



CAUSES OF DELAYS IN CONSTRUCTION PROJECTS IN TURKEY

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Abstract. In both developing and industrialized countries, deviation from a planned time schedule is one of the most frequently encountered problems in construction investments. Various factors faced with during construction period prevent systematic flow of work, which causes time-based anomalies as a conclusion. Considering the vital importance of the construction industry on the macro-economic structure of a country, it is inevitable to be aware of considerable effect of the timely completion on the allocated project budget. In this study, causes of time extensions in the Turkish construction industry and levels of their importance were examined together. In total, 34 factors affecting project duration were taken into account. A questionnaire survey, including these factors, was then applied to 71 construction companies in Turkey, and the outcomes were evaluated by means of statistical analyses. According to the results, “design and material changes” was found to be the most predominant factor, followed by “delay of payments” and “cash flow problems”. In terms of importance levels of factor groups, financial factors were found to be the first group, while environmental factors were the least effective group. It should be also noted that managerial causes of time extensions are encountered in developed and developing countries, whereas financial causes are experienced in developing countries only.

Keywords: delay, time extension, construction projects, Turkey.

1. Introduction

Time extensions are very serious and chronic problems in construction projects (Kazaz, Ulubeyli 2009). The late completion of a project results in the overrun of the construction budget allocated at project inception as well as the delay of the potential income that could be obtained with the operation of the constructed facility. Similarly, the early completion of a project likely causes cost extension due to complications of overstaffing. Although some changes in a time schedule can normally be made according to client's demands, construction projects are described as “successful” on condition that they are completed in the planned time, budgeted cost, and specified quality (Ritz 1994). According to Enshassi *et al.* (2009), delays are one of the most important factors affecting project performance. In practice, total project duration may potentially go beyond the calculated limits of the scheduled time because of the owner, contractor, subcontractors, or some technical, legal, and natural difficulties.

As a common problem of the construction domain, time extensions have been observed in many developed and developing countries to date (Sullivan, Harris 1986; Kaming *et al.* 1997; Long *et al.* 2004; Lo *et al.* 2006; Sambasivan, Soon 2007). Similar to global construction industries, time-based overruns have been frequently experienced in the Turkish construction sector as well (Arditi *et al.* 1985). Therefore, the objectives of the study are:

- to determine factors that cause time extensions;
- to find out how much important these factors are in practice;
- to compare, in this respect, the current position of Turkey with those of other countries around the world.

2. Methodological background

For this study, related literature was initially reviewed to expose possible delay factors in construction projects (Kazaz, Tuncbilekli 2009; Tuncbilekli 2009). In total, 49 factors were gathered. These factors were then investigated by interviewing with representatives of members of TCA (Turkish Contractors Association) face to face to reveal whether the factors have been observed in the Turkish construction sector. This sample group was chosen since it is an accepted list of contractors within the Turkish construction industry. The member firms of TCA perform approximately 70% of total investments made in Turkey, and they have undertaken 90% of the work done abroad in the field of construction. There are 149 contractor companies, and 71 (47.65%) of them positively responded to the survey request. The number of companies interviewed ($n = 71$) is called as “large sample size” and statistically adequate ($n \geq 30$) to represent the whole.

After the first questionnaire survey, a total of 34 factors remained. In other words, 15 factors were eliminated

since each one of them could be represented by a similar or more comprehensive one among 34 factors. For example, “heavy rain” and “flooding” were removed from the factor list in favor of “adverse weather conditions”. At the second round of the questionnaire survey, importance levels of these 34 factors were asked to the representatives of 71 contractors. Of these industrial practitioners, 55.6% were project managers and 44.4% were site managers. In terms of their professional backgrounds, 48.9% have experience more than 10 years, 13.3% have been working for 6–10 years in the industry, 26.7% have been working for 2–5 years, and 11.1% have experience less than 2 years. Respondents’ titles and work experiences are critical issues in evaluating outcomes of this survey, since they directly influence the reliability and validity of research results.

In the analysis of the data obtained in the second survey, the relative importance index (RII) technique was employed. In this method, the following equation was used:

$$I = \frac{\sum_{i=1}^5 a_i \cdot x_i}{\sum_{i=1}^5 x_i},$$

where: I shows the relative importance index and i indicates the index of answer category, such as 1 (not important), 2 (somewhat important), 3 (important), 4 (very important), and 5 (extremely important). In the numerator, a_i represents the numerical value of answer of the related i , changing between 0 and 4 ($i = 1 \rightarrow a_i = 0$; $i = 2 \rightarrow a_i = 1$; $i = 3 \rightarrow a_i = 2$; $i = 4 \rightarrow a_i = 3$; $i = 5 \rightarrow a_i = 4$), and x_i denotes the frequency of the related answer of i in total answers given to i . The concluding intervals of numerical values obtained in the analysis are presented in Table 1.

Table 1. Resultant index intervals

Not important	Somewhat important	Important	Very important	Extremely important
0.00–0.80	0.81–1.60	1.61–2.40	2.41–3.20	3.21–4.00

3. Research findings

In this study, 34 factors that cause time overruns in construction projects were gathered under 7 factor groups. These were classified as follows.

Environmental factors:

- adverse weather conditions;
- geological problems;
- site location and layout;
- work accidents.

Financial factors:

- cash flow problems;
- contractor’s financial problems;
- delay of payments;
- fluctuation in material prices;
- inflation.

Labor-based factors:

- construction defects;
- poor labor productivity;
- shortage of skilled workers.

Managerial factors:

- conflicts between the parties in site;
- contract related disputes;
- contractor’s excessive work load;
- design and material changes;
- estimation problems;
- lack of contractor’s experience;
- manager-worker relations;
- poor coordination between the parties in site;
- poor quality control;
- poor site management.

Owner-based factors:

- bureaucracy;
- management faults.

Project-based factors:

- lack of feasibility studies;
- old construction methods;
- poor maintenance of works, materials, and equipment;
- project scale;
- rarely used construction methods.

Resource-based factors:

- improper material selection;
- material storage problems;
- poor material management;
- poor resource productivity;
- transportation problems of resources.

Considering the views of participants, the most predominant ten causes of time overruns out of 34 factors were determined as can be seen in Table 2. The first five factors were described as “very important”, alerting the industry considerably against to the time extension threat. Three of them belong to financial factors, and this shows that the main notion behind the endemic timing problem in the sector depends largely on economic conditions of owners and contractors. Overall, the most significant factor was found to be “design and material changes”, followed by “delay of payments”, “cash flow problems”, “contractor’s financial problems”, and “poor labor productivity”, respectively.

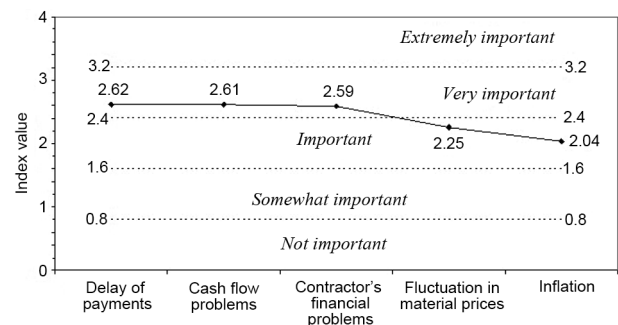
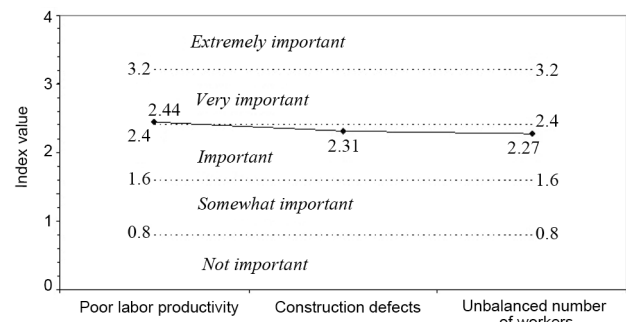
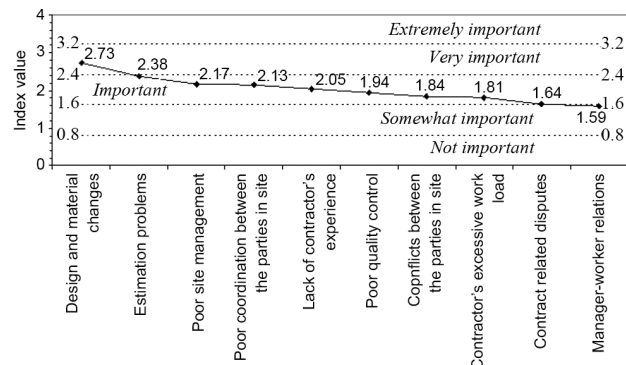
Financial factors include five items of which relative importance values are shown in Fig. 1. Among them, “delay of payments”, “cash flow problems”, “contractor’s financial problems”, and “fluctuation in material prices” were ranked second, third, fourth, and tenth in the general standing, respectively. Although “inflation” is the 16th factor, it was also described as “important”, such as “fluctuation in material prices”. The first three factors were found out as “very important” causes of time overruns and are closely connected with each other. Cash flow problem of an owner may probably cause delay of monthly progress payments that will be made to the main contractor. Thus, this owner-based monetary problem

Table 2. The top ten causes of time extensions

Factor Groups	Factors	Rank	Importance Level
Managerial factors	Design and material changes	1	Very important
Financial factors	Delay of payments	2	Very important
Financial factors	Cash flow problems	3	Very important
Financial factors	Contractor's financial problems	4	Very important
Labor-based factors	Poor labor productivity	5	Very important
Managerial factors	Estimation problems	6	Important
Project-based factors	Lack of feasibility studies	7	Important
Labor-based factors	Construction defects	8	Important
Labor-based factors	Unbalanced number of workers	9	Important
Financial factors	Fluctuation in material prices	10	Important

directly and negatively affects contractors' financial strengths. Similarly, inflation and the constant increase of material prices are the other two factors having a close relationship. This connection can be explained by the fact that unstable inflation likely has a great effect on material prices. In reality, the first three factors in this group indicate budget problems in the project-level, whereas the last two factors denote financial matters in the country-level. However, it is evident that overrun-based financial problems in construction projects essentially arise from private owners and public institutions, and to some extent, from general contractors. It can also be claimed that a country's financial atmosphere has indirect impact on the time extension issue of a construction investment. These arguments clearly point out that a sound time planning and projection is not made by the parties in a project, and that owners are not utilized professional project management services and consultants.

There are three labor-based factors, and their index values and importance levels are illustrated in Fig. 2. "Poor labor productivity", "construction defects", and "unbalanced number of workers" were located in the fifth, eighth, and ninth rank of the general standing, respectively. Of them, the first one was called "very important", while the others were "important" causes of time overruns. Considering that the entire construction trades are almost totally performed by workers during the erection phase, it is obvious how much important labor productivity, the number of workers, and the quality of workmanship are. A low level of worker productivity may probably result in activity-based time extension, and thus, delay of total project duration. In addition, lack of concentration of workforce can lead to the defected and poor quality production. Defected works, in turn, cause rework and the loss of time, money, and motivation. On the other hand, the number of workers is essential to balance the capacity allocated for the project. Sudden and large variations in this capacity can have negative effects on the adaptation process of crews to each other, and thereby on their productivities. In this context, labor-based factors such as poor productivity, poor workmanship, and poor human resources planning can be perceived as bad signs of the Turkish construction sector.

**Fig. 1.** Relative importance of financial factors**Fig. 2.** Relative importance of labor-based factors**Fig. 3.** Relative importance of managerial factors

As can be seen in Fig. 3, "design and material changes" was found to be the most significant factor both in ten managerial factors and in the general ranking. It is also the

unique factor that has “very important” impact on time overruns in this group. Among all, “estimation problems” are the top ranked sixth factor and defined as “important”. Importance ranks of the remaining factors are as follows in descending order: “poor site management” (11th), “poor coordination between the parties in site” (14th), “lack of contractor’s experience” (15th), “poor quality control” (19th), “conflicts between the parties in site” (21st), “contractor’s excessive work load” (22nd), “contract related disputes” (26th), and “manager-worker relations” (27th). Except the last one, they are “important” factors. Only “manager-worker relations” were described as “somewhat important”. Changes in design drawings and material types have strong power to affect (i) activity-specific feasibility studies, (ii) material procurement, (iii) scheduling, and (iv) coordination. In case of these changes during construction, some deviations in cost and time schedules can occur. Also, Enshassi *et al.* (2010) state that variation orders result in time delay. Similarly, lack of a competent planning department makes the construction process a complicated issue. In fact, the first two factors in the group prove that contractors do not attach the required importance to the planning and estimating throughout the project. Not only planning engineers but also site managers and site engineers are significant figures for the management of a project. Incapable managers in a job-site also lead to failures in coordination and in quality audits, disputes between parties, and poor communication between them and workers. In this point, it is vital to select a suitable contractor for an owner. A main contractor that has inadequate experience in the related field of construction and that has been simultaneously executing a large amount of works can be accepted as a symptom of a potentially unsuccessful project. Besides following an attentive process for contractor selection, agreeing on a well-established contract also minimizes or totally removes most of the possible conflicts that can be arisen for both parties during construction.

Among others, the owner-based group comprises two “important” factors, as shown in Fig. 4. “Bureaucracy”, one of these factors, was ranked 13th, while “management faults” were calculated to be in the 24th place. Especially in developing countries, public construction projects usually encounter various bureaucratic barriers, and thus delays in executing the works due to the lack of required approvals of public institutions. Poor management skill of an owner is another drawback for the health of a construction project. Public institution in a public project or enterprising company’s board of directors in a private project may suffer from lack of management ability as a client while applying basic administrative principles. In summary, both factors point out that public institutions and private companies that make construction investments in Turkey do not have established sound management structure, and ignore professional decision-making process to some extent.

Project-based factor group is composed of five factors. In Fig. 5, their numerical index values and corresponding verbal intervals are shown. “Lack of feasibility studies”, the seventh in the general order, is the single project-based factor among the top ten factors. It is

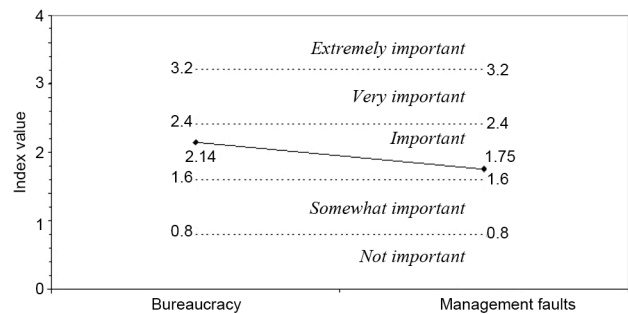


Fig. 4. Relative importance of owner-based factors

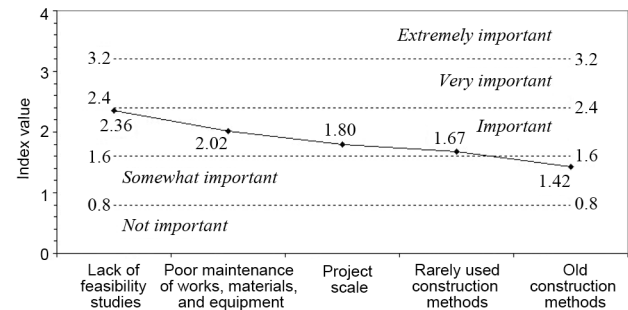


Fig. 5. Relative importance of project-based factors

respectively followed by “poor maintenance of works, materials, and equipment” (17th), “project scale” (23rd), “rarely used construction methods” (25th), and “old construction methods” (32nd). Only “old construction methods” were described as “somewhat important” by respondents, while the remaining four factors were “important”. If contractors do not pay the required attention to detailed feasibility studies before the construction stage, many planning and structural problems may probably appear, causing delays in time schedule and product defects after construction. “Poor maintenance of works, materials, and equipment” may similarly result in reworks and delays. Although “project scale” does not have a relatively great index value, it can affect project duration since the larger the scale, the more the number and the complexity of tasks and the harder the management. In this group, “rarely used construction methods” and “old construction methods” are the least important factors, which indicate that estimators can foresee reasonable time schedules in accordance with the construction method chosen at project inception.

As can be seen in Fig. 6, resource-based factor group consists of five items. Considering these factors, “poor material management” was found to be in the 12th order, followed by “poor resource productivity” (18th), “improper material selection” (20th), “material storage problems” (28th), and “transportation problems of resources” (31st). In the group, the first three factors are “important” causes of time overruns, while the last two are “somewhat important” factors. Since material is one of the three main inputs of a construction process, poor management of them directly and considerably influence the time schedule. In this group, poor productivity of resources such as material and equipment was denoted as another dominating cause of time extensions because of

the close relationship between productivity and time in terms of old types of construction machines as well as the long distance between the job-site and material quarries. Moreover, ill-matched characteristics of materials can be the hidden cause of poor quality products, reworks, and also interruption of project activities. The least significant factor in the group was found to be “transportation problems of resources”. This is because transportation is a minor or secondary issue in today’s fast communicating and globalizing world.

Environmental factor group is made up by four factors, as can be seen in Fig. 7. In this group, factors are successively ranked in the general standing as follows: “adverse weather conditions” (29th), “site location and layout” (30th), “geological problems” (33rd), and “work accidents” (34th). At the same time, each of these factors was described as “somewhat important” by participants. Since weather conditions can be estimated in a monthly or yearly basis by means of effective communication with local meteorological offices, it does not have great potential to lead to serious scheduling problems. Because of the fact that location and layout of a construction site are among primary inputs in estimating and planning, they are carefully taken into account in small- and large-scale projects. Although the geological condition of a site has also utmost importance in terms of structural safety and there are numerous negative instances in this respect, it is still ignored by owners and contractors during feasibility studies. The “work accidents” factor possesses the lowest index value in the group and in the general ranking list. Although occupational accidents frequently occur in the construction sector and this has serious complications on projects, participants did not give sufficient importance to this factor due to the fact that this type of accidents has been either ignored or concealed in many instances.

Importance levels of seven factor groups are shown in Fig. 8. According to the surveyed participants, the “financial factors” group is the most significant (1st) among others. This group was followed by “labor-based factors” (2nd), “managerial factors” (3rd), “owner-based factors” (4th), “project-based factors” (5th), “resource-based factors” (6th), and “environmental factors” (7th), respectively. Here, “financial factors” were defined “very important” and “environmental factors” were determined as “somewhat important”, while the other five groups were included in the interval of “important”. As an expected finding, monetary matters have vital aspect in delay analysis owing to the direct interaction between cost and time in construction projects. The industry suffers from subsequent five groups in terms of time extensions as well. On the other hand, the relatively low index value of the last group may be connected with the poor or light perception of the construction sector concerning environment-based delay factors.

4. Comparison with other countries

In many construction industries around the world, time-based overruns are regarded as one of the most critical project delivery problems. Numerous research studies on this particular domain of the construction management

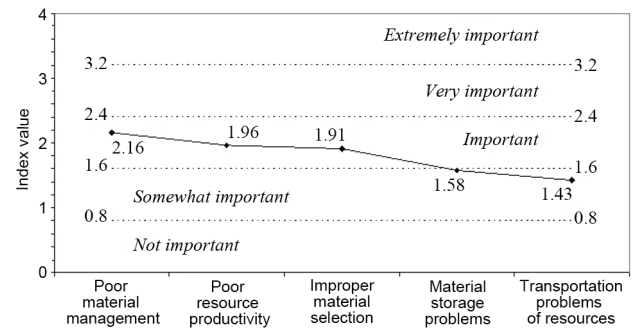


Fig. 6. Relative importance of resource-based factors

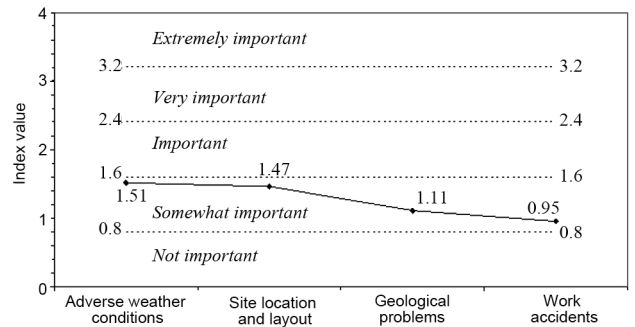


Fig. 7. Relative importance of environmental factors

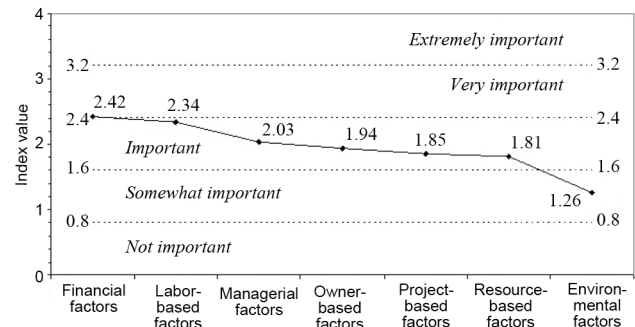


Fig. 8. Relative importance of factor groups

literature have been carried out to date. In Tables 3 and 4, findings of these previous articles are presented. In total, there are 17 papers that were carried out in 17 different countries. Of them, the UK and the US can be categorized under developed countries, while the remaining can be accepted as developing countries. As shown in Tables 3 and 4, top delay factors found in these countries were marked with a tick. Frequency counts of each ticked factor were expressed as a percentage of total number of factors identified by in the literature (Fig. 9).

Considering all of the 16 countries except Turkey, “owner-based factors” seem to be the most frequently encountered group of overruns. This can be because bureaucratic processes and management faults are two endemic problems of owners or owner companies. In addition to this argument, since respondents in this study were contractors, they could have charged the other contract side (that is, owner) with the source of time extension problem, seeing them the main decision-maker of construction investments. Generally speaking, 46.88% of this type of factors is among the top causes of time overruns.

End of Table 3

Factors causing time overruns	Turkey (<i>Current study</i>)	Turkey (Arditi <i>et al.</i> 1985)	Egypt (El-Razek <i>et al.</i> 2008)	Ghana (Frimpong <i>et al.</i> 2003)	Hong Kong (Lo <i>et al.</i> 2006)	Indonesia (Kaming <i>et al.</i> 1997)	Jordan (Sweis <i>et al.</i> 2008)	Kuwait (Koushki <i>et al.</i> 2005)	Lebanon (Mezher, Tawil 1998)
<i>Labor-based factors</i>									
Poor labor productivity	√					√			
Construction defects	√	√							
Shortage of skilled workers	√	√				√	√		
<i>Resource-based factors</i>									
Poor material management		√		√		√			
Poor resource productivity						√			
Improper material selection									
Material storage problems									
Transportation problems of resources			√						
<i>Owner-based factors</i>									
Bureaucracy		√	√		√				√
Management faults		√			√		√	√	√
<i>Project-based factors</i>									
Lack of feasibility studies	√		√	√			√		√
Poor maintenance of works, materials, and equipment									
Project scale									
Rarely used construction methods									
Old construction methods									

Table 4. Causes of construction time overruns in another 9 countries around the world

Factors causing time overruns	Malaysia (Sambasivan, Soon 2007)	Nigeria (Aibinu, Odeyinka 2006)	Saudi Arabia (Al-Kharashi, Skitmore 2009)	Thailand (Toor, Ogunlana 2008)	UAE (Faridi, El- Sayegh 2006)	UK (Sullivan, Harris 1986)	US (Baldwin <i>et al.</i> 1971)	Vietnam (Long <i>et al.</i> 2004)	Zambia (Kaliba <i>et al.</i> 2009)
<i>Financial factors</i>									
Delay of payments									√
Cash flow problems	√	√							√
Contractor's financial problems		√		√	√			√	√
Fluctuation in material prices									
Inflation		√							
<i>Environmental factors</i>									
Adverse weather conditions						√	√		
Site location and layout				√					
Geological problems						√	√		
Work accidents									
<i>Managerial factors</i>									
Design and material changes				√		√	√		√
Estimation problems	√	√		√	√			√	
Poor site management	√	√	√	√	√	√		√	
Poor coordination between the parties in site	√					√			√
Lack of contractor's experience	√		√	√				√	

End of Table 4

Factors causing time overruns	Malaysia (Sambasivan, Soori 2007)	Nigeria (Aibinu, Odeyinka 2006)	Saudi Arabia (Al-Kharashi, Skitmore 2009)	Thailand (Toor, Ogunlana 2008)	UAE (Faridi, El-Sayegh 2006)	UK (Sullivan, Harris 1986)	US (Baldwin <i>et al.</i> 1971)	Vietnam (Long <i>et al.</i> 2004)	Zambia (Kaliba <i>et al.</i> 2009)
Poor quality control				√			√		√
Conflicts between the parties in site	√								
Contractor's excessive work load									
Contract related disputes				√			√		√
Manager-worker relations									
<i>Labor-based factors</i>									
Poor labor productivity				√	√				
Construction defects	√				√	√	√		√
Shortage of skilled workers	√		√	√	√		√		√
<i>Resource-based factors</i>									
Poor material management	√				√	√			
Poor resource productivity	√								
Improper material selection									
Material storage problems									
Transportation problems of resources		√	√			√	√		√
<i>Owner-based factors</i>									
Bureaucracy			√		√	√	√	√	
Management faults		√	√		√				
<i>Project-based factors</i>									
Lack of feasibility studies		√			√	√	√	√	
Poor maintenance of works, materials, and equipment		√							
Project scale									
Rarely used construction methods									
Old construction methods								√	

5. Conclusions

In this study, answers of the following three questions were investigated: (i) which factors are basic causes of time overruns in Turkish construction industry, (ii) how much important are these factors that have been met to date, and (iii) what are the positions of other countries in this regard? According to the results, “design and material changes” was determined as the most significant factor, followed by “delay of payments” and “cash flow problems”. “Contractor’s financial problems” and “poor labor productivity” were subsequent factors in the general ranking. Taking into consideration the factor groups, financial factors and labor-based factors were found to be the first two groups, while the least effective one was the group of environmental factors. Specifically speaking, financial problems arise from owners and main contractors. Especially, the macro-economic atmosphere has considerable influence on delays of construction investments in Turkey. As most of large scale and high-budget construction projects are public-based investments, public institutions (i.e., owners) could likely have difficulties in paying pro-

gress payments on time, and this in turn means that main contractors make late payments to their in-house staff, subcontractors, and suppliers. In terms of labor-based factors, (i) poor productivity, (ii) poor workmanship, and (iii) poor human resources planning seems to be alarming signals of the domestic construction sector in Turkey. In fact, there are numerous productive labor-only subcontractors in the Turkish construction industry. However, Turkish general contractors undertake many projects in foreign markets, and these subcontractors’ high-quality and skilled workers are employed in high-paying and referencing international projects. Considering managerial factors, main contractors ignore the planning and estimating tasks because project management departments in Turkish construction firms are newly established except some well-known companies and still gaining importance gradually. Therefore, it is important to select a professional contractor for clients. Also, signing a problem-free contract will reduce many potential disputes during the construction period. Here, it is clear that owners in Turkey do not utilize modern management principles. In the project-level, contractors do not attach the required atten-

tion to feasibility studies before construction, resulting in time extensions and product defects. When the resource input are the point in question, some factors such as poor management of materials, poor productivity of resources, and poor characteristics of materials should be rehabilitated in order not to face with project delays. In terms of environmental issues, it was observed that geological conditions are still ignored by owners and contractors at project inception, and that the industry does not attach sufficient importance to occupational accidents because of the lack of a strong social security system in Turkey. As the more reliable the security system in Turkey owing to adaptation of related European Union regulations, the smaller the number of work accidents will be.

When delay groups in 16 countries except Turkey are investigated by reviewing literature, "owner-based factors" are ranked first, among others. Furthermore, it was found out that financial causes have not been experienced in developed countries to date and managerial causes of time extensions have been encountered in 16 countries. In Turkey, however, "financial factors" are the primary group that should be taken into account. When Turkey is compared with 16 countries, it is seen that labor-based and managerial factors are common problems. Observing the position of Turkey throughout the last 25 years, it was exposed that owner-based causes of overruns have been almost eliminated and that there has been an increase in the number of financial causes. Naturally, both private entrepreneurs and public institutions (namely owners) in the construction industry have been improving their working customs towards a professional understanding in time. In terms of monetary causes, the present instable economic environment of the country and the world at the last decade seems to be the main reason behind the increasing trend of financial delay factors.

In Turkey, the slow pace of development in modern site management methods as well as hard acceptance and negligence of modern construction planning techniques by the industry leads to both financial problems and frequent changes in estimated time schedules. All of the factors except uncontrollable environmental items can be best minimized by means of sufficient financial resources, successful and competent site/project management, and skilled and experienced technical practitioners.

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