

**CAUSES OF DELAY IN AND THEIR EFFECTS ON
CONSTRUCTION PROJECTS IN TURKEY**

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PROJECTS IN TURKEY

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Especially dedicated to:
my beloved wife, Betül Özkaya Sarıkaya;
my dear father Mustafa Sarıkaya;
my dear mother Semra Sarıkaya.

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ABSTRACT

CAUSES OF DELAY IN AND THEIR EFFECTS ON CONSTRUCTION PROJECTS IN TURKEY

One of the most common problems in the construction project is delays. Delay is referred as an act or event that extends the time required to perform the tasks under a contract. Projects can be delayed due to number of reasons that may be due to the owner, the contractor, the consultants' acts, severe weather conditions or any other unexpected conditions. They may occur early or later in the project development, alone, or with other delays. Delays can be minimized only when their causes are identified. The objective of this study is to identify the major causes of delays, their effects on construction projects in Turkey. This study was carried out based on literature review and a questionnaire survey. A total of fifty-one factors and nine groups that contributed to the causes of delay, the six factors that effects delays were identified based on both literature review and construction conditions in Turkey. The questionnaire survey was distributed to the targeted respondents in Turkish construction industry. The objectives of the study have been successfully achieved. The ten top-ranked factors accorded by the construction participants; suspension of the project by owner, delays in contractor's progress payment by owner, unrealistic project duration, slowness of the owner decision making process, inadequate early planning of the project, financing by contractor during construction, shortage of labor, slow delivery of materials, obtaining permits from municipality and design changes by owner or his agent during construction. Labor related delays were ranked the most significant group that causes delays, followed by finance related delays, material-related delays, changes/revision related delays, and contractual related delays. Time and cost overrun were the common effects of delays in construction projects in Turkey.

ÖZET

TÜRKİYE’DE İNŞAAT PROJELERİNDE GECİKMEME SEBEP OLAN FAKTÖRLER VE BU FAKTÖRLERİN ETKİLERİ

İnşaat projesinde en yaygın sorunlardan bir gecikmelerdir. Gecikmeler, planlanan program veya sözleşme programına göre çalışmalarının geç tamamlanması olarak tanımlanabilir. Projeler, proje sahiplerinin, yapımcı şirketlerin, danışmanlık yapan şirketlerin eylemleri, olumsuz hava etkileri, ya da diğer beklenmeyen olaylar sebebiyle gecikebilir. Olası bir gecikme, proje gelişimden önce veya sonra, tek başına yada birkaç gecikmeyle aynı anda oluşabilir. Gecikmeler, yalnızca onlara sebep olan faktörlerin belirlenmesiyle minimize edilebilir. Bu çalışmanın amacı Türkiye’deki gecikmelerin önemli nedenlerini tespit etmek ve olası etkilerini değerlendirmektir. Bu çalışma, yapılan anket değerlendirilmelerine ve gerekli literatür çalışmaları bağlı kalınarak oluşturuldu. Gecikmeye sebep olan elli bir adet faktör, dokuz grup altında ve bu gecikmelerin olası altı adet etkileri, literatür çalışması ve Türkiye’nin içinde bulunduğu inşaat koşulları göz önüne alınarak oluşturuldu. Anketler Türkiye’ nin inşaat sektöründe önde gelen şirketlerine ve şirket çalışanlarına ulaştırılmıştır. Çalışma hedeflerine başarıyla ulaşılmıştır. Ankete katılan katılımcılarının belirtmiş olduğu sonuçlara göre gecikmeye sebep olan ilk on faktörler sırasıyla şöyledir; İşverenin projeyi askıya alması, işverene yapılan hak ediş ödemelerindeki gecikmeler, gerçekçi olmayan proje süreleri, işverenin karar almadaki yavaşlığı, erken planlamadaki yetersizlikler, müteahhit şirketin inşaat süresindeki finansal durumu, işçi yetersizliği, malzeme tedariginde yaşanan yavaşlık, kamu kuruluşlarında gerekli izinlerin alınması ve işverenin veya işveren temsilcisinin inşaat süresi boyunca yapmış olduğu tasarım değişiklikleri. İşçiye bağlı etkenler grubu en önemli gecikmeye sebep olan grup olarak değerlendirilirken, bu grubu sırasıyla; finansal kaynaklı faktörler, malzemeye dayalı faktörler, değişimler / revizyona bağlı faktörler, sözleşmeye dayalı faktörler ve işçiye bağlı faktörler izlemektedir. Zaman aşımı ve maliyet artışı ise Türkiye’deki inşaat projelerinde en sık rastlanan gecikmelerin sebep olduğu etkenler olarak ortaya çıkmaktadır.

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LIST OF SYMBOLS/ABBREVIATIONS

d	The difference in ranking between the contractors and consultants
I	Relative Importance Index
i	Response category index = 1,2,3,4,5.
N	The number of variables
r_s	The Spearman's rank correlation coefficient
W_i	Weight assigned to i th response
X_i	Frequency of the i th response given as percentage of the total responses for each factors
Σ	Sum of
FIDIC	Fédération Internationale Des Ingénieurs-Conseils

1. INTRODUCTION

1.1 Introduction

Modern construction projects even moderate in size are generally multidisciplinary in nature and they involve participation of designers, contractors, subcontractors, specialists, construction managers, and consultants. With the increasing size of the project, number of participants in the project also increase.

The construction sector is one of the most significant sectors that contribute to Turkey's economic growth. The volume and complexity of some projects in Turkey's construction sector pose a great challenge and provide a wealth of opportunities to various companies in the construction industry. Construction projects have been mushroomed in Turkey since 2003, however in recent years the construction industry is not steadily increasing. Ocal et al. [1] considered construction sector as a 'locomotive' as it leads the commercial activities within these sectors and is related with about nearly two hundreds sectors.

Unlike other types of industries where the development and manufacture of product can be standardized and tested before being purchased, the nature of projects in the construction industry is extremely diverse. Every project is unique. Even where identical buildings are under construction, the site conditions in each will differ and introduce new challenges [2]. Therefore, some problems are occurred within the project phase inevitably.

Even with today's advanced technology and management understanding of project management techniques, construction projects continue to suffer delays and project completion dates still get pushed back.

Long et al. [3] defined that a project is successful when it is finished on time, within budget, in accordance with specifications and to stakeholders' satisfaction.

Unfortunately, due to many reasons, high project performance and project success are not commonplace in the construction industry, especially in developing countries.

The problem of delays in the construction industry is a global phenomenon. Failure to achieve targeted time, budgeted cost and specified quality result in various unexpected negative effects on the projects. For example, it might be costly for owner, consultant, contractor. While the owner loses by missing out on the potential revenues from the use of the project and by increased overhead cost for contract administration and supervision, the contractor also loses due to increased costs in over-head and tied-up financial capital. Especially the contractors' losses could include lost opportunities for new projects because of diminished financial capabilities. In public projects, the people may also be effected by the delay in the utilization of the facilities and by the extended inconveniences such as traffic disturbances.

Delay could be also defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. Completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. However, it is rarely happen that a project is completed within the specified time.[4]

Stumpf [5] refered that delay as an act or event that extends the time required to perform the tasks under a contract. It usually shows up as additional days of work or as a delayed start of an activity.

Delays in construction can cause a number of changes in a project such as late completion, lost productivity, acceleration, increased costs, and contract termination. The party experiencing damages from delay needs to be able to recognize the delays and the parties responsible for them in order to recover time and cost. However, in general, delay situations are complex in nature. A delay in an activity may not result in the same amount of project delay. A delay caused by a party may or may not affect the

project completion date and may or may not cause damage to another party. A delay can be caused by more than one party; however, it can also be caused by none of the parties (such as unusually severe weather conditions).

1.2 Background of the Study

Large construction projects with their features of complexity and capital requirement have resulted interest to many researchers. Numerous researches have also examined and identified the causes of delays in construction project. Many articles and studies conducted on causes of delay in construction projects, both locally and internationally have been reviewed.

Al-Khalil and Al-Ghafly [6] made a survey research in order to investigate three components of delay in the construction of water and sewage works in Saudi Arabia which are the frequency of delayed projects, the extent of delay, and the responsibility for delay. The results of their survey showed that a high percentage of projects were subject to delay in Saudi Arabia. The frequency of delayed projects seems to be associated with the contractor but not with the region where the project is located. They also concluded that the delay occurred frequently in medium and large size projects, and considered severe in small projects. The significant causes are financial problems, changes both in the design and scope, being slow in making decisions and approvals by owner, entanglement in acquiring work permit, and coordination and communication problems between the parties.

Assaf and Al-Hejji [4] in Saudi Arabia conducted a survey in order to determine the causes of delay and their importance according to each of the project participants, i.e., the owner, consultant and the contractor. 73 causes of delay were researched. It was found that average of time overrun is between 10% and 30% of the original duration in Saudi Arabia. The most common cause of delay identified by parties is “change order”. They also found that 70% of projects experienced time overrun.

Chan and Kumaraswamy [7] conducted a survey to evaluate the relative importance of 83 potential delay factors in Hong Kong construction projects and found five principal factors: poor risk management and supervision, unforeseen site conditions, slow decision making, client-initiated variations, and work variations.

Okpala and Aniekwu [8] carried a survey to find out major causes of delay and cost overrun in Nigeria. The three major causes of delay are; shortage of materials, financing, payments for completed works and poor contract regarding delay. Price fluctuations, delay, and fraudulent practices were identified as the three most important factors that cause cost overruns.

Odeyinka and Yusif [9] studied the causes of delays in Nigeria housing projects. The main categories evaluated: client, consultant, and contractor-caused delays, and extraneous factors. Client-caused delays were ascertained to arise from variation orders, slow decision making, and cash flow problems whereas contractor-caused delays were from financial difficulties, material management problems, planning and scheduling problems, inadequate site inspection, equipment management problems, and shortage of manpower. The causes of delays as a part of consultant responsibilities are incomplete drawing, slow response by consultant, variation orders, late issuance of instruction, and poor communications. Inclement weather, acts of God, labor dispute, and strikes were found to be extraneous factors responsible for delays.

Kumaraswamy and Chan [10] in 1998 also categorized eight delay factors, these are: project related factors, client related factors, design team related factors, contractor related factors, materials, labor, plant and equipments, and external factors. The most significant factors found to be leading to delays in building and civil engineering works are unforeseen ground conditions, poor site supervisions, low speed of decision making involving all project teams, client initiated variations, necessary variations of work, and inadequate contractor experience.

Ayman H Al-Momani [11] conducted a survey to investigate the causes of delays on 130 public projects in Jordan. A survey indicated that poor design and negligence of

the owner, change of orders, weather condition, site condition, late delivery, economic conditions, and increase in quantities are the main causes of delay.

Ayodeji et al.[12] made an another survey to find out factors in Nigeria. Based on the overall ranking of the forty-four factors, the following are the top ten factors in order of contribution to overall delays: contractors' financial difficulties, clients' cash flow problem, architects' incomplete drawing, subcontractors' slow mobilization, equipment breakdown and maintenance problems, suppliers' late delivery of ordered materials, incomplete structural drawings, contractors' planning and scheduling problems, price escalation, and subcontractors' financial difficulties.

Abdul-Rahman et al. [13] mentioned that poor management of project knowledge encourages difficulty of access to valuable and quality knowledge in performing project tasks. This in turn will lead to repeated mistakes, slow and wrong decision making, and as a consequence, it will lead to an increase in time and delay events.

Arain et al. [14] identifies the causes of inconsistencies between the design and construction of large building projects by carrying out survey in Saudi Arabia. The results showed that the involvement of designer as consultant, communication gap between constructor and designer, insufficient working drawing details, lack of coordination between parties, lack of human resources in design firm, lack of designer's knowledge of available materials and equipment, and incomplete plans and specifications were considered as the most important causes of the project design and construction interface inconsistencies, whereas project management as a professional service, weather conditions, nationalities of participants, involvement of the contractor in design conceptual phase, unforeseen problems, involvement of the contractor in design development phase, and government regulations were the least important causes of inconsistencies between professionals at the project design and construction interface in large building projects.

Le-Hoai et al [15] administered and analyzed a questionnaire survey, this research has identified problems related to delays and cost overruns during construction phase

and then ranked them from different viewpoints of parties with respect to three types of indices. In overall context, poor site management and supervision, poor project management assistance, financial difficulties of owner, financial difficulties of contractor; design changes are five most frequent, severe and important causes.

Long et al. [3] identified problems, together with the extent to which they occur and influence performance on large construction projects in Vietnam. Sixty-two problems were identified as a result of a comprehensive literature survey and extensive contributions of industry professionals in Vietnam. The construction participants accorded inaccurate time estimating, slow site clearance, slow government permits, lack of capable owner's representatives, obsolete technology and unsatisfactory site compensation, high ratings in terms of degree of occurrence and level of influence.

Frimpong et al.[16] investigated delay and cost overruns in construction projects and groundwater construction projects in Ghana. The paper presents the results of a questionnaire survey conducted to identify and evaluate the relative importance of the significant factors contributing to delay and cost overruns in Ghana groundwater construction projects. Respondents of this survey included people from owners, consultants and contractors involved in groundwater projects in Ghana. The results of the study revealed the main causes of delay and cost overruns in construction of groundwater projects included: monthly payment difficulties from agencies; poor contractor management; material procurement; poor technical performances; and escalation of material prices.

Kaming et al. [17] studied influencing factors on 31 high-rise projects in Indonesia and found out that cost overruns occur more frequently and are more severe problem than time overruns. They pointed out 11 variables of delays and 7 variables of cost overruns. Out of which, materials cost increased by inflation, inaccurate quantity take-off and labor cost increased due to environment restriction are the first three causes of cost overruns; while design changes, poor labor productivity, inadequate planning, materials shortage and inaccuracy of materials estimate are first five causes of delays.

Iyer and Jha [18] conducted a questionnaire survey on the factors affecting cost performance of Indian construction projects. Factor analysis of the response on the 55 success and failure attributes identified through literature review and personal interview extracted seven factors. Critical success factors obtained by the analyses are: project manager's competence; top management support; project manager's coordinating and leadership skill; monitoring and feedback by the participants; coordination among project participants; and owners competence and favourable climatic condition. However factors adversely affecting the cost performances of projects, are: conflict among project participants; ignorance and lack of knowledge; presence of poor project specific attributes and non existence of cooperation; hostile socio economic and climatic condition; reluctance in timely decision; aggressive competition at tender stage; and short bid preparation time.

Another survey made by G. Sweis et al.[19] in Jordan to be able to identify causes of construction delays of residential projects in Jordan. Survey conducted to residential projects consultant engineers, contractors, and owners, and interviews with senior professionals in construction field. Most correspondents agreed that, financial difficulties faced by the contractor and too many change orders by the owner are the leading causes of construction delay. Severe weather conditions and changes in government regulations and laws ranked among the least important causes.

Lo et al. [20] made a recent survey to obtain the causes of delay in Hongkong. This research disclosed the six most significant causes of construction delay. These are: Unforeseen ground conditions, poor site management and supervision, client variations, inexperienced contractor, slow coordination and seeking of approval from concerned authorities, and inadequate contractor resources

Noulmanee et al. [21] investigated causes of delays in highway construction in Thailand and concluded that delays can be caused by all parties involved in projects; however, main causes come from inadequacy of subcontractors, organization that lacks of sufficient resources, incomplete and unclear drawings and deficiencies between

consultants and contractors. The study suggested that delay can be minimized by discussions that lead to understanding.

Al-Barak [22] discussed the main causes of failure in construction industry in Saudi Arabia by surveying 68 contractors and about 34 different causes of failure. The study concluded that lack of experience, poor estimation practices, bad decisions in regulating company's policy, and national slump in the economy are the severe factors.

Ogunlana and Promkuntong [23] surveyed the delays experienced in high-rise building construction projects in Bangkok, Thailand, was undertaken and the result compared with other studies of delays and overruns around the world to determine whether there are special problems that generate delays for construction in developing economies. The results of the study support the view that construction industry problems in developing economies can be nested in three layers: (a) problems of shortages or inadequacies in industry infrastructure (mainly supply of resources); (b) problems caused by clients and consultants and (c) problems caused by contractor incompetence/inadequacies.

In Kuwait, recent work by Koushki et al. [24] was identified estimates of time delays and cost increases and their causes. The three main causes of delays are changing orders, owners' financial constraints, and owners' lack of experience. And three first causes of cost overruns are contractor- related problems, material-related problems and owners' financial constraints.

In Nigeria, Mansfield et al. [25] pointed out the causes of delays and cost overruns in public highway and building projects and found that the four most important items agreed on by the contractor, consultants, and public clients surveyed were the financing of and payment for completed works, poor contract management, change in site conditions, and shortages of materials.

Recent work by K.C. Iyer et al. [26] presented that every delay in construction project regarding payment, or site handing over, or temporary stoppage of work

conducts time loss finally which prompts invoking of ‘Time delay and extension’ clause. Therefore it is getting necessary to understand all aspects of disputes arising out of time delay and extension clause.

Kaliba et al. [27] made a study to find out that bad or inclement weather due to heavy rains and floods, scope changes, environmental protection and mitigation costs, schedule delay, strikes, technical challenges, inflation and local government pressures were the major causes of cost escalation in Zambia’s road construction projects. On the other hand, delayed payments, financial processes and difficulties on the part of contractors and clients, contract modification, economic problems, materials procurement, changes in drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications and labour disputes and strikes were found to be the major causes of schedule delays in road construction projects. Appropriate project management practices are thus required to curb the causes and effects of cost escalation and schedule delays in road construction projects.

Bordoli and Baldwin [28] examined the causes of delays in building projects in the United States. Weather, labor supply, and subcontractors were found to be the major causes of delays.

A.Assaf et al [29] researched the main cause of delays in large building projects in Saudi Arabia and their relative importance index. The most important delay factors according to contractors were preparation and approval of shop drawings, delays in constructors’ progress, payment by owners and design changes by owners. The most important delay factors according to consultant were cash problems during construction, the relationships between different subcontractors’ schedules in the execution of the project, and the slowness of the owners’ decision – making process. The most important delay factors according to owners were design errors, excessive bureaucracy in project owner organization, labor shortages, and inadequate labor skills.

Sambasivan and Soon [30] made a survey in Malaysia. The main purpose of this study is to identify the delay factors and their impact on project completion. A questionnaire survey was conducted to solicit the causes and effects of delay from clients, consultants, and contractors. This study identified ten most important causes of delay and six different effects of delay. Ten most important causes respectively were: contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work, problems with subcontractors, shortage in material, labor supply, equipment availability and failure, lack of communication between parties, and mistakes during the construction stage. Six main effects of delay were: time overrun, cost overrun, disputes, arbitration, litigation, and total abandonment.

El-Razek et al. [31] identified the main causes of delay in construction projects in Egypt from the point of view of contractors, consultants, and owners. The overall results indicated that the most important causes are: financing by contractor during construction, delays in contractor's payment by owner, design changes by owner or his agent during construction, partial payments during construction, and nonutilization of professional construction/contractual management.

In Lebanon, Mezher and Tawil [32] conducted another survey. It was found that all three parties generally agreed on the ranking of the major categories of delay factors. Owner had more concerns with regard the financial issues whereas contractors ranked contractual relationship highest and finally consultant firms ranked project management highest.

Aibinu and Jagboro [33] researched the effects of construction delays in Nigeria. The findings showed that time and cost overruns were frequent effects of delay. Delay had significant effect general on completion cost and time. Acceleration of site activities coupled with improved clients' project management procedure and inclusion of appropriate contingency allowance in precontract estimate can assuage the adverse effect of construction delays. In this research; it is also founded that time overrun, cost

overrun, dispute, arbitration and litigation and total abandonment are the most top rated six effects that occurred as a result of delays.

Arditi et al. [34] investigated the causes of delays in public project in Turkey. The result indicate that lack of resources, public agencies' and contractors' financial difficulties; organizational deficiencies and delays in design work, frequent change of orders and considerable extra work are the most important sources of delays. Some of the causes are related with economic policies whereas the other causes are dependent on measures to be taken by contractors and public agencies.

Manavazhia and Adhikarib [35] conducted a survey to investigate material and equipment procurement delays in highway projects among the 22 highway projects in Nepal. Delay in the delivery of materials and equipment to construction sites is generally caused cost overruns in projects especially in developing countries. Rankly, organizational weaknesses, suppliers' defaults, governmental regulations and transportation delays have a negative effect on material and equipment organization. However, the actual impact of these delays on project costs was only the 0.5 % average of the total budgeted cost of the projects.

1.3. Problem Statement

Construction projects can be delayed for a large number of reasons. Delays have significant effect on completion cost and time of construction. Construction projects in Turkey generally suffer problems of performance failures, cost wastage, and so on due to the schedule delays.

There are a number of researches on construction delays and their effects in several countries such as Indonesia [17], USA [28], Kuwait [24], Hong Kong [7], India [18], Jordan [19] ,Saudi Arabia [6], Nigeria [8,12], Thailand [21,23] and Malaysia [30]. Since the characteristics of construction sectors differ from one country to another, there is also need recent studies in Turkey about the causes and results of delays in

construction industry. This study aims to investigate the delay issues and their effects in Turkey.

Surveys, have been conducted on the causes of delays in different countries summarized in Table 1.1.

Table 1.1. Summary of previous studies on causes of delay in construction industry

Researchers	Country	Major causes of delays
Al-Khalil and Al-Ghafly	Saudi Arabia	Financial problems
		Changes both in the design and scope
		Being slow in making decisions and approvals by owner
Chan and Kumaraswamy	Hong Kong	Poor risk management and supervision
		Unforeseen site conditions
		Slow decision making
Okpala and Aniekwu Mansfield et al.	Nigeria	Shortage of materials
		Financing payments for completed works
		Poor contract management
Ayman H Al-Momani	Jordan	Poor design and negligence of the owner
		Change orders
		Weather condition
Long et al.	Vietnam	Inaccurate time estimating
		Slow site clearance
		Slow government permits
Frimpong et al.	Ghana	Monthly payment difficulties from agencies
		Poor contractor management
		Material procurement
Kaming et al.	Indonesia	Design changes
		Poor labor productivity
		Inadequate planning
Koushki et al.	Kuwait	Changing orders
		Owners' financial constraints
		Owners' lack of experience
Kaliba et al.	Zambia	Delayed payments
		Financial processes and difficulties
		Contract modification
Bordoli and Baldwin	U.S.A	Weather
		Labor supply
		Subcontractors relations
Sambasivan and Soon	Malaysia	Contractor's improper planning
		Contractor's poor site management
		Inadequate contractor experience

Table 1.1. (Continued)

Researchers	Country	Major causes of delays
El-Razek	Egypt	Financing by contractor during construction
		Delays in contractor's payment by owner
		Design changes by owner or his agent during construction
Mezher and Tawil	Lebanon	Financial problems
		Contractual relationship
		Insufficient project management
Manavazhia	Nepal	Organizational weaknesses
		Suppliers' defaults
		Governmental regulations

1.4. Aim and Objective of the Study

One major question of concern however arises: What are the major causes of delays in Turkey construction industry and their relative importance? Thus it is important to determine the most significant factors that cause delay and their effects in Turkey construction industry.

This research was therefore, aimed at identifying the major causes of delays, effects of delays and some methods and recommendation of minimizing delays in construction projects in Turkey construction industry. To perform these aims the following objectives have been defined.

- Evaluate the factors contributing to delays in Turkey by looking at factors, related to the parties and external factors
- Assess the effects of the factors to project delays, and in that regard,
- Identify the methods of minimizing construction delays.

1.5 Scope of the Study

The scope of the research mainly focused on literature review and a questionnaire survey. The survey was conducted especially in big cities, such as Istanbul and Ankara

where the biggest companies located in and where the huge volume and complex projects are generally carried out.

In this research, we identified major causes of delay and categorized them as financial-related, labor-related, revision and change-related, contractual-related, environment-related, rules/regulations-related, equipment-related material-related and project management/project control-related factors. Additionally, some of the important effects of delay were also examined in this study.

A questionnaire was developed to assess the perceptions of the parties (owner consultants, contractors) of the relative importance of the causes and the effects of construction delays. The developed survey questionnaire was distributed to the respondents that taking place in construction industry in Turkey.

2. CAUSES OF CONSTRUCTION DELAYS

2.1. Introduction

One of the most important problems in the construction project is delays. Due to the nature of construction, delays are a way of life in the construction industry. Delays occur in almost all construction and the magnitude of these delays varies from project to project. Some projects are only few hours delay like strikes, some of them might delay over a year. Dealing with delays are one of the most complicated and difficult problem to analyze within the construction process. Therefore delays are grouped on the basis of their sources.

2.2. Types of Delays

The literature generally classifies delays according to liability into the following two major types: excusable and nonexcusable. An excusable delay is one that are beyond the control of the contractor, entitle the contractor to extensions of contract time. Common excusable delays for a contractor include design problems, owner-initiated changes, unanticipated weather, labor disputes etc. Nonexcusable delays are those that are within the control of the contractor, are the result of the contractor's action, or are due to the failure of the contractor to anticipate expected conditions, such as increased lost work days during severe weather conditions.

2.2.1. Excusable Delays

Excusable delays are those not attributable to the contractor's actions or inactions, and typically include unforeseen events, events beyond the contractor's control or events without fault or negligence, such as acts of God.

Excusable delays affecting activities on the critical path can entitle the contractor to time extension, if the completion date was extended. They can also have an impact on

noncritical activities; these need further analysis to determine whether additional time extension is warranted or the reduction of float time can be justified. Excusable delays can be further classified into compensable and noncompensable delays.

Compensable Delays are delays that are unforeseeable and beyond the contractor's control, but for which the contractor is entitled to not only a time extension but also additional compensation. Excusable compensable delays are generally caused by the owner's actions or inactions. It might be caused by a direct change or providing misleading information, it may be caused by a suspension of work, or it may be caused by any of the revision or owners' decision change. Contractor can easily request both a time extension and compensation for that time extension, but before that contractor must demonstrate that the owner was the cause of that delay.

Noncompensable excusable delays are delays that are not the fault of the owner or the contractor. They are "Acts of God" or other unforeseeable causes beyond the control of both parties. Contracts usually contain a clause called the force majeure clause, which mentions the various causes of delays for which neither party is legally responsible. Force majeure delays most often entitle the contractor to an extension of time or performance, but not to additional costs, although this depends on the contract language. Unusually severe weather conditions can be assessed a noncompensable excusable delays when the weather for that region is way more severe than what is normally expected for that time of year, or than what has taken place in the past. The contractor is only entitled to a time extension when the weather is unusually severe. The determination of what constitutes unusually severe weather is based upon a review of the historical weather data for that area. For a contractor to request a time extension for unusually severe weather, contractor should demonstrate what the weather was that he experienced and compare this with previous historical weather data.

2.2.2. Nonexcusable Delays

Nonexcusable delays can be attributed to the actions, or inactions, of the contractor or its subcontractor. Contractor is not entitled to time extension or delay damages. Some of the more common contractor caused delays include: Lack of coordination of tradesmen and subcontractors, delay by the contractor in obtaining materials, the contractor's financing problems, the contractor's failure to adequately manage and coordinate the project site, improperly allocating labor and other resources on the project; poor workmanship, failure to submit shop drawings and related materials to the owner for approval in a timely manner, lack of adequate and sufficient construction equipment, lack of coordination of tradesmen and subcontractors, the contractor's failure to mobilize quickly enough and failure to perform the work in a proper manner.

2.2.3. Concurrent Delays

Concurrent delays occur when two or more delays take place simultaneously or overlap to some degree. Different methods are available for assessing and analyzing responsibility for concurrent delays, but it is difficult to determine which delays are concurrent or occurred alone. If this cannot be done between the owner and the contractor, legal proceedings may be needed to resolve the issue. In analyzing these delays, each is assumed separately and its impact on other activities and the whole project duration is determined. Special attention must be paid to those noncritical activities affected by the delay. An example of a concurrent delay would be the client failing to supply detailed designs for specific machine installations and, at the same time, workers who would have installed those machines were on strike. Both excusable compensable and excusable noncompensable elements are present. Although such guidelines are useful for the purpose of carrying out delay analysis, it is in the best interest of all parties involved in a construction project to agree, at the beginning, the definitions of such delays and to accommodate them through contract language.

Briefly, whenever a delay occurs, there may be grounds for a claim requesting time extension or damage compensation.

2.3. Causes of Delays

There are many ways that a construction project can be delayed. Delay may be result of parties direct action or of their failure to act with in the construction process. In addition, outside forces and parties often intervene to delay the project.

Delay claims typically relate to unanticipated project events and circumstances which extend the project and/or prevent work from being performed as originally planned. There are many common causes for schedule delays on a construction project, which include mismanagement and lack of administration; site access restrictions; different site conditions; permits and approvals from local department; financial problems; defective plans and/or specifications; changes and revise was made in the work; labor productivity issues; document review/approval; testing/inspections; inclement weather and so on.

Simply, the delays can easily detailed as owner-related, contractor-related, consultant-related and the delays not caused by any parties.

Finance and payments for completed work, excessive change orders slow owner's decision-making process, owner interference, and ill-defined duties and responsibilities are major factors that related to owner. Payments managing from owners are the main source of revenue for both contractor and designer. When owners delay payments to contractors, a financial obstacle is now occurred on the contractors' part. Owners always give tight schedule for contractor which might be scheduled challenging and impractical to achieve within the given time. Briefly, owners always tend to rush projects for specific time and money reasons.

Owners sometime intervene in the construction phase inappropriately. Owners may require lots of design changes in design phase. This may result from poor scope of work definition in tender documents or simply changing their mind during the construction phase. Excessive changes and unreasonable demands is made by owner,

without consulting designer or regardless of designer opinions, might be dangerous and jeopardize project objectives.

In some cases, owners rush into awarding contracts without securing the right of way to the contractors. This might also cause in delays. Also, owners do not solve disputes in a timely manner which might result in litigation or arbitration in the future.

In addition, the owner has certain rights, such as the right to stop work, to carry out the work in a case of contractor neglect, to retain separate prime contractors, to make changes within the general scope of the contact, and to terminate the contract due to the owners' suddenly bankruptcy or commercial failure. Although it does not seem a major risk for delays, but there are some cases where owners cancel projects or breach their contracts due to bankruptcy that simply related to instable financial situations especially in developeing countries like Turkey.

The owner may agree to furnish special equipment or material for the project which is commonly seen on hospital and energy constructions. The failure to provide special materials in a timely fashion may lead to compensable delays. On the other hand, if the material furnished by the owner is defective, this may entitle the contractor to recovery of related delay costs.

Other example of owner failures to provide proper contract administration include unreasonable delays in reviewing shop drawings and submittals, delay in providing necessary inspection, delay in final acceptance of the project.

The owner is also responsible for delayed issue of a notice to proceed. The notice to proceed is intended to give the owner the flexibility to resolve certain problems before the contract time begins to run. Owner must act within a reasonable period of time because to wait too long would invite a delay claim in the early stages of the project.

Often the owner takes on the obligation of providing on-site utility services such as water, temporary or permanent electricity. Generally, such services are the responsibility of the contractor, but the owner may agree to supply them when the contract is for the partial renovation of an owner-occupied facility or the construction of a new structure that is one part of existing facility. Temporary interruptions in electric and water supply do not lead to extensive project delays.

Because of the integral role the consultant has; in the development of the project design, preparation of contract documents, and contract administration, difficulties in its performance may have a significant impact upon the progress of the construction work. Preparation and approval of drawings, design errors, delays in work approval, uncompromising attitude are common problems for which consultants are held responsible in literature and also in experienced life.

Design defects include errors as well as lack of coordination between the various aspects of the design such as architectural, structural, mechanical, electrical or site plan may lead to delays in completion. However certain areas such as site plans, foundation design, mechanical design and especially renovation projects seem to generate more problems than others.

Site engineering and soil conditions, including relatively simple aspects of site plans, such as surveys and bounds are frequently the source of dispute and cause delays. Often the site plan errors are extensive, giving an impression of extremely sloppy work. Although the inability to detect the presence of hidden subsurface conditions may be excusable, designers may not accurately locate the elevation or location of known underground utility lines and may fail to identify the utilities entirely. This may be either the result of the owner's not having accurate information for the designer to evaluate or merely the designer's failure to obtain available information.

Another major factor that directly effect all parties is the designer's slow response in making correction and revisions. Even though design problems are often discovered with sufficient time to allow for redesign, the designer may react defensively, claiming

the sufficiency of the design. In some cases, a contractor or the owner resolve the problem through shop drawing process in order to accelerate the construction.

However, if the contractor can demonstrate the deficiency of the design, the delay caused by the slow response in correcting the design is regarded as compensable delay. Even if the original design is not defective, the contractor may require additional detail or clarification of the contract documents. Delay in providing the details may result in compensable delay for the contractor. In addition, slow response in providing remedial directives and design for a differing site conditions may give rights to contractor to recover its delay costs.

Designer site visits, tests and inspections may seem contribute to delays, however it is generally held that unreasonable delays in inspections that affect contract completion are compensable delays. Any delay by the designer in performing the inspection may interfere with the contractor's work and delay progress.

Contractors in developing economies are entrepreneurs who are in the business of making money at the lack of management. They pay low wages, submit very low bids and have very little, if any, ability to plan and coordinate contracts that these all lead delays.

Contractor-related problems concern problems or adverse factors caused by contractors. They involve inadequate experience construction errors, poor site management and supervision, equipment failures or allocation problems, inadequate labor skills, site manager lacking authority, improper planning and scheduling, inaccurate estimation, and poor contract management.

Before bid period, most contracts provide single site visit and review the plans for contractors in order to get familiar with the concept of project. In this pre-bid period contractor is obligated to inquire about design errors, and if it fails to do so, it proceeds at its own risk. However this period given by the owner is generally not enough to evaluate the risks and unforeseen factors. Once the bid has been submitted, it is too late

to rebid the project to include any major omissions. Thus, the contractor who underbid the project is often stuck and may look for ways to avoid the loss.

Generally, even if a careful evaluation is made on the specifications and drawings, the low bid selection method required on most public projects encourages the contractor to take risks on design interpretation and try to get a change orders. If performance specifications are provided within the tender documents, the contractor may be responsible for the details of the design and may be responsible for any delay.

Another problem area is the dimensions on existing, as-built drawings especially in renovation works. If the contract documents indicate that the dimensions should be confirmed in the field, the contractor may be held to proceed its own peril.

Lack or departure of qualified experienced technical staff is also one of the major problems that not generally confined to contractors. Some contractors' personnel therefore lack the experience needed to foresee problems before they arose. It is hard to hire and retain qualified staff for specific projects especially for sole projects like refinery, bridge projects.

There are also some delays that not to be caused by any parties, such as weather, culturel difference, economic risk etc.

Labor strikes and disputes among workers can disrupt construction activity and may affect project objectives negatively. The social and cultural differences are another factors. The economic risks including inflation and sudden changes in prices can also be grouped in that category. This relates to the risk of price increases during the construction phase. Another risk relates to economic factor is fluctuating exchange rates that affect the profitability of the project. The natural risk includes unexpected inclement weather and unforeseen site conditions are the other factors that may contribute to delays.

Other risks include unfairness, especially in developing or undeveloped countries such as Turkey, in tendering during the pre-construction phase and local protectionism which includes favoring local companies.

2.4. Identify Factors and Groups of Causes of Delays

The effects and causes of project delays were first examined and identified through a relevant international literature review. Previous studies, carried out from country to country, were used to form a comprehensive list of delay causes. It was remarked that in Assaf et al.[30] study has the largest number of delay causes.

Therefore, the causes stated in the Assaf et al.[30] study were considered as datum, while causes in the other studies were compared against it to set up a more extensive list of delay causes in order to both fit into the Turkey's construction conditions and to be relevant to Turkey situation and regulations. In addition, the delay factors grouped into nine major groups: financing, materials, contractual relationships, changes, government relations, labor, project scheduling and control, equipment, and environment. It was determined to use the similarly same nine groups while changing the "government relations" and "changes" description to be "rules and regulations" and "changes/revisions" respectively to give an expanded view of the delay causes shown in other studies. Totally, 93 factor of delays were discussed. As a result, fifty-one common causes of delay related to civil construction projects in Turkey were selected or added to list for further examination in this study.

Besides, six causes of effects were also added into the group list which they were considered significant effects in Turkey construction industry.

2.4.1. Factors of Finance Related Delays

"Financing by contractor during construction", "delays in contractor's progress payment by owner", "partial payments during construction" factors were selected for this group. "Financial fluctuation" was also added in this group due to the unstable economy and exchange rates that affect deeply in construction sector in Turkey.

Factors of Finance Related Delays	Status
Financing by contractor during construction	Selected
Delays in contractor's progress payment by owner	Selected
Partial payments during construction	Selected
Financial fluctuation (floating exchange rate, inflation)	Added

Figure 2.1. Breakdown of factors of finance related delays

2.4.2. Factors of Labor Related Delays

“Shortage of labor”, “poor labor productivity”, “labor and management relations” were found suitable for this survey. “Labor skill” is already represented in less labor productivity. There are no workers from different countries in Turkey, therefore “nationality of laborers” factor was deleted. “Labor injuries” was seen to have a minor effect in projects, and “labor disputes and strikes” are not common in Turkey.

Factors of Labor Related Delays	Status
Shortage of labor	Selected
Labor skill	Already Represented
Less labor productivity	Selected
Nationality of laborers	Deleted
Labor injuries	Deleted
Labor disputes and strikes	Deleted
Labor and management relations	Selected

Figure 2.2. Breakdown of factors of labor related delays

2.4.3. Factors of Changes/Revision Related Delays

“Design changes by owner or his agent during construction”, “design errors made by designers”, “foundation conditions encountered in the field” and “mistakes in soil investigation” factors were selected. “Geological problems on site” and “water table

conditions on site” were already represented in “mistakes in soil investigation”. “Suspension of the project by owner”, “errors due to lack of experience” and “lack of facilities on construction site” factors were added because these factors are very common in Turkey. The factor of “errors committed during field construction at job site” was seen as already represented in the “errors due to lack of experience” factor.

Factors of Changes/Revision Related Delays	Status
Design changes by owner or his agent during construction	Selected
Suspension of the project by owner	Added
Design errors made by designers	Selected
Foundation conditions encountered in the field	Selected
Lack of facilities on construction site	Added
Mistakes in soil investigation	Selected
Errors committed during field construction at job site	Already Represented
Errors due to lack of experience	Added
Water table conditions on site	Already Represented
Geological problems on site	Already Represented

Figure 2.3. Breakdown of factors of changes/revision related delays

2.4.4. Factors of Contractual Related Delays

The following factors were selected. “The relationship between different subcontractors’ schedules in the execution of the project”, “the conflict between contractor and consultant”, “slowness of the owner decision making process”, “nonutilization of professional construction/contractual management”, “project delivery systems used (design-build, general contracting, turnkey etc.)”, “difficulty of coordination between various parties (contractor, subcontractor, owner, consultant working on the project)”, “legal disputes between various parties in the construction project”, “controlling subcontractors by general contractors in the execution of work”.

“The joint ownership of the projects”, “ the unavailability of financial incentives for contractor to finish ahead of schedule”, “uncooperative owners” and “contract modifications” factors are not common in construction industry in Turkey, thus these factors were deleted. “Unrealistic project duration”, “insufficient penalties for delays”, “insufficient original contract duration” were added because most of the projects were subjected to time delay in Turkey. “Completeness of project information factor” and “insufficient communication between the owner and designer in design phase” factors were also deleted, because similar factors were represented in project management/project control group. “Poor contract management”, “nonadherence to contract conditions” and “mistakes and discrepancies in contract documents” factors already represented under the “nonutilization of professional construction/contractual management.” factors.

Factors of Contractual Related Delays	Status
The relationship between different subcontractors' schedules in the execution of the project	Selected
Unrealistic project duration	Added
The conflict between contractor and consultant	Selected
Slowness of the owner decision making process	Selected
Poor organization of the contractor or consultant	Selected
Nonutilization of professional construction/contractual management	Selected
Project delivery systems used (design-build, general contracting, turnkey etc.)	Selected
Insufficient penalties for delays	Added
Insufficient original contract duration	Added
Difficulty of coordination between various parties (contractor, subcontractor, owner, consultant working on the project)	Selected
Legal disputes between various parties in the construction project	Selected
Controlling subcontractors by general contractors in the execution of work	Selected
Uncooperative owners	Deleted
Insufficient communication between the owner and designer in design phase	Deleted
Poor contract management	Already represented
Nonadherence to contract conditions	Already represented
Mistakes and discrepancies in contract documents	Already represented
The joint ownership of the projects	Deleted
The unavailability of financial incentives for contractor to finish ahead of schedule	Deleted
Negotiations and obtaining of contracts	Already represented
Contract modifications	Deleted
Completeness of project information	Deleted

Figure 2.4. Breakdown of factors of contractual related delay

2.4.5. Factors of Environmental Related Delays

“Hot weather effect on construction activities”, “rain effect on construction activities” causes were merged into a single “adverse weather conditions” cause. “Flood Hurricane” and “wind damage” causes were also merged into the “unexpected weather /climate conditions (Hurricane, Flood etc.)” factor. “Fire” was seen as not applicable, and thus deleted. The cause of “social and cultural factors” was not seen as a determinant factor of delay. “Insufficient available utilities on site” was also deleted, because similar factor was represented in the factors of project management/project control related group.

Factors of Environmental Related Delays	Status
Adverse weather conditions	Added
Unexpected weather /climate conditions(Hurricane, Flood etc.)	Added
Hot weather effect on construction activities	Merged
Rain effect on construction activities	Merged
Flood	Merged
Hurricane	Merged
Wind damage	Merged
Fire	Deleted
Insufficient available utilities on site	Deleted
Social and cultural factors	Deleted

Figure 2.5. Breakdown of factors of environmental related delays

2.4.6. Factors of Equipment Related Delay

“Shortage in equipments”, “unskilled operators”, “slow delivery of equipment” factors were found suitable to investigate in Turkey construction sector. “Equipment failure” were seen to be represented by “shortage in equipments.” “Equipment productivity” and “lack of high-technology equipment” were deleted, because construction companies in Turkey usually have regular and similar technology.

Factors of Equipment Related Delays	Status
Shortage in equipments	Selected
Unskilled operators	Selected
Equipment productivity	Deleted
Equipment failure	Already represented
Slow delivery of equipment	Selected
Lack of high-technology equipment	Deleted

Figure 2.6. Breakdown of factors equipment related delays

2.4.7. Factors of Rules & Regulations Related Delays

“Obtaining permits from municipality”, “excessive bureaucracy in project owner operation”, “building codes used in the design of the projects”, “changes in laws and regulations” were seen as suitable. “Safety rules”, “OSHA regulations”, “obtaining permits for laborers”, “building regulations in coastal regions” were seen not applicable to the construction industry in Turkey. “Building permits approval process” was represented into the “obtaining permits from municipality.”

Factors of Rules & Regulations Related Delays	Status
Obtaining permits from municipality	Selected
Excessive bureaucracy in project owner operation	Selected
Building codes used in the design of the projects	Selected
Building permits approval process	Already Represented
Changes in laws and regulations	Selected
Safety rules	Deleted
OSHA regulations	Deleted
Coastal construction control line permit	Deleted
National flood insurance program	Deleted
Obtaining permits for laborers	Deleted
Building regulations in coastal regions	Deleted

Figure 2.7. Breakdown of factors of rules & regulations related delays

2.4.8. Factors of Material Related Delays

“Shortage in construction materials”, “slow delivery of materials”, “materials changes in types and specifications during construction” and “imported materials and plant items” factors were selected. “Damage of materials in storage” was not common and thus it was seen to have a rather low effect on project duration.

Factors of Material Related Delays	Status
Shortage in construction materials	Selected
Slow delivery of materials	Selected
Materials changes in types and specifications during construction	Selected
Damage of materials in storage	Deleted
Imported materials and plant items	Selected

Figure 2.8. Breakdown of factors of material related delays

2.4.9. Factors of Project Management & Control Related Delays

Nine factors related to project management and project control were selected. These are; “Lack of database in estimating activity duration and resources”, “inadequate early planning of the project”, “lack of training personnel & management support to model the construction operation”, “inspection and testing procedures used in the project”, “application of quality control based on foreign specification”, “accidents during construction”, “preparation and approval of shop drawings”, “waiting for sample material approval” and “staffing problems.

“Inadequate project information”, “lack of experiences in project management & scheduling process” and “lack of experiences and information preparing in price quotation” were thought to be critical factors, therefore these three factors were added.

“Judgment and experience of the involved people in estimating time and resources”, “inadequate review”, “timeliness of project information” factors was already represented under the “lack of database in estimating activity duration and resources

factor”. “Poor subcontractor performance” and “often change of subcontractors” were already represented with in the “lack of experiences in project management & scheduling process” factor.

“Traffic control regulation practiced in the site of the project”, “damage to structure” are factors that rarely faced with in Turkey, thus these factors were deleted. “Different site conditions”, “preparation of scheduling networks and revisions by consultant while construction is in progress” and “construction methods” factors were delated because similar factor were represented in the groups of change/revision and contractual related factors. “Transportation delays” can be also incorporated into other causes such as “shortage of construction materials” and “shortage in equipment” in the material and equipment groups, respectively. These factors were summarized in Figure 2.9.

Factors of Project Management & Control Related Delays	Status
Lack of database in estimating activity duration and resources	Selected
Inadequate early planning of the project	Selected
Lack of training personnel & management support to model the construction operation	Selected
Inspection and testing procedures used in the project	Selected
Application of quality control based on foreign specification	Selected
Accidents during construction	Selected
Judgment and experience of the involved people In estimating time and resources	Already represented
Poor subcontractor performance	Already represented
Often change of subcontractors	Already represented
Preparation and approval of shop drawings	Selected
Waiting for sample material approval	Selected
Preparation of scheduling networks and revisions by consultant while construction is in progress	Deleted
Traffic control regulation practiced in the site of the project	Deleted
Damage to structure	Deleted
Staffing problems	Selected
Inadequate project information	Added
Lack of experiences in project management & scheduling process	Added
Lack of experiences and information preparing in price quotation	Added
Transportation delays	Already represented
Inadequate review	Already represented
Different site conditions	Deleted
Construction methods	Deleted
Timeliness of project information	Already represented

Figure 2.9. Breakdown of factors of project management & control factors related delays

3. EFFECTS OF CONSTRUCTION DELAYS

3.1. Introduction

In Turkey, construction sector is an important sector. Although not working to its fullest potential, it is still one of the prime interest industry in Turkey. Growth in this sector is critical for growth in national income as it is among the largest sectors that generates employment within the country as well as a key indicator of the economy of Turkey. As many other both underdeveloped and developing country, Turkey also face with some negative effects due to construction delays.

3.2. Effects of Delays

With the increasing size and complexity in nature of project the conditions of the contracts also tend to become more complicated, which in turn add to number of negative effects and further delay the settlement of disputes. The delay cause some general undesired or unexpected effects that are given below.

- It hampers the project progress if delay arises during execution stage.
- It is detrimental to the relationship between parties that turn into disputes. (such as owner and contractor)
- It generally contributes to the cost and time overruns.
- It may cause some litigation problem such as arbitration and in worse cas total abandonment.
- It sends bad signals to foreign investors thereby slowing down the national progress and employment.

3.2.1. Time overrun

Construction contracts try to control the contract time, which is usually closely regulated. Generally the project is delayed by contractor due to the poor an improper site management that often caused time overrun. However in some cases, the contractor is delayed for a reason that is not its own fault. If the design firm or the owner's representative take a slow decision within the project process, an extension of the contract time may be requested, because the contractor has an agreement directly with owner within the specific day. Then it is getting inevitable to face with some time overrun issues. Especially in small projects which have a short duration, the contractor is forced to speed up construction, which might cause time overrun. The actual duration is generally greater than the estimated.

In construction industry, the poor performance of projects in terms of time overruns are commonplace over the last three decades. For example, there was an announced 50–80 %delays on 1627 World Bank sponsored projects between 1974 and 1988, together with an average of 23.3 % U.K. government construction projects from 1993 to 1994 were subjected to time overrun [28]. Additionally, average time overruns percentage on samples of public building projects and private building projects, which were studied in 1994 in Hong Kong, were found to be 9,17 and 14 respectively [36].

Sambasivan and Soon [37], regarding to their survey, concluded that factors such as inadequate planning by the contractors, improper site management by the contractors, inadequate project handling experience of contractors, and delay in the payments for the work completed directly affect the completion of the project and cause time overrun.

3.2.2. Cost overrun

It is certain that cost is one of the prime factor for the project success. Most of the significant factors affecting project costs such as construction time, contractor's planning capability, procurement methods and market and economic conditions

including the level of construction activity. A project otherwise completed may not be regarded as successful until and unless it satisfies within the cost expectations.

Cost overrun is a very frequent phenomenon and is almost associated with all projects of construction industry. Cost overrun can be simply defined as when the final cost of the project exceeds the original estimates. In developing countries where these overruns sometimes exceeds 100% of the anticipated cost of the project. Low quality materials may cause higher construction cost than expected because of the loss of materials during construction. This results from a lack of standards for materials and management systems.

Project delays can also cause cost overruns illustrating through additional overheads and potential claims between the parties. But many national construction organizations have set themselves targets for the purposes of measuring and improving the current levels of construction time performance on different categories of projects. This would help particularly in reducing durations for construction on a realistic basis, that also does not adversely impact on other priorities.

Lee [38] indicated that 95 and 100% of road and rail projects, respectively, had a maximum cost overrun of 50% in Korean Social Overhead Capital Projects. The reasons for cost overruns are: Changes in the scope, delays during construction, unreasonable estimation and adjustment of project costs, and no practical use of the earned value management system.

Le-Hoai et al.[15] noted that, especially in Asia and Africa based construction project, most causes of delay and cost overrun of construction project relate to the human and management problems.

Iyer and Jha [18] indicated that short duration projects where each day of delay can have large detrimental effect on cost.

3.2.3. Dispute

The unique aspects of each project and the unique constitution of each construction team are common reasons for disagreements to occur. Whatever the sources of the disagreement, disputes in construction industry are common. Because conflicts are commonplace on construction places, the potential disputing parties are well advised to outline the appropriate procedures to follow during disputes. It is better to be done before starting construction in order not to face with any claim clauses.

3.2.4. Litigation

Most disputes start with some small beginnings. If both parties claimly discuss an issue and listen carefully to other's comments or ideas, a good opportunity will exist for the desired resolution of that matter. But if negotiations fail to resolve a dispute and there is no contractual clauses for the specific dispute, the parties will find themselves in a lawsuit. The process for filing claims is often specifically addressed in the contract documents.

Litigation is very time-consuming with the resolution of the dispute often occurring long after the project is completed. Many courts are backlogged with cases, so a speedy court decision is seldom realized. Paralel to time consumption, it also leads to some cost of court settlement.

3.2.5. Arbitration

Arbitration has traditionally been the most popular alternative to litigation. Many construction contracts now require that disputes be resolved by arbitration particularly in private sector. Binding arbitration means that the disputing parties will agree to adhere to the decisions reached.

Arbitration differs from litigation in that the rules of evidence are eased and the discovery proceedings are not formally defined. The advantage of arbitration compared

with litigation are that it is less time-consuming and less expensive. However, many cases are very involved and technically complex. Much time will be required to establish all the facts, and this can be costly but still less expensive comparing to litigation.

3.2.6. Total Abandonment

Provisions for termination of construction, which are also included in most contracts, typically occur in two varieties: termination for default of the contractor and termination for convenience of the owner. In a termination for provisions, the owner may reserve the right to terminate the contract at any time, regardless of the percentage of completion of the project. On the other hand, most construction contracts also give the contractor the authority to terminate a contract. The ability of the contractor to terminate the contract is one of the powerful tool that provides some assurance that the owner will not interfere to contractor's work effort.

3.3. Identify the Effects of Delays

Time overrun, cost overrun, dispute, arbitration, litigation, and total abandonment are the effects of delays that often can be seen in construction phase in Turkey. Therefore, these six effects of construction delay were identified to investigate within the questionnaire survey.

4. RESEARCH METHODOLOGY

4.1. Introduction

The goal of this study was to quantify the causes and effects of delay in Turkey construction industry. Therefore, fifty-one factors cause delays and six delay effects were selected which were identified through both literature review and conditions of Turkey. A questionnaire was developed in order to evaluate the importance of the identified causes and their effects.

4.2. Data Distribution

Several means were employed to deliver the questionnaires to potential respondents. Face-to-face deliveries are preferred to promote respondents and raise the response rate but several different means such as email and post are also employed. Because of the difficulty in gathering questionnaires by post, the expectation of a very low response rate with this approach, the data were gathered in person. A snowballing technique was used to select participants; meaning potential participants were obtained from existing participants. Moreover, some of the contractors, consultants information was collected from Chamber of Commerce of Turkey and from the lists of contractors from literature.

4.3. Questionnaire Design

The questionnaire is divided into two main parts. Part I is related to general information for both the company and respondent. Owner, consultants and contractors were further requested to answer questions with related to their previous experience in the construction industry and their opinions about delay in projects they experienced.

Part II includes the list of the identified causes of delay in construction project. These causes are classified into nine groups according to the sources of delay: financial-

related, labor-related, revision/change-related, contractual-related, environment-related, rules/regulations-related, equipment-related, material-related and project management/project control-related factors. Effects of delays also took part in this section.

Respondents, in the open-ended question of the questionnaire also point out that other causes of delays and their effects that were not mentioned in the survey. These data were also gathered through a questionnaire.

4.4. Data Analysis

Sambasivan and Soon [30] used the relative importance index method to calculate the relative importance of the various causes and effects of delays. The similar method was used in this study within owners, consultants or contractors groups. The five-point Likert scale ranged from 1 (not important) to 5 (extremely important) was adopted and transformed to relative importance indices (RII) for each factor as follows:

$$RII = \frac{\sum W}{A*N} \quad (4.1)$$

where W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e. 5 in this case), and N is the total number of respondents. The RII value had a range from 0 to 1 (0 not inclusive), higher the value of RII, more important was the cause or effect of delays. The RII was used to rank (R) the different causes. These rankings made it possible to cross-compare the relative importance of the factors as perceived by the three groups of respondents. Each individual cause's RII perceived by all respondents were used to assess the general and overall rankings in order to give an overall picture of the causes of construction delays in Turkey construction industry. The same method was adopted for ranking the effects. The indices (RII) were then used to determine the rank of each effects. These rankings also made it possible to cross compare the relative importance of the items as perceived by the three groups of respondents. The weighted average for each item for the three

groups of respondents was determined and ranks (RII) were assigned to each item representing the perception of the three groups.

5. ANALYSES AND DISCUSSION

5.1. Introduction

Delay is a serious problem in the construction industry especially in Turkey. It is costly for all parties that involved in construction projects, ranging from owners to subcontractors. Owners probably lose money by missing out on potential revenues from the use of the project and through increased overheads for contract administration and supervision. Contractor also losses in overheads and profit due to the increased prices through project progress and therefore have to tied-up their capital. Therefore, determining the factors that cause delays in Turkey construction projects is essential.

5.2. Data Collection

In order to evaluate and analyze the causes of delay and their effects overrun in construction projects, a wide range of people involved in this survey. The questionnaire was directed towards three groups in both public and private organizations: owners of the projects, consulting offices, and contractors working in the construction projects. The sample selected for each of the three groups is described below as:

- Owners comprising the government agency, private organizations (industries), and individual owners.
- Consultants working in construction projects.
- Contractors who are involved in project.

As a result, a total of 151 responses were collected. The demographic characteristics of the respondents involving their working experience are given in Table 5.1

Table 5.1. Demographic characteristics of respondents

<u>Demographic characteristic</u>	<u>Frequency</u>	<u>Percent</u>
<u>Type of organization</u>		
Owner	45	29.8
Consultants	54	35.8
Contractors	52	34.4
<u>Age</u>		
Less than 20	-	-
20–29	46	30.5
30–39	56	37.0
40–49	24	15.9
50 and above	25	16.6
<u>Education</u>		
Pre-university	14	9.3
University	67	44.4
Post graduate	70	46.3
<u>Occupational level / Fields of specializations</u>		
Owner/Partner	12	7.9
Project Manager	32	21.3
Director	10	6.6
Contract Manager	2	1.3
Engineer	50	33.1
Architect	7	4.7
QA/QC	7	4.6
Others	31	20.5
<u>Number of years working experience</u>		
Less than 5 years	28	18.5
5–10 years	47	31.1
10–20 years	43	28.5
More than 20 years	33	34.4

Table 5.1. (Continued)

<u>Largest project involved based on contract sum (percentage)</u>	
Less than 10 millions	21
10 millions–50 millions	26
50 millions–200 millions	31
More than 200 millions	22

5.3. Analysis of Result

The primary data collected from the first and second part of the questionnaire was analyzed from the perspective of clients, consultants and contractors. Each individual causes perceived by all respondents was computed for both within the groups of factors and for overall analysis.

The relative importance index, RII, was computed for each cause to identify the most significant causes. The causes were ranked based on RII values. From the ranking assigned to each cause of delays, we were able to identify the most important factors.

5.3.1. Project Based Causes of Delays

Construction planning is a fundamental and challenging activity in the management and execution of construction projects. A good construction plan is the basis for developing the budget and the schedule for work. Therefore, In Part I some of the questionnaire was designed in order to evaluate the importance of project management in Turkey.

According to the data obtaining from Part I, %95 of companies make a plan before starting the project, %67 of all participant using CPM, Critical Path Method, for the planning phase and also %82 of participants that involved in survey mentioned that planning software is generally used in their companies. In addition %76 of companies employ permanent planning engineers for their projects.

It is also indicated that %72 of project manager give weight to the project management and %50 of participants taking place in construction sector thought that project management is essential in order to reduce delays and overruns.

In this part, it was also asked participants to specify the period of project that they involved in and regarding this period how long the mentioned project was subjected to time overruns. These data are important to reflect the possible delays for further projects in Turkey.

Table 5.2. gives the breakdown of these periods and their time overruns obtaining from past experienced of participants.

Table 5.2. Time periods of projects and their time overruns

Less than 1 year				
1-2 months	2-3 months	3-5 months	5-7 months	>7 months
%63	%19	%12	-	%6
Between 1–2 year				
1-3 months	3-6 months	6-9 months	9-12 months	>12 months
%31	%45	%14	%7	%3
Between 2–4 year				
1-4 months	4-7 months	7-10 months	10-15 months	>15 months
%8	%37	%22	%24	%9
More than 4 year				
1-5 months	5-8 months	8-12 months	12-18 months	>18 months
%16	%12	%20	%24	%28

It was shown in Table 5.2 that delay occurs frequently in both public and private projects in Turkey especially for medium and large size projects and the extent of delay is severe, especially for short and long duration projects.

Participants also specified the possible risks of delays according to the project characteristics such as type of project delivery, type of owner and also type of project.

The respondents' perceptions regarding these features have been summarized in Table 5.3.

Table 5.3. Risk distribution of delay (type of project delivery, owner and project)

Type of Project Delivery			
Design-Build	Design-Bid-Build	Build OperateTransfer	Others
%35	%30	%23	%12
Type of Project			
Building	Industrial	Highway	Infrastructure
%14	%15	%12	%12
Dam/Water Resources	Commercial Building	Marine Structures	Other
%13	%11	%12	%11
Type of Owner			
Public Authority	Municipality	Private Sector	PublicPrivatePartnership
%30	%22	%26	%22

5.3.2. Factors and Groups that Causes Delays

In order to evaluate the delay causes by each party independently, the contractors', consultants', and owners' data were separated and analyzed individually. This process is also useful in order to determine the degree of agreement between each party's responses. The importance index was calculated for each party for all delay causes and the delay causes were ranked accordingly within the each group.

5.3.2.1. Factors of Finance Related Delays. It can be seen from Table 5.4. that there is no difference in the ranking orders between the parties. The four financial factors agreed by the owners, contractors and consultants causes delays were; contractor's progress payment by owner, financing by contractor during construction, financial fluctuation (floating exchange rate, inflation), partial payments during construction respectively in ranking.

As to the other three factors, delays in contractor's progress payment by owner have become more frequent for all three parties in construction industry. Failure to

provide sufficient funding resources to contractors for the job had done will make it difficult for the contractors to meet project objectives. Contractor and subcontractors without having a good payment could easily lose their control over cash flow and fall into trap of high interest loans that may subsequently cause collapse.

Table 5.4. the result of factors of finance related delays

Factors of Financial Related Delays		Owner		Consultant		Contractor		Overall	
		R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
F1	Financing by contractor during construction	0.88	2	0.82	2	0.87	2	0.85	2
F2	Delays in contractor's progress payment by owner	0.92	1	0.85	1	0.90	1	0.89	1
F3	Partial payments during construction	0.59	4	0.63	4	0.67	4	0.63	4
F4	Financial fluctuation (floating exchange rate, inflation)	0.82	3	0.76	3	0.77	3	0.78	3

Figure 5.1. shows the mapping charts for the factors of financial related delay based on the relative important index.

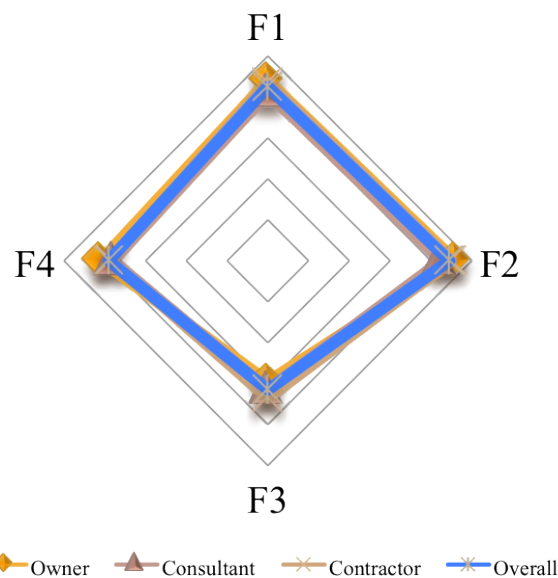


Figure 5.1. Mapping charts for the factors of financial related delays

5.3.2.2. Factors of Labor Related Delays.

Table 5.5 The result of factors of labor related delays

Factors of Labor Related Delays		Owner		Consultant		Contractor		Overall	
		R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
L1	Shortage of labor	0.90	1	0.91	1	0.77	2	0.85	1
L2	Less labor productivity	0.86	2	0.83	2	0.75	3	0.81	2
L3	Labor and management relations	0.80	3	0.74	3	0.77	1	0.77	3

According to the table Table 5.5., there is nearly no difference in the ranking orders. Shortage of labor seems one of the most important factors in this group. It was surprised that contractors who directly employ workers rate the “less labor productivity” factor as a less critical factor than the others.

Mapping charts for the factors of labor related delay based on the relative important index is shown in Figure 5.2.

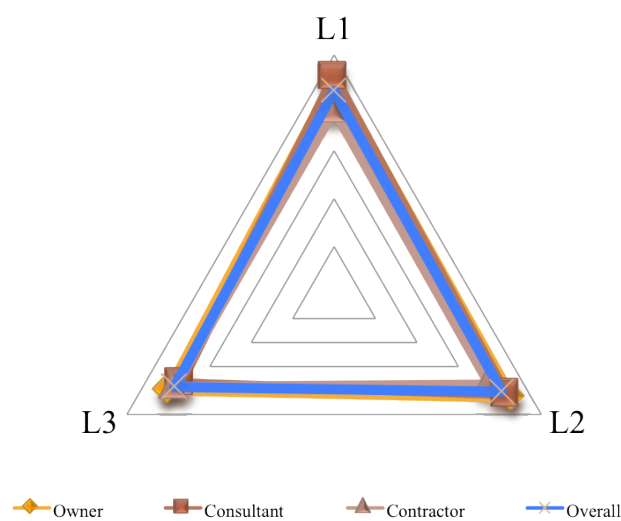


Figure 5.2. Mapping charts for the factors of labor related delays

“Less labor productivity” factor took place in second, whereas “labor and management relations” was ranked the less important factor in overall ranking within this group. Sufficient construction workers are available in Turkey, but the main problem is finding and hiring the skilled and qualified workers.

5.3.2.3. Factors of Changes/Revision Related Delays. “Suspension of the project by owner” and “design changes by owner or his agent” during construction is the common critical factors that all the parties ranked in this group. “Mistakes in soil investigation” ranked sixth in the owner and fifth in the consultant category whereas it ranked third in the contractor category. This is not unexpected because contractor face with soil conditions in the site and this factor can be claimed by contractor on the other parties. “Lack of facilities on construction site” ranked as the lowest critical common factor for all parties. The other result of changes/revision related factors can be followed Table 5.6.

Table 5.6. The result of factors of changes/revision related delays

Factors of Changes/Revision Related Delays		Owner		Consultant		Contractor		Overall	
		R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
R1	Design changes by owner or his agent during construction	0.80	2	0.85	2	0.79	2	0.81	2
R2	Suspension of the project by owner	0.91	1	0.89	1	0.88	1	0.90	1
R3	Design errors made by designers	0.78	4	0.77	4	0.78	5	0.78	3
R4	Foundation conditions encountered in the field	0.77	5	0.74	6	0.78	4	0.76	5
R5	Lack of facilities on construction site	0.70	7	0.66	7	0.71	7	0.69	7
R6	Mistakes in soil investigation	0.75	6	0.75	5	0.79	3	0.76	6
R7	Errors due to lack of experience	0.78	3	0.78	3	0.77	6	0.77	4

Figure 5.3. shows the mapping charts for the factors of changes/revision related delay based on the relative important index.

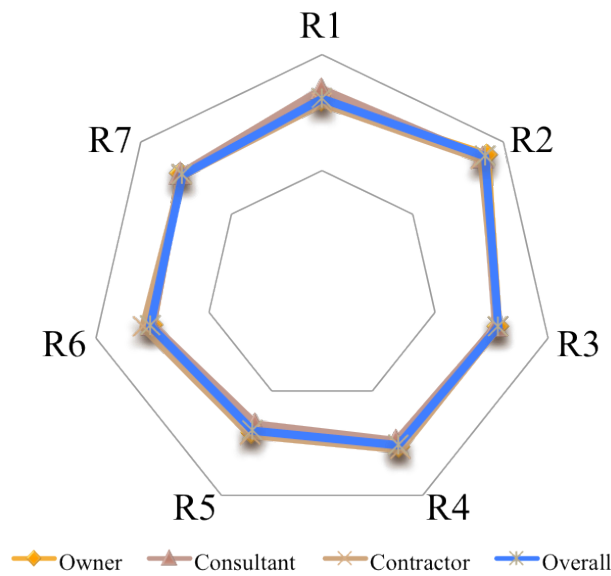


Figure 5.3. Mapping charts for the factors of changes/revision related delays

5.3.2.4. Factors of Contractual Related Delays. In this contractual related group, the five most important factors almost agreed by the owners, contractors and consultants are “unrealistic project duration”; “slowness of the owner decision making process”; “controlling subcontractors by general contractors in the execution of work”; “insufficient original contract duration”; “nonutilization of professional construction/contractual management”

“Nonutilization of professional construction/contractual management” is ranked as the fifth most important factor that cause of delay in the all parties result. It was clearly seen from this point that less paying attention are given in project management in Turkey; however it is thought one of the critical factors that hinder cost and time overruns especially for developing countries.

“Project delivery systems used (design-build, general contracting, turnkey etc.)” and “insufficient penalties for delays” are thought uncritical factors for delay. Table 5.7. can follow the other factors.

Table 5.7. The result of factors of contractual related delays

Factors of Contractual Related Delays		Owner		Consultant		Contractor		Overall	
		R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
C1	The relationship between different subcontractors' schedules in the execution of the project	0.75	8	0.79	4	0.70	10	0.75	7
C2	Unrealistic project duration	0.86	1	0.87	1	0.88	2	0.87	1
C3	The conflict between contractor and consultant	0.76	7	0.71	10	0.72	8	0.73	8
C4	Slowness of the owner decision making process	0.83	2	0.85	2	0.90	1	0.86	2
C5	Poor organization of the contractor or consultant	0.77	6	0.75	8	0.74	6	0.75	6
C6	Nonutilization of professional construction/contractual management	0.78	5	0.77	5	0.75	5	0.77	5
C7	Project delivery systems used (design-build, general contracting, turnkey etc.)	0.70	11	0.67	12	0.68	11	0.68	11
C8	Insufficient penalties for delays	0.65	12	0.63	11	0.59	12	0.62	12
C9	Insufficient original contract duration	0.80	3	0.76	7	0.79	4	0.78	4
C10	Difficulty of coordination between various parties	0.74	9	0.77	6	0.65	7	0.72	10
C11	Legal disputes between various parties in the construction project	0.74	10	0.72	9	0.71	9	0.72	9
C12	Controlling subcontractors by general contractors in the execution of work	0.80	4	0.83	3	0.81	3	0.81	3

Mapping charts for the factors of contractual related delay based on the relative important index is shown in below Figure 5.4.

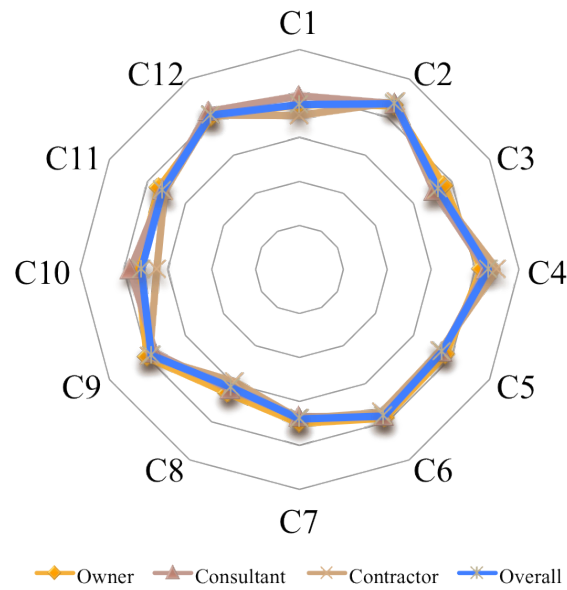


Figure 5.4. Mapping charts for the factors of contractual related delays

5.3.2.5. Factors of Environmental Related Delays.

Table 5.8 the result of factors of environmental related delays

Factors of Environmental Related Delays	Owner		Consultant		Contractor		Overall	
	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
Adverse weather conditions	0.69	2	0.67	2	0.65	2	0.67	2
Unexpected weather /climate conditions (Hurricane, Flood etc.)	0.73	1	0.77	1	0.65	1	0.72	1

This group involved two natural factors; “unexpected weather/climate conditions (Hurricane, Flood etc.)” was placed firstly and adverse weather conditions was ranked secondly. The respondents ranked the geological condition factor generally low. Unexpected weather / climate conditions (Hurricane, Flood etc.) and adverse weather conditions are the most difficult and unknown factors because they cannot be controlled and estimated in a short period. In Turkey, the effect of these natural factors may not be very significant, but it is worthy of consideration especially for contractor depending on where the construction is occurred.

Figure 5.5. shows the mapping charts for the factors of equipment related delay based on the relative important index.

5.3.2.7. Factors of Rules/Regulations Related Delays.

Factors of Rules & Regulations Related Factors		Owner		Consultant		Contractor		Overall	
		R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
RR1	Obtaining permits from municipality	0.86	1	0.85	2	0.79	1	0.83	1
RR2	Excessive bureaucracy in project owner operation	0.82	2	0.77	1	0.77	2	0.79	2
RR3	Building codes used in the design of the projects	0.71	3	0.77	4	0.73	3	0.74	3
RR4	Changes in laws and regulations	0.67	4	0.65	3	0.70	4	0.67	4

Table 5.10. The result of factors of rules & regulations related delays

Contractor and owner rank “Obtaining permits from municipality “and” excessive bureaucracy in project owner operation the most critical two factors in this group. It was not surprised because contractors and owners are generally struggling to obtain required permits neither from municipality or public authority. “Changes in laws and regulations” seems the less important factor in this group.

On the other hand, government or public authorities have tried to help the investors especially who invest in large and mega projects. However, bureaucracy and corruption are hardly eradicated. Bureaucracy and corruption process have to be reduced for more investment projects in Turkey.

Mapping charts for the factors of rules & regulations related delay based on the relative important index is shown in below Figure 5.6.

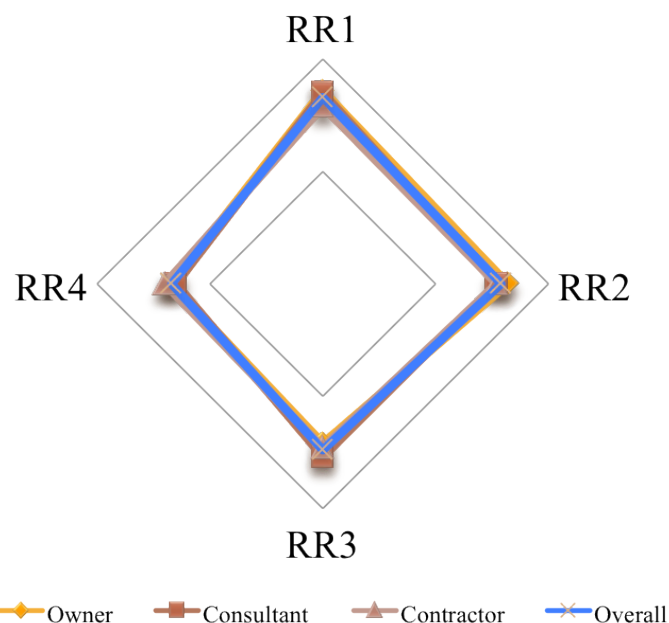


Figure 5.6. Mapping charts for the factors of rules & regulations related delays

5.3.2.8. Factors of Material Related Delays. There is no difference in the ranking orders in each parties; “Slow delivery of materials”; “shortage in construction material” are the top two causes of delays in overall. “Imported materials and plant items” and “materials changes in types and specifications” follow these two factors.

Table 5.11. The result of factors of material related delays

Factors of Material Related Factors		Owner		Consultant		Contractor		Overall	
		R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
M1	Shortage in construction materials	0.85	2	0.82	2	0.87	2	0.78	2
M2	Slow delivery of materials	0.90	1	0.85	1	0.90	1	0.84	1
M3	Materials changes in types and specifications	0.77	4	0.63	4	0.67	4	0.76	4
M4	Imported materials and plant items	0.82	3	0.76	3	0.77	3	0.77	3

Figure 5.7. shows the mapping charts for the factors of material related delay based on the relative important index.

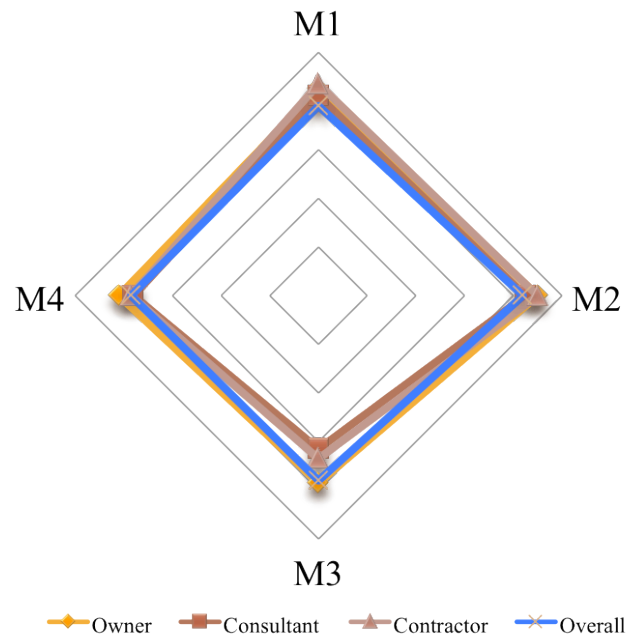


Figure 5.7. Mapping charts for the factors of material related delays

The established bureaucratic structures in material procurement processes in developing countries like Turkey seem to hinder the easy flow of construction materials. In Turkey, the processing of an order can take from a week to several months especially in national custom clearance departments if the materials have to be imported for the specific project like refinery construction.

Project procurement involves the development of contract strategy, the management of contracting activities from initiation such as project and contract definition, market study through tendering process, contract documentation to contract performance, management and administration after contract award. However, the effective material procurement management seem one of the essential duty especially for the contractors, the project team of owner, consultants and contractors should join to establish proper material procurement strategy and methods in order to remove all the obstacles in the material procurement.

5.3.2.9. Factors of Project Management & Control Related Delays. The owner, consultant and contractor identified “Inadequate early planning of the project” as the top cause of delay in this group. “Lack of experiences and information preparing in price

quotation” was ranked second by the owner and contractor whereas this factor was ranked as sixth by consultant. “Lack of training personnel & management support to model the construction operation” factor took place in third in overall ranking. The owners, contractors and consultants saw “Lack of database in estimating activity duration and resources” factor within the first five most important factors that were almost agreed. “Accidents during construction”, “staffing problems” thought as uncritical factors in overall ranking, however “staffing problem” was ranked ninth by contractor, it is probably because of managing many workers in the construction site. The other ranked factors can be followed by the Table 5.12.

Poor construction management can produce deficiencies in the contractor's plan, cost control, and overall site management due to the absence of specialization, lack of adequate experience training at the senior management level and inadequate technical manpower. However less concern was still being given to project management in Turkey.

Mapping charts for the factors of rules & regulations related delay based on the relative important index is shown in Figure 5.8.

Table 5.12. The result of factors of Project Management & Control Related Delays

Factors of Project Management Control Related Delays		Owner		Consultant		Contractor		Overall	
		R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
P1	Lack of database in estimating activity duration and resources	0.77	5	0.79	4	0.70	5	0.75	4
P2	Inadequate early planning of the project	0.87	1	0.91	1	0.79	1	0.86	1
P3	Lack of training personnel & management support to model the construction operation	0.78	4	0.81	3	0.76	3	0.78	3
P4	Inspection and testing procedures used in the project	0.68	10	0.71	8	0.61	8	0.67	10
P5	Application of quality control based on foreign specification	0.73	8	0.68	10	0.63	7	0.68	8
P6	Accidents during construction	0.67	11	0.73	7	0.57	11	0.65	11
P7	Preparation and approval of shop drawings	0.70	9	0.69	9	0.75	4	0.71	6
P8	Waiting for sample material approval	0.74	7	0.67	11	0.66	6	0.68	9
P9	Staffing problems	0.66	12	0.57	12	0.59	9	0.61	12
P10	Inadequate project information	0.77	6	0.77	5	0.53	12	0.69	7
P11	Lack of experiences in project management and scheduling process	0.81	3	0.81	2	0.57	10	0.73	5
P12	Lack of experiences and information preparing in price quotation	0.86	2	0.77	6	0.78	2	0.80	2

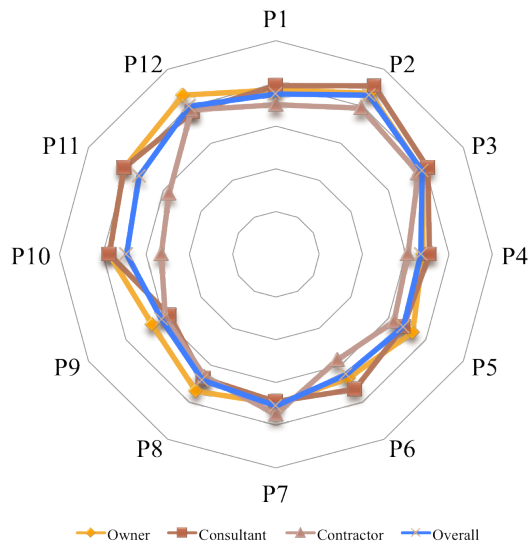


Figure 5.8. Mapping charts for the factors of project management /control related delay

5.3.2.10. Ranking of Factors that Cause Delays.

Table 5.13. The ranking result of factors that cause delay

Delay Factors	Overall		Owner		Consultant		Contractor		Related Group
	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	
Suspension of the project by owner	0.90	1	0.91	2	0.89	3	0.88	3	Changes/revision
Delays in contractor's progress payment by owner	0.89	2	0.92	1	0.85	5	0.90	1	Financial
Unrealistic project duration	0.87	3	0.86	8	0.87	4	0.88	4	Contractual
Slowness of the owner decision making process	0.86	4	0.83	13	0.85	6	0.90	2	Contractual
Inadequate early planning of the project	0.85	5	0.87	6	0.91	1	0.79	14	Project Man./ Cont.
Financing by contractor during construction	0.85	6	0.88	5	0.82	12	0.87	5	Financial
Shortage of labor	0.85	7	0.90	3	0.91	2	0.77	18	Labor
Slow delivery of materials	0.84	8	0.90	4	0.85	9	0.90	13	Material
Obtaining permits from municipality	0.83	9	0.86	9	0.85	8	0.79	9	Rules / Regulations
Design changes by owner or his agent during construction	0.81	10	0.80	20	0.85	7	0.79	7	Changes/revision
Less labor productivity	0.81	11	0.86	7	0.83	10	0.75	24	Labor
Controlling subcontractors by general contractors in the execution of work	0.81	12	0.80	22	0.83	11	0.81	6	Contractual
Lack of experiences and information preparing in price quotation	0.80	13	0.86	11	0.77	27	0.78	15	Project Man./ Cont.
Shortage in equipments	0.79	14	0.86	10	0.81	15	0.72	29	Project Man./ Cont.
Excessive bureaucracy in project owner operation	0.79	15	0.82	16	0.77	24	0.77	17	Rules / Regulations
Financial fluctuation (floating exchange rate, inflation)	0.78	16	0.82	14	0.76	29	0.77	16	Financial
Design errors made by designers	0.78	17	0.78	23	0.77	20	0.78	8	Changes/revision
Lack of training personnel & management support to model the construction operation	0.78	18	0.78	26	0.81	13	0.76	23	Project Man./ Cont.
Insufficient original contract duration	0.78	19	0.80	21	0.76	30	0.79	12	Contractual
Shortage in construction materials	0.78	20	0.85	12	0.82	25	0.87	30	Material

Table 5.13 (Continued)

Imported materials and plant items	0.77	21	0.82	17	0.76	33	0.77	22	Material
Errors due to lack of experience	0.77	22	0.78	24	0.78	19	0.77	20	Changes/revision
Slow delivery of equipment	0.77	23	0.82	15	0.79	16	0.70	34	Equipment
Labor and management relations	0.77	24	0.80	19	0.74	35	0.77	19	Labor
Poor organization of the contractor or consultant	0.76	25	0.77	25	0.75	21	0.74	25	Contractual
Foundation conditions encountered in the field	0.76	26	0.77	27	0.74	36	0.78	10	Changes/revision
Mistakes in soil investigation	0.76	27	0.75	34	0.75	31	0.79	11	Changes/revision
Materials changes in types and specifications during	0.76	28	0.77	29	0.63	32	0.67	21	Material
Poor organization of the contractor or consultant	0.75	29	0.77	28	0.75	34	0.74	27	Contractual
Lack of database in estimating activity duration and resources	0.75	30	0.77	30	0.79	18	0.70	35	Project Man./ Cont.
The relationship between different subcontractors' schedules in the execution of the project	0.75	31	0.75	35	0.79	17	0.70	37	Contractual
Building codes used in the design of the projects	0.74	32	0.71	41	0.77	28	0.73	28	Rules / Regulations
The conflict between contractor and consultant	0.73	33	0.76	32	0.71	39	0.72	31	Contractual
Lack of experiences in project management and scheduling process	0.73	34	0.81	18	0.81	14	0.57	50	Project Man./ Cont.
Legal disputes between various parties in the construction project	0.72	35	0.74	36	0.72	38	0.71	33	Contractual
Difficulty of coordination between various parties	0.72	36	0.74	37	0.77	22	0.65	42	Contractual
Unexpected weather /climate conditions (Hurricane, Flood etc.)	0.72	37	0.73	29	0.77	23	0.65	44	Environmental
Unskilled operators	0.71	38	0.76	33	0.71	40	0.68	39	Equipment
Preparation and approval of shop drawings	0.71	39	0.70	43	0.69	42	0.75	26	Project Man./ Cont.
Lack of facilities on construction site	0.69	40	0.70	44	0.66	47	0.71	32	Changes/revision
Inadequate project information	0.69	41	0.77	31	0.77	26	0.53	51	Project Man./ Cont
Project delivery systems used (design-build, general contracting, turnkey etc.)	0.68	42	0.70	42	0.67	45	0.68	38	Contractual
Waiting for sample material approval	0.68	43	0.74	38	0.67	46	0.66	41	Project Man./ Cont.
Application of quality control based on foreign specification	0.68	44	0.73	40	0.68	43	0.63	45	Project Man./ Cont.

Table 5.13 (Continued)

Changes in laws and regulations	0.67	45	0.67	47	0.65	48	0.70	37	Rules / Regulations
Adverse weather conditions	0.67	46	0.69	45	0.67	46	0.65	41	Environmental
Inspection and testing procedures used in the project	0.67	47	0.68	46	0.71	41	0.61	46	Project Man./ Cont.
Accidents during construction	0.65	48	0.67	48	0.73	37	0.57	49	Project Man./ Cont.
Partial payments during construction	0.63	49	0.59	51	0.63	49	0.67	40	Financial
Insufficient penalties for delays	0.62	50	0.65	50	0.63	50	0.59	48	Contractual
Staffing problems	0.61	51	0.66	49	0.57	51	0.59	47	Project Man./ Cont.

Based on the ranking, the five most important causes of construction delays as perceived by owners were: (1) Delays in contractor's progress payment by owner; (2) Suspension of the project by owner; (3) Shortage of labor; (4) Slow delivery of material; (5) Financing by contractor during construction.

The five most important causes of construction delays as perceived by consultants were: (1) Inadequate early planning of the project; (2) Shortage of labor; (3) Suspension of the project by owner; (4) Unrealistic project duration and (5) Delays in contractor's progress payment by owner.

The five most important causes of construction delays as perceived by contractor were: (1) Delays in contractor's progress payment by owner; (2) Slowness of the owner decision-making process; (3) Suspension of the project by owner; (4) Unrealistic project duration and (5) Financing by contractor during construction.

Within the ten most important causes, two of the causes were under the financial-related group, two were under the changes/revision related group, another two were under contractual related group, and only one cause was under labor related, material related, rules/regulations related and project management/control related group.

5.3.2.11. Ranking of Groups that Cause Delays.

Table 5.14. The ranking result of groups of factors

Groups of Delay	Owner		Consultant		Contractor		Overall	
	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
Finance related delays	0.80	4	0.77	4	0.80	1	0.79	2
Labor related delays	0.85	1	0.82	1	0.76	3	0.81	1
Changes/revision related delays	0.79	5	0.78	3	0.79	2	0.78	4
Contractual related delays	0.77	6	0.76	6	0.74	5	0.76	5
Environmental related delays	0.71	9	0.72	9	0.65	9	0.69	9
Equipment related delays	0.81	3	0.77	5	0.70	7	0.76	6
Rules/Regulations related delays	0.77	7	0.76	7	0.75	6	0.76	7
Material related delays	0.83	2	0.78	2	0.76	4	0.79	3
Project management / Control related delays	0.75	8	0.74	8	0.66	8	0.72	8

Table 5.14. summarizes RII and ranking of the categories of causes of delay as perceived by three different respondent groups. It can be seen from the table that within five groups (Labor related, material related, equipment related, finance related, changes/revision related delays) there is nearly no difference in the ranking orders of important index by owner and consultant. There is a closer consensus between consultants, owner and overall groups. However contractor ranked labor and financial related groups as the most important two factors. Rules/Regulations related delays group was seemed the less important group for all parties.

5.3.3. Effects of Delays

The primary data collected from the questionnaire was analyzed from the perspective of clients, consultants and contractors. The calculation of RII and ranking were done. Based on the ranking, the important effects of construction delay as perceived by all parties were: time overrun (RII = 0.75), cost overrun (RII = 0.72), dispute (RII = 0.68), total abandonment (RII = 0.62) litigation (RII = 0.60) and

arbitration (RII = 0.59). Table 5.15 gives the ranking of effects based on response of all respondents (owners, contractors and consultants).

Cost and time overruns have been identified as general problems in the construction industry worldwide, Turkey is no exception, however the degree of the problem varies from one country to another.

Table 5.15. The ranking result of effects of delays factors

Effects of delay factors		Owner		Consultant		Contractor		Overall	
		R.I.I	Rank	R.I.I	Rank	R.I.I	Rank	R.I.I	Rank
EF1	Time Overrun	0.82	1	0.75	1	0.69	2	0.75	1
EF2	Cost Overrun	0.80	2	0.59	4	0.79	1	0.72	2
EF3	Dispute	0.74	3	0.64	2	0.68	3	0.68	3
EF4	Arbitration	0.64	5	0.56	5	0.57	6	0.59	6
EF5	Litigation	0.62	6	0.56	6	0.63	4	0.60	5
EF6	Total Abandonment	0.65	4	0.60	3	0.61	5	0.62	4

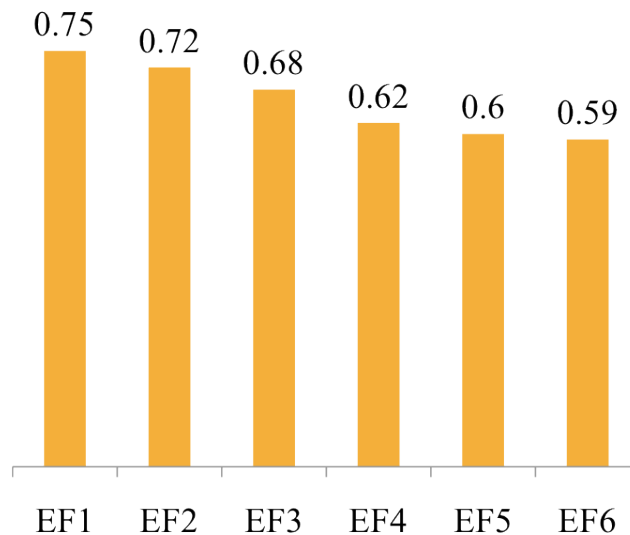


Figure 5.9. Column charts for the effects of delays

Column charts for the effects of delays on the relative important index is shown in Figure 5.9.

5.3.4 Result of the Spearman's Rank Correlation Coefficient

The Spearman's rank correlation coefficient is used to measure the degree of agreement or disagreement associated with the importance ranking of each two parties while ignoring the ranking of the third party.

Spearman's Correlation was calculated among the three parties. Correlation is a relationship measure among different parties or factors and the strength and direction of the relationship. In this research it is used to show the degree of agreement between the different parties. The correlation coefficient varies between +1 and -1, where +1 implies a perfect positive relationship (agreement), while -1 results from a perfect negative relationship (disagreement). It might be said then that sample estimates of correlation close to unity in magnitude imply good correlation, while values near zero indicate little or no correlation. The Spearman's rank correlation coefficient is used to measure and compare the association between the rankings of two parties for a single cause of delay, while ignoring the ranking of the third party. And it is calculated by the following formula:

$$r_s = 1 - [(6 \sum d^2) / (n^3 - n)] \quad (5.1)$$

where r is the Spearman rank correlation coefficient between two parties, d is the difference between ranks assigned to variables for each cause, and n is the number of pairs of rank.

Table 5.16 The Result of the Spearman's Rank Correlation Coefficients

Spearman rank correlation coefficient	Owner	Consultant	Contractor
Owner	1	0.843	0.720
Consultant	0.843	1	0.621
Contractor	0.720	0.621	1

Results show that there is relatively good agreement between each two groups of parties in ranking delay causes with the highest degree of agreement (about 84.3%) between owners and consultants, while, the lowest degree of agreement is between contractors and consultants of about 62.1%. Due to relative agreement between each group of parties in ranking causes, results of this study can be dependable.

Consultant and contractor, which resemble the conflicting views especially because of drawing and change orders, had opposing views between two parties. Within this study, the position of the consultant was seen as more favorable to the owner that might be due to the contractual relationship between them.

5.4. Identify the Causes of Delays

The groups of delay causes were analyzed based on the overall results. This section identifies the results obtained in the earlier section. The results obtained by analyzing the causes of delays and the effects of the delays will be discussed.

5.4.1. Financial Related Delays

Financier-related causes are problems in the financing domain. Financing could be expected to get a serious problem especially for contractors, when they are not paid regularly. Irregular payment, especially for public projects in Turkey is one of the major cause of liquidity problem for contractors. Arditi et al.[35] carried out a survey to find out causes of delay in Turkey in 1985. In this study, contractors's difficulties in receiving montly payments from public agencies ranked as a second important reason for delays in public project.

Financing and payment of the project are the most important obligations for the owner. Owners sometimes have a difficulty in obtaining loans due to high and unstable rates. In some contract regulations and conditions, owner can withhold the contract award if the project is not appropriately funded. Before accomplishment of the contract, the contractor may be entitled to proof that the owner has made sufficient financial

organization. Once the contract has been awarded, delays resulting from the owner's financial problems, or the failure to pay the contractor amounts properly due, are the owner's full responsibility. It is generally known that, if the contractor can prove that the project was delayed because the owner delayed obtaining the required financing, the owner will not be entitled to liquidated damages for his period. The contractor, at the same time, may also be entitled to additional costs if the delayed payment caused the work to be stopped and restart later when payments were able to be made. In worst case, delay in payment may permit the contractor to terminate the contract.

The economic risk in Turkey, including inflation and sudden changes in prices, seems one of the highest risk in the construction industry. This relates to the risk of price increases during the construction phase. Another risk relates to the fluctuating exchange rates that have a deep effect on the profitability of the project. While, Turkish economy continued with decreased inflation and interest rates, the high oil prices closely linked with rebar prices and unstable floating exchange rate are the most obstacle factors that makes difficulty in estimating for price quota.

5.4.2. Labor Related Delays

Construction workers are the ones who carry out the work in a company, and they can be an important factor in making the company either profitable or bankrupt and also causing delay. With this concept in mind, companies should be more considerate to their workers, and pay more attention to human relations within their organizations. The management of workers welfare and human behavior can also play a vital role in both developing behavior among the workers and productivity of any construction organization. In addition, the employee turnover and wastage is an extremely important issue for construction companies in Turkey. Hereby, construction managers are also responsible for selecting, managing, distributing, organising, and putting to use all of work resources.

Labor productivity is another factor that might lead to delay. Kazaz et al. [39] carried out a study to find out factors influencing construction labour productivity in Turkey. The study was examined in four main groups constituted from organizational,

economic, physical, and socio-psychological factors. The most effective factor among them was statistically determined as the organizational factors, followed by economic, physical, and socio-psychological factors. It can be easily seen that organizational factors unexpectedly have a stronger effect than economic and socio-psychological ones. It is also clear that the importance of organizational management is now perceived at the top level in developing countries.

Motivation also affect labor productivity. Zakeri et al.[40] made a survey to locate motivation factors among the workers in Iran. Motivation factors among Iranian construction operatives have been identified in this survey and ranked as following; The first five most important motivation factors are, in descending order: fairness of pay, incentive and financial rewards, ontime payment, good working facilities and safety at work.

On the other hand, over staffing at the work place can result in serious cost implications and provide increased opportunities for unnecessary worker interference. This could also be a disruptive condition that can impair construction productivity.

The nonavailability or the shortage of skilled manpower in the construction industry in Turkey had compelled contractors to modify the method of construction. This lack is more likely to occur in complex projects.

Generally, delays due to inadequate labor force are classified as a inexcusable delay. If there is a labor shortage of a particular trade in the local market and the contractor diligently seeks for workers, the resulting delay may not be excusable. Sometimes the contactor may try to blame for the labor shortage on the owner, such as getting permission to some critical sites, like refinery construction and delay for this process. Costs of labor problems caused by the owner may be compensable.

5.4.3. Change/Revision Related Delays

Most construction contracts give the owner the right to make changes within the general scope of the contract without invalidating or breaching the contract. The changes may be directed by the owner or its agent. Generally making such changes, the owner also may be responsible for the impact upon the constructor's time and cost of performance.

Hanna et al.[41] mentioned that small projects run in a small time line, therefore there is usually little or no time for design before the construction starts. This causes more design changes and change orders that impede the project. The average percent design complete prior to construction for small projects is 20,9 less than large projects. It is estimated that the United States construction industry spends \$13–26 billion in one year for construction change orders. The total cost of project change could reach \$50 billion dollars annually with the additional financial resources spent on claims and legal disputes.[42]

Many analyses showed that design fees are often less than 10% of the total construction costs, however the design is the single most important influence on those costs. Changing in the decisions and commitments made during the design phase have a deep impact on later expenditures. Owners and their designers slow in decision and inadequate information given by owners that resulting contractors wasting resources may also cause the time overruns.

Change orders tend to occur more often in private projects than public sector, because private owners are in the habit of changing plans parallel with the changing economic climate, to meet customer demands or for marketing reasons. Owner requests for changes are usually made at short notice, thereby impacting contractor's plans. Some change orders can be large magnitude changes requiring extensive redesign.

Defective designs and incomplete drawings is one of the general acceptance that cause major delays. The design might not be complete or include many mistakes or may

be not constructable. The majority of delays were traced to inconsistent detailing of drawings. Designers maybe rushed to complete the design phase by owners in order to early start. Another risk is the deficiencies in drawings and specifications. This risk relates to the quality of drawings and specifications produced by the design professional.

Mendelsohn [43] surveyed that probably 75% of the problems encountered on site were generated at the design phase. He also briefly mentioned that a designer has a conceptual mind and a contractor has a concrete mind. One relates to intangibles and the other relates to tangibles.

There is a considerable difference of opinion among owners and designer regarding who bear the responsibility for unforeseen physical conditions encountered during construction. Many owners make no representation in their contract documents that conditions indicated by the bidding documents will actually be encountered, then all risk of initial interpretation and later change assigned to the contractor. However, if the owner attach the geotechnical design summary report for complex underground or sub-surface projects into the tender documents in order to establish baseline geotechnical conditions which will become the basis for the contractor, then the contractor accepts full price risk for the site conditions.

5.4.4. Contractual Related Delays

A contract is an agreement, usually between two parties, that is enforceable by law. Once a contract has been written, issues may arise which the parties to the agreement can not satisfactorily resolve between themselves. All construction contracts involve an element risk, and one of the important functions in preparing for construction contracts is the assessment of risks, and the use of various legal and commercial techniques of managing the risks. Risk management is the art of applying management skills to minimize the risks in a both private and public construction project.

Majority of construction works are carried out through written contracts. The most public projects in Turkey used to follow the standard contract conditions formulated by the two government organisations namely Kamu Ihale Kurumu (KIK), and MSB (Milli Savunma Bakanlığı) till recently. FIDIC conditions were introduced in recent two decades for some complex public works on the insistence of the funding agencies like World Bank or European Union.

K.C. Iyer et al. [26] mentioned that the contract language is considered difficult to comprehend and they are therefore a major source of disputes. With the both increasing size and complexity in nature of projects the contract conditions tend to be more complicated, which is more likely in turn add to number of disputes and further more delays.

Current construction projects are complex efforts requiring the support of the design and construction profession. Therefore, a realistic time for project execution will decrease the possibility of disputes between owner and the contractors [11]. Especially for the public projects in Turkey the realistic time is greater than the time specified in the contract. Therefore, time extensions are granted for many reasons, such as designer changes or errors, user changes, weather and late deliveries.

Construction contracting is extremely time sensitive. Owners lose opportunity and profits waiting for completion of late projects. Similarly, when projects are late to complete, contractors carry the financial burden of maintaining field and office personnel beyond dates anticipated at the time the project was priced. In today's competitive marketplace, few owners or contractors can afford the cost of late projects.

Since time is important in many construction contracts, it might be expected that bonuses for early completion and penalties for late completion of work would be a common feature of those contracts, but it seems they are not. For many projects, owners shift at least part of the risk of late completion onto contractors. The most common form of risk shifting is the inclusion of a liquidated damages provision in the construction agreement. Liquidated damages are damages defined in the construction contract and

chargeable against funds due the contractor fails to complete the project beyond the contract completion date. Hence, a liquidated damage provision provides a straight forward method of calculating damages recoverable by an owner in the event of late completion. Whereas liquidated damages must be related to the actual damages incurred by an owner due to late completion of the work, there is no such necessary relation with the penalty. A penalty is like a fine or monetary punishment for late completion, and likewise a bonus is a monetary reward for early completion.

Due to the increased complexity of the project in recent years and the highly competitive nature of the construction industry, a construction project is generally executed by several subcontractors. For instance, it is common for construction project to involve many subcontractors working on the same site in the same time period. Therefore, effectively managing the numerous subcontractors is also one of the crucial challenge for the general contractor and for its site managers in order to ensure project completion timely.

Subcontractors can contribute to the construction process for as much as 90% of total project value [44]. Managing subcontractors does not simply involve asking them to allocate resources (labor, material, and machinery/equipment) into the job site whenever an activity is scheduled, and then pushing them to speed up the work without a clear consciousness of schedule risk. Factors or uncertainties such as weather, labor, site conditions, material delivery, and equipment breakdown can influence the time performance of subcontractors, affecting total project duration.[45]

K.C. Iyer et al.[26] mentioned that the drawings also play an important role in the contract documents. Different types of contracts are in practice, where, the drawings are not only the responsibility of the owner. The contractor may be required to prepare the drawings (as in design-built project) which are then checked by the owner. They can cause three situations: delay from contractor's side in preparation; delay from the owner's side in checking; and delay from both the parties. For the first two cases, the responsibility of delay is easily ascertained while in the third situation which is more likely create case of concurrent delay, the claim has to be resolved using apportionment. In case, the supply of drawings is the owner's responsibility and if the notice

requirement is not submitted by contractor, the contractor forfeits his rights of getting compensation. On the other hand, if the owner does not respond to such notice, it is assumed that owner is aware of the consequences.

Contract delivery method might also leads to delay. Therefore, choosing appropriate delivery method by owner is one of the most essential point in order to set and delivery the risk among each parties including construction project. There are several types of construction contracts and methods of construction delivery that are used in Turkey. The differences between types of contracts primarily lie in who takes the risk, who has to pay for cost over runs, and who keeps the savings if the project costs less than the estimate. In a major construction project, some or all of the different types of contracts may be used. There may be one type of contract between the owner and the primary contractor and different types of contracts between the primary contractor and the sub-contractors.

The Design-Bid-Build is one of the traditional method of delivery system that design works by a team of architects and engineers and then advertise the plan to solicit bids from construction firms. The winning firm becomes the general contractor, responsible for overall completion of the project using the firm's own employees, sub-contractors, or a combination of both. The design and construction phases of the project are clear and distinct. A complete set of design documents is finished before the contractor becomes involved. There are several advantages to this process. First of all it has been around for a long time and is well understood. The design documents must be thorough and complete which lessens the chance of misunderstandings which means that in the construction phase contractor is probably not be faced with some difficulties in drawings. Therefore this delivery method seems to lessen the time related delays. On the other hand, this method takes the greatest amount of time to complete so that sometimes it can not be profitable on owner's part especially for complex and facilities project, like hospital or refinery. Design-Bid-Build is most frequently done using a lump sum bid contract, but guaranteed maximum price is also sometimes used.

Another delivery method is Design-Build that is very old method. In this process the owner selects one contractor to both design and build the project. The owner selects a contractor who then hires the design team as required. Design-Build is primarily intended to save time. Because the designers and contractors work together from the beginning, the design effort can be substantially reduced. It is not necessary to prepare drawings in great detail if the contractor already understands what needs to be done. Time is saved by using a fast track delivery method, where the contractor begins working on each phase of the construction as soon as the design for that phase is complete. Ideally the designers complete the next phase just as the contractor is ready to start that phase. There may be some slight savings in design costs. Since the owner and the contractor commit to a cost before design is started, there is an amount of uncertainty which will more likely to cause delays associated cost and time.

Construction Management is a relatively new method of delivery in which the owner hires a construction professional early in the design phase. The construction manager works with the design team to help ensure that the design is something that can in fact be built for a reasonable cost and that the contractors will be able to understand the design drawings and specifications. This can result in a reduction of the total design effort similar to what occurs in Design-Build. The great advantage of construction management is its emphasis on teamwork, and the fact that a contractor is involved in the design and decision making process almost from the start. Another advantage is that the owner can often be more involved in the selection of sub-contractors if so desired. Therefore, not so many change orders is claimed among the parties, meanly less delays are occurred.

5.4.5. Environmental Related Delays

Adverse weather conditions can affect outside activities in construction projects. In the summer, especially South part of Turkey, the weather conditions are hot and severe. Work productivity during that period might be low. In addition, it is very difficult to perform certain construction activities, such as concreting, during that period. On the other hand, the east side of Turkey face with adverse weather conditions.

When weather conditions vary, the contractor needs to adjust the construction schedules accordingly. On the designer's part, the weather also plays a role in shaping the entire design scheme.

Most construction contracts do not excuse all delays caused by weather conditions. All types of weather conditions may impact the contractor's performance: rain, abnormal humidity, frozen earth, winter weather, extreme heat and summer weather. However the occurrence of unusually severe weather conditions may not be always entitle the contractor to an extension of time; the contractor may need to demonstrate that the weather caused a delay to the contract work. If the weather does not actually delay the contractor, no time extension is due.

5.4.6 Equipment related delays

Construction equipment is one of the most important physical assets in construction companies. It plays an important role in construction operations and constitutes a major portion of construction projects.

Construction equipment management is also one of the critical factor that might cause time and cost overruns. Equipment management includes purchase, retirement, replacement, operations, logistics, and maintenance of equipment. The objective of the construction firm should be to minimise operation, maintenance, and repair costs, while achieving high utilisation of the construction equipments.

In the event of running several projects at the same time, delay might be occurred due to the lack of equipment or equipment management related problems. For example, if multiple small projects are running at the same time or if a large project is governing the small one, the equipment and labor are usually shared in which the priority is often given to the large projects.

Equipment supply in Turkey construction industry is generally better than other resources as there are many foreign and local equipment sales and hire companies

5.4.7. Rules & Regulations Related Delays

There is also a risk of delays in obtaining permits and approvals from the concerned government entities. Delays associated with government authorities are taken time in granting permits. Especially obtaining the permits from local public authority in Turkey takes more time due to requiring lots of regulations. Therefore, construction projects can be delayed by permit problems.

In the typical construction contract, the contractor has the responsibility of obtaining and paying for building permits, government inspection, and licenses. Generally, it is the owner's responsibility to obtain all other approvals and or resolve design problem that affect the required governmental approvals.

The political risk involves war threats and political instability. Political risk identification, measurement, and management are key to successful international construction contracting. Multinational contractors are particularly sensitive to quick, unexpected change in the political environment that affects principal cash-flow elements of their projects. In addition, unfamiliarity with government regulations would make the project difficult to execute for foreign investors or cause delays.

5.4.8. Material Related Delays

Materials management plays a critical role especially for imported material and plant items. Materials purchases for most of the sites surveyed were made by the head office whereas, few sites could purchase materials directly in emergencies.

The changes in material types and specifications can occur quite frequently in the construction phase which may eventually affect the project completion. Material changes may be based on a personal propensity to create change. Hence the cause of such inconsistencies is different from that caused by the shortage of materials

The shortage of construction materials is a procurement problem that can affect the project completion. Occasionally, the shortage of materials may change the design to accommodate the new materials used as the replacement.

Procurement delays have various adverse effects on other processes in the construction cycle. Occasionally, the procurement delay may cause an entire change or replacement for originally specified materials or equipment for the project. Procurement delay may therefore cause a need for project activities to be reworked.

Material approval is a process in which the contractor gets an approval from the consultant before using the material. This may cause inconsistencies if the process is long and the contractor needs to interrupt the construction process to get the materials approved.

5.4.9. Project Management / Control Related Delays

In practice, project management has focused on maximizing performance in terms of time, costs and quality. In recent years more attention has been paid to manage the project in the construction sector in the world. However in Turkey, great attention has not been paid to the organizational structures of each participant.

Mustapha and Naoum[4] mentioned on their study that the construction management is getting tougher. Projects are becoming much more complicated and difficult and the industry's managers are facing unprecedented changes, exemplified by changes in commercial practices, new technology, a shift in social attitudes, new contractual procedures and, of foremost importance, clients who are now much more sophisticated and knowledgeable and placing the emphasis more than ever, on tight completion dates and higher quality standards. And their statistical analysis showed that managerial effectiveness is mostly associated with the personal variables and job conditions.

Communication among the parties decrease undesirable delays. Construction project traditionally involves two major professionals in the construction industry. These two professionals are the designer and the contractor. Communication for the effective coordination between these two parties is the key factor to be considered for the successful completion of a project. It is postulated that disagreements between these two parties have caused barriers in the design phase and construction process.

Mostly, construction industry includes large number of small and medium sized enterprises and subcontractors which carries on its operational activity for large main contractors. The wrong subcontractor if appointed can lead to numerous losses and delays and his removal is the most depressing thing to do. Although there are advantages in adopting the subcontracting system and some strategic benefits from the use of labour subcontracting, but this system has adverse consequences for workers, companies, the industry and human resource functions.

The nature of construction industry is such that full scope of work cannot be decided at the time of tendering and change orders are inevitable for successful completion of the project. Subsurface conditions and owner's changing requirement are often unpredictable leading to extra work. Extra work is identified as a major source of delay in case of residential building projects, particularly when users and the owner/engineers are two different entities. While the owner and his agent are party to contracts and they are only authorised to communicate with the contractor, the prospective users sometimes directly give suggestions to the contractor that lead to delay. To avoid the delay related to extra work, experience plays a key role in forecasting the probable areas of extra work and incorporating the relevant clauses in conditions of contract. In case of the extra work, it should be made clear by the contractor that the contractor is not doing the work as a complimentary service, but expects the compensation for that before accepting the extra work.

In a multiplayer environment like construction, the plans and specifications must be clear and unambiguous for better understanding of the required job. Inadequate plans and specifications can cause major variations that may eventually affect project

completion. This is because a change in the plans and specifications during the construction phase requires changes in construction planning, costing, and procurement activities. If the specifications or plans are incomplete, or unclear, it will create interpretation problems which will affect the quality of the project. This creates inconsistencies at the design and construction interface.

Working drawing details are the graphical forms of communication between the designer and the contractor. To convey a complete concept of the project design, the working drawings must be clear and concise. Insufficient working drawing details may cause problems at the design and construction interface. This is because insufficient working drawing details can result in misinterpretation of the actual requirement of a project.

D G Proverbs [46] indicated that with the increasing complexity of modern construction projects, demand for efficient and competent managers in the industry grows. Managers must be able to organise both technologies and human resources.

The construction manager is the professional who manages the construction phase of a project. The construction manager carries out the construction phase in an organized way to eliminate the risks of delays and other problems. In most construction firms do not employ construction manager on site for their projects. Consequently, this may increase interface problems between the contractor and the owner.

Unfamiliarity of the parties with building codes would render the project difficult to execute. In addition, the overseas designer follows international standards such as ASTM or their own countries' standards which may differ from the local building codes of Turkey particularly in complicated project. This may cause a lack of coordination among construction professionals.

There is a risk of accidents during construction which may have negative impact on all other project objectives such as cost overruns, delays, loss of productivity and loss of morale. Accident is another source of delay when the complete project site has

been shut for sometime, or work is suspended, or on some emotional ground there is labour unrest leading to stoppage of work. The responsibility of the accident automatically assigns the responsibility of the corresponding delay. However, there are various reasons that can lead to accidents, and the main problem is to ascertain its responsibility. Although there are many unforeseeable events that could lead to the accidents. Force majeure, actions not following safety, error in the design/drawing, substandard work norms, actions of subcontractor and use of facility before its handing over might cause unwanted accidents.

The main after-effect of the accident is the loss of time as well as damage to work or workforce. These huge losses in circumstances like force majeure are to be shared by both the parties. On the other hand, if the safety considerations are given a little attention leading to accidents, the contractor is held responsible for the accident. As in case of substandard work leading to accident, it is contractor's responsibility to absorb the losses only if the work was not approved by the owner. But if the owner had approved the work, then the loss has to be borne by the owner.

5.4.10. Common Effects of Delays

Cost and schedule overruns can occur due to a wide range of causes on various types of projects. The literature reviewed showed that completing projects within time is one of the biggest challenges facing the construction industry. If risks are not managed well, schedule overruns are likely to occur. Many risks, apart from increasing costs, have the tendency to disrupt works, causing delays and hence prolonging the duration of a project. It was clear that schedule overrun risks in Turkey were significantly high all projects.

Schedule delay refers to a situation where a construction project does not come to completion within the planned period. Time is an integral part of every plan a company develops for performing contract work. There is a relationship between the schedule, the scope of work, and project conditions. Changes to any one or more of the above three can affect the compensation level and time of completion.

Due to delayed payments, project durations increased and costs escalated. It was also pointed out that due to political and other influences; the scope of works on most government-funded projects could be increased without due regard to budgetary, schedule and other constraints. Budget overruns, if not controlled, have the potential to adversely affect the completion of projects.

Time overrun on construction projects are very common. It is usually accompanied by cost overruns. These have a debilitating effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, cash-flow problems, and a general feeling of trepidation towards each other

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

This dissertation investigates the major causes of delay in Turkey's construction industry through a questionnaire survey among contractors, consultants and owners. The major objective of this dissertation was to identify problems, together with their effects which they occur and influence performance on construction projects in Turkey. Fifty-one factors were identified as a result of a comprehensive literature survey and conditions of construction sector in Turkey.

The ten top-ranked factors that cause delays in construction projects in Turkey accorded by the construction participants are as follows ; (1)Suspension of the project by owner, (2)Delays in contractor's progress payment by owner, (3)Unrealistic project duration, (4)Slowness of the owner decision making process, (5)Inadequate early planning of the project, (6)Financing by contractor during construction, (7)Shortage of labor, (8)Slow delivery of materials, (9)Obtaining permits from municipality and (10)Design changes by owner or his agent during construction.

“Suspension of the project by owner” factor ranked as a top-ranked factor. Proper costing is essential in every capital project. The initial cost estimates done by owner should be as accurate as possible. Delayed payments due to complex financial processes in owner organizations would cause financial difficulties and worst still, suspension of the projects.

Delay in payment by owner has become more frequent in this industry, contractors and subcontractors without having a good payment monitoring mechanism could easily lose their control over cash flow. Moreover, since payments may be linked with certain milestones, the plan to achieve milestones would also be important to manage the cash flow and financial control.

The owner may also have a tendency to underestimate a project duration. As a delay factor this was found to be important especially by contractors. This problem result from not having any systematic approach or procedure for setting contract duration.

Owners and their designers slow in decision result in wasting of contractors' resources. Slow decision process between parties lead to projects delayed or postponed. Moreover, it has reduced project's profits or has caused extravagance.

The financial problems of contractors is the sixth importance factor in Turkey, however, this factor is at the first rank in Hong Kong, Jordan and Nigeria. Contractors mostly advance their money for projects and just receive the payment after completing work packages or all project works. If contractors meet financial difficulties, project progression will be affected. This problem is frequent and severe in Turkey.

Shortage of labor resources component comprises "staff team spirit/morale" and "staff performance". A company consists of a team of different expertise who are playing different roles. It needs cooperation within the team to achieve the objectives. Cooperation cannot be established if staffs are working individually or without any team spirit.

Good materials management have a major role especially for imported material and plant items. Materials purchases for most of the sites surveyed were made by the head office whereas, few sites could purchase materials directly in emergencies. That process might also cause delay with time overruns. Additionally, the changes in material types and specifications can occur quite frequently in the construction phase which may eventually affect the project completion.

Public utility or private projects also require work permits to be issued by various government authorities. Difficulties in obtaining such permits is another delay factor which directly cause time overruns.

There are various reasons for design changes during the construction processes. Whenever a change order occurs, it needs to add, delete, or modify the original plans and specifications accordingly. Generally, changes in design are frequent in projects where construction starts before design is finalized. Therefore, it is important for the consultant engineer in checking, reviewing and approving the design submittals prior to construction phase. The more the skilled designer has been identified at the tender stage, the less the cost and time have paid for design-related headache arising later.

Within the groups, labor related delays was ranked the most significant groups that cause delays, followed by finance related delays, material-related delays, changes/revision related delays, contractual related delays, and labor related delays.

The effects of delays were also investigated in this dissertation. It is also found that out of six effects, cost and time overruns are the two main effects of delays in Turkey.

Due to delayed payments, project durations increased and costs escalated. Budget overruns, if not controlled, have the potential to adversely affect the completion of projects.

From the survey, it is found that cost and schedule overrun risks were significantly high on each project in Turkey. Some of these schedule overruns are so severe that they could increase the original project durations.

By foreseeing the common problems identified in this thesis and maybe others in future projects, construction participants in Turkey can both avoid delays for which they are responsible and mitigate severe effects of the other delays.

6.2. Recommendations

Based on this study, and with developing countries in mind, some recommendations in order to minimize and control delays in construction are given as follows:

Owners should give special attention to the following factors:

- Pay progress payment to the contractor on time because it can impair the contractor's ability to finance the work.
- Minimize change orders during construction to avoid delays.
- Avoid delay in reviewing and approving of design documents than the anticipated.
- Check for resources and capabilities, before awarding the contract to the lowest bidder.

Contractors should consider the following factors:

- Shortage and low productivity of labor: Sufficient number of labors should be assigned and be motivated to improve productivity.
- Financial and cash flow problems: Contractor should manage its financial resources and plan cash flow by utilizing progress payment.
- Planning and scheduling: They are continuing processes during construction and match with the resources and time to develop the work to avoid cost overrun and disputes.
- Site management and supervision: Administrative and technical staff should be assigned as soon as project is awarded to make arrangements to achieve completion within specified time with the required quality, and within the estimated budget.

Consultants should look to the following points:

- Reviewing and approving design documents: any delay caused by the consultant engineer in checking, reviewing and approving the design submittals prior to construction phase, could delay the progress of the work
- Inflexibility: Consultants should be flexible in evaluating contractor works.
- Producing design documents on time: consultant should set a schedule to complete design documents on time, otherwise result in a delay of work completion.
- Mistakes and discrepancies in design documents: They are common reasons for redoing designs and drawings and may take a long time to make necessary corrections.

APPENDIX

I.BÖLÜM	
<i>KİŞİSEL BİLGİLER / ŞİRKET BİLGİLERİ</i>	
İSİM:
SOYAD:
Firma Adı:
İletişim Bilgileri	
e-mail.....	Telefon.....
Eğitim Düzeyi	
<input type="checkbox"/> Üniversite Öncesi	<input type="checkbox"/> Üniversite
<input type="checkbox"/> Yüksek Lisans/Doktora	
Meslek	
<input type="checkbox"/> İşveren/Ortak	<input type="checkbox"/> Proje Müdürü
<input type="checkbox"/> Mühendis/Saha Mühendisi	<input type="checkbox"/> Mimar
<input type="checkbox"/> Koordinatör	<input type="checkbox"/> Kalite Kontrol
<input type="checkbox"/> Kontrat Yöneticisi	
<input type="checkbox"/> Diğer(.....)	
İş Deneyim Süresi	
<input type="checkbox"/> 5 yıldan az	<input type="checkbox"/> 5-10 yıl arası
<input type="checkbox"/> 10-20 yıl arası	<input type="checkbox"/> 20 yıldan fazla
Yaş	
<input type="checkbox"/> 20' den az	<input type="checkbox"/> 20-29
<input type="checkbox"/> 30-39	<input type="checkbox"/> 40-49
<input type="checkbox"/> 50 ve yukarı	
Uzmanlık Alanı / Alanları	
<input type="checkbox"/> Konut	<input type="checkbox"/> Altyapı
<input type="checkbox"/> Karayolu/ Ulaştırma	<input type="checkbox"/> Deniz Yapıları
<input type="checkbox"/> Endüstriyel Yapı	<input type="checkbox"/> Baraj / Su
<input type="checkbox"/> Diğer(.....)	
Organizasyondaki Yeriniz	
<input type="checkbox"/> İşveren	<input type="checkbox"/> Danışman
<input type="checkbox"/> Yüklenici	
Şirketinizde/projenizde inşaat başlamadan önce planlama yapılıyor mu ?	
<input type="checkbox"/> Evet <input type="checkbox"/> Hayır	
Projelerinizde müstakil bir Planlama Mühendisi istihdam ediliyor mu ?	
<input type="checkbox"/> Evet <input type="checkbox"/> Hayır	
Şirketinizde/Projelerinizde Planlama için bir software kullanılıyor mu ?	
<input type="checkbox"/> Evet <input type="checkbox"/> Hayır	
Planlama için Critical Path Method (CPM) kullanılıyor mu ?	
<input type="checkbox"/> Evet <input type="checkbox"/> Hayır	
Proje müdürleri projenin diğer konularına göre Planlamaya ne kadar önem veriyorlar ?	
<input type="checkbox"/> Çok önemli	<input type="checkbox"/> Oldukça Önemli
<input type="checkbox"/> Önemli	<input type="checkbox"/> Az önemli
<input type="checkbox"/> Önemsiz	
Sizce genelde Türk İnşaat firmaları Planlamaya ne kadar önem veriyorlar ?	
<input type="checkbox"/> Çok önemli	<input type="checkbox"/> Oldukça Önemli
<input type="checkbox"/> Önemli	<input type="checkbox"/> Az önemli
<input type="checkbox"/> Önemsiz	

II.BÖLÜM

Türkiye'deki İnşaat Projelerinde Gecikmeye Sebep Olan Faktörlerin ve Etkilerinin Belirlenmesi Anketi

A) PROJEYE BAĞLI SORULAR

Aşağıda kısmi iş tecrübeniz boyunca içinde yer aldığınız projelerde meydana gelmiş olan gecikmeleri göz önünde bulundurarak yanıtlayınız.

Aşağıda belirtilmiş olan projeye bağlı sorular; (a) ve (b) şeklinde iki gruptan oluşmaktadır. (a) kısmında iş tecrübeniz boyunca yer almış olduğunuz proje türlerine ait özelliklerden; (b) kısmında ise sınıflandırılmış olan proje türlerinin gecikmeye etki derecesini hemen altında verilen risk derecelendirmelerinden birini seçerek belirtiniz.

RISK SEVİYELERİ				
1	2	3	4	5
Risksiz	Az Riskli	Riskli	Oldukça Riskli	Çok Riskli

- 1.a Projeleri tiplerinden göre sınıflandırsak hangi tür projelerde yer aldınız?
Lütfen işaretleyiniz

- | | |
|---|---|
| <input type="checkbox"/> Konut | <input type="checkbox"/> Ticari Yapı |
| <input type="checkbox"/> Endüstriyel | <input type="checkbox"/> Altyapı |
| <input type="checkbox"/> Karayolu/Ulaştırma | <input type="checkbox"/> Deniz Yapıları |
| <input type="checkbox"/> Baraj/Sulama | <input type="checkbox"/> Diğer (.....) |

- 1.b Bugüne zamana kadar edindiğiniz tecrubeleriniz doğrultusunda aşağıdaki proje türleri için gecikme olma riskinin derecesini belirtiniz.

Konut	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Endüstriyel	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Karayolu/Ulaştırma	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Altyapı	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Baraj/Sulama	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Ticari Yapı	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Deniz Yapıları	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Diğer	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

2.a Projeleri işveren türüne göre sınıflandırsak hangi tür projelerde yer aldınız.
Lütfen işaretleyiniz

- Kamu Kuruluşları Kamu-Özel Sektör Ortaklığı
 Özel Kuruluşlar Belediyeler / Yerel Yönetimler

2.b Projelerin işveren türüne göre gecikme olma risk seviyesini belirtiniz.

Kamu Kuruluşları

- 1 2 3 4 5

Özel Kuruluşlar

- 1 2 3 4 5

Kamu-Özel Sektör Ortaklığı

- 1 2 3 4 5

Belediyeler / Yerel Yönetimler

- 1 2 3 4 5

3.a Projeleri kontrat türüne göre sınıflandırsak hangi tür projelerde yer aldınız.
Lütfen işaretleyiniz

- Design-Built (Dizayn-Yapım) Design-Bid-Built (Dizayn - İhale -Yapım)
 Built - Operate -Transfer (Yap-işlet-Devret) Diğer (.....)

3.b Projelerin kontrat türlerine göre gecikme olma risk seviyesini belirtiniz.

Design-Built (Dizayn-Yapım)

- 1 2 3 4 5

Design-Bid-Built (Dizayn - İhale -Yapım)

- 1 2 3 4 5

Built - Operate -Transfer (Yap-işlet-Devret)

- 1 2 3 4 5

Diğer (.....)

- 1 2 3 4 5

4.a Projeleri yapılmış olan ödeme şekline göre sınıflandırsak hangi tür projelerde yer aldınız.
Lütfen işaretleyiniz

- Lump-Sum (Götürü Bedel)
 Unit-Price (Birim Fiyat)
 Cost + Fixed Fee (Maliyet+ Sabit Kar)
 Cost + Fixed Fee with Guaranteed Maximum Cost
(Maliyet + Sabit Karlı Garanti Maksimum Fiyat)
 Cost + Percentage of Cost (Maliyet+ Yüzdeye Bağlı Kar)
 Diğer (.....)

4.b Projelerin ödeme türlerine göre gecikme olma risk seviyesini belirtiniz.

Lump-Sum (Götürü Bedel)

1 2 3 4 5

Unit-Price (Birim Fiyat)

1 2 3 4 5

Cost + Fixed Fee (Maliyet+ Sabit Kar)

1 2 3 4 5

Cost + Fixed Fee with Guaranteed Maximum Cost (Maliyet + Sabit Karlı Garanti Maksimum Fiyat)

1 2 3 4 5

Cost + Percentage of Cost (Maliyet+ Yüzdeye Bağlı Kar)

1 2 3 4 5

Diğer (.....)

1 2 3 4 5

5.a Projeleri finansal büyüklüklerine göre sınıflandırsak hangi proje türlerinde yer aldınız. Lütfen işaretleyiniz

- 10.000.000 TL den az
- 10.000.000 TL - 50.000.000 TL arası
- 50.000.000 TL - 200.000.000 TL arası
- 200.000.000 TL den fazla

6.a

Projeler, kontratta yer alan normal sürelerine göre sınıflandırılmıştır. Öncelikle ne kadar sürelik projelerde yer aldığınızı, ardından bu projelerin genel olarak ne kadar sürelik bir gecikmeye maruz kaldığını işaretleyiniz.

Normal Proje Süresi 1 yıldan az

Projelerin ortalama gecikme süreleri

1 - 2 ay arası 2 - 3 ay arası 3 - 5 ay arası 5 - 7 ay arası 7 ayı aşkın

Normal Proje Süresi 1 - 2 yıl arası

Projelerin ortalama gecikme süreleri

1 - 3 ay arası 3 - 6 ay arası 6 - 9 ay arası 9 - 12 ay arası 12 ayı aşkın

Normal Proje Süresi 2 - 4 yıl arası

Projelerin ortalama gecikme süreleri

1 - 4 ay arası 4 - 7 ay arası 7 - 10 ay arası 10 - 15 ay arası 15 ayı aşkın

Normal Proje Süresi 4 yıldan fazla

Projelerin ortalama gecikme süreleri

1 - 5 ay arası 5 - 8 ay arası 8 - 12 ay arası 12 - 18 ay arası 18 ayı aşkın

7.a Projelerin zamanında tamamlanamaması çeşitli negatif sonuçlara sebep olurlar. Çalıştığınız projelerdeki gecikmelerin aşağıdaki hangi sonuçlara sebep olduğunu gözlemlediniz. Lütfen işaretleyiniz

- Time Overrun (Süre Uzatımı)
- Cost Overrun (Maliyet Artışına)
- Dispute (Münakaşa)
- Arbitration (Tahkim)
- Litigation (Hukuki Sürec,Dava)
- Termination / Total Abandonment (Kontrat Feshi)

B) GENEL SORULAR

Aşağıda Türkiye'deki inşaat projelerinde gecikmeye sebep olan bazı faktörler gruplarına göre sıralanmıştır; her faktör için projenin gecikmesine etki derecesini hemen altında verilen derecelendirmelerden birini seçerek belirtiniz.

Finansal Kaynaklı Faktörler

— İnşaat süresi boyunca yüklenicinin finansal yeterliliği

- Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— İşveren hakediş ödemelerindeki gecikmeler

- Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— İnşaat sırasındaki öngörülmemiş kısmi ödemeler

- Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Finansal dalgalanmaya bağlı etkenler (Enflasyon,dalgali kur vs)

- Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

İşgücü Kaynaklı Faktörler

— Personel / İşçi yetersizliği

- Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Düşük iş verimliliği

- Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— İşçi ve yönetim ilişkisi

- Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

Değişiklik/Revizyon ve Öngörülme Faktörleri

— İşveren ve/veya temsilcisi kaynaklı dizayn revizyonları

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Projenin işveren tarafından askıya alınması

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Projedeki dizayn hataları

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Sahada karşılaşılan beklenmedik zemin koşulları

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Sahada karşılaşılan yetersiz altyapı

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Zemin raporu kaynaklı hatalar

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Tecrübesizlikten kaynaklanan hatalar

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

Sözleşme Kaynaklı Faktörleri

— Projede yer alan altyüklenici firmalar arasındaki iş programı bazlı sorunlar

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Gerçekçi olmayan proje süresi

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Anayüklenici ve danışman firma arasındaki görüş farklılıkları

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— İşveren kaynaklı kararlardaki yavaşlık

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Anayüklenici ve danışman firma arasındaki zayıf organizasyon

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Profesyonel Proje/kontrat yönetimi kullanılmaması kaynaklı sorunlar

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Projelerde kullanılan kontrat türü (Design-Built,Design-Bid-Built , ..vs)

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Etkili olmayan gecikmeye bağlı cezalar

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Orijinal kontrat süresinin yetersiz olması

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Farklı partiler arasındaki koordinasyondaki zorluklar

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Projede yer alan partiler arasındaki hukuki uyumsuzluklar

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Altyüklenici firmaların anayüklenici tarafından kontrolü

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

Hava Şartlarına Bağlı Faktörler

— Olumsuz İklim Şartları

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Beklenmedik Hava / İklim Olayları (Sel,Kasırga,Yangın ve benzeri)

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

Ekipman / Teçhizat Kaynaklı Faktörler

— İnşaat ekipmanlarındaki eksiklikler

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Operatör kaynaklı yetersiz tecrübe

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Ekipman tedarikindeki yetersizlikler

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

Kurallar ve Düzenlemelere Bağlı Faktörler

— Kamu kuruluşlarından temin edilmesi gereken izin ve prosedürler

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Proje sahibinin uygulamalarındaki aşırı bürokrasi

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **Dizayn aşamasında kullanılan yapım şartnameleri**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **Hukuki ve kanuni düzenlemelerdeki değişiklik**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

Malzemeye Bağlı Faktörler

— **İnşaat malzemelerindeki eksiklikler**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **Malzeme tedarikindeki yetersizlik**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **Malzeme tip ve özelliklerinde inşaat esnasındaki değişiklikler**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **İthal edilen malzemeler ve tesis ekipmanları**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

Proje Yönetim / Proje Kontrolüne Bağlı Faktörler

— **Projedeki aktivite süreleri ve kaynaklarının öngörülmesindeki veri yetersizliği**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **İnşaat başlangıcındaki plansızlık veya yetersiz plan**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **Planlama Mühendisi / Planlama Bölümü eksikliğine bağlı yetersizlik**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **Projede uygulanan Test ve gözlem prosedürleri**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **Yabancı şartnameler bazlı kalite kontrol uygulamaları**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **İnşaat süresince meydana gelen kazalar**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— **İmalat resimlerinin hazırlanması ve onayı**

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Malzeme örnekleri onayının beklenmesi

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Genel personel problemleri

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Proje verilerindeki yetersizlik ve eksiklik

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Planlama ve iş programının hazırlanmasındaki yetersizlik

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

— Fiyat teklifi hazırlanmasındaki bilgi ve tecrübe yetersizliği

Çok önemli Oldukça Önemli Önemli Az önemli Önemsiz

Projelerdeki gecikmeye sebep olan başka faktörler varsa lütfen belirtiniz.

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GEÇİKMELERİN ORTAYA ÇIKARTMASI MUHTEMEL ETKİLER

Aşağıda Türkiye'de gecikmeye maruz kalan projelerde ortaya çıkması muhtemel sorunlar sıralanmıştır. Türkiye'deki projelerde gecikme olması durumunda, aşağıdaki her bir olumsuz sonucun ortaya çıkma riski seviyesi sizce nedir ? Belirtiniz.

RISK SEVİYELERİ				
1	2	3	4	5
<i>Risksiz</i>	<i>Az Riskli</i>	<i>Riskli</i>	<i>Oldukça Riskli</i>	<i>Çok Riskli</i>
— Time Overrun (Süre Uzatımı)				
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
— Cost Overrun (Maliyet Artışına)				
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
— Dispute (Münakaşa)				
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
— Arbitration (Tahkim)				
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
— Litigation (Hukuki Süreç,Dava)				
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
— Termination / Total Abandonment (Kontrat Feshi)				
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Projelerdeki gecikme nedeniyle ortaya çıkan yukarıda belirtilmiş olumsuz etkileri minimize etmek için paylaşmak istediğiniz bir fikir veya öneriniz varsa lütfen belirtiniz.

.....

ANKET SONU

TESEKKÜRLER

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