of the advertisements. This shows the importance of teamwork in construction projects. In addition, as Table 6 indicates, management skills and communication skills are also important for civil engineers and their employers, likely because most civil engineers work with others and have subordinates. Parallel to these findings, Al-Khafaji et al.'s (2003) study presenting points of attention and drivers for a civil engineering program for the 21st century consistent with the U.S. ABET EC2000 accreditation requirements emphasizes that civil engineering education in the future should equip its students with knowledge of and skills in leadership, innovation and creativity, marketing, teamwork, communication, economics, social and environmental issues, and international context.

One striking result of our study is the lack of importance given to innovation. Only 6 (1.41%) employers included being innovative in their ads.

Table 7: Considered other requirements in ads

Requirements	N	P (%)
Military Service	210	49,18
No obstacle to travel	160	37,47
No obstacle to work abroad	37	8,67
Working Abroad	52	12,18
Advanced Education (Master Degree)	7	1,64
Graduated University	23	5,39

Table 7 shows other requirements asked for by employers. According to this, having no obstacle to travel is in the highest demand after military service. Globalization trends are creating a world environment which facilitates global opportunities for the civil engineers. A construction company can do business in different countries simultaneously, or focus on different countries at different times. Parallel to this situation, having no obstacle to working abroad is also a significant result.

Job advertisements rarely mention an advanced degree as a requirement. Only seven (1.64%) of the ads our study examined mentioned an advanced degree. That may be because of the belief that after a bachelor's degree, experience is considered more than graduate education.

In 5.39% of ads, a preference for graduates of a particular university is expressed. This is a result of the reputation for training highly qualified engineers which some universities have developed.

4. CONCLUSION

This paper represents the results of an investigation of the skills and competencies required by today's construction companies in ads, with a particular focus on technical, computer, language, and interpersonal skills. According to the analysis, it is technical skills that employers mention most often in job ads. The other most frequently mentioned skills are, in order of descending frequency, computer skills, language skills, and interpersonal skills.

The rapid growth in big projects and government investment in new construction requires good technical and financial estimation. As a result, cost estimation and bidding is the most demanded experience field.

Computer usage in civil engineering is growing rapidly. The need for computer skills is clearly shown in the results of this study. In more than half of advertisements analyzed knowledge of at least one computer programme was needed. In particular, Civil engineers should have knowledge of programmes such as MS Office and AutoCAD.

Foreign language skills are also important for Turkish civil engineers. Those Turkish civil engineers who plan to have a career globally should learn at least one foreign language, particularly English.

According to this study, interpersonal skills and technical skills are both very important. Almost half of the ads mention interpersonal skills. This is likely a reflection of the collaborative nature of most civil engineering projects. The most frequently occurring interpersonal skill asked for is being team oriented. Management skills and communication skills are also highly valued. In civil engineering education, classes which include topics related to these fields will be very helpful for students' future careers.

One striking result of our study is the frequency with which advertisements give place to positions related to sales and marketing. The number of civil engineers who work as sales engineer is increasing. This can be considered a new trend. Companies that produce construction materials prefer sales engineers who have detailed knowledge of these materials.

The needs of the Turkish construction industry, in terms of knowledge, skills and attitudes of its employees, parallel trends worldwide. As Da Fonseca (2001) indicated, in the 21st century, civil engineers should be equipped with both a good knowledge of the basic sciences as well as knowledge and skills related to topics such as decision making, communication, computers, foreign languages, microeconomics, finance and accounting.

It is hoped that the results of this study can be utilized both by civil engineers and civil engineering departments of Engineering Faculties to design curricula for their students.

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