

**THE REPUBLIC OF TURKEY
İSTANBUL KÜLTÜR UNIVERSITY
INSTITUTE OF GRADUATE STUDIES**

**CAUSES AND EFFECTS OF CONSTRUCTION PROJECT
DELAY**

MASTER OF SCIENCE THESIS

**by AMEER AMER RAIQ
1800005530**

Department: Industrial Engineering

Program: Engineering Management

Supervisor: Assist. Prof. İlayda Ülkü

JUNE 2021

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Supervisor and Chairperson:	Assist. Prof. İlayda Ülkü
Members of Examining	Assist. Prof. Duygun Fatih
Committee:	Demirel
	Assist. Prof. Eylül Damla
	Gönül Sezer

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4/6/2021

Ameer RAIQ

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LIST OF SYMBOLS

RII	Relative importance index.
W	weight for each factor
A	the highest rank
N	number of respondent people



Üniversite	: İstanbul Kültür Üniversitesi
Enstitü	: Lisansüstü Eğitim Enstitüsü
Anabilim Dalı	: Endüstri Mühendisliği
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ÖZET

İNŞAAT PROJESİ GECİKMESİNİN NEDENLERİ VE ETKİLERİ

AMEER AMER RAIQ

Bina inşaatı projesinde yaşanan gecikme, inşaat sektöründe en sık karşılaşılan sorunlardır ve bu sektörü olumsuz etkilemektedir. Genellikle bu soruna inşaat sektörü ile ilgili birçok faktör neden olmaktadır. Bu araştırma, yapısal projelerin gecikmesine neden olan en önemli nedenlere ve tetikleyicilere ulaşmak, bunları analiz etmek ve her bir nedenin önemini belirlemek için değiştirildi ve inşaat projesinde gecikmelere neden olan 97 neden rapor edildi. İnşaat sektöründe inşaat projelerinin gecikmesine neden olan faktörlerin önemi, faktörlerin ve tarafların önemlerine ve etkilerinin yüzdelerine göre tablolar halinde düzenlendiği (RII) 'ye göre sınıflandırılmış ve son olarak bazı noktalar önerilmiştir. ve elde edilen sonuçlara dayanarak ve bu noktaların zemine uygulanmasının inşaat projelerinin görünür gecikmesini azaltmaya katkıda bulunacağına dair bazı tavsiyeler verildi.

Anahtar Kelimeler: İnşaat gecikmesi; Göreli önem indeksi yöntemi; gecikme; proje gecikmesi; inşaat; inşaat projeleri

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ABSTRACT

CAUSES AND EFFECTS OF CONSTRUCTION PROJECT DELAY

AMEER AMER RAIQ

building construction project delay is the most common issues in building industry and it is having a negative effect on this industry. Usually, this problem is caused by many factors related to the construction sector. This research is amended to reach the most significant reasons and triggers that cause structural projects to be delayed, analyze them, and identify the significance of each causes, as many as 97 reasons have been reported as leading to construction project delays. The importance of the factors that lead to delayed construction projects in the construction sector has been classified according to (RII), where the factors and parties were arranged in tables according to their importance and percentage of their impact, and finally some points were suggested, and some advice was given based on the results obtained and that the application of these points on the ground will contribute to reducing the apparent delay of construction projects

Keywords: Construction delay; Relative importance index method; Delay; Project delay; Construction; Construction projects

1. INTRODUCTION

The building industry is one of the most important sectors affecting the industrial sector as it provides job opportunities for millions of people and contributes to improving the global economy (NCSI, 2015). Construction projects are considered successful if they are done on plan and according to schedule and within the expected budget (Majid, 2006). The problem of delaying the delivery of the project is one of the most serious issues confronting building sectors, and it is more common in developing countries (AL Suliman, 2019 and Aziz, 1970). Delayed construction projects were defined as the project was delayed beyond the time previously agreed upon by the contracting parties (S. Assaf and S. Al-Hejji, 2006). It was also known as the time elapsed between the project end date and the agreed-upon project delivery date. (S. Faradi and S.M. El-Sayegh, 2006) and It was also defined as a period of delay in delivering the project beyond the previously specified date (B. Bramble and M. Callahan, 1987). 70% of the projects witnessed delays and exceeding the planned and agreed-upon time, as the average percentage of overruns ranged between 30% - 50% of the time previously agreed upon, and this overshoot led to a decrease in the cost of projects by 50% (S. Assaf and S. Al-Hejji, 2006). The delay in the completion of projects negatively affects projects (M. Fallahnejad, 2012). Delay in the projects leads to the occurrence of many problems that include various aspects, such as the increase in the cost of the project over the cost that was previously determined, the decrease in the value of profits or their lack thereof, and many problems between the parties involved in the contract that leads to resorting to the judiciary to resolve disputes and terminate the contract (Charles Amoatey, et al., 2015). Yang and Yin (2009) mentioned in his study that delays may occur in all construction projects if the project management and employees do not have sufficient knowledge and that these delays affect the project in multiple ways. Patil et al. mentioned in 2013 that the performance of the company or the work responsible for construction projects can be evaluated through their ability to complete the project according to the agreed standards and deliver them on time. Shebob et al. (2012) and Addo (2015), was mentioned that the percentage of delays in projects varies according to the size and type of the

facility. Andrew, and Holt (2012) stressed that if there is a delay in the construction projects, it follows the schedule set in advance, and this may cause an increase in the cost and a loss of capital. In a study conducted on the causes of delayed the projects, it was found that there are many different reasons that lead to delays in projects Where their study included many of the reasons that lead to delayed construction projects in India, and they developed a relationship between the negative factors to be able to predict the consequences. Their study relied on questionnaires and interviews to gather information (Doloi et al., 2012). In another study, it was examined the reasons leading to delays in building sector in the Sultanate of Oman and found the main reasons that lead to these causes (Alnuaimi and Al Mohsin, 2013). In another study that was led to delayed the construction projects, an analysis of relationships between the various causes leading to delayed projects and their impact on the duration of the project was adopted as a methodology for this study (Gonzalez et al., 2013). In another study conducted in Pakistan and Ghana, the main causes and impacts of construction project delays are analyzed (Amoatey et al., 2015). In another study conducted in Turkey, the reasons for the delay of projects were studied by conducting interviews with the owners of Turkish companies specialized in the field of construction projects to collect information and identify the most important reasons for construction projects as a methodology for the study (Gunduz et al., 2012). There are many previous studies that talked concerning the reasons for the delay of construction projects and increase their cost in many countries, but there are few studies that talked about the reasons for the delay of the project in detail for each of the project parties such as the consultant contractor the owner and external reasons and studying any of these The parties have the greatest impact on delayed projects, and what are the most common reasons that have a major impact on project delays for each party.

1.1. Research problem

- Who among these parties is the most responsible for delaying the project (consultant, contractor, or the owner)?
- What are the most delaying reasons for consultant, contractor, and the owner)?

- How influential are problems related to (design, equipment, labors, project, and the materials) to cause delays in building sectors?
- How influential are the external problems causes delays in construction project?
- What are the most important problems project may face that have large effect on delays in the construction project?

1.2. Research objective

This study aims to knowing the most common reasons that lead to delayed construction sectors in Jordan and Turkey, Assess the significance of the factors based on the percentage of their effects on building delays. and investigate the effect of the project's stakeholders on the causes that cause delays in the building industry. The aim of this study is to identify the most significant and frequent causes of construction project delays so that they can be avoided as far as possible. This study answered some questions which mention below:

- What are the most important reasons that lead to delayed construction projects?
- What is the arrangement of the parties responsible for the project, according to the relationship between them and the delay in construction projects?

1.3. Methodology

The quantitative method was used to analyze the relationship between the knowledge and data that were obtained. Quantitative analysis is a demographic analysis method where a value is placed for any variables whether these variables are demographic such as (gender, color) after that make a comparison or link between these variables (Statistics Solutions, 2020).

The research revolves around the construction engineering projects in Jordan and Turkey as the information was taken from engineers working in the engineering sector in these two countries.

Information and data were collected by creating a questionnaire form using Google Form and then distributing it to a sample of engineers in Jordan and Turkey, where this sample included males and females, different experiences,

and different engineering sectors. The questionnaire included 17 questions and sample answers were taken from 200 engineers from different fields.

The data was analyzed by a software program “SPSS” using the “quantitative statistics” method it is a set of relationships and processes that describe a set of data in a summary way (Kenton, Will., 2020).

1.4. Structure of the thesis

The study covers the following chapters

Chapter 1: The general background of the research is explained, and the main objectives for which this study was prepared are explained

Chapter 2: Many previous researches were compelled that studied the same idea that was studied in this research. The significance of the building industry was explained, the definition of project delay and the most prominent reasons that lead to it.

Chapter 3: Many basic matters were explained in the course of the research, such as the methodology followed, methods of obtaining the data that were used, the mechanism for analyzing the accessed data, and the mechanism used to obtain the results.

Chapter 4: The data previously obtained by means of the quantitative analysis were analyzed. All groups were analyzed, each group separately to identify the most significant reasons that contribute to construction project delays, and to give weight to each factor, which helps to renew the most important factors. The most common reason

Chapter 5: The results obtained were explained and summarized and some advice suggested that, if followed, will contribute to reducing the problem of building sectors.

2. LITERATURE REVIEW

The problem of delayed construction projects occurs in a lot of countries, as it is a phenomenon that the construction sector suffers from it. The reason that leads to delays in this type of project is the number of risks available in it and the inability to anticipate avoiding these risks (Gardezi et al., 2014). Despite this, construction projects still enrich the problem of delay, as the effect of this problem appears during the duration of the project. Therefore, it causes many disputes between the parties, and in most cases the parties' resort to the judiciary to resolve these disputes (Marzouk and El-Rasas, 2014). The full experience and awareness of the parties shows how the delay reasons lead to the completion of the project according to the specified schedule and the pre-planned cost, that many construction projects occur in which there is a delay beyond the specified time and an increase in the expected cost. Odeh and Battaineh, mention in 2002 that often stems in projects that depend on a traditional approach, which is Granting the bid to the owner of the lowest price regardless of the experience available to him. The importance of building sector will be explaining in this, while the reasons for the delay in completing the building project process, in addition to describing the methods used to reduce this phenomenon.

2.1. The importance of the construction sector

The construction sector witnessed an abrupt and rapid growth, especially after the Second World War, as the construction sector had a remarkably positive impact on the economies of countries and on the unemployment rate. Ozcelebi mention in 2016 that building construction sector is one of the most important employment sectors. Building construction industry is a very important industry in different countries because of its direct influence on the economy of those countries, as in the state of Palestine the construction sector has a percentage of 33% of the GDP and takes higher positions if compared to the rest of the sectors, for example if compared with the entertainment sector or the education sector (Mahamid 2011, Gonzalez et al., 2011). Turkey is classified among the largest countries in construction projects, as it is 6% of the domestic product coming from construction projects. The construction sector constitutes 30% of the Turkish economy, and approximately 1.5 million people work in these projects, meaning that these projects are occupied by 10 percent. Of the employees in Turkey (Natalia, 2020). In a previous study centered on

improving delivery of construction project in Ghana it has been confirmed that the construction industry occupies a rate of 5 to 10% of the global gross product and that there are approximately 10% of citizens of various countries working in the field of construction industry, that the construction sector is growing at a rate of 7 to 8 percent annually and this growth is considered Very fast growth (Asubay and Mensah, 2015). The building construction industry is a very important sector in Jordan as it plays an important role in the Jordanian economy as it is linked with other sectors, directly and indirectly, and significantly affects the growth of the economy. But what happened was the opposite of what was expected, as the growth of construction projects decreased during that period in the years 2015, 2017 and 2018. Despite this decrease, the construction sector continued to affect the Jordanian GDP, as it was contributing at a rate ranging from 3.0% to 3.5% of the Jordanian gross domestic product, according to the report of the Central Bank of Jordan for the year 2018 (JSF, 2019). In another previous study centered on analyzing factors affecting delays in Indian construction project it was mentioned that the construction sector affects at a rate ranging between 6% to 9% of the gross income output in India and that it is considered the largest sector in India after the agricultural sector, as it has a growth rate ranging between 8% to 10% (Doloi et al., 2012).

2.2. Construction delay

Construction project delay is one of the most effect problem in the construction sectors. and most of these projects suffer from this problem, and the event of a building project delay results in a rise in expense and time, and this problem may occur because of a specific reason or several reasons (Emeka, 2016). Na Ayudhya says in study's prepared in 2011 Among the most famous reasons that lead to delayed construction projects is the unreasonable agreed period, change of owner of some requests, lack of clarity of construction plans and designs, haste, and lack of commitment to promises. In studies prepared by Tawil et al. in (2014), Afshari et al. in (2011) and Acharya et al. in (2006) They described the lateness in construction projects as being late in delivering the project beyond the time according to the agreement due to the participating parties, including the owner and the contractor together. Abdullah et al. (2010) define the delay in building sectors as the extra time required to complete the task, and delays occur building sectors if the work performed in real-time is less than what you had previously considered.

Motaleb and Kishk (2010).Suresh and Kanchana in their studies prepared in 2015 they said the lateness in building construction sector is also described as the delivery of the project after the time specified in advance in the concluded contract. One of the damages caused by delays in construction projects is the possibility of contract termination, increased costs, and reduced productivity).

2.3. Causes of construction delay

In perverse studies done by Hampton et al. (2012) and Le-Hoai et al. (2008) mention that Some of the reasons There are several reasons that contribute to construction project delays and cost increases, and among these reasons are that the project is complex, the environment is difficult, the size of the project is large, and the scope of work is wide. In Lowsley and Linnett (2006) research Other reasons for the delay in construction projects are mentioned, among them are climatic conditions, lack of resources, unexpected conditions, and errors in the design stage. Assaf and Al-Hejji said in their studies which prepared in (2006) that one of the main reasons for delayed construction projects is the financial problems between the owner and the contractor. Fugar and Agyakwah-Baah in (2010) made a research on the progress of building structure projects in Ghana, where the reasons were classified into categories, and then analyzed them when it the result show that the causes which had more effect on the project period and it causes to delay in construction projects is the delay in the approvals issued by the concerned government institutions, the inaccuracy of the initial study of time and cost, the difficulty of banking transactions, And weak supervision team. Sweis et al. (2008) was mentioned in their study that the the primary causes of building project delays in Jordan are the shortage of financial ability of the contractor and the reluctance of the owner to make critical decisions. Ayman (2000) in that study, the quantitative analysis method was used to obtain the most important reasons that lead to the liberalization of building projects, According to the findings, the most common sources of project collusion are design issues, modifications in the facility after the design process is completed, bad weather, and a lack of financial resources, and these factors often result in the contractor requiring more time to finish the project. Doloi et al. (2012) They analyzed the reasons that lead to construction projects in India, and among the most prominent reasons that they reached were the inefficiency of the project manager and the lack of understanding of the project sufficiently. Faridi and El-sayegh (2006) They investigated the causes that could contribute to construction

project delays in the United Arab Emirates, and the findings included 44 explanations that have a significant impact on construction project delays. They also mentioned that this issue has a negative impact on the economy and local development in the United Arab Emirates. Al-Kharashi and Skitmore in (2009) The research focused on the causes with construction project delays for each of the project parties individually, including the owner, contractor, consultant, and other factors. Lo et al. (2006) They talked about the problems of delayed construction projects in Hong Kong, where many causes of delayed construction projects that they identified in advance were addressed and classified according to whether it was a simultaneous delay, Excusable delay, Non-excusable delay

In Long (2015), described a term simultaneous delay as a term that is used if two reasons lead to the delay of construction projects at a certain time, such as if there is still a reason for arising because of the owner and a reason for creating because of the proceedings, and the two reasons affect the cooperation of the projects and within the same scope of work. Hamzah et al (2011) They defined the simultaneous delay as the occurrence of more than one factor causing construction projects. Alaghbari et al in 2007 discussed in that study that the occurrence of more than one reason leading to conflict in construction projects with a specific period leads to complicating the problem more than if the delay was due to one reason. There are types of delays that, although they affect the project's end period negatively, but there is no conflict between the owner and the contractor because of these delays and are somewhat acceptable because these delays occur because of unexpected circumstances and outside the control of the contractor, some examples of factors that Lead to this kind of delay: 1- The occurrence of a strike that canceled the work. This reason will certainly lead to a delay in the completion of the work although this reason is not always classified under the item of acceptable delay unless the owner and contractor agreed in advance on this point in The contract concluded between them, 2- The occurrence of a fire or a natural disaster, as such circumstances occur without human intervention, except in the event that this disaster was anticipated and alerted earlier and the necessary measures have not been taken, 3- The occurrence of sudden changes to the architectural design, especially in the implementation phase The project (Dinakar 2014; Alaghbari et al. 2007; Alaghbari 2005; Iyer et al. 2008; and Hampton et al. 2012). Compensation for the delay is made to the other party only if the other side does not contribute to the delay (Bramble and Callahan 2011). When

changes occur in construction projects due to unacceptable or unjustified factors by the contractor, the contractor will not destroy any compensation from the owner. On the contrary, the contractor is required to complete the project within the specified period and pay compensation to the owner if the project is not delivered on time (Gardezi et al. 2014).

2.4. Reasons that contribute to delayed construction projects

The reasons leading to the delay in construction projects were classified into four main sections according to the source leading to the occurrence of the cause of delay, and these sections included Factors that occur due to the consultant, Factors that occur due to the contractor, reasons Factors that occur due to the owner, and external factors. In a previous study for each of Emeka, 2016, Ahmed et al. 2003; Gardezi et al. 2014; Alaghbari (2005) and Alaghbari et al. (2007) they listed the reasons for construction project delays that were attributable to the consultant, and among these reasons were a lack of expertise, an inability to make prompt decisions, and the absence of the supervising engineer from the work site. In another study did by Odeh (2002), Some of the causes of construction project delays in Jordan have been identified, including inadequate preparation, poor administration, a lack of integrity, and a failure to adhere to quality requirements. As for referring to the reasons related to the contractor, In a previous study by Enshassi et al. (2009), it was mentioned that two basic factors lead to delays in construction projects due to the contractor, namely a lack of financial viability and a lack of careful management, and that the financial aspect is one of the factors often related to the contractor that leads to the failure of construction projects. In previous studies of each of and Alaghbari et al. (2005), Gardezi et al. (2014) and Ahmed et al. (2007) Several explanations were given as to why building projects were delayed, and one of the most notable was a lack of funds. These causes include the contractor's financial difficulties, a shortage of personnel or needed labor, a lack of expertise, and project mismanagement. Odeh (2002) and Battaineh (2002) was support that in their studies, of the most significant causes related to the contractor are financial problems, lack of experience, poor management in the project, problems related to the subcontractor, problems with the materials used such as lack of availability or fluctuation of prices in the market, and the lack of possession of modern high-tech equipment. in his studies made a definition the financial difficulty as a lack of financial liquidity, inability to purchase materials, inability to pay workers' salaries, or inability to rent or buy equipment and

machinery needed to complete the project. Thornton (2007) studied the most important reasons that lead to the lack of financial liquidity or the difficult economic conditions of the contractor and found that among the most important of these reasons are the weaknesses of the management and its insufficient experience, the inability to identify risks, the weakness of the executive staff. (Liu 2010) mentioned another reason that leads to economic difficulties, which is the contractor's resort to taking debts or loans to complete the project and lack of ability to pay these accumulated debts on time. There are conditions that contribute to the effectiveness of operations and programs, and the most significant of these gaps is the availability of an accessible and efficient method of communicating and communicating knowledge, regardless of the sale of the operation or the type of project (Dunkelberger, 2009). One of the issues that cause delays in building projects is a lack of an efficient and modern way of communication, which means a lack of effective and active project management, which can contribute to inadequate communication among project workers, for example, if there is no effective means of communication between the contractor and the supplier. This is due to a misunderstanding between the contractor and the supplier, so there will be a delay in the delivery of the required materials or the shipment of materials with specifications sneezing the required specifications of the contractor (Ali *et al.*, 2010). To ensure the success of the construction projects, there must be a department that has sufficient knowledge and experience to enable it to perform its tasks to the fullest. Examples of the responsibilities of the project management are auditing the structural, mechanical, and electrical architectural plans and making sure that they are correct and that no scheme conflicts with the other, managing the process of ordering and purchasing the materials it needs. Location, and coordination between project parties. If the administration fails to fully implement its responsibilities, this will only lead to problems and thus delays in construction projects (Kadir *et al.*, 2005). Many reports have confirmed that one of the major factors for the delays in the most common building projects is management's incompetence and lack of proper expertise. In a previous study of Stewart and Spencer (2006) several methods have been proposed for the success of a management system, and among these Six-sigma. It is considered a modern and advanced method for improving management. Its functions are detection, monitoring, calculation, review, and production, and it is regarded as one of the approaches that contribute significantly to reducing construction project delays

caused by administrative issues. Antony and Banuelas (2002) They stressed in their studies that Six Sigma is a tool used to improve management efficiency and thereby maximize earnings, lower costs, and meet consumer expectations. Toor and Ogunlana (2008); Ahmed *et al.* (2003); Yang and Ou (2008); Sweis *et al.* (2008). Augustine and Mangvwat (2001); In a previous study Ali *et al.* (2010) it was mentioned that the papers that are used on the site by the contractor are either the property of the contractor or that the contractor has left them for a specific period of time to meet their purpose according to the schedule for which the contractor must be used and managed accurately in order not to exceed the schedule The planned schedule and the emergence of problems between the contractor and the owner of the tools or exposure to financial penalties and a detrimental effect on the project's lifespan. In a study prepared in Moscow, it was found that the most prominent problems facing construction projects there are a lack of materials (Wendle., 2008). In a previous study Alaghbari *et al.* (2007), Some of the reasons for construction project delays caused by the owner were listed, including the owner's lack of financial capacity, the termination or postponement of work on the project, and a lack of contact between the owner and the contractor. In addition to the previous reasons, Odeh and Battaineh (2002) is added the illogical period of the contract or the timeframe in which the project must end. The scarcity of resources, the bad economic conditions in the country, the lack of some necessary equipment for the completion of the project, the bad weather condition, and the adherence to it to move materials are among the external factors that cause building projects to be delayed. (Ahmed *et al.* 2003; Alaghbari 2005 and Alaghbari *et al.* 2007).

2.5. Summary

Delays in the building industry are one of the most common issues that construction companies face. It is desirable to know the reasons that lead to delays in projects and to understand them accurately to reduce their appearance and recurrence. In this chapter, the importance of the construction sector was identified, and previous studies were based on the definition of the problem of delayed construction projects and based on the available articles on this topic, the most important reasons that lead to delays in projects were mentioned and classified according to the cause, if it was due to the consultant, contractor, owner, Or external factors, this helps to intimidate the cause of the problem and facilitate solutions to it

and reduce its appearance. The table 2.1 shown the summary for the important references was mentioned before in this chapter according to its relationship with this study.



Table 2.1: Reference's summary

Year	Author(s)	Objective	Application area
2014	Syed Gardezi Irfan Manarvi and Jamal Gardezi	Knowing the reasons that led to delay of the project and not completing it in the previously specified time	Pakistan
2014	Mohamad M. Marzouk and Tarek El-Rasas	Study the reasons that lead to delayed construction projects	Egypt
2002	Abdalla M Odeh and Hussien T Battaineh	Identifying the most significant causes of building project delays and assessing the significance of each aspect	Jordan
2016	Ozuzhan Ozcelebi	Analysis of the impact of the construction sector on the Turkish economy	Turkey
2011	Ibrahim Mahamid	Determine the factors that lead to delayed construction projects, depending on the opinion of the consultant	Palestine
2015	Emmanuel Kwaku Salifu- Asubay And Collins Adjei Mensah	Evaluate the effect of using outdate and ineffective building methods on construction projects	Ghana
2012	Hemanta Doloi, Anil Sawhney, K.C. Iyer, and Sameer Rentala	Determine the causes of delayed construction projects and find a way to predict the impact of these factors	Indi
2016	Emeka, Onozulike, J	Determine the various forms of construction project delays and the most significant causes of this crisis.	Nigeria
	Norngainy Mohd Tawil,	Finding the reasons that	

2014	Muhamad Azry Khoiry, Noraini Hamzah, and Wan Hamidon Wan Badaruzzaman	lead to delays in construction projects for educational facilities	Malaysia
2011	H.Ashari, Shahrazad Khosravi, A.Ghorbanali, Mahdi Borzabadi, And Mahbod Valipour	Clarify the reasons for construction project delays that come under the unjustified reasons for a MAPNA category.	Hong Kong
2010	Mohd Razaki Abdullah, and Ismail Abdul Rahman	Determine the root causes of MARA management procurement construction project delays.	Malaysia
2010	Omayma Hashim Motaleb and Mohammed Kishk	Finding the most important reasons that lead to delayed construction projects and knowing the extent of their impact in the United Arab Emirates	United Arab Emirates
2015	Reeshma B Suresh and S. Kanchana	Finding the most important factors that lead to delayed construction projects, arranging the factors causing delay in projects according to their importance, and giving some advice that could contribute to reducing the problem of construction projects.	Kerala Region

2012	Gerard Hampton, Andrew N. Baldwin, and Gary Holt	Comparison between the public and private sector in terms of procurement related to construction projects	Scotland
2008	Long Le-Hoai, Young Dai Lee, and Jun Young Lee	Comparing the causes that lead to delayed construction projects and analysing them in order to classify them	Vietnam
2006	Sadi A. Assaf, and Sadiq Al-Hejji	To determine the important delay factors, To see how important the factors of delay are to all of parties, and look into the expectations of the 3 main relevant parties in every building project: owners, contractors, and consultants.	Saudi Arabia
2010	Fugar and Adwoa B. Agyakwah-Baah	To determine the causes of building delays and to assess the causes as a function of the main parties	Ghana
2007	Wael Alaghbari, Mohd. Razali A. Kadir, Azizah Salim, and Ernawati	Determine the most important factors that arise due to the parties participating in the construction projects that lead to their delay	Malaysia

3. RESEARCH METHODOLOGY

This chapter Will explained, the methodology that was followed in preparing this study, the mechanism for collecting data and information, identifying the countries from which data were collected, and the mechanism for analyzing the data collected to reach its goal of this study.

3.1. Study Approach and design

The term research design refers to the plan adopted by the researcher to complete his studies to the fullest, as there are many designs for the research and the design is chosen by the researcher according to the type of research or project (Walliman, 2011). The quantitative method was used in this analysis to investigate the relationship between the knowledge or evidence that was gathered. Quantitative analysis is a demographic analysis method where a value is placed for any variables whether these variables are demographic such as (gender, color) after that make a comparison or link between theses variables (Statistics Solutions, 2020). The quantitative method depends on experience and mathematical calculations and provides a detailed explanation of the data that was analyzed (Cresswell 2009). There are several previous studies that talked about the causes of delayed construction projects, which were carried out using different methodologies from the quantitative methodology. Sambasivan and Yau 2007 in a previous study said that focused on the causes that lead to delayed projects and the extent of their impact, they used the qualitative approach as a methodology for there study. On the other hand, there are several previous studies that used the quantitative methodology. For example, Seboru (2015) used the quantitative methodology as a methodology to study the causes of delayed projects in the road sector. In this research, the quantitative methodology was used because different values and data were dealt with, such as that data were collected from different places, different experience, different fields, and so on.

3.2. Questionnaire Design

The questionnaire was defined as several questions that express a specific topic or a specific idea, the purpose of which is to identify the point of view of a group of people on the same topic (Emeka, 2016). In this research, the method of the questionnaire was used to collect information, as the questionnaire was designed to contain two main parts. The first part included personal questions about the person who filled out the questionnaire. The second part included a question about the

reasons for the delay of projects. There was a question that was directed that it cannot be bypassed without setting. An answer and another question are optional, the nature of the answer was two types a multiple choice and a written answer. The first section included a question about the gender of the person, the job title, the type of companies he worked for, whether they were (consulting companies, contracting companies, government institutions, or educational institutions), the number of years of experience In the engineering sector the years of experience were classified for periods of one year up to 21 and more, and every 5 years were considered as a period, the name of the institution or company for which he works, and the last question in the first section was about whether a person thinks studying a problem of delayed construction projects should a study be done about it or no. Figure 3-1 and 3-2 shown the first part of the questionnaire which prepared to collect data for this research.

Causes of delay in constriction project

This questionnaire aim to collect data for preparing a master thesis. The expected response time is 15 minutes.

1. Gender *

- ☐ Male
- ☐ Female

2. Job title *

Enter your answer

3. What kind of companies do you work for? *

- ☐ Engineering consulting company
- ☐ Engineering contracting company
- ☐ Governmental engineering departments
- ☐ Engineering departments in educational institutions

Figure 3.1: First part of the questionnaire

4. How many years of experience do you have? *

☐ 1-5

☐ 6-10

☐ 11-15

☐ 16-20

☐ 21 and more

5. What is your company name

6. In which country do you work? *

☐ Turkey

☐ Jordan

7. Do you think that the impact of construction project delays should be studied? *

☐ Yes

☐ No

Figure 3.2: First part of the questionnaire

The scope of the concerns regarding the causes for building project delays is addressed in the second part of the questionnaire. This section was divided into 6 groups, the first group was for the causes related to the consultant, The second group consisted of causes related to the manufacturer, the third group consisted of causes related to the designs, the fourth group consisted of causes related to facilities, the fifth group consisted of causes related to external conditions, the sixth group consisted of causes related to personnel, the seventh group consisted of causes related to supplies, and the eighth group consisted of causes related to the owner, and the ninth group was the causes related to the project . A field has been created for people who want to add reasons not mentioned in the questionnaire. The Likert scale is used to grade the responses in this segment. The answers were divided into reasons based on the importance of each mentioned reason. They were divided into very weak, weak, average, strong, and very strong. Emeka et al. (2016) conducted a

review, he stated that the Likert scale gives more meaningful results than the individual scale. Figure 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10 and 3.11 shown the second part of the questionnaire which was prepared to collect data for this research.

8. According to your experience, assess the hereunder points regarding its impact in construction projects delays (Consultant Related) *

	Very weak	Weak	Average	Strong	Very strong
Lack of consultant experience in construction projects	☐	☐	☐	☐	☐
Conflicts between consultant and design engineer	☐	☐	☐	☐	☐
Delay in approving major changes in scope of work by consultant	☐	☐	☐	☐	☐
Delay in performing inspection and testing	☐	☐	☐	☐	☐
Inaccurate site investigation	☐	☐	☐	☐	☐
Inadequate project management assistance	☐	☐	☐	☐	☐
Late in reviewing and approving design documents	☐	☐	☐	☐	☐
Poor communication and coordination between owner and contractor	☐	☐	☐	☐	☐

Figure 3.3: Consultant related cause

9. According to your experience, assess the hereunder points regarding its impact in construction projects delays (Contractor Related) *

	Very weak	Weak	Average	Strong	Very strong
Frequent change of subcontractors	☐	☐	☐	☐	☐
Inadequate contractor experience	☐	☐	☐	☐	☐
Inappropriate construction methods	☐	☐	☐	☐	☐
Incompetent project team	☐	☐	☐	☐	☐
Ineffective project planning and scheduling	☐	☐	☐	☐	☐
Obsolete technology	☐	☐	☐	☐	☐
Poor communication and coordination between owner and consultant	☐	☐	☐	☐	☐
Poor site management and supervision	☐	☐	☐	☐	☐
Rework due to errors	☐	☐	☐	☐	☐
Unreliable subcontractors	☐	☐	☐	☐	☐
Inadequate site investigation	☐	☐	☐	☐	☐
Inappropriate contractor's policies	☐	☐	☐	☐	☐
Poor financial control on site	☐	☐	☐	☐	☐

Figure 3.4: Contractor Related Causes

11. According to your experience, assess the hereunder points regarding its impact in construction projects delays (Equipment Related) *

	Very weak	Weak	Average	Strong	Very strong
Equipment allocation problem	☐	☐	☐	☐	☐
Frequent equipment breakdowns	☐	☐	☐	☐	☐
Improper equipment.	☐	☐	☐	☐	☐
Inadequate modern equipment	☐	☐	☐	☐	☐
Low efficiency of equipment.	☐	☐	☐	☐	☐
Shortage of equipment	☐	☐	☐	☐	☐
Slow mobilization of equipment	☐	☐	☐	☐	☐

Figure 3.5: Equipment Related Causes

16. According to your experience, assess the hereunder points regarding its impact in construction projects delays (Project Related) *

	Very weak	Weak	Average	Strong	Very strong
Complexity of project (project type, project scale, etc.)	☐	☐	☐	☐	☐
Inadequate definition of substantial completion	☐	☐	☐	☐	☐
Ineffective delay penalties	☐	☐	☐	☐	☐
Legal disputes between project participants	☐	☐	☐	☐	☐
Original contract duration is short	☐	☐	☐	☐	☐
Unfavorable contract clauses	☐	☐	☐	☐	☐

Figure 3.6: Project Related Causes

14. According to your experience, assess the hereunder points regarding its impact in construction projects delays (Materials Related) *

	Very weak	Weak	Average	Strong	Very strong
Changes in material types and specifications during construction	☐	☐	☐	☐	☐
Damage of sorted materials	☐	☐	☐	☐	☐
Delay in manufacturing materials	☐	☐	☐	☐	☐
Escalation of material prices	☐	☐	☐	☐	☐
Late delivery of materials	☐	☐	☐	☐	☐
Poor procurement of construction material	☐	☐	☐	☐	☐
Poor quality of construction materials	☐	☐	☐	☐	☐
Shortage of construction materials	☐	☐	☐	☐	☐
Unreliable suppliers	☐	☐	☐	☐	☐

Figure 3.7: Labors Related Causes

13. According to your experience, assess the hereunder points regarding its impact in construction projects delays (Labors Related) *

	Very weak	Weak	average	Strong	Very strong
Absenteeism	☐	☐	☐	☐	☐
Low motivation and morale of labor	☐	☐	☐	☐	☐
Low productivity of labor	☐	☐	☐	☐	☐
Personal conflicts among labor	☐	☐	☐	☐	☐
Shortage of labor	☐	☐	☐	☐	☐
Slow mobilization of labor	☐	☐	☐	☐	☐
Unqualified/inadequate experienced labor	☐	☐	☐	☐	☐
Labor injuries on site	☐	☐	☐	☐	☐

Figure 3.8: Labors Related Causes

12. According to your experience, assess the hereunder points regarding its impact in construction projects delays (External Related) *

	Very weak	Weak	Average	Strong	Very strong
Accidents during construction	☐	☐	☐	☐	☐
Poor project management assistance	☐	☐	☐	☐	☐
Different tactics patterns for bribes	☐	☐	☐	☐	☐
Delay in obtaining permits from municipality	☐	☐	☐	☐	☐
Delay in performing final inspection and certification by third party	☐	☐	☐	☐	☐
Delay in providing services from utilities(water, electricity, etc.)	☐	☐	☐	☐	☐
Global financial crisis	☐	☐	☐	☐	☐
Loss of time by traffic control and restriction at job site	☐	☐	☐	☐	☐
Sudden failures actions	☐	☐	☐	☐	☐
Price fluctuations	☐	☐	☐	☐	☐
Problem with neighbors	☐	☐	☐	☐	☐
Slow site clearance	☐	☐	☐	☐	☐
Unexpected surface& subsurface conditions(soil, water table, etc.)	☐	☐	☐	☐	☐
Unfavorable weather conditions	☐	☐	☐	☐	☐
Inadequate production of raw material in the country	☐	☐	☐	☐	☐
Inappropriate government policies	☐	☐	☐	☐	☐
Thefts done on site	☐	☐	☐	☐	☐

Figure 3.9: External Related Causes

15. According to your experience, assess the hereunder points regarding its impact in construction projects delays (Owner Related) *

	Very weak	Weak	Average	Strong	Very strong
Change orders	☐	☐	☐	☐	☐
Conflicts between joint-ownership	☐	☐	☐	☐	☐
Delay in approving design documents	☐	☐	☐	☐	☐
Delay in progress payments (Funding problems)	☐	☐	☐	☐	☐
Delay in site delivery.	☐	☐	☐	☐	☐
Improper project feasibility study	☐	☐	☐	☐	☐
Lack of capable representative	☐	☐	☐	☐	☐
Lack of owner experience in construction projects	☐	☐	☐	☐	☐
Lack of incentives for contractor to finish ahead of schedule	☐	☐	☐	☐	☐
Poor communication and coordination between consultant and contractor	☐	☐	☐	☐	☐
Slowness in decision making	☐	☐	☐	☐	☐
Suspension of work by owner	☐	☐	☐	☐	☐
Inadequate planning	☐	☐	☐	☐	☐
Mode of financing and payment for completed work	☐	☐	☐	☐	☐
Long period between design and time of bidding/tendering	☐	☐	☐	☐	☐
Inappropriate contractual procedure	☐	☐	☐	☐	☐
Additional work	☐	☐	☐	☐	☐
Bureaucracy in bidding/tendering method	☐	☐	☐	☐	☐
Selecting inappropriate contractors	☐	☐	☐	☐	☐

Figure 3.10: Owner Related Causes

10. According to your experience, assess the hereunder points regarding its impact in construction projects delays (Design Related) *

	Very weak	Weak	Average	Strong	Very strong
Complexity of project design	☐	☐	☐	☐	☐
Design changes by owner or his agent during construction	☐	☐	☐	☐	☐
Design errors and omissions made by designers	☐	☐	☐	☐	☐
Insufficient data collection and survey before design	☐	☐	☐	☐	☐
Lack of design team experience in construction projects	☐	☐	☐	☐	☐
Mistakes and delays in producing design documents	☐	☐	☐	☐	☐
Misunderstanding of owner's requirements by design engineer	☐	☐	☐	☐	☐
Poor use of advanced engineering design software	☐	☐	☐	☐	☐
Unclear and inadequate details in drawings	☐	☐	☐	☐	☐
Incomplete project design	☐	☐	☐	☐	☐
Defective design made by designers	☐	☐	☐	☐	☐

Figure 3.11: Design Related Causes

This questionnaire was prepared after a lengthy reading of several previous studies that examined the causes of building projects rampant, where the most important and most common reasons that leads to construction projects liberalization were collected and presented in this questionnaire. This questionnaire was distributed by e-mail, social media, and directly to companies in Jordan and Turkey. In this study, the reasons for the delay of the projects presented in the questionnaire were considered as variable, and that includes the reasons resulting from the consultant, the contractor, the owner, materials, external conditions, design, project, equipment, and manpower.

3.3. Research Population

3.3.1. Country Selection

This research focused on causes and effect of construction project delay, the case of study was Jordan and Turkey, and the target was the engineering sector in both of this tow country such as construction companies, consultant companies, educational institutions, and government department.

3.4.1 Sampling

Construction is one of Jordan's and Turkey's most important industries, and we attach this sector to contractors, consultants, engineers, owners, and many other parties who deal with the construction industry, directly or indirectly. In order to study these areas where there are a huge number of construction projects, a specific mechanism must be used to take samples covering this area in order for it to become possible to generalize the results. (Davey et al., 2010). As a result, the most convenient approach was used in this analysis to gather data in a detailed and precise manner, and the samples that were taken consisted of engineers from various disciplines, contractors, government agencies specialized in the engineering sector, and educational departments specializing in the engineering sector.

3.4. Analysis Method

In this study, the data collection process took about a month, where 200 people answered the questionnaire. The answers of 199 people were approved and entered the Statistical Package for Social Sciences program (SPSS) to analyse this data. Emeka, 2016 defined quantitative analysis as an analysis method that arranges variables and parameters according to their importance. In this study the quantitative analysis from Statistical Package for Social Sciences program (SPSS) was used to analyse the data this is done by using standard deviation and mean score. The RII method was used to determine the significance of the causes, since this method ranks the causes on a scale of 0 to 1, with 0 being the weakest and 1 being the strongest, using the following equation 3.1 (Sambasivan et al., 2007):

$$RII = \frac{\sum w}{(A*N)} \quad (3.1)$$

RII: Relative importance index.

W: weight for each factor = $(5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1)$

A: the highest rank = 5

N: number of respondent people.



4. DATA ANALYSIS AND RESULTS

In this chapter, all previously obtained data will be analyzed using the quantitative methodology as mentioned previously, and to answer the questions raised in this research, a quantitative analysis of the data collected from 199 respondents was used. Whereas, the respondent's data will be analyzed, such as years of experience, workplace, and field of work, and then analyzing the causes related to each party and comparing the importance of the causes.

4.1. Personal data of the Respondents

After the data obtained from the questionnaire were entered on the (SPSS) program and analyzed by the number of 199 respondents depending on their on the country, gender, the main field of their work and specialization, it was found that the number of males who responded to the questionnaire was 64.8%, which is equivalent to 129 out of 199, and the percentage of females was 35.2%, equivalent to 70 females. Table 4-1 shown the frequency and the percentage for each of male and female and in figure 4-1 shown the frequency for male and female as a chart

Table 4-1: Gender frequency

Gender	Frequency	Percentage
Male	129	64.8
Female	70	35.2
Total	199	100

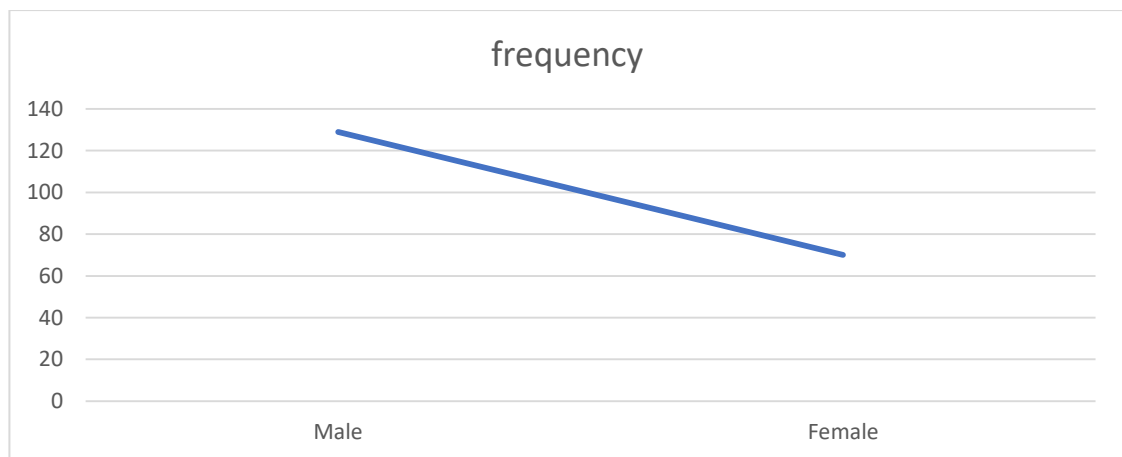


Figure 4.1: Gender, frequency chart

As for the country in which the people responding to the questionnaire work, 52.8% work in Turkey, or approximately 105 engineers, and 47.2% the percentage of people who work in Jordan, approximately 94 engineers. Table 4.2 shown the frequency and the percentage for each of Turkey and Jordan. Figure 4.2 shown the frequency for Turkey and Jordan as a chart

Table 4.2: Country frequency

Country	frequency	Percentage
Turkey	105	52.8
Jordan	94	47.2
Total	199	100

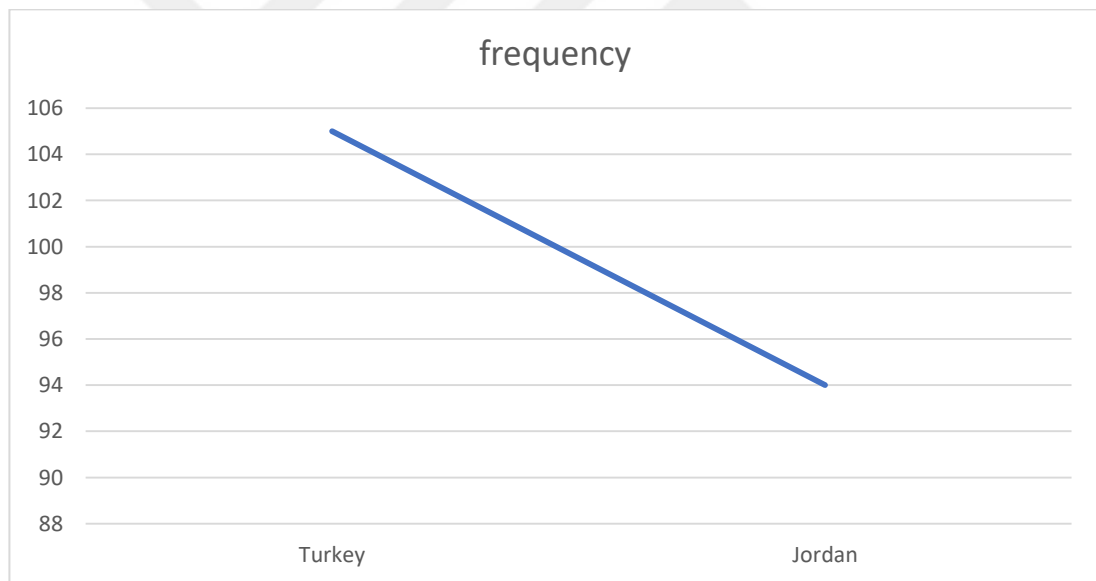
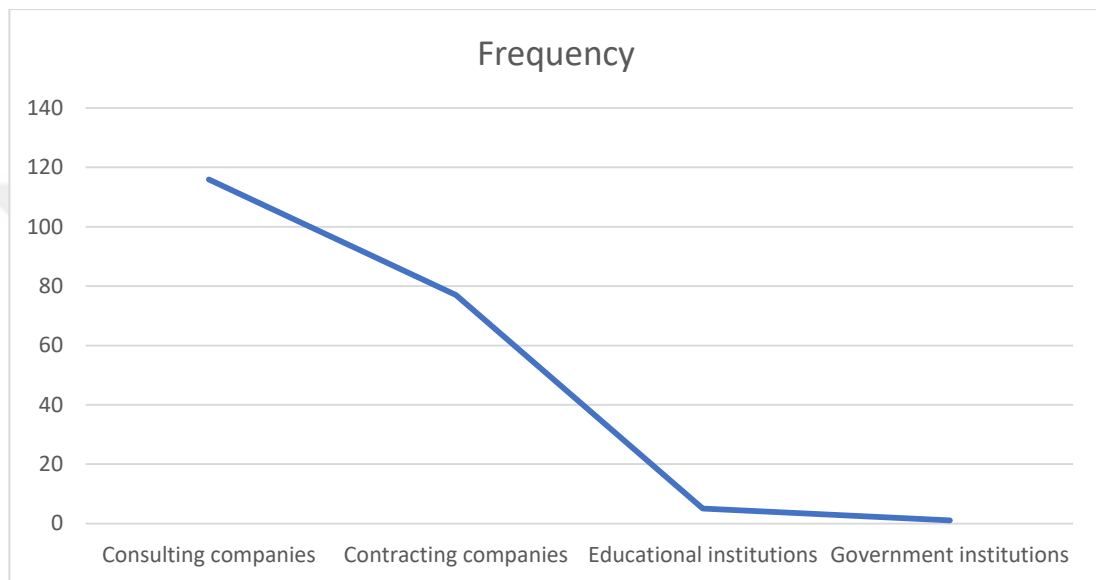


Figure 4.2:Country, frequency chart

As for the field of work, a percentage 58.3%, approximately 166 people work in consulting companies, and this was the largest percentage, followed by people who work in contracting companies their percentage was 38.7%, or about 77 people, then educational institutions at a rate of 2.52%, about 5 people, and finally government institutions at a rate of 0.5%, one person. Check table 4.3 and figure 4.3.

Table 4.3: Field frequency

Field	Frequency	Percentage
Consulting companies	116	58.3
Contracting companies	77	38.7
Educational institutions	5	2.5
Government institutions	1	0.5
Total	199	100

**Figure 4.3:** Field, frequency chart

Whereas, the 199 respondents were from various engineering disciplines, as the percentage of civil engineers who responded to the questionnaire was 68.3%, or approximately 136 civil engineers, and they were the largest, followed by architects at a rate of 20.1%, equivalent to the 40 architects, and then electrical engineers at a rate 6.54%, which is equivalent to 13 electrical engineers, and 3.02% of mechanical engineers who responded to the Spanish, which is approximately 6 engineers, and there was also 1.5% who represented the owners of contracting companies, equivalent to the 3 people, and 0.5% represented the owners of consulting companies, equivalent to One person. Check table 4.4 and figure 4.4.

Table 4.3: Specialization, frequenc

Specialization	Frequency	Percentage
Architectural Engineering	40	20.1

Civil Engineering	136	68.3
Consulting company owner	1	0.5
Contractor company owner	3	1.5
Electrical engineering	13	6.5
Mechanical engineering	6	3.0
Total	199	100

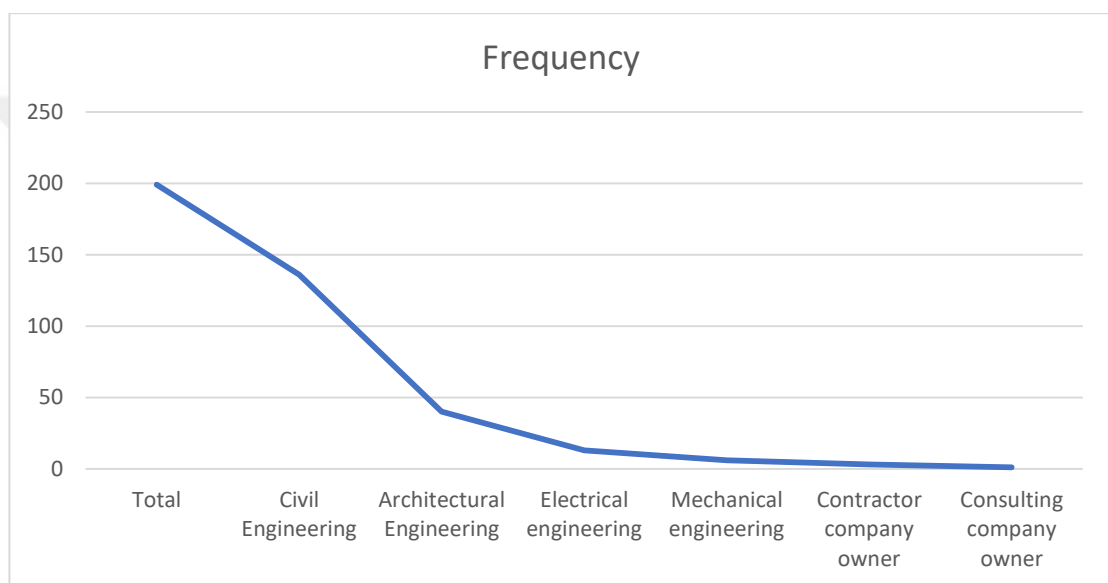


Figure 4.4: Specialization, frequency chart

As for the years of experience, it was found that 8.5% of the respondents have 1-5 years of experience, equivalent to 17 engineers, 19.1% of the respondents have 6-10 years of experience, or about 38, 19.6% of the respondents have 11-15 years of ink, which is approximately 39 engineers, 27.6% of respondents have 16-20 years of experience, that is, approximately 55 people, and 25.1% of respondents have 21 years or more of experience, or nearly 50 engineers. Check table 4-5 and figure 4-5.

Table 4.4: Year of experience, frequency

Year of experience	Frequency	Percentage
1-5	19	8.5

6-10	38	19.1
11-15	39	19.1
16-20	55	27.6
21 and more	50	25.1
Total	199	100

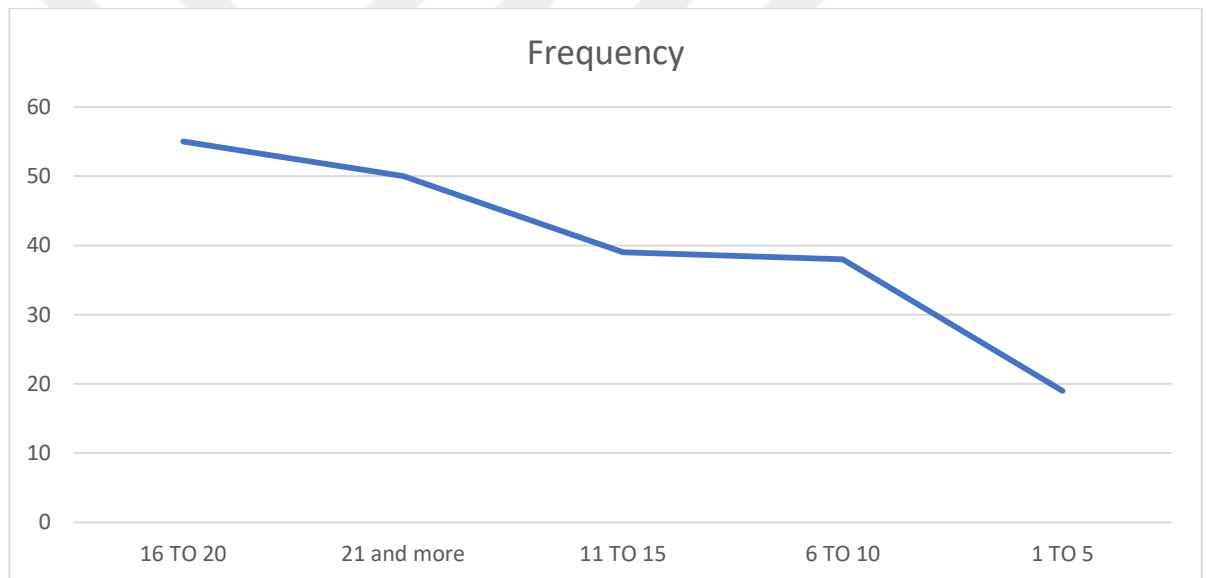


Figure 4.5: Year of experience, frequency chart

4.2. Constriction delay causes

There are several causes that cause building projects to be postponed, including issues with the consultant, contractor, architecture, machinery, external, labors, supplies, owner, and project.

4.2.1. Causes related to the consultant

Data were collected and analyses by the (SPSS) program, where the answers were distributed according to the extent of the influence of the factors that delay the construction projects from very weak to very strong, then the RII for each factor was

found as shown in the table and the chart below. Where it was found that the three most important consultant related factors lead to delayed construction projects from the most influential to the least, which it lacks experience in construction project, delay in approving major changes by consultant, and conflicts between consultant and design engineer. Check Table 4.6 and figure 4.6.

Table 4.5: RII for consultant related factor

Causes related to the consultant						
Rank # Causes	Very week	Week	Average	Strong	Very strong	RII
Lack of experience in construction project	1	17	9	118	54	0.808
Conflicts between consultant and design engineer	10	31	18	80	60	0.749
Delay in approving major changes by consultant	0	9	49	103	38	0.770
Delay in performing inspection and testing	10	17	81	65	26	0.680
Inaccurate site investigation	1	28	62	53	55	0.733
Inadequate project management assistance	18	8	59	77	37	0.707
Late in reviewing and approving design document	8	19	53	90	29	0.713
Total	48	129	331	586	290	0.736

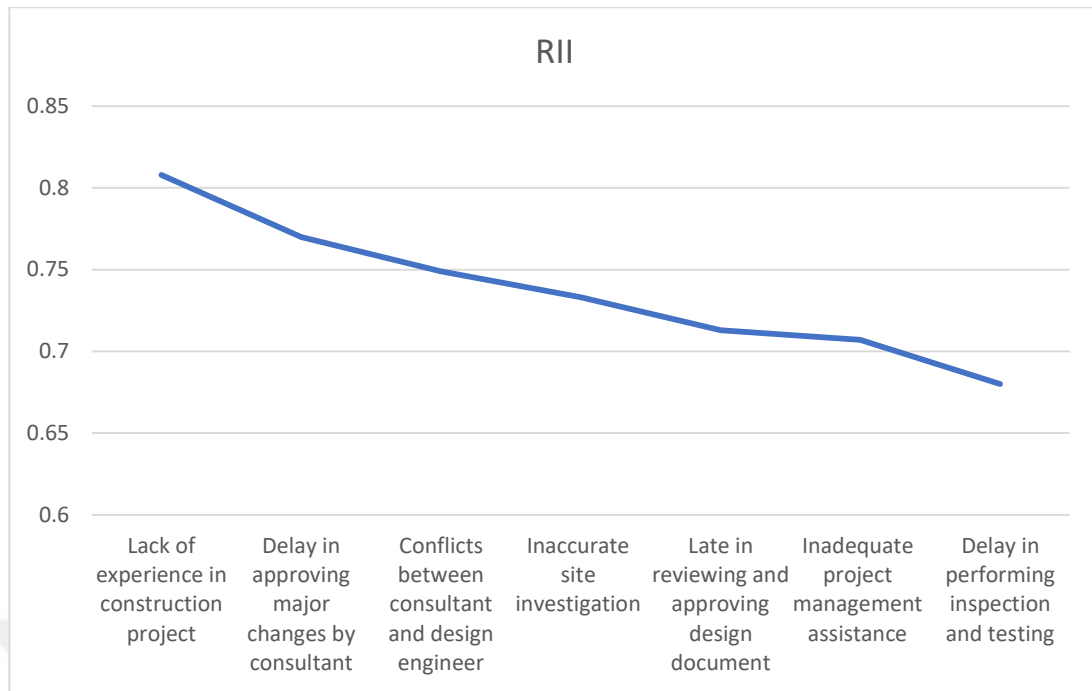


Figure 4.6: RII for consultant related factor

4.2.2. Causes related to contractor

Data were collected and analyzed by the (SPSS) program, where the answers were distributed according to the extent of the influence of the factors that delay the construction projects from very weak to very strong, then the RII for each factor was found as shown in the table and the chart below. Where it was found that the three most important contractor related factors lead to delayed construction projects from the most influential to the least, Which it Ineffective project planning and scheduling, Inappropriate construction methods, Poor financial control on site. Check table 4.7 and table 4.7.

Table 4.6: RII for contractor related factor

Causes related to contractor						
Rank # Causes	Very week	Week	Average	Strong	Very strong	RII
Frequent change of subcontractors	0	16	87	70	26	0.706
Inadequate contractor experience	3	10	37	103	46	0.779
Inappropriate construction methods	0	1	33	82	83	0.848

Incompetent project team	0	1	19	144	35	0.814
Ineffective project planning and scheduling	0	9	29	54	107	0.860
Obsolete technology	1	30	60	74	34	0.710
Poor communication and coordination between owner and consultant	1	3	74	92	29	0.745
Poor site management and supervision	2	3	48	81	65	0.805
Rework due to errors	0	4	41	104	50	0.801
Unreliable subcontractors	1	1	49	95	53	0.799
Inadequate site investigation	2	32	49	69	47	0.727
Inappropriate contractor's policies	0	23	40	92	44	0.757
Poor financial control on site	3	14	25	63	94	0.832
Total	13	147	591	1123	713	0.784

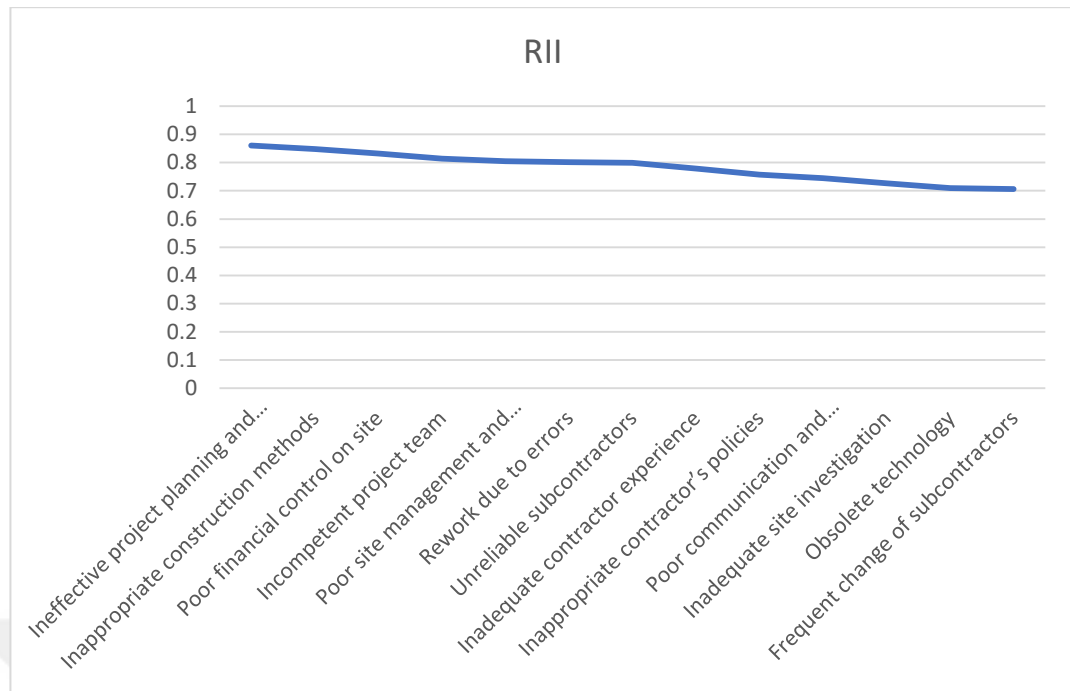


Figure 4.7: RII for contractor related factor

4.2.3. Causes related to design problems

Data were collected and analyzed by the (SPSS) program, where the answers were distributed according to the extent of the influence of the factors that delay the construction projects from very weak to very strong, then the RII for each factor was found as shown in the table and the chart below. Where it was found that the three most important design related factors lead to delayed construction projects from the most influential to the least, which it is misunderstanding of owner's requirements by design engineer, design errors and omissions made by designers, and design changes by owner or his agent during construction. Check table 4.8 and figure 4.8.

Table 4.7 : RII for design problems related factor

Causes related to design						
Rank # Causes	Very week	Week	Average	Strong	Very strong	RII
Complexity of project design	7	34	64	78	16	0.662
Design changes by owner or his agent during construction	3	14	31	104	47	0.779

Design errors and omissions made by designers	1	3	53	56	86	0.824
Insufficient data collection and survey before design	1	21	21	122	34	0.768
Lack of design team experience in construction projects	8	2	51	108	30	0.751
Mistakes and delays in producing design documents	2	18	58	93	28	0.728
Misunderstanding of owner's requirements by design engineer	0	2	27	93	77	0.846
Poor use of advanced engineering design software	8	6	78	72	35	0.721
Unclear and inadequate details in drawings	4	17	48	86	41	0.735
Incomplete project design	1	5	63	80	50	0.774
Defective design made by designers	3	17	56	75	48	0.749
Total	38	139	550	967	492	0.759

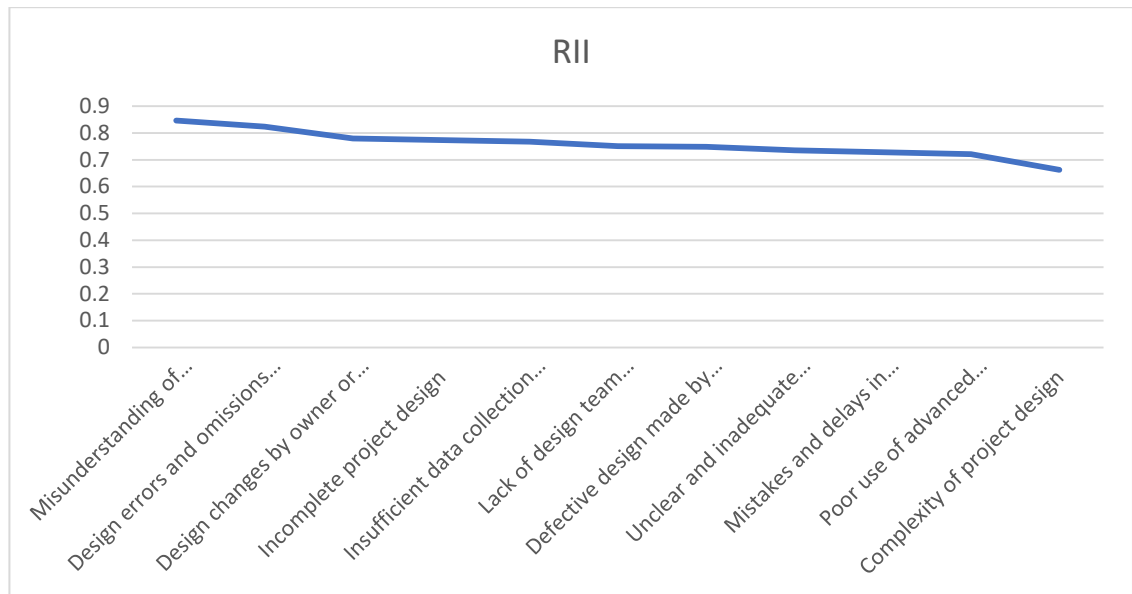


Figure 4.8: RII for design problems related factor

4.2.4. Causes related to equipment's

Data were collected and analyzed by the (SPSS) program, where the answers were distributed according to the extent of the influence of the factors that delay the construction projects from very weak to very strong, then the RII for each factor was found as shown in the table and the chart below. Where it was found that the three most important equipment's related factors lead to delayed construction projects from the most influential to the least, which it slow mobilization of equipment, improper equipment, and frequent equipment breakdowns. Check table 4.9 and figure 4.9.

Table 4.8: RII for equipment related factor

Causes related to equipment						
Rank # Causes	Very week	Week	Average	Strong	Very strong	RII
Equipment allocation problem	0	26	81	76	16	0.662

Frequent equipment breakdowns	2	13	35	137	12	0.779
Improper equipment.	0	3	71	71	54	0.824
Inadequate modern equipment	0	18	54	125	2	0.768
Low efficiency of equipment.	0	2	100	57	40	0.751
Shortage of equipment	1	18	39	62	79	0.728
Slow mobilization of equipment	0	3	87	84	25	0.846
total	3	83	467	612	228	0.741

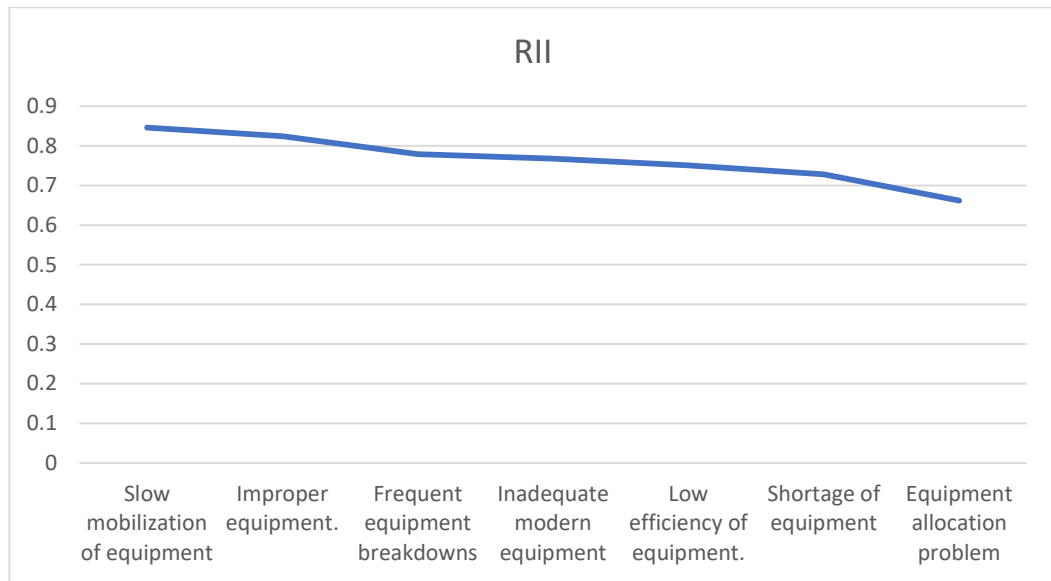


Figure 4.9: RII for equipment related factor

4.2.5. Causes related to external factors

Data were collected and analyzed by the (SPSS) program, where the answers were distributed according to the extent of the influence of the factors that delay the construction projects from very weak to very strong, then the RII for each factor was found as shown in the table and the chart below. Where it was found that the three most important external related factors lead to delayed construction projects from the most influential to the least, which it different tactics patterns for bribes, price fluctuations, and delay in obtaining permits from municipality. Check table 4.10 and figure 4.10.

Table 4.9: RII for external related factor

Causes related to external						
Rank # Causes	Very week	Week	Average	Strong	Very strong	RII
Accidents during construction	9	71	88	12	19	0.561
Poor project management assistance	16	73	60	75	11	0.701
Different tactics patterns for bribes	0	10	34	63	92	0.838
Delay in obtaining permits from municipality	0	7	58	74	60	0.788

Delay in performing final inspection and certification by third party	0	0	110	71	18	0.708
Delay in providing services from utilities (water, electricity, etc.)	1	2	81	63	52	0.764
Global financial crisis	1	39	25	74	60	0.754
Loss of time by traffic control and restriction at job site	28	22	67	62	20	0.624
Sudden failures actions	1	5	52	96	45	0.779
Price fluctuations	0	12	28	108	51	0.799
Problem with neighbours	11	11	85	72	20	0.679
Slow site clearance	1	1	104	48	1	0.515
Unexpected surface & subsurface conditions (soil, water table, etc.)	1	25	69	83	21	0.698
Unfavourable weather conditions	4	47	77	59	12	0.628
Inadequate production of raw material in the country	8	14	51	107	19	0.716
Inappropriate government policies	0	23	88	70	18	0.683
Thefts done on site	12	20	79	65	23	0.667
Total	93	382	1156	1202	542	0.702

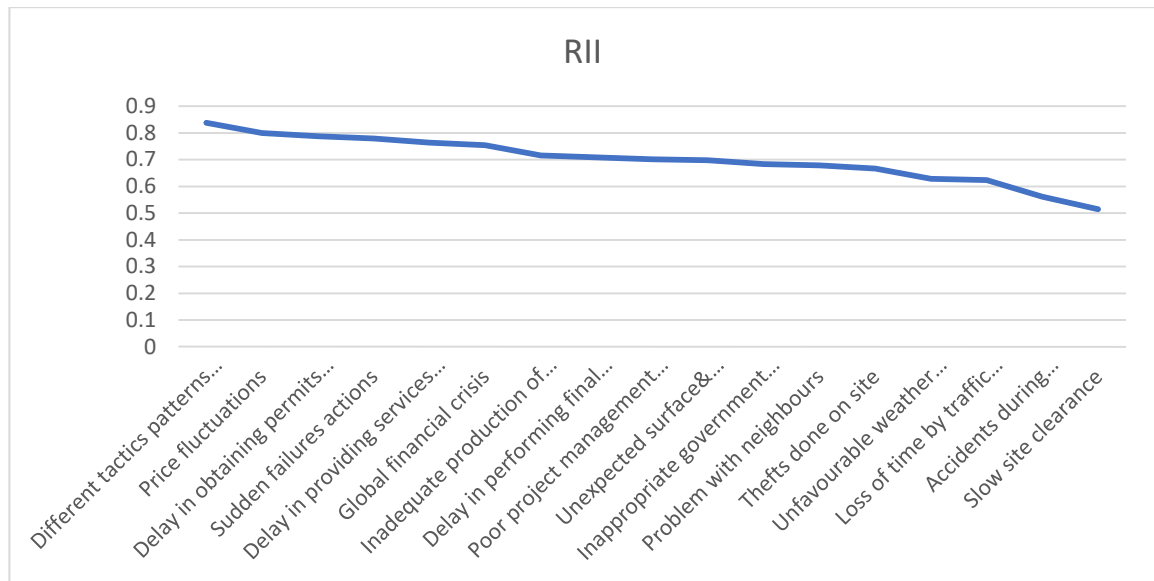


Figure 4.10: RII for external related factor

4.2.6. Causes related to labors

Data were collected and analyzed by the (SPSS) program, where the answers were distributed according to the extent of the influence of the factors that delay the construction projects from very weak to very strong, then the RII for each factor was found as shown in the table and the chart below. Where it was found that the three most important labors related factors lead to delayed construction projects from the most influential to the least, low productivity of labor, Labor injuries on site, and labor injuries on site. Check table 4.11 and figure 4.11.

Table 4.10: RII for labors related factor

Causes related to labors						
Rank # Causes	Very week	Week	Average	Strong	Very strong	RII
Absenteeism	10	37	87	46	19	0.627
Low motivation and morale of labor	5	42	41	95	16	0.675
Low productivity of labor	1	14	41	97	46	0.774
Personal conflicts among labor	1	35	95	66	2	0.633
Shortage of labor	1	0	54	132	12	0.755
Slow mobilization of labor	1	11	52	109	26	0.749

Unqualified/inadequate experienced labor	1	9	80	70	39	0.738
Labor injuries on site	1	6	51	105	36	0.769
Total	21	154	501	720	196	0.715

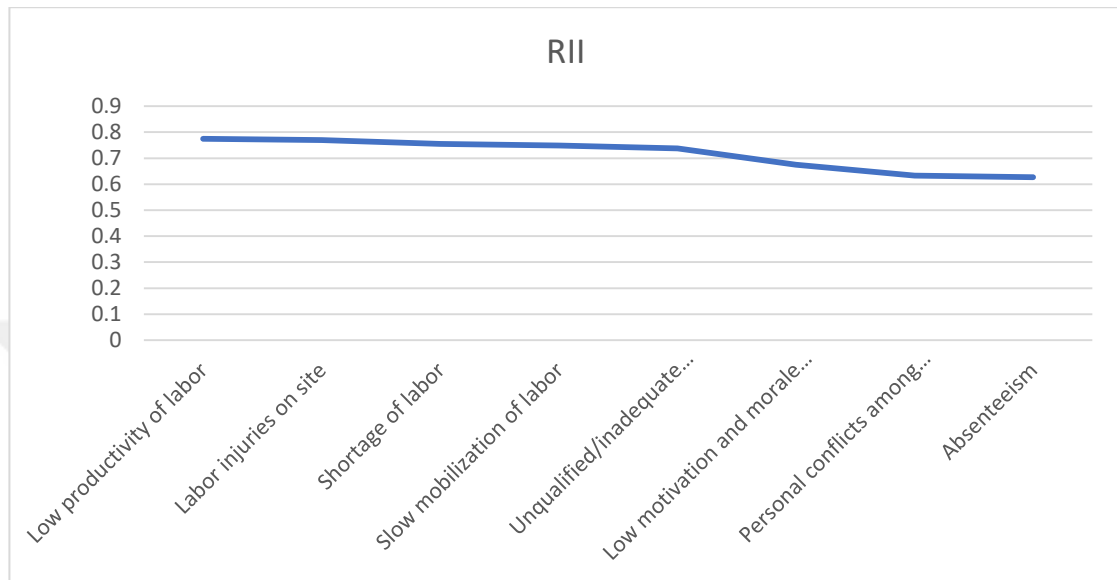


Figure 4.11: RII for labors related factor

4.2.7. Causes related to materials

Data were collected and analyzed by the (SPSS) program, where the answers were distributed according to the extent of the influence of the factors that delay the construction projects from very weak to very strong, then the RII for each factor was found as shown in the table and the chart below. Where it was found that the three most important materials related factors lead to delayed construction projects from the most influential to the least, late delivery of materials, delay in manufacturing materials, and Unreliable suppliers. Check table 4.12 and figure 4.12.

Table 4.11: RII for materials related factor

Causes related to materials						
Rank # Causes	Very week	Week	Average	Strong	Very strong	RII
Changes in material types and specifications during construction	12	28	65	57	37	0.679
Damage of sorted materials	0	22	50	119	8	0.714
Delay in manufacturing materials	0	2	73	86	38	0.761
Escalation of material prices	0	15	102	73	9	0.677
Late delivery of materials	1	2	50	111	35	0.778
Poor procurement of construction material	0	21	60	94	24	0.722
Poor quality of construction materials	2	2	82	82	31	0.739
Shortage of construction materials	5	6	75	94	19	0.717
Unreliable suppliers	0	12	53	102	32	0.755
Total	20	110	610	818	233	0.727

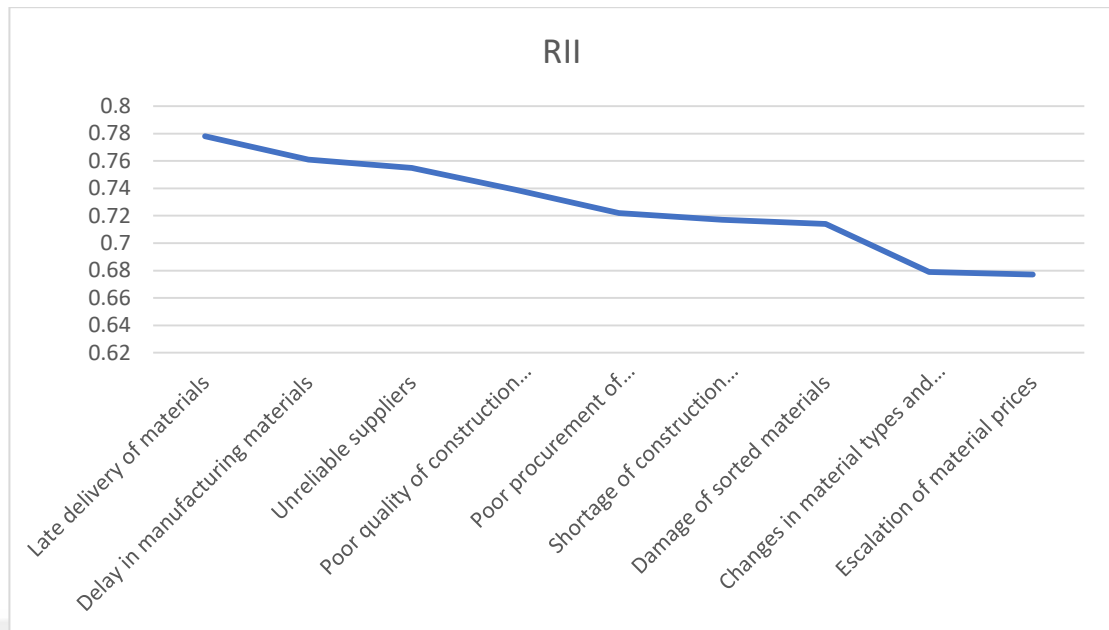


Figure 4.12: RII for material related factor

4.2.8. Causes related to owner

Data were collected and analyzed by the (SPSS) program, where the answers were distributed according to the extent of the influence of the factors that delay the construction projects from very weak to very strong, then the RII for each factor was found as shown in the table and the chart below. Check table 4.13 and figure 4.13.

Table 4.12: RII for owner related factor

ID	Causes related to owner						RII
	Rank # Causes	Very week	Week	Average	Strong	Very strong	
1	Change orders	7	20	49	96	27	0.717
2	Conflicts between joint ownership	2	13	43	114	27	0.752
3	Delay in approving design documents	0	12	16	126	45	0.805
4	Delay in progress payments (Funding problems)	0	11	21	53	114	0.871
5	Delay in site delivery.	0	17	34	115	33	0.765

6	Improper project feasibility study	9	18	44	79	49	0.742
7	Lack of capable representative	0	20	73	87	19	0.706
8	Lack of owner experience in construction projects	10	35	63	63	28	0.664
9	Lack of incentives for contractor to finish ahead of schedule	4	30	78	64	23	0.672
10	Poor communication and coordination between consultant and contractor	0	13	106	49	31	0.698
11	Slowness in decision making	0	20	74	87	18	0.704
12	Suspension of work by owner	1	12	40	72	74	0.807
13	Inadequate planning	3	12	30	112	42	0.779
14	Mode of financing and payment for completed work	3	11	42	99	44	0.771
15	Long period between design and time of bidding/tendering	9	18	81	90	1	0.656
16	Inappropriate contractual procedure	5	22	94	66	12	0.658
17	Additional work	5	56	68	34	36	0.640
18	Bureaucracy in bidding/tendering method	11	28	100	51	9	0.619
19	Selecting inappropriate contractors	3	11	36	123	26	0.759
20	Total	72	379	1092	1580	658	0.726

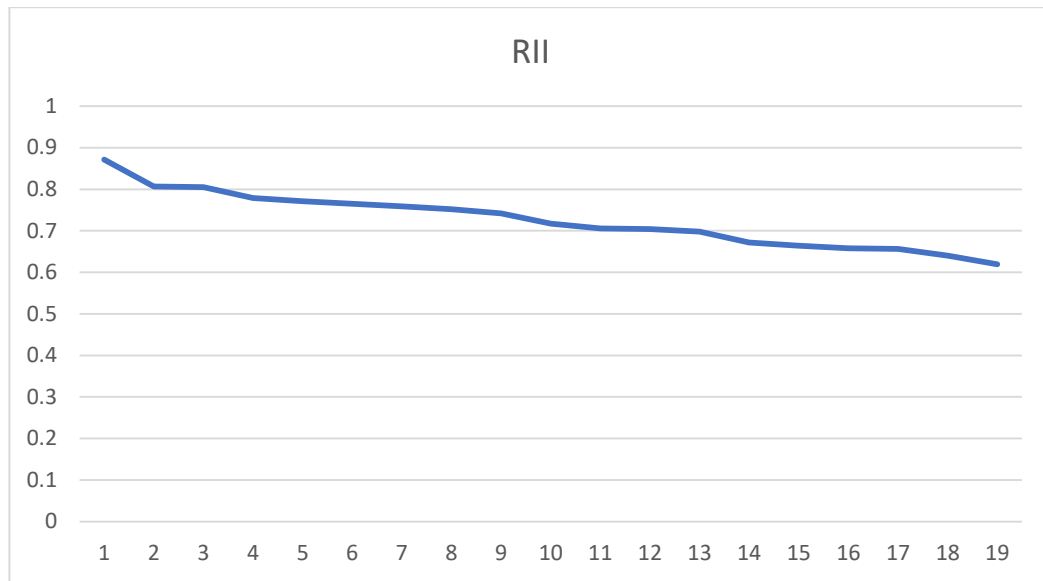


Figure 4.13: RII for owner related factor

4.2.9. Cases related to project

Data were collected and analyzed by the (SPSS) program, where the answers were distributed according to the extent of the influence of the factors that delay the construction projects from very weak to very strong, then the RII for each factor was found as shown in the table and the chart below. Where it was found that the three most important owner related factors lead to delayed construction projects from the most influential to the least, legal disputes between project participants, original contract duration is short, and ineffective delay penalties. Check table 4.14 and figure 4.14

Table 4.13: RII for project related factor

Causes related to project						
Rank # Causes	Very week	Week	Average	Strong	Very strong	RII
Complexity of project (project type, project scale, etc.)	3	13	73	86	24	0.716
Inadequate definition of substantial completion	1	14	93	74	17	0.692
Ineffective delay penalties	0	3	56	105	35	0.773
Legal disputes between project participants	0	1	43	89	66	0.821

Original contract duration is short	9	0	37	99	54	0.789
Unfavorable contract clauses	1	20	28	117	33	0.762
Total	14	51	330	570	229	0.759

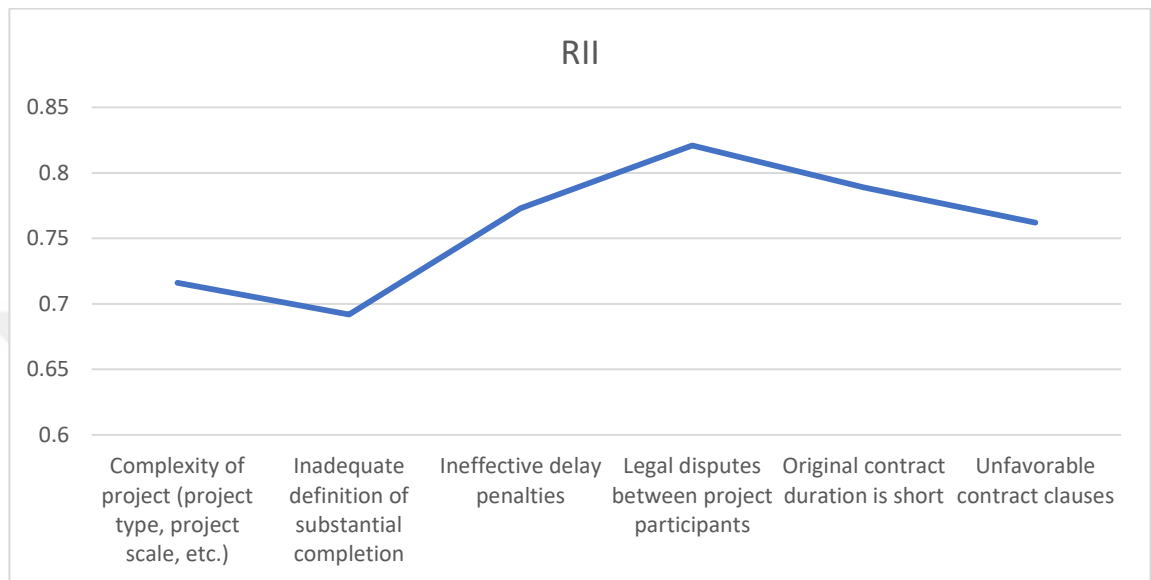


Figure 4.14: RII for project related factor

4.3. Comparison of the parties that contribute to project delays

In this study, the factors that cause delay in construction projects in Jordan and Turkey were searched and these reasons were classified according to the party that caused this delay, and the groups were the consultant, contractor, design problems, equipment, external factors, labor, materials, owner, And the project. As the results indicated that the biggest cause of delay in construction projects is the contractor and then the project and design problems have the same degree of influence. After that, all the equipment, the consultant, the materials, the owner, the manpower, and the external factors come. The table and graph below show the RII for each party and its arrangement according to the net effect, highest to lowest. Check table 4-15 and figure 4-15.

Table 4.14: RII and rank for parties

Causes	RII	Rank
Contractor	0.784	1

Design problems	0.759	2
Project	0.759	3
Equipment's	0.741	4
Consultant	0.736	5
Materials	0.727	6
Owner	0.726	7
Labors	0.715	8
External factors	0.702	9

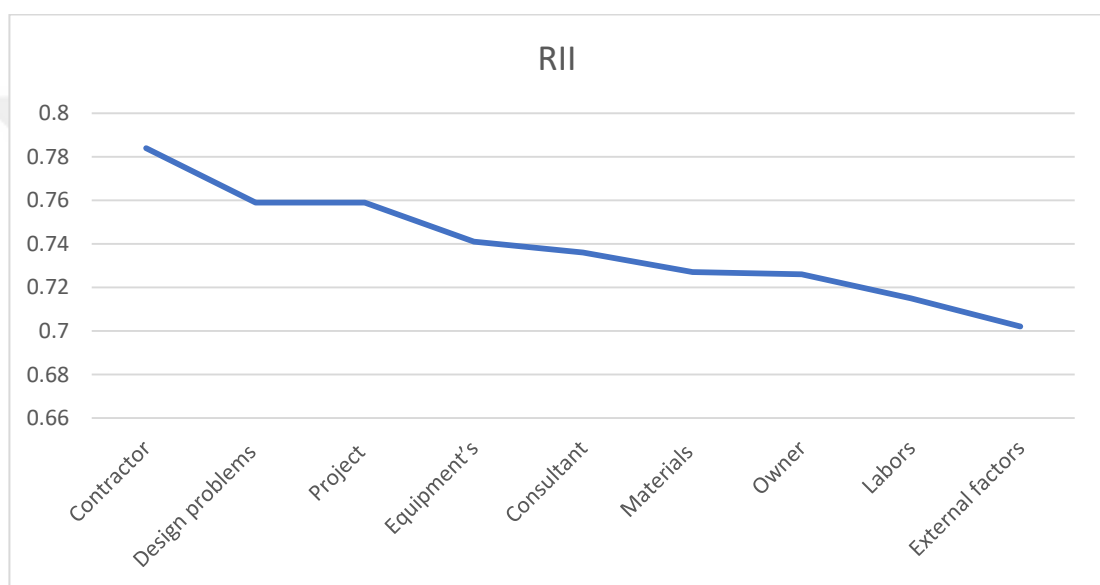


Figure 4.15: RII for project related factor

4.4. Summary

In this chapter, the data collected by the questionnaire was analyzed by the SPSS program through quantitative analysis and finding the RII for each element. 199 people answered the questionnaire, both males and females, where the percentage of males who responded to the questionnaire was 64.8%, while the percentage of females was 35.2%. The data were taken from two countries that the study focused on, Jordan and Turkey, where the largest percentage of respondents were engineers and company owners in Turkey, at a rate of 52.8%, while engineers and company owners residing in Jordan accounted for 47.2%. The focus of publishing the questionnaire was on consulting firms, contracting companies, educational institutions, and government institutions related to engineering work, as respondents who responded to the questionnaire who work in consulting firms

maintained a rate equivalent to 58.3%, followed by contracting companies at a rate of 38.7%, educational institutions at a rate of 2.5%. Finally, governmental institutions, with a rate of 0.5% of the number of respondents. The respondents were from various civil, architectural, electrical, and mechanical engineering disciplines, owners of contracting companies, and consulting firms' owners, where the percentage of civil engineers who responded to the questionnaire was 68.3%, engineers' architects by 20.1%, electrical engineers by 6.5%, mechanical engineers by 3%. %, Owners of contracting companies a rate of 1.5%, and owners of consulting companies a rate of 0.5%. 25.1% of the respondents had years of experience from 21 years and more, 27.6% had years of experience from 16 to 20 years, 19.1% had years of experience from 11 to 15 years, 19.1% had ink years from 6 to 10 years, and 8.5% would have ink. 1 to 5 years. All the above represent the trend data of the respondents who responded to the questionnaire. In this study, the causes that lead to delayed construction projects were classified, and these groups were the reasons related to the consultant, the contractor, design problems, equipment, external factors, labor, materials, owner, and the project. Where the data taken from the questionnaire was analyzed and the strength of its strength was classified into very weak, weak, medium, strong, and very strong, then the frequency and RIIs were found to determine the extent of the impact of each group and conceal the factors related to the contractor are among the main reasons that lead to the delay of the construction projects schedule Below, each group is shown and arranged according to its impact, from largest to least impact. For materials related. Check table 4.16.

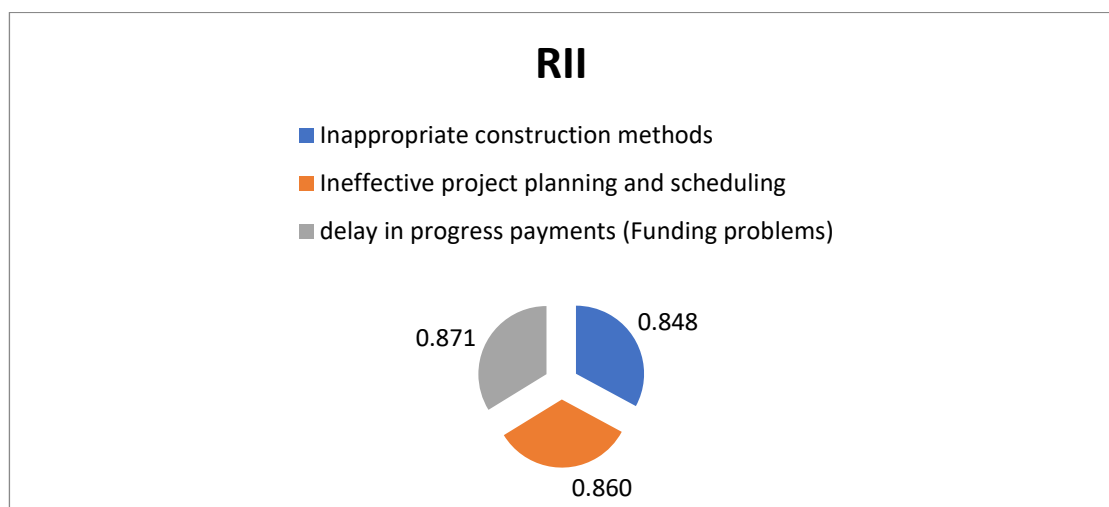
Table 4.15: RII and rank for parties

Causes	RII	Rank
Contractor	0.784	1
Design problems	0.759	2
Project	0.759	3
Equipment's	0.741	4
Consultant	0.736	5
Materials	0.727	6
Owner	0.726	7
Labor	0.715	8
External factors	0.702	9

table 4-17 and figure 4-17 shows the rank for the most important causes and it shows Which party is responsible for it.

Table 4-16: The most important causes

Causes	RII	Responsible party
delay in progress payments (Funding problems)	0.871	Owner
Ineffective project planning and scheduling	0.860	Contractor
Inappropriate construction methods	0.848	Contractor

**Figure 4.16:** RII for most important causes

5. CONCLUSION AND RECOMENDATION

To reduce the problems of delayed construction projects, the reasons that lead to this problem must be clear and known. This study aims to know and clarify the main reasons and factors that lead to delayed construction projects, as 97 factors that contribute to the delay in construction projects were taken into consideration. These factors were distributed into 9 groups according to the parties causing these factors, and these groups were causes related to the consultant, causes related to the contractor, causes related to design problems, causes related to equipment, causes related to external factors, causes related to workers, causes related to materials, causes related to the owner, and the causes related to the project. These groups were analyzed for each group separately and found the relative importance index for each of these factors in each group and found the relative importance index for the group. Through the relative importance index, the most important factors in each group were identified; the most important factors among all these factors, and the groups were arranged according to their importance and the extent of their impact on the occurrence of problems of delay in construction projects. Check table 5-1 and 5-2.

Table 5.1: Most three important causes

Causes	RII	Responsible party
delay in progress payments (Funding problems)	0.871	Owner
Ineffective project planning and scheduling	0.860	Contractor
Inappropriate construction methods	0.848	Contractor

Table 5.2:Rank for parties

Causes	RII	Rank
Contractor	0.784	1
Design problems	0.759	2
Project	0.759	3
Equipment's	0.741	4
Consultant	0.736	5

Materials	0.727	6
Owner	0.726	7
Labor	0.715	8
External factors	0.702	9

Based on the results obtained previously, some points can be noted that could limit the problem of delayed construction projects in the future:

- The owner who wants to set up a project must resort to people with sufficient experience to conduct a study of the expected costs, before starting the project to avoid falling into the problem of unavailability of financial liquidity and failure to provide payments, and this is one of the most important reasons for the delay of construction projects
- When choosing a contractor, it is necessary to make sure of his appropriate and sufficient experience that enables him to complete the project in the best way. The insufficient experience of the contractor is considered one of the most important factors that lead to the loss of construction projects.
- The contractor must have a staff with sufficient experience and skills to enable them to complete an effective plan and schedule for the construction process and the required activities, and this team must be able to update the schedule and amend it with the least possible losses in the event of a specific circumstance.
- The site manager must be carefully selected, have extensive experience and expertise, have the ability to make critical decisions when it comes to the task, and have an administrative cadre with real management skills for the sake of the project's success because ineffective management will impede work and cause delays in construction projects.
- The Maltese must, before requesting any change or addition to the project, hold a meeting with the competent persons and study the situation and the extent of the impact of this change on the schedule to avoid any delay in the project.
- Ensure that the party supplying the necessary materials has high credibility and punctuality, because the occurrence of delays in the delivery of materials leads to a large delay in construction projects.

- The main contractors, especially in large projects, must choose the subcontractors responsible for completing the work with high experience and reliable, because choosing subcontractors who do not have experience will lead to many problems in work and delay in the performance of the work, thus delaying the delivery of the project beyond the specified date.
- The consulting company must follow up the work on the site and make sure that the work is correct and that there are no errors and make sure of that constantly to know the errors early, which leads to easy adjustment or repair.
- The contractors or subcontractors must choose qualified and experienced workers and laborers to avoid or reduce accidents that may occur.
- The delivery of the site and the necessary plans to the contractor should not be delayed starting work, and the delay in that is promised, except in the event of external circumstances.
- In the event of problems related to the owner, the owner must make decisions quickly and accurately so that the work does not stop for a long period.
- One of the most important things that must be considered is to find an effective means of communication between the parties to the project in general in order to coordinate between them in the event of problems being able to communicate in order to find a solution that suits all the participating parties. Due to misunderstanding, this leads to construction projects conflict

It is expected in the future to conduct a similar study, but for a specific type of projects such as towers, bridges, infrastructure, treatment plants, and others. It is possible to conduct a study that examines the causes of delay for a specific type of construction project in detail and to reach more accurate results related to this type of project.

BIBLIOGRAPHY

- Alsuliman, Jawad A. "Causes of Delay in Saudi Public Construction Projects." *Alexandria Engineering Journal*, Elsevier, 24 July 2019,
- Aziz, 1970 "Exploring Delay Causes of Road Construction Projects in Egypt: Semantic Scholar."
- Andrew, N.G.H. and Holt, B.G. (2012). "Project delays and cost: stakeholder Perceptions of traditional v. PPP procurement", *Journal of Financial Management of Property and Construction*, 17(1) pp. 73 – 91.
- Alnuaimi, A.S. and Al Mohsin, M.A. (2013). Causes of delay in completion of Construction projects in Oman. *International Conference on Innovations in Engineering and Technology*. pp 25-26.
- Asubay, E.K.S. and Mensah, C.A. (2015). Improving Delivery of Construction Projects in Ghana's Cities: A Lean Construction Approach, *International Journal of Sustainable Construction Engineering & Technology*, vol 6(1).
- Afshari, H., Khosravi, S., Ghorbanali, A., Borzabadi, M. and Valipour, M. (2011), "Identification of causes of non-excusable delays of construction projects", *Proceedings of 2010 International Conference on E-business, Management and Economics*, Vol. 3, IACSIT Press, Hong Kong
- Afshari, H., Khosravi, S., Ghorbanali, A., Borzabadi, M. and Valipour, M. (2011), "Identification of causes of non-excusable delays of construction projects", *Proceedings of 2010 International Conference on E-business, Management and Economics*, Vol. 3, IACSIT Press, Hong Kong
- Aynur Kazaz, S.U. (2012). CAUSES OF DELAYS IN CONSTRUCTION PROJECTS IN TURKEY. *JOURNAL OF CIVIL ENGINEERING AND MANAGEMENT*, Volume 18(3): 426-435.
- Abdullah, M. R., Rahman, I. A., Asmi, A., and Azis, A. (2010). "Causes of Delay in MARA Management Procurement Construction Projects." 1(1), 123–138.
- Al-Kharashi, A., Skitmore, M., (2009). Causes of delays in Saudi Arabian public sector construction projects. *Construction Management and Economics* vol27, pp 3–23.

- Alaghbari, W., Kadir, M.R.A., Salim, A., and Ernawati. (2007). The significant factors Causing delay of building construction project in Malaysia, *engineering, construction and architectural management*, 14(2), pp. 192 – 206
- Alaghbari, W.A.M. (2005). Factors affecting construction speed of industrialized building system in Malaysia, master thesis, University Putra Malaysia, Serdang.
- Acharya, N. K., Lee, Y. D., Kim, S. Y., Lee, J. C., and Kim, C. S. (2006). “Analysis of Construction Delay Factor: A Korean Perspective.” *Proceedings of the 7th Asia Pacific Industrial Engineering and Management Systems Conference*, 883–895.
- Ahmed, S.M., Azhar, S., Kappagntula, P. and Gollapudil, D. (2003), “Delays in construction: a brief study of the Florida construction industry”, *Proceedings of the 39th Annual ASC Conference*, Clemson University, Clemson, SC, pp. 257-66.
- Ali, S.A., Smith, A., Pitt, M. and Choon, H.C. (2010) Contractors perception of factors contributing to project delay: case studies of commercial projects in Klang Valley, Malaysia. *Journal of Design & Built Environment*, Vol 6 (2)
- Antony, J. and Banuelas, R. (2002) Key ingredients for the effective implementation of six sigma program. *Measuring Business Excellence*, 6(4), 20–27.
- Augustine, U.E. and Mangvwat, J. (2001). Time-overrun Factors in Nigerian Construction Industry. *Journal of Construction Engineering and Management* 127(5):pp. 419-425.
- Bramble, B.B. and Callahan, M.T. (2011). *Construction delay claims*, Wolters Kluwer, Law and business. 4th Edition, London: Aspen
- Charles Amoatey, et al. 2015 “Analysing Delay Causes and Effects in Ghanaian State Housing Construction Projects.” *International Journal of Managing Projects in Business*, Emerald Group Publishing Limited, 5 Jan. 2015,
- Doloi, H., Sawhney, A., Iyer, K.C. and Rentala, S. (2012). Analysing factors affecting delays in Indian construction projects, *international journal of project management*, vol30, pp 479-489.

- Dinakar, A. (2014). Delay Analysis in construction project, international journal OF Emerging technology and Advanced Engineering, 4(5).
- Dunkelberger, L. (2009). *How to Stop Losing Money on Inefficient Communication*. Retrieved from
- Davey. J. W.. Gugiu. P. C.. & Coryn. C. L. (2010). Quantitative methods for estimating the reliability of qualitative data. *Journal of MultiDisciplinary Evaluation*. 6(13). 140-162.
- Emeka, Onozulike. "Causes of Delay in Large Construction Project in Nigeria Construction Industry." UCLan, 1 Jan. 2016, clock.uclan.ac.uk/13797/.
- Enshassi, A., Al-Najjar, J. and Kumaraswamy, M. (2009),"Delays and cost overruns in the construction projects in the Gaza Strip", *Journal of Financial Management of Property and Construction*, Vol. 14(2). pp. 126 – 151
- Fugar, F D K and Agyakwah-Baah, A B (2010) 'Delays in building construction projects in Ghana', *Australasian Journal of Construction Economics and Building*, **10** (1/2) 103-116.
- Faridi, A.S. and El-Sayegh, S.M. (2006). Significant factors causing delay in the UAE Construction industry, *Construction Management and Economics*, 24:11, 1167-1176.
- Gonzalez, P., Gonzalez, V., Molenaar, K. and Orozco, F. (2013). Analysis of causes of delay and time performance in construction projects, *American Society of Civil Engineering (ASCE)*.
- Gardezi, S.S.S., Manarvi, I.A. and Gardezi, S.J.S. (2014). "Time Extension Factors in Construction Industry of Pakistan, Fourth International Symposium on Infrastructure Engineering in Developing Countries, IEDC 2013. *Procedia Engineering* vol77, pp196 – 204.
- George Agyekum-Mensah, Andrew David Knight, (2017) "The professionals'perspective on the causes of project delay in the construction industry", *Engineering, Construction and Architectural Management*, Vol. 24 Issue: 5, pp.828-841

- Hampton, G., Baldwin, A.N. and Holt, G. (2012). "Project delays and cost: stakeholder perceptions of traditional v. PPP procurement", *Journal of Financial Management of Property and Construction*, Vol. 17 (1), pp. 73 – 91.
- Hamzah, N., Khoiry, M.A., Arshad, I., Tawil, N.M. and Ani, A.I.C. (2011). Causes of Construction delay-theoretical framework, the 2nd International Building Control Conference, *Procedia Engineering*, vol20, pp.490-495.
- Iyer, K.C., Chaphalkar, N.B. and Joshi, G.A. (2008). Understanding time delay disputes in construction contracts, *international journal of project management*, vol26, pp 174 – 184.
- Kenton, Will. 2020 "Descriptive Statistics." Investopedia, Investopedia,
- Kadir, M.R.A., Lee, W.P., Jaafar, M.S., Sapuan, S.M. and Ali, A.A.A. (2005). Factors affecting construction labour productivity for Malaysian residential projects. *Structural Survey* 23(1): pp.42-54.
- Le-Hoai, L., Lee, Y.D. and Lee, J.Y. (2008), "Delay and cost overruns in Vietnam large construction projects: a comparison with other selected countries", *Journal of Civil Engineering*, Vol. 12 No. 6, pp. 367-77.
- Lo, T.Y., Fung, I.W.H., Tung, K.C.F., (2006). Construction delays in Hong Kong civil engineering projects. *Journal of Construction Engineering Management* vol132, 636–649.
- Long, R.j.P.E. (2015). Analysis of concurrent delay on construction claims. *Long International*
- Liu, Z. (2010). Strategic Financial Management in Small and Medium-Sized Enterprises. *International Journal of Business and Management* 5(2):pp. 132-136.
- Majid, I. A. (2006). "Causes and effect of delays in Aceh construction industry." .” Master’S thesis, Univ. of Technology Malaysia, Johor Bahru, Malaysia.
- Marzouk and El-Rasas. (2014), analysis delay causes in Egyptian construction projects, *journal of advanced research*. Vol 5(1). Pp49-55.

- Mahamid, I. (2011). "Risk matrix for factors affecting time delay in road construction projects: owners' perspective", *Engineering, Construction and Architectural Management*, 18(6) pg. 609 – 617.
- Ministry of Public Works (1979) Agreement Form. Turkish Ministry of Public Works, Ankara. State Planning Organization (1978a) Programme for 1978. Turkish Prim Ministry State Planning Organization, Ankara.
- Motaleb, O. and Kishk, M. (2010). An Investigation into Causes and Defects of Construction Delays in UAE, the Scott Sutherland School of Architecture and Built Environment, Robert Gordon University, Aberdeen,
- M.Fallah, Mohammad Hossein. "Delay Causes in Iran Gas Pipeline Projects." *International Journal of Project Management*, Pergamon, 22 Aug. 2012,
- Natalia. "Construction Industry in Turkey: Figures and Facts." Novron, 24 Nov. 2020,
novron.com/construction-industry-in-turkey-facts-and-figures/.
- Na Ayudhya, B.I. (2011). Evaluation of Common Delay Causes of Construction Projects in Singapore, *Journal of Civil Engineering and Architecture*, Volume 5, No. 11 (Serial No. 48), pp. 1027-1034, ISSN 1934-7359, USA, David publishing.
- NCSI (2015) National Center for Statistics and Information, Oman. Statistical Yearbook, 2015, Issued No. 43, (Accessed 15 October, 2016).
- Odeh and Battaineh, (2002). Causes of construction delay: traditional contracts, *International Journal of Project Management* vol20, pp 67-73.
- Ozcelebi, Oguzhan. "Determinants of Construction Sector Activity in Turkey: A Vector Autoregression Approach, 16 Apr. 2011.
- Patil, S.K., Gupta, A.K., Desai, D.B. and Stajan, A.S. (2013). Causes of delay in Indian transportation infrastructure projects, *International Journal of Research in Engineering and Technology*, 2(11)
- Projects: The case of Jordan', *International Journal of Project Management* **26** (6) 665-74
- "Quantitative Research Approach." *Statistics Solutions*, 22 June 2020,

- S. Assaf and S. Al-Hejji, Causes of Delay in Large Construction Projects. International Journal of project Management, 24 (4), 2006.
- Suresh, G. And Kanchana, S. (2015). A Study on Quantification of Delay Factors Construction Industry (Kerala Region) International Journal on Engineering Technology and Sciences. Volume 2(5).
- Sweis, G., Sweis, R., Abu Hammad, A. and Shboul, A. (2008) 'Delays in construction
- Stewart, R.A. and Spencer, C.A. (2006) Six-sigma as a strategy for process improvement on construction projects: a case study. Construction Management and Economics. Vol 24, 339–348.
- Seboru , M.A. (2015). An Investigation into Factors Causing Delays in Road Construction Projects in Kenya. *American Journal of Civil Engineering*. Vol. 3, No. 3, 2015, pp. 51-63
- Smith JR., 2007 Delay time analysis in microtunneling projects. J Constr Eng Manage, ASCE 2007;133(2):191–5.
- Tawil, N.M., Khoiry, M. A., Hamzah, N., Badaruzzaman, W.H.W., Arshad, I., Azrillah A.A. and Idris, N.B. (2014). Determination of the causes of the Construction Delay in Higher Learning Institutions in Malaysia Using the Rasch Model Analysis. Life Sci Journal. 11(7), pp 308-316, (ISSN: 1097-8135).
- Thornton, G. (2007). *Surety Credit Survey for Construction Contractors: The Bond Producer's Perspective*. Retrieved from
- Toor, S. and Ogunlana, S.O. (2008). Problems causing delays in major construction projects in Thailand. *Construction Management and Economics* 26: pp. 395-408.
- Wendle, J. (2008, July 15). Heavy trucks, construction equipment, stolen in Russia Western models safer because of advanced technology. *The Moscow Times*. Retrieved from
- Walliman, N. (2011), research methods the basics. London: Routledge Taylor and Francis group.

- Yang, J.B., Yin, P.C., (2009). Isolated collapsed but-for delay analysis methodology. *Journal of Construction Engineering and Management*. 135 (7), 570–578
- Yang, J.B. and Ou, S.F. (2008). Using structural equation modelling to analyse relationships among key causes of delay in construction. *Canadian Journal of Civil Engineering* 35: pp. 321-332.

