T.C.
ISTANBUL GEDİK UNIVERSITY
INSTITUTE OF GRADUATE STUDIES

RISK MANAGEMENT IN CONSTRUCTION PROJECTS IN IRAQ

MASTER'S THESIS

Areej Ali ALSAADI

Engineering Management Master in English Program

AUGUST 2021

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Thesis Advisor: Assist. Prof. Dr. Redvan GHASEMLOUNIA

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LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ MÜDÜRLÜĞÜ

Yüksek Lisans Tez Onay Belgesi

Enstitümüz, Engineering Management Department İngilizce Tezli Yüksek Lisans Programı (191281030) numaralı öğrencisi Areej Ali Alsaadi'nin "Risk Management in Construction Projects in Iraq" adlı tez çalışması Enstitümüz Yönetim Kurulunun 16.08.2021 tarihinde oluşturulan jüri tarafından *Oy Birliği* ile Yüksek Lisans tezi olarak *Kabul* edilmiştir.

Öğretim Üyesi Adı Soyadı

Tez Savunma Tarihi : 16/08/ 2021

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DECLARATION

I, Areej Ali ALSAADI, do hereby declare that this thesis titled as “Risk Management in Construction Projects in Iraq” is original work done by me for the award of the masters degree in the faculty of Engineering Management. I also declare that this thesis or any part of it has not been submitted and presented for any other degree or research paper in any other university or institution. (16/08/2021)

Areej Ali ALSAADI

ACKNOWLEDGEMENTS

To the soul of my beloved father ... My role model and whoever taught me to live with dignity and honour, may God have mercy on you.

To my mother's kind soul ... It is the epic of love and the joy of life and an example of sincerity and generosity, may God have mercy on you.

To my dear brothers … Who supported me and stood with me in this world

For my children ... A piece of my heart and my first and last love

I dedicate my research ...

PREFACE

Praise be to God first and foremost

Always be loyal to people who are loyal in giving

Who cannot fulfil their rights with words

But appreciated and respected

To all of our respected teachers who made the future generation, who shone the way for us, and were the best support

And special thanks to ...

Assist. Prof. Dr. Redvan GHASEMLOUNIA

Also thanks to everyone who contributed to the success of this project ...

You all thanks and appreciation

August 2021 Areej Ali ALSAADI

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ABBREVIATIONS

GDP : Gross Domestic Product
GNI : Gross National Income
PRM : Project Risk Management
RM : Risk Management
SPSS : Statistical Package For The Social Sciences
PM : Project Management

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RISK MANAGEMENT IN CONSTRUCTION PROJECTS IN IRAQ

ABSTRACT

The study was conducted to clarify the impact of poor planning on the delay in the implementation of current construction projects in Iraq.

In this way, the factors that lead to inadequate planning in the time management of projects will be familiarized by conducting a survey on a sample of engineers working in the Iraqi construction industry.

The research sample includes a group of engineers working in the public and private sectors in all engineering disciplines.

The research sample included 50 engineers from various engineering disciplines, and they received their opinions on the questions asked.

Through the statistical analysis of the data of this study, the most important conclusions were drawn:

1- The delay in the completion of engineering projects is due to the lack of a clear understanding of the concept of administrative and engineering planning for construction companies.

2- The delay in the completion of engineering projects is due to insufficient awareness on the part of the contractor.

3- The lack of interest of the implementing companies and the regulatory authorities in awareness programs for engineers such as PMP.

4- Risk management in projects takes place at the time of danger and during the project.

Keywords: *Construction industry in Iraq, risk management in the construction industry, Risk management practices*

IRAK'TA İNŞAAT PROJELERİNDE RİSK YÖNETİMİ

ÖZET

Çalışma, zayıf planlamanın Irak'taki mevcut inşaat projelerinin uygulanmasındaki gecikme üzerindeki etkisini netleştirmek için yapılmıştır.

Bu sayede Irak inşaat sektöründe çalışan bir mühendis örneği üzerinde anket yapılarak projelerin zaman yönetiminde yetersiz planlamaya neden olan faktörler hakkında bilgi sahibi olunacaktır.

Araştırma örneklemi, tüm mühendislik disiplinlerinde kamu ve özel sektörde çalışan bir grup mühendisi içermektedir.

Çeşitli mühendislik disiplinlerinden 50 mühendisin yer aldığı araştırma örneklemi, sorulan sorular hakkında görüşlerini aldı ve bu çalışmanın verilerinin istatistiksel analizi ile en önemli sonuçlara ulaşıldı:

1- Mühendislik projelerinin tamamlanmasındaki gecikme, inşaat şirketleri için idari ve mühendislik planlaması kavramının net bir şekilde anlaşılmamasından kaynaklanmaktadır.

2- Mühendislik projelerinin tamamlanmasındaki gecikme, müteahhit tarafından yeterince bilinçlendirilmemesinden kaynaklanmaktadır.

3- Uygulayıcı firmaların ve düzenleyici otoritelerin PMP gibi mühendislere yönelik bilinçlendirme programlarına ilgi göstermemesi.

4- Projelerde risk yönetimi, tehlike anında ve proje sırasında gerçekleşir.

Anahtar Kelimeler: *Irak'ta inşaat sektörü, inşaat sektöründe risk yönetimi, Risk yönetimi uygulamaları*

1. INTRODUCTION

Human has known danger since the beginning of mankind, and God created the resort to various means to confront these dangers, therefore all human religions have urged the need to face risks and the importance of managing them properly, and Likewise, man’s constant and continuous endeavour to use modern scientific methods to confront these risks and try to reduce them and that research are still permanent and continuous in order to find ways and means to confront the new risks that humans face due to progress.

One of the important areas in which its development had the emergence of many risks that must be studied well to try to reduce their effects is the field of construction, technology and design, and construction projects require many resources of manpower, finance, equipment, materials, and technical capabilities, and the construction project has a long implementation period (Elbeltagi**,** 2009).

These factors in addition to adhering to specific restrictions for each project in terms of cost, time and quality, makes construction projects vulnerable to many risks that affect the project implementation time and increase its costs (Koulafetis, 2017).

Understanding the nature of risks and analyzing them in order to develop a strategy for managing and dealing with them, these risks associated with some stage of the project, as well as finding a corrective path that includes a change in the course of work at a stage of the project work so that the results not only avoid the realized risks, but also avoid the risks that are not realized, is critical right now , However, in addition to monitoring and managing the safety of plans, the subject matter, and verification that it is actually being implemented to maintain the integrity of the project's work phases, they also contribute to increasing the degree of work efficiency in the project (Koulafetis, 2017).

Any institution's risk management must identify the most critical aspects that will effect the project, and it must do so exactly and thoroughly, as well as analyze the likelihood of these risks occurring , each one's influence on the project must be

discussed, as well as the methods and processes utilized to deal with them, all of which contribute to preventing or lowering the likelihood of these occurrences, also risks and their implications for the project.

The risk management also monitors risks and attempts to control them by identifying those risks and designing appropriate plans to fluctuate and confront these risks if they occur, in addition to monitoring the emergence of new potential risks and working to follow them up throughout the various stages of the project. The risks in the project are managed through different paths, including In that preventive path, it includes taking measures to avoid the emergence of risks associated with a stage of the project's work, as well as identifying a corrective path that involves a change in the course of work in one stage of the project's work that not only avoids the realized dangers, but also contributes to increasing the project's degree of work efficiency, In addition to monitoring and managing the integrity of these plans and confirming that they are being followed to ensure the safety of the project's work stages (Koulafetis, 2017).

1.1 Background

During the past decades, Iraq has faced several wars, sanctions and conflicts, the repercussions of which have caused economic stagnation and a decline in the provision of basic services, recently, however, Iraq slowly started to develop as a democracy, especially after 2003 (The World Bank, 2017).

Certainly, one of the important aspects of the development of any country is the development in the field of construction industry and projects, and this development will certainly lead to the emergence of some risks that need to be studied and solutions developed in order to mitigate them or try to reduce their effects on the project (Chohan, 2016).

Construction projects, like other projects, will be different from one project to another, depending on the nature of the project, its goal, the number of workers, the capital and the time specified for it, and for each of these factors there are several risks that he will be exposed to and these risks ,if not taken into consideration, will lead to several problems. In time and budget, the project may be permanently suspended (Clausen, Kraay, Murrell, 2011).

However, development plans, projects, and investor interests were often hampered by issues such as security, corruption, and bureaucracy, which were facing major challenges to participate in rebuilding the damaged infrastructure (Foreman, 2013)

In fact, the late project or the increase in the cost of the project has become a very natural thing and it can be seen at any stage of the project and it seems that this delay is inevitable, however, it can be avoided or reduced in most projects if an appropriate study of the project is carried out before starting its implementation (Abed, 2018).

In addition to the aforementioned reasons that lead to exposing projects to several important risks, there are external circumstances that sometimes lead to a delay in projects or an increase in its financial cost and may stop the project, and among these conditions are the weather conditions such as high or severe low temperatures, which leads to the stoppage of work for several days, which in turn leads to a delay in the project in addition to financial loss (White, 2012).

The unstable security situation in the country is linked to a direct and strong relationship with the implementation of projects, especially after 2003 and due to the conditions that the country went through and the poor security conditions in several cities, which led to the suspension and postponement of many projects.

In addition to the fragility of the confidence of the investors, who were and still are afraid to enter into projects due to the non-commitment of other parties to the project, and all these factors that affect the construction industry in Iraq, and therefore many potential investors still view the construction sector in Iraq as a risk and it must be well planned before trying enter into it.

The regulatory framework is important so that investors know their work properly, and if they give the money to the developers, the projects will go ahead and they will be able to get the planned profits from these projects, as well as for anti-corruption solutions, "Corruption slows everything down," says John Turner,The mayor of Baghdad has made great efforts to fight corruption and it is important that other agencies do the same (White, 2012).

1.2 Context

Through a field survey, it was found that there are multiple variables during the stages of establishing construction projects in Iraq, and this research will lead to

identifying these risks, classifying them and their causes, as well as determining who bears them and controls them using risk management.

The significance of the research lies in determining the extent to which engineers understand the importance of studying the concept of risk management in the construction industry and identifying the risks that are most likely to occur and have the greatest influence (Varajão, Colomo-Palacios, Silva, 2017).

In the construction phase, its analysis and potential response to potential risks in the project phases of construction projects in Iraq, therefore a common feature of failed and stalled projects are the lack of effective project management which should be.

The proper implementation of best project management practices to improve project management performance, leading to improved quality and speed, reduced errors, lower costs due to less re-work, reduced time delays and obstacles, and the use of better timescale, and customer satisfaction (Langer, Slaughter, Mukhopadhyay, 2008)(Milosevic, Patanakul, 2005).

Firms and organizations can use many methods and means in selecting the most appropriate processes and technologies to improve project management and reduce risks, such as ISO 21500: 2012 and PMBOK are good examples of these standards.

ISO 21500: 2012 is a project management standard that can be utilized by any type of organization, whether public, private, joint, or community-based, and for any size or duration of project (ISO, 2012).

ISO 21500: 2012 is compliant with PMBOK 5, the PMBOK 5 (Project Management Knowledge Authority Handbook - 5th Edition) provides guidelines and instructions for managing individual projects and defines and clarifies concepts related to project management.

It also describes the life cycle of the project and the important and necessary processes linked to each other and affect one of them on the other, whether positively for the success of the project, and perhaps sometimes in a negative way if it is not properly studied (PMI, 2013).

The significance of this research lies in determining the extent of the engineers' knowledge of the importance of studying the concept of risk management in the

construction industry and the risks that are likely to occur and the most influential in the construction phase, as well as their analysis and the possible

response to potential risks within the project stages of construction projects in the State of Iraq, the research is divided into four major chapters, First, the concepts of risk and risk management will be discussed, this discussion will take place based on the sources of the previous literature and the special features of the constructive view, after which the literature section concludes by highlighting the most relevant findings in the context of this study.

In the third chapter, we find it consisting of interviews with individuals associated with construction projects, and the aim of it is to determine the project risks, also Interviewees were asked to describe the risks they encountered at work and their means of managing these risks in construction projects, and the aim of chapter 4 is to combine the results of questionnaires with a review of the literature to identify the main findings, their significance, and their implications for current risk management practices (PMI, 2013).

1.3 Purposes

Construction projects in Iraq are of a special nature and are affected by many factors, which makes them exposed to multiple risks, due to the length of the implementation period and the multiple stages, starting from the decision.stage through the implementation and until the final delivery, which leads to increased uncertainty and increased likelihood.

One of the most successful and crucial strategies for managing construction projects is risk management, and the goal is to increase one's chances of successfully finishing the project on time, on budget, and with the fewest possible complications ,the most essential estimate for engineering and building projects in Iraq is the financial estimate, followed by the time estimate, and accurate early cost estimates are critical for corporations and engineering teams , also financial and time estimates are made over the life of the project, from the initial assessment through the various design phases to the site of construction, and the initial cost estimates form the basis against which all future estimates are compared, and perhaps the best way to get an overview of the project management process is to research in detail

how to plan a project, then it delves into details about each of the skills and activities associated with converting the project plan into a successful project in terms of cost and time, and on the other hand, planning requires a more reflective and long-term view of the project, and may include planning activities that are not expected to occur, but must be taken into account in terms of causes and when they may occur, however, good planning for any project is the cornerstone that can save the project from many risks that it may be exposed to during the implementation phase, so careful planning leads, along with good implementation, to project success and minimizing risks, andon the other hand, poor planning, even with good past implementation may lead to a successful project, but it is often fraught with problems, crises and stress because the project manager and his team have been saving the project rather than looking for other opportunities to develop the project

(Fahirah, 2005)(Benator, Thumann, 2003).

For this research, some of hypotheses were considered, and the questionnaire was prepared based on these hypotheses, which were:

1- Most of the risks in Iraq's building industry are entirely the responsibility of the contractor.

2- In Iraqi construction establishments, pre-construction risk management approaches are not be used.

3- Most of the risks are mitigated during construction or when the risk occurs.

The pilot study of this research includes several interviews with representatives of many different construction projects in Iraq, but some of the interviews were conducted with representatives of subcontractors, i.e., subcontractor.

Other parties interviewed include the supplier, the customer, and the main contractor, and the primary goal of these interviews was to gather information and experiences from the interviewees from risk management processes, understand the types of risk management techniques used on construction sites, and reach specific targets that can be used later for avoide or reduce the risks of construction projects inside Iraq and knowing the real causes of these risks, methods of treatment and the most important objectives of the research:

1- Determine the causes of construction risks.

2- Determining the risks of construction in Iraq.

3- Develop the strategies to respond to risks.

1.4 Semantics, Scope and Definitions

A descriptive-analytical approach was followed to identify and evaluate the causes of risks affecting the implementation of construction projects in Iraq, through a set of data collected through the questionnaire on which this message was based, which was distributed to a number of workers in the construction industry, including owners, contractors, consultants and engineers, and the statistical analysis program(SPSS) was used to analyze the data as an introduction to the stage of interpreting the results and generalizing them to reach the recommendations.

Some of the definitions of risk are :

1- Risk: unknown factor or event that has the potential for, and if it happens a negative impact in at least one goal of the project's objectives of scheduling and cost, quality and safety, and the science of risk management focuses on studying, identifying and evaluating the risks that a project may be exposed to and managing those risks to reduce the impact on the project (Artto, Kujala, 2008).

2- Uncertainty: Because there is a shortage of information about what will happen in the future and when the influence and extent will occur, an event or a factor cannot be defined precisely, but it has the potential for, and cannot be accurately anticipated the consequence (Artto, Kujala, 2008).

3- Risk management: systematic process throughout the project life cycle, aims to identify and analyze the risks, and then respond to them to get the maximum score or accepted to be removed or controlled and tuned (Artto, Kujala, 2008).

4- There is always a need to distinguish between how risk management allows flexibility in implementing different strategies in projects to reduce risks. There are two considerations:

1- Strategic decisions: risk managers must demonstrate strategic skills when identifying and anticipating risks or opportunities as well as making the right decisions to respond to these risks.

2- Situational and temporary adjustments: behaviors need to be totally or partially changed when circumstances require changes in risk strategy.

As new realities emerge during the project implementation period, the risk management process must respond to these situations that occur without a previous account of them and this is often necessary so that emergencies do not arise due to these risks (Hampton, 2009).

1.5 Thesis Outline

This research content of five main chapters as follows:

- Chapter one: Introduction: This chapter shows the background, context, purpose, main objectives and the problem of the research.
- Chapter two: Literature review, this chapter shows a historical review .
- previous studied to identify the main factors affecting the performance of
- Construction projects.
- Chapter three: Methodology: this chapter shows the methodology used in previous studies and the methodology used in this research to achieve the required objectives.
- Chapter four: Results analysis: this chapter shows analysis, discussion of research results.
- Chapter five: Conclusions and recommendations.
- Appendix
- References

2. LITERATURE REVIEW

2.1 Project Risk Management

Risk management in projects is currently one of the most important topics of concern for researchers and practitioners-Tioner work in project management, as one of the project's eight-core areas Body of Knowledge Management (PMBOK) by the Institute for Project Management, the largest pro-Project management-committed professional company (Raz, Michael, 2001).

In addition, most project training programs managers have a risk management course, most project training programs managers have a risk management course, also Project risk management (PRM) is frequently viewed as a phase that runs concurrently with the project's preparation, execution, and control stages before concluding and closing, practical implications of these findings indicate that project managers put greater emphasis on preparation in high-risk project circumstances to achieve project performance, while project steering committees need to be more involved in authorizing low-risk project plans to facilitate the realization of benefits, literature on project management defines a comprehensive variety of accepted risk management mechanism, developed mainly from four iterative phases: risk identification, risk assessment , risk reaction Managing the risk management process is also the preparation and execution Inclusive (Zwikael, Pathak, Singh, Ahmed, 2014)(Klemetti, 2006).

The potential for improvement should also be there when dealing with risks consider, for example, the undertaking of a project with fewer resources or maybe an unexpected window of opportunity to exploit, and the risks are at the very heart of the company risks and opportunities linked, prospects do not occur without threats connected with them, also the threats ,in reality, the value of a project increases; typically higher risks lead to higher opportunities (Klemetti, 2006)(Mills, 2001).

Since opportunities and risks are rarely separate, they too can be dealt with simultaneously, and most scholars, for example , tend to use the term 'uncertainty'

rather than 'risk' emphasizes the point of risk all negative and positive hands, in a broader sense, the mechanism should not be merely to ensure a good project completion but also improvement of project goals standards and targets, this means the transformation of project risk management into managing project uncertainty,risk management is not limited to a few processes, but it includes many processes to be able to obtain appropriate results for risk management for a proposed project, and most of the most important decisions in a project are sometimes related to risk management, which means who is the cause and who bears these risks, the broad, in-depth and appropriate study must be carried out for each project and according to its type, as it will study how to mitigate project risks, as well as how to deal with it and with other project parties and actors responsible for managing risks, risk management decisions can be made in advance and this is very important to avoid problems that occur during the project, but before a venture starts, the technique of each actor, and the capacity to bear and to handle risks, they must be known before risks are assigned, project management risks at the business level, which must take all of these into consideration and which will be discussed later, and their impact according to the variables mentioned above, also this chapter provides a description of the risk management processes, focusing on new and emerging aspects, and also provides the solution to the first investigative issue (Ward, Chapman, 2003).

2.2 Project Risk and Uncertainty of a Project

Despite countless studies on risks, they still lack a clear and intelligible foundation, risks are frequently perceived as undesired and unfavorable calendars, and we can reach to two risk concepts: First, experts generally agree that risks might have negative implications (e.g., time delays, financial loss, etc.)(Harrin, 2013).

Sometimes the risks are positive and the positive risks mean any situation, event or situation that leads to a potential positive impact on the project, some people prefer to refer to positive risks as opportunities and negative risks as threats to assist distinguish between them in project management, However, as with most things in life, there are often adjustments throughout the course of projects, Sometimes these adjustments lead to reducing the project cost or the time required to implement it, leading to the project ending with less than the planned budget or time (Harrin, 2013).

Second, risks are not related to work only, that is, individual action points, that risks are sometimes also related to future and unexpected project conditions, and these circumstances may not be suitable that lead to the occurrence of risks because one of the important and necessary points in any project is that it is sometimes difficult to predict the conditions of the project in the future, especially in the early stages of work in the life of the project, but in some cases, circumstances may change during the life of the project, which leads to the emergence of new risks that may occur or increase due to these uncalculated changes, and sometimes they may become more severe than what was expected for the first time (Turner, 1999)(Chapman, Ward, , 2002).

Here, risk analysis should only be done when some events are explained because the degree of influence in the significance and consideration of these unforeseen events is not taken into account, it has been replaced by a more neutral term that can represent a larger range than the danger traditionally indicates, the term or meaning of uncertainty is suggested to replace risk because it can easily represent fluctuations and ambiguities of risk, and the worlds of Chapman and ward explain the important uncertainty is very important in all projects are about more than just time, cost and surely project goals (Klemetti, 2006)(Serpella, Ferrada, Howard, Rubio, 2014).

Uncertainty includes, for example, problems such as which parties should participate, their motives and relevance to the project the strategic objectives of the company, as well as management must be considered these doubts are efficient because they are a best practice in project risk management, but sometimes not all factors can be expected at the beginning of the project, however decisions must be made a risk must be expected as a result of these decisions, also other dimensions may clarify the risks (Turner, 1999).

Perception of risk is known as one of the key areas for improving technology practices to deal with risk, that is, finding solutions early to reduce losses, and Kähkönen suggests that the concept of risk should be able to be interpreted in more accurately, describing each individual case, and if there is no single, clear definition of risk it is also missing doubt, but these perspectives mentioned above help us to take a comprehensive and broad definition of risks(Klemetti, 2006) (Turner, 1999).

2.2.1 Project risk categorizations

Risk assessment, is the method of determining individual project risks and overall project risk sources and register the assets they possess, also the key advantage of this process is the recording of current single project risks sources of general risk to the enterprise.

It also gathers information so that the project team can have an accurate response to some threats , also the project risks can be classified in several ways, depending on details or views , but some of them are mentioned as a group of risks, while others are taken into consideration as project problems according to the work related to this type of project, and according to the type of impact or according to the project stage, the most typical types of classifications are presented in Figure 2.1 (PMBoK, 2017) (Miller, Lessard, 2001).

Figure 2.1: Typical risk categorization

Source: (Miller, Lessard, 2001)

Turner 1999 suggested that threats can be separated either by their future effects or by the way they are controlled, so these types can be further classified into business risk, insurable risk, external risk, and internal risk, for example bad weather is external risks because it cannot be managed by a project manager and business risks are those risks that need to be considered in general to be able to take advantage of the positive effects of a crisis, Miller and Lessard 2002 researched large-scale infrastructure projects (e.g. constructing a new plant) and identified risks by source, and there are three groups for business, completion and institutional risks, market risk is primarily due to uncertainty of demand, construction risks relate to technological risks before and after the execution of a project (for example, a factory 's capacity.would be as designed and planned), that show in Figure 2.2 (Miller, Lessard, 2001).

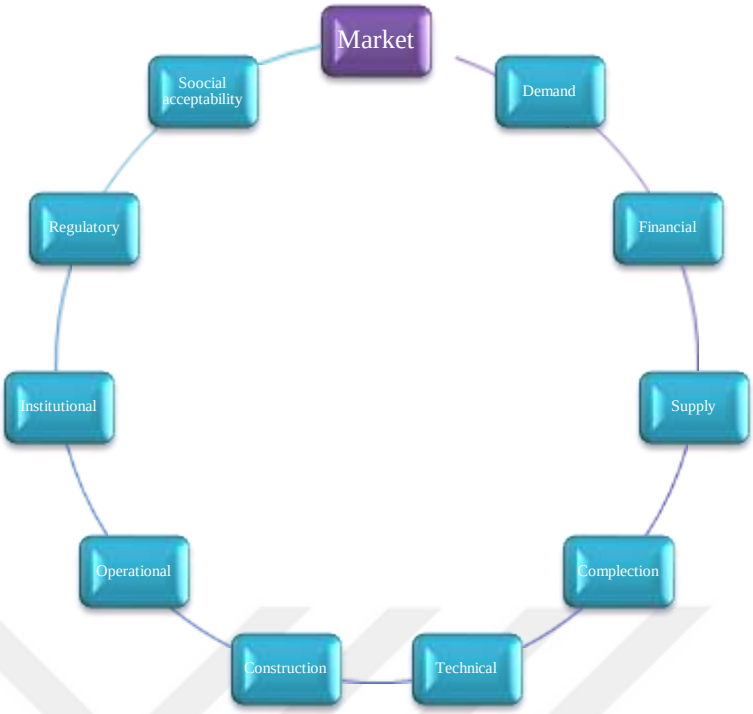

Figure 2.2: Risk categorization according to Miller and Lessard

Source: (Miller, Lessard, 2001).

Another section by Finnerty, whose book on project finance describes that there are nine types of risks, which we will find in Figure 2.3, These risks are constructed from a project financing perspective and correspond to the risk ratings for construction projects Figure 2.4 (Finnerty, 1996).

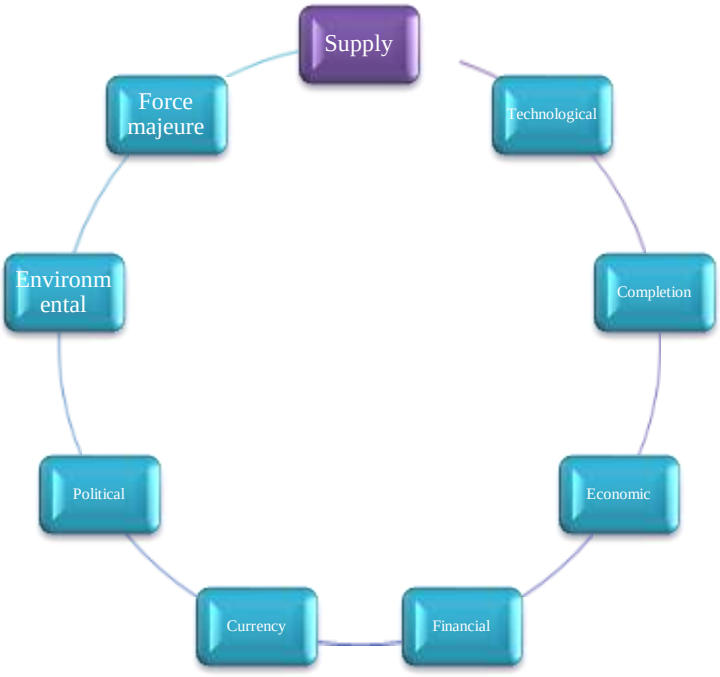

Figure 2.3: Risk categorization according to Finnerty

Source: (Finnerty, 1996)

Assessments help in identifying lists of important risks when identifying risks before and during the project, but they are not sufficient to form a complete picture of the actual risks that may occur, for example, risks due to equipment problems or political hazards are the best examples of risks that are not caused by the main contractor, also Baloy and Price concluded extensive literature studies on construction project risks from two different classification perspectives.

First, the comprehensive list of risk schedule (2.4) and the list of impact schedule Figure 2.5 (Baloi, Price, 2003).

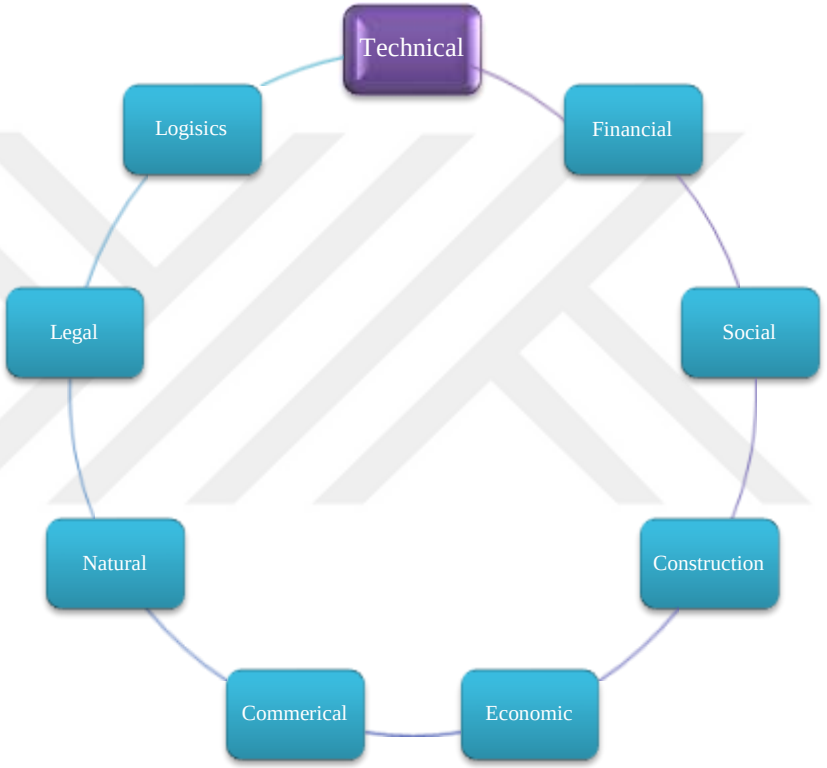

Figure 2.4: Risk categorization according to Baloy and Price

Source: (Baloi, Price, 2003).

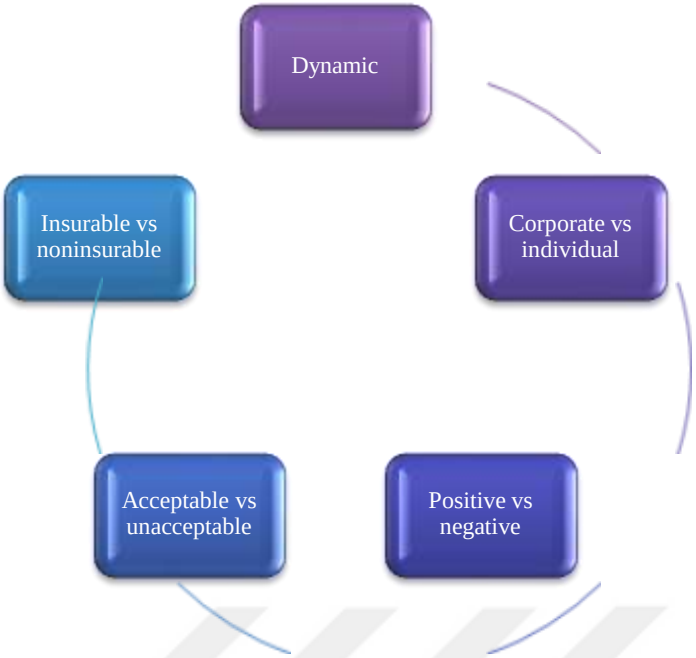

Figure 2.5: List of impact schedule according to Baloy and Price

Source: (Baloi, Price, 2003)

2.2.2 Risk in typical construction projects

Construction projects have a poor reputation for failing to meet timetables and expense goals; this is why it is incredibly important to identify sources of risk because it is not generally possible to identify single risks, also the building projects are defined as very complex, often unique projects, where threats come from a variety of sources, due to the various sources of uncertainty and risks, many of which are not under the direct control of the project participants, these projects are often characterized by continuous decision-making, and they found other significant causes of delays and owner interference, poor familiarity with vendors, financing and payments, quality of labour, a slower decision taken, improper preparation and subcontractors (Artto, Kujala, 2008)

Therefore, to have a good project, all project personnel must be qualified and equipped to carry out their tasks with certain means to carry out the work properly and to consolidate the current situation, the authors propose various forms of promotions and bonuses for good production and more than just price-giving capabilities, in construction projects Cohen and Palmer identified risk patterns, they found that usually, risks are assessed during the very early stages of the project (feasibility and planning), while the impacts are not felt until the start-up phases of

construction and development, and their list of typical risk sources for building projects is provided in Figure 2.6 (Finnerty, 1996)(Cohen, Palmer, 2004).

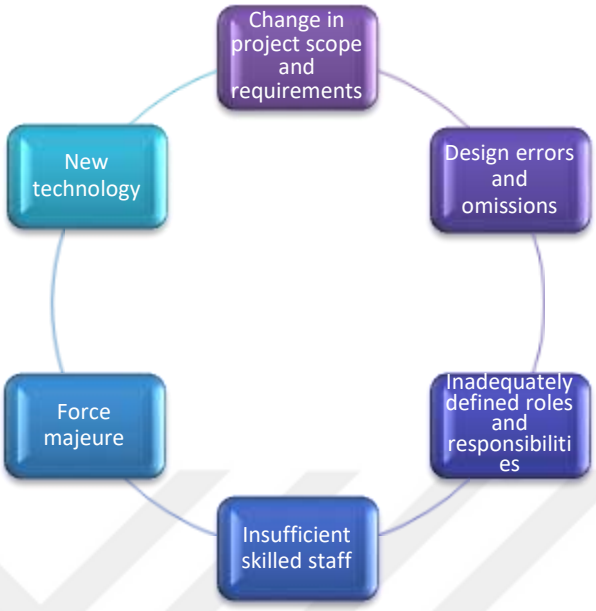

Figure 2.6: Typical risk sources in construction projects according to Cohen and Palmer

Source: (Baloi, Price, 2003).

2.2.3 Project schedule and cost estimate

The project schedule is determined as well as the time estimate as a strategy to perform the implementation of one of the project items, with the basic principles for implementing each task and the required quantities for the expected period for each project chart (Saeed, 2018).

The estimation of costs and quantities in addition to the prices of the resources or costs required by the project, and the cost is estimated using experience, calculations and resource cost forecast, also the setting of these goals is a very important starting point for controlling projects and trying to reduce risks (Olawale, Sun, 2015).

- Cost estimation anticipate the quantities, price and / or cost of the.resources.required to complete the project, estimates are used as input to the projected budget, and cost estimates are determined by using experience.
- Estimating the schedule, ,or schedule, which describes the action plan to be carried out, as well as the sequence in which the activities will be carried out and the amount of time allotted to each step.

- Basic cost estimation - The baseline cost is described as the cost that can be fairly and properly expected; the baseline cost estimate must be correct, impartial, and neutral; and the basic cost estimate can occasionally contain items like miscellaneous item allowances as well as other extra adjustments. Costs associated with volatility and changes in commodity prices, such as steel and oil, are examples of such variables (Abed, 2018).

2.2.3.1 Cost estimate data

- The person who was costed on the project should be able to determine the desired completeness of the data related to the project development stages, often for values in the way that constantly postpones thinking in production and recognition, “If I can have another day or two, the accuracy is much better” (Abed, 2018).

2.2.3.2 Cost estimation and project development level

There are four main, important, and essential levels for project development,the assessment for each of these levels of project development has specific purposes, these levels are including the following:

1- **Planning:** Planning level estimation is used estimate financing needs for long term planning as well as for prioritizing needs, these estimates are usually formatted with little detail to define the project.

2- **Scoping:** Scoping level estimation is usually used to assign a base cost to a project, the scoping estimate is very important because it is the basis used to set the budget.

3- **Design.**

4- Pre-made project estimates are frequently used to track changes in the projected cost of finishing a project in order to calculate the current budget, and this should occur each time the cost estimate is updated, as should the timeline, and when compared to the new estimate, this documentation will aid the estimator in generating accurate future estimates.

- **Final estimate or bid / allow:**The engineer's estimate is created for the final evaluation of the contract in preparation for declaration or approval and is

used to commit construction money as well as evaluate contractor bids, but some of the approaches used to prepare final estimates include cost and risk based (Abed, 2018).

2.3 Literature View of Construction Industry Risk Management Programs

2.3.1 Overview

The primary objective of this chapter is to clarify and provide insight into the existing theoretical literature as an introduction to this topic and clarify some definitions and an explanation of the topics as well as the processes involved in data analysis and discussion, in addition it provides evidence and findings from similar past and current studies that can serve as a basis for comparison and discussion with the findings of current research.

It also identifies some potential gaps and limitations of the existing literature that have been addressed here by the results of the present study, the risks in construction projects in Iraq as in other countries are an important factor in affecting the total project costs, and thus allocating them has a very large impact on the project budget.

Construction projects are open systems, not closed systems, meaning they cannot be determined in terms of cost, time, and so forth, which increases the diversity of the project and its risks, also the risk management process must be adapted to the environment in construction projects, but this has not happened so far (Zaghloul, Hartman, 2003)(PMI, 2008).

2.3.2 Theoretical background

Much research has been conducted on the risk management process, especially in the construction industry, which is described as a fragmented and complex environment due to the large number of stakeholders involved in it, this part of the research also contributes to clarifying the stages of the risk management process and how it is integrated with the rest of the project management processes, it also sheds light on the success of the project and the role of the risk management process in achieving this success, in addition, here we will define the common methodologies and criteria used to manage project risks, with which we can arrive at an assessment of risk management maturity that we have to work with, but in general, the literature agrees

that a project involves temporary work to produce a specific product or to obtain a requested service, while differing in its consideration of an activity or organization (Zaghloul, Hartman, 2003)(PMI, 2008).

The Project Management Institute defines a project as “a temporary endeavor undertaken for the purpose of obtaining a unique product, service, or result”, but from another point of view, Steiner 1969 emphasized the definition of a project as a temporary "organization", that is, an organized group of people dedicated to their work for a specific purpose or goal (Steiner, 1969)(Chapman, Ward, 2007).

Projects generally involve large, costly, and high-risk work and undertakings that must be completed on a specified date, for certain amounts of money, and within a specified level of performance, and in order to obtain unique and distinctive project results, distinct and new ways of working and dealing with uncertainty are required,the results were achieved in all new projects under difficult and sometimes complex technical, political, economic and social conditions, but uncertainty is the central problem of managing any project, and the project-based management is one of the important and essential strategies that companies, institutions and contractors pursue to achieve the desired goals, therefore, there must always be well thought out and planned strategies in advance to implement the project and achieve its own desired goals, likewise the characteristics of strategic planning can be appropriately integrated within the overall management framework, resulting in valuable insights and possibilities regarding the relationship of project managers to the ultimate success of the project (Chapman, Ward, 2007)(Salih, 2015).

Chapman and Ward introduces a new concept of risk as (uncertainty) meaning either a threat or an opportunity to avoid risk, noting that by managing risk, it is possible to identify and manage all of the many sources of uncertainty that lead to shaping our perceptions of threats and risks that may be exposed, andthey are trying to highlight that risk management must take into account the management of the sources of uncertainty in the project seriously and the performance that can be achieved and which is important in most cases, it also emphasizes the impact of developing project objectives, which in turn will influence risk potential , and the previous literature generally indicates the importance of risk management as a major and important part of achieving project goals, but turner considered risk management at the heart of

project management, given the unique nature and outcomes of the project (Turner, 1999)(Zaghloul, Hartman, 2003)(Salih, 2015).

2.4 Risk Identification Techniques

2.4.1 Brainstorming

Here, group brainstorming techniques are divided into two phases, the first phase is the idea generation phase, where the participant generates the largest possible number of ideas possible, and the second phase will be the idea selection phase, and in this phase the ideas are filtered and only the appropriate ones are selected, and only those ideas that have been approved remain on them by the whole group (Martinelli, Milosevic, 2016).

2.4.2 Delphi technique

Delphi technology is a technique that can be leveraged for the purpose of obtaining consensus on expected future events from a group of experts. Backed by the structured knowledge, experience and creativity of a team of experts, it is a process used to reach a collective decision or opinion through the opinion of a committee or group of experts, experts answer several rounds of questionnaires, after which all responses are collected and shared with the whole group after each round (Martinelli, Milosevic, 2016).

2.4.3 Interviews and expert judgments

They are sometimes unorganized, semi-structured, or sometimes organized individually or perhaps collectively at other times and with a group of experienced project members, specialists, or project stakeholders (Salih, 2015).

2.4.4 Checklist

It consists of a list of items marked with yes or no and can be used by individual or group project team members,after each project, a post review should be done where you can identify and list the most important risks, this list can be used for later projects, but be careful here that there is no checklist that contains all risk (Salih, 2015).

2.4.5 Influence diagram

It is a graphical depiction that comprises nodes that reflect a problem's choice factors and the conventional impact, also there are three sorts of contracts in the diagram: utility, choice, and information, and a causal link exists between the utility node and chance and probability, but the danger is categorized into groups or classes in this case, and each category is given a title (Salih, 2015).

2.4.6 Flowchart

A graphical tool that illustrates the steps of the process, but this technique is applied in order to gain a better understanding of the risks or interconnectedness of the components, it is an introduction to the flow diagrams of the risk management process. It defines the risk management diagrams, the specific and detailed activities or action steps required to implement the various processes within the risk management(Salih, 2015).

2.4.7 Cause and effect diagrams

Sometimes these are also called Ishikawa diagrams or sometimes called fishbone diagrams, these diagrams show how different factors can be linked to potential problems or impacts, powerful cause and effect charts with which project managers can use this simple method for the purpose of identifying the causes that lead to the occurrence of risks, and if these causes are treated, then the risks can be reduced or eliminated altogether (Steiner, 1969).

2.5 Risk Management Context

2.5.1 Categories of risk

Through many studies that have been conducted on the topic of risks in construction projects in Iraq and some neighboring countries, such as Jordan and Kuwait, as well as some other developing countries in Asia and Africa, client risks are considered primary risks in addition to the lack of technical and managerial skills possessed by contractors, in addition it also indicates the external risks associated with delays and deficiencies caused by the suppliers and the unskilled workforce working on the project (NED, 2011).

Also, the literature reviewed highlights the importance of the relationship between project size and complexity and risk, the results of this study provide a new insight into the risks in the construction industry in Iraq, which have not been previously reached through any of the previous research, the results of our study agree with most of the previous studies conducted in neighboring countries in emphasizing the impact of customer-related risks because of their great importance in risk management in the construction industry, butthis study also distinguishes the dominant type of clients in construction projects in Iraq represented by the government, it provides a suitable analysis of the risk dimensions arising from the mutual relationship between contractor and client while managing project risks by meeting representatives from both sides,in addition to conducting interviews with professionals from private companies, as well as targeting many employees who work as heads in project management and planning departments, data analysis in Iraq reveals that the risk of non-cooperation of clients is high in most cases, in addition, this study identifies significant risks arising from issues related to security in Iraqwhich leads to deficiencies in the standards of the contracting process (Salih, 2015) (NED, 2011).

2.5.2 Risk strategies

Previous literature reviewed indicates the low level of maturity of risk management practice in construction projects in many developing countries, however previous or current research studies have not provided an accurate description of the level of risk management that construction companies do not practice in Iraq, the importance of this research includes its preliminary assessment of the current state of risk management practice in Iraq by contracting companies operating in Iraq, and there are specific strategies followed such as incidental reserves of time and cost, as well as reliance on expert judgment, and outsourcing, and these characteristics are evidence of the low maturity of the risk management practice (Trujillo del Valle, Cohen, Freixas, Sheehy, 1998)(Zou, Zhang, Wang, 2006).

2.6 The Organizational Context Barriers

Previous literature lacks in-depth studies in the internal structure of Iraqi companies and their impact on the various strategies and operations of the project, with the

exception of two surveys conducted by the United States Agency for International Development and the World Bank in which they referred to several issues such as the lack of corporate governance practice and the failure to use technology in their work, this study provides interviews and analyzes with the purpose of contributing comprehensively and significantly to establishing the internal dynamics affecting RMP, these studies provide a detailed and broad explanation of the organizational structure, knowledge management, and specialization in construction projects, additionally, it shows the effect of the lack of a good and understandable regulatory strategy on practices like PMP and thus on RM (Trujillo del Valle, Cohen, Freixas, Sheehy, 1998)(Zou, Zhang, Wang, 2006).

2.7 Risks from the External Environment Context

The current literature indicates the existence of a reciprocal relationship between external forces such as Economics, politics, regulation and technology on the one hand, and the practice of internal operations within companies on the other hand,the current literature does not specifically cover the construction industry in Iraq, also it does not indicate the direct influence of external forces on RM, the literature refers to the "what" of external forces more than "how" they affect the formal operations of private companies, to address this gap, the current study emerges to provide new insights into the external environment and its direct impact on the practice of (RMP) by construction companies in Iraq, the current results show the nature of the relationship between government clients on the one hand and contractors on the other side, which dominates the context of the construction industry in Iraq, this study also shows how a set of variables from regulations, laws, and policies of owners and customers, which can be considered external variables, affect the internal dynamics of these companies, which prevent private companies from adopting the risk management process (Zaghloul, Hartman, 2003) (Trujillo del Valle, Cohen, Freixas, Sheehy, 1998) (Zou, Zhang, Wang, 2006).

2.8 Key Risks Versus Stakeholders

Many of the main risks, which occur during the implementation period of construction projects and lead to delay or increase in the cost of the project, relate to clients, designers, contractors, subcontractors, government agencies and the external environment (Chen, Guilin, Poon, 2004).

2.8.1 Customer risk

There are many major risks to clients that are exposed to projects in general and construction projects in particular, which lead to losses in time, cost and effort, therefore, they must be identified and studied in depth to try to avoid them, a "tight project schedule" can be considered the most important risk, as clients must prepare a work schedule that allows for sufficient but not excessive time, in this schedule all design activities and negatives should be accommodated and since time and cost are always closely related, it undoubtedly the long schedule will ruin the project cost-benefit, also, sometimes “customer variations” lead directly to changes in planning, design and construction, therefore these differences are due to two reasons, either a change in customer opinion or a misunderstanding and the wrong interpretation of customer needs in the project, also, one of the important points is that clients need to form a specialized team to obtain approvals from government agencies and prepare the project documents efficiently and effectively (Chen, Guilin, Poon, 2004).

2.8.2 Risks related to designers

"Design variations" generally occur during the design stage of a project and may occasionally result from problems such as "client variations" and incorrect designs, and in order to avoid these mistakes, the design team must not only fully understand what the clients and owners want as defined in the project brief, but also create an effective communication scheme between designers and the selection, and also contractors/subcontractors can be involved from the start of work on designs to reduce inaccuracies, likewise, “insufficient or incorrect. site information such as (soil testing and survey report)” can affect carrying out it before starting work on any design scheme, here the borehole, soil testing and surveying should be performed with government laboratories as well as the assessment of the bearing of

neighbouring buildings to ensure site conditions and reduce unexpected risks (Chen, Guilin, Poon, 2004).

2.8.3 Risks related to contractors

“Improper construction program planning” may result from contractors ’lack of knowledge in planning construction programs, also the capacity and skills to manage construction, implementation and design programs should be used as key criteria in hiring contractors, sometimes lack coordination among project participants may lead to chaos in the management of the construction team and programs, leading to problems and increased risks in the project, therefore, the contractor or project manager must be involved and he must be skilled in coordinating the team and arranging plans and programs, also likewise, the lack of a sufficient number of professionals and managers as well as the unavailability of a sufficient number of skilled workers may lead to delays in the construction phase (Chen, Guilin, Poon, 2004).

2.8.4 Risks related to subcontractors

Subcontractors' low business efficiency is the only major recognized risk related to subcontractors, but unlike a general contractor who has been continuously managing a construction site for a long time, subcontractors usually allocate their human strength and other resources to different projects at the same time to achieve the maximum profit possible, and without any successful and appropriate management skills, subcontractors cannot successfully manage their businesses and resources to meet the needs of the construction sites they employ (Chen, Guilin, Poon, 2004).

2.8.5 Risks related to government agencies

Sometimes clients and contractors complain about "lengthy approval procedures in government departments" and "government bureaucracy”, usually this type of risk is outside the control of the project stakeholders, to attract investment, investors, companies and contractors, government agencies must always make great and continuous efforts to create a suitable environment for these investors in which government procedures and approval procedures must be reduced or at least the approval time shortened and bureaucracy reduced, and likewise, the project team must build strategies to maintain a close relationship with local government officials

and communicate with them as well as record everything in black and white (Chen, Guilin, Poon, 2004).

2.8.6 Risks related to external issues

External risks are among the risks that have a strong impact on project delay and cost increase, which the project team must take into consideration, the most important of which is building materials price inflation, also the price of building materials always changes in response to the existing financial inflation and the relationship between supply and demand in the building materials market, since this type of risk is usually unavoidable, so clients must choose an appropriate and good type of contract such as a lump sum for the purpose of transferring risks to other parties if they occur, while the contractor should always be cautious in avoiding the use of fixed-price contracts to incur these risks, also, one of the methods that used to deal with potential price fluctuations in the markets are to add an emergency premium and add it to the contract to avoid potential losses in these cases (Chen, Guilin, Poon, 2004)(Adams 2008).

2.9 Risk Management Plan

The risk management strategy defines the structure and approach that the project team will identify and track, but early in the project designing a risk management strategy will help to minimize potential issues or at least reduce their effect on the project if they arise, also having a well-thought-out strategy will help the project managers contend with the challenges of the project when they emerge and stop them until they affect their project in the best case (Maurya, Yadav, Singh, Deep, Yadav, 2020).

2.9.1 Developing a risk management plan

Most of the time, making decisions is one of the most difficult jobs for project managers to do, and the subject of decision-making will not be difficult in a state of complete certainty, because all the information needed for decision-making is already in place and the results of decisions can be clearly and correctly predicted, however, project managers' lives are very complex, and most of the time a lot of their decisions are made with uncertain results and incomplete information, this is the real

area of project risk management, but beyond that sometimes lies an area of complete uncertainty, sometimes with a complete lack of knowledge, where nothing is known, and absolute uncertainty about the results (Maurya, Yadav, Singh, Deep, Yadav, 2020).

2.9.2 Risk management approach

A risk management plan is a document developed at the beginning of the project through which it can provide a framework for dealing with risks and trying to control them and reduce their impacts throughout the life of the project (Maurya, Yadav, Singh, Deep, Yadav, 2020), the plan includes a general description of the approach used in identifying, managing, evaluating and monitoring project risk events, which should include important information such as:

- Risk management methodology: it means identifying and describing tools and resources methods, data and tools that can be used to deal with risks.
- Responsibilities and roles: it means determining who does what in project risk management, from the project team members as well as the company's of risk management teams.
- Budget and Timing: it means setting the budget to manage the risks of the project.

Continuous reporting and monitoring (Maurya, Yadav, Singh, Deep, Yadav, 2020)

(Tohidi, 2011).

3. RESEARCH DESIGN

This chapter deals with a description of the research methodology and defining the study population and the characteristics of individuals the target study or sample who achieves its objectives and proves its hypotheses by collectingthe data and their validity and consistency, and the statistical methods of treatment that they used in the analysis the information.

3.1 Methodology and ResearchDesign

3.1.1 Methodology

The analytical descriptive method, which was focused on examining the phenomena as it occurs in reality, was utilized to achieve the desired research findings through data collection and statistical analysis to evaluate the validity of the study's hypotheses.

These statistics were collected in the governorates of Babil and Baghdad, and statistical analysis of the data was performed to evaluate the statistical significance of the study's hypothesis on Morale level, seeks to put to the test the following hypotheses:

1- The contractor has complete responsibility for the majority of risks in Iraq's building sector.

2- In Iraqi building projects, pre-construction risk management measures are not used.

3- The majority of risks are frequently reduced during construction or when risks occurs.

3.1.2 Research design

To obtain the information and preliminary data for this study, the questionnaire was designed to know the impact of risks in the construction industry in Iraq, based on

the methodology used and the method of data with the help of the research hypotheses, the questions in the questionnaire were divided into three groups:

1. First Section

This section contains general information about the persons participating in the questionnaire: (academic qualification, years of work experience, sector type, current workload).

2. Risk Rating:

(Physical and human risks, environmental and natural hazards, design risks, logistical risks, Financial risks, legal risks, risks directly related to implementation, political risks and management risks).

3. Methods for mitigating risks:

Pre-stage for implementation :(use methods of quantitative risk analysis for accurate forecasting, reliance on practical experience in creating a work program before implementation, add a reserve time for the period, transferring risks or dividing them into the project parties, refer to similar and previously implemented projects and try to find out the risks they have gone through, and make a schedule that can be updated and changed when needed and use the modern systems (using integrated computer programs)), during the implementation phase: (increasing labour and /or machinery, increasing working hours, changing the sequence of implementation processes or overlapping between them, full and appropriate coordination with subcontractors, and careful supervision of works to avoid their rejection or re-implementation).

3.2 Participants

The researcher relied on sending the questionnaire to the largest number of workers in the field of study to obtain the required study data, and the example includes project managers in consulting offices and engineers from various disciplines with different years of experience, interviews were conducted with 50 engineers at some of the worksites and company headquarters; The study population includes engineering consultancy offices and public and private sector companies working on construction projects in various specializations, whether construction, roads, electricity or sanitation.

3.3 Instruments

In this research, care was taken to formulate the questionnaire data in a simple and uncomplicated manner, taking into account the cultural level of the samples participating in the questionnaire, by moving away from meanings that are difficult to understand and that are not clear, accordingly, the survey form was created to satisfy the needs of the research population, and the sample was chosen using a statistical approach, following which the questionnaire was created in its final form, and the questionnaire was used to collect 50 samples from the whole community.

3.4 Procedure and Timeline

Here, an electronic questionnaire was used to obtain the results, and the questionnaire was sent to the target group through electronic means of communication (e-mail and messenger) to make the process of collecting information, obtaining results and analyzing them statistically clear, understandable and simple.

An important point on this survey is consistency, which will give the reliability of the test here the same results if it is used more than once under similar conditions, and consistency also means that if a test is applied to a group of individuals, their score is observed, then the same test is repeated on the same group, and a result on the same score is obtained, test is completely consistent.

3.5 Analysis

The Statistical Package for the Social Sciences (SPSS) software is used to analyze statistical data for the aim of confirming the validity and reliability of the questionnaire through internal consistency, also correlation coefficients are measures of the strength of a linear relationship between two variables, with values ranging from -1.0 to 1.0, but the value is either more than 1.0 or less than -1.0 indicating that there is a measurement error in the correlation, and this demonstrates that the variables change, also in opposing directions that is for one variable to rise positively, there must be a. decrease in the second variable, but if the correlation between two variables is 0, then there is a linear link between them; the intensity of the relationship between the variables varies in degree depending on the correlation

coefficient value among thema score of 0.2, for example, indicates that there is a positive association between two variables, although it is weak and unlikely. Analysts in several fields of research do not consider correlations to be significant until a value surpasses 0.8 A correlation coefficient with an absolute value of 0.9 or more, on the other hand, indicates a very high connection with the accompanying correlation. The coefficients are less than the test's level of significance of = 0.05. Accordingly, then we get the conclusion that the variable is true Constructive validity, meaning constructive validity, has also been computed for what was assessed, and It is one of the measures of accuracy of activities and it assesses the amount to which goals are met, as well as the extent to which each component of the study is connected to the overall result of the questionnaire paragraphs(Dybjer, Colloquium, 2010).

Reliability was also calculated, which means accuracy and consistency in the respondents' answers, as well as consistency in results regardless of test frequency; additionally a fixed questionnaire yields the same results when applied to the same individuals and under the same conditions, but once again, one of these measures is Cronbach - alpha, with values typically ranging between 0 and 1, where (0) indicates no relationship between items, and (1) indicates absolute internal consistency and the value of the alpha correlation coefficient was higher than (0.7) acceptable and satisfactory, and higher than (0.8) which is very good, and it is considered higher than (0.9), and it shows a high level of internal stability, the amount to which the instrument assesses what is referred to as its self-validity It is planned to assess, i.e. the degree of validity of the results Self-validity is defined mathematically as the square root of the coefficient of dependability (Mohajan, 2017) (Schaefer, Colgan, Tsang, Bassuk, Mahajan, 2017).

After the data collection scale was confirmed after being subjected to the aforementioned tests, and to making sure that the data follow a normal distribution or not for the purpose of choosing appropriate tests for the data, the Parametric Statistics was based on the basic assumption that the data subject to analysis must be tracking a normal distribution, or nonparametric statistics, which do not assume that the data are normally distributed, although statisticians indicated that if the researcher uses a large sample compared to the study population, there is no need to worry about the normal distribution of the data.

The questionnaire referred to one of the most important tests for the normal distribution of data, which is the (Kolmogrove-Smirnov) test and to conduct a statistical analysis of these variables of this questionnaire, and It has been coded as in Table 3.1 (Afeez, Maxwell,Otekunrin, Happiness, 2018).

Table 3.1: Variables coding

Variable	Dimension	No. of items	Symbol
Classification of risks	9	29	X1
	Physical and human risks	3	X11
	Environmental and natural risks	3	X12
	Design risks	4	X13
	Logistical risks	3	X14
	Financial risks	4	X15
	Legal risks	2	X16
	Risks directly related to implementation	4	X17
	Political risks	2	X18
	Administrative risks	4	X19
Means of remedying the effects of risks	2	12	X20
	Before the implementation phase risks	7	X21
	After the implementation phase risks	5	X22

4. RESULTS AND ANALYSIS

4.1 Analysis and Discussions of the Results of the Study Hypotheses

This part dealt with discussing and interpreting the results of the field study through the information that resulted from the individuals' answers to the questionnaire forms according to the methodology used, as well as presenting the results of the statistical analysis and testing the hypotheses of the study.

4.2 Validity and Reliability of Questionnaire

4.2.1 Internal consistency

Internal consistency is a measure that relies on correlations between different items on the same test, and it measures whether a group of items proposing to measure the same general structure produces similar and similar scores.

Table 4.1: the correlation coefficients between each paragraph of the risk classification scale and the overall degree of variable

Number of Item	Item	Pearson Correlation Coefficient	Sig.
1	Low production capacity of workers / breakdown of machine	0.75**	0.000
2	Supply of low quality materials	0.67**	0.000
3	Accidents happen due to lack of safety precautions	0.77**	0.000
4	Natural disasters (floods)	0.80**	0.000
5	Inappropriate weather conditions	0.75**	0.000
6	Difficulty accessing the site	0.79**	0.000
7	Mismatch between quantities, plans and specifications	0.71**	0.000

Table 4.1: Continue

8	Mismatch between architectural and structural plans	0.77*	0.000
9	accuracy in calculating quantities	0.67**	0.000
10	commissioning to incompetent designers	0.65**	0.000
11	Inaccurate project scheduling	0.66**	0.000
12	Poor communication within working range	0.81**	0.000
13	Shortage of labor, machinery and materials	0.78**	0.000
14	Inflation	0.77**	0.000
15	Exchange rate instability	0.81**	0.000
16	Delayed payments as per contract	0.83**	0.000
17	Poor management of the contractor's cash flow	0.79**	0.000
18	Difficulty obtaining the necessary permits to work	0.79**	0.000
19	The emergence of legal disputes during the implementation phase between the project parties and the delay in resolving them	0.76**	0.000
20	Design change	0.75*	0.000
21	Low level of quality of work due to time constraints of implementation	0.77**	0.000
22	Implementation errors due to a misunderstanding of the plans, terms and specifications	0.71**	0.000
23	There is a difference between real and nodal quantities	0.80**	0.000
24	New government laws affecting work	0.78**	0.000
25	Security instability	0.77**	0.000
26	Unclear planning due to project complexity	0.65**	0.000
27	Poor communication between the project parties	0.63**	0.000
28	Poor management of resources	0.70**	0.000
29	Lack of necessary information	0.73**	0.000

* Significance of Correlation coefficient at 0.05, ** high significance of correlation coefficient at 0.01

Table 4.1 displays the correlation coefficients between each paragraph of the risk categorization scale and the total degree of variable, also demonstrating that the correlation coefficients are all significant, because the probability value is 0 the significance level associated with the correlation coefficients is less than the significance level provided for the test = 0.05, that mean this implies that the variable is trustworthy.

Table 4.2: The correlation coefficients between each paragraph of the means of remedying the effects of risks scale and the overall degree of variable

Number of Item	Item	Pearson Correlation Coefficient	Sig.
1	Methods to mitigate the effects of risk	0.70**	0.000
2	Use quantitative risk analysis methods to accurately predict time duration	0.81**	0.000
3	Reliance on practical experience in creating a work program before implementation	0.77**	0.000
4	Add reserve and security for the period as a precaution for the schedule risk	0.71**	0.000
5	Transferring or dividing risks with the project parties	0.76**	0.000
6	Refer to similar projects implemented or underway and obtain information to produce an accurate work program	0.66**	0.000
7	Use of modern systems (integrated computer programs)	0.77**	0.000
8	Increased labor and / or machinery	0.76**	0.000
9	Increasing working hours	0.69**	0.000
10	Change the sequence of implementation processes or overlap between them	0.67**	0.000
11	Full coordination with subcontractors	0.61**	0.000
12	Close supervision of works to eliminate rejection of workers and re-	0.80**	0.000

* Significance of Correlation coefficient at 0.05, ** high significance of correlation coefficient at 0.01

Table 4.2 shows the correlation coefficients between each paragraph of the means of mitigating risks scale and the..overall degree of variable, demonstrating that the correlation coefficients are all significant because the probability value Sig. associated with the correlation coefficients is less than the level of significance specified for the test 0.05 this is an indication that this variable can be reliable.

Table 4.3: The Correlation coefficients between each of the paragraphs of each dimension of the dimensions of the risk classification variable and the overall degree of each dimension

Number of Item	Item	Pearson Correlation Coefficient	Sig.
1	Low production capacity of workers / breakdown of machine	0.78**	0.000
2	Supply of low quality materials	0.89**	0.000
3	Accidents happen due to lack of safety precautions	0.77**	0.000
4	Natural disasters (floods)	0.77**	0.000
5	Inappropriate weather conditions	0.79**	0.000
6	Difficulty accessing the site	0.65**	0.000
7	Mismatch between quantities, plans and specifications	0.75**	0.000
8	Mismatch between architectural and structural plans	0.72*	0.000
9	accuracy in calculating quantities	0.88**	0.000
10	commissioning to incompetent designers	0.70**	0.000
11	Inaccurate project scheduling	0.67**	0.000
12	Poor communication within working range	0.77**	0.000
13	Shortage of labor, machinery and materials	0.80**	0.000
14	Inflation	0.78**	0.000

Table 4.3: Continue

15	Exchange rate instability	0.65**	0.000
16	Delayed payments as per contract	0.67**	0.000
17	Poor management of the contractor's cash flow	0.79**	0.000
18	Difficulty obtaining the necessary permits to work	0.68**	0.000
19	The emergence of legal disputes during the implementation phase between the project parties and the delay in resolving them	0.68**	0.000
20	Design change	0.62*	0.000
21	Low level of quality of work due to time constraints of implementation	0.60**	0.000
22	Implementation errors due to a misunderstanding of the plans, terms and specifications	0.60**	0.000
24	New government laws affecting work	0.76**	0.000
25	Security instability	0.68**	0.000
26	Unclear planning due to project complexity	0.71**	0.000
27	Poor communication between the project parties	0.78**	0.000
28	Poor management of resources	0.71**	0.000
29	Lack of necessary information	0.67**	0.000

* Significance of Correlation coefficient at 0.05, ** high significance of correlation coefficient at 0.01

The Correlation.coefficients between each of the paragraphs of each dimension of the dimensions are shown in Table 4.3 the total degree of each dimension and the correlation coefficients are all significant, indicating that the risk categorization variable and the overall degree of each dimension are both significant, and the level of significance for the correlation coefficients is less than the level of significance set for the correlation coefficients.

Table 4.4: Correlation coefficients between each of the paragraphs of each dimension of the dimensions of the means of remedying the effects of risks scale variable and the overall degree of each dimension

Number of Item	Item	Pearson Correlation Coefficient	Sig.
1	Methods to mitigate the effects of risk	0.66**	0.000
2	Use quantitative risk analysis methods to accurately predict time duration	0.81**	0.000
3	Reliance on practical experience in creating a work program before implementation	0.66**	0.000
4	Add reserve and security for the period as a precaution for the schedule risk	0.59**	0.000
5	Transferring or dividing risks with the project parties	0.58**	0.000
6	Refer to similar projects implemented or underway and obtain information to produce an accurate work program	0.77**	0.000
7	Use of modern systems (integrated computer programs)	0.65**	0.000
8	Increased labor and / or machinery	0.64*	0.000
9	Increasing working hours	0.62**	0.000
10	Change the sequence of implementation processes or overlap between them	0.67**	0.000
11	Full coordination with subcontractors	0.78**	0.000
12	Close supervision of works to eliminate rejection of workers and re-implementation	0.77**	0.000

* Significance of Correlation coefficient at 0.05, ** high significance of correlation coefficient at 0.01

The correlation coefficients between each paragraph of the means of mitigating hazards scale and the overall degree of variable are displayed in Table 4.4 illustrating that the correlation coefficients are all significant since the probability value Sig. the

level of significance specified for the test 0.05 is smaller than the correlation coefficients, also this demonstrates that the variable is trustworthy.

4.2.2 The Constructive validity

Table 4.5 displays the correlation coefficients for each dimension of the questionnaire. are statistically significant connected with the correlation coefficients for calculating the overall score of the questionnaire's items is less more than the specified probability value for the test (5%).

Table 4.5: Correlation coefficients between each dimension of the study and the total score of the paragraphs of the questionnaire

Number of Item	Dimension	Pearson Correlation Coefficient	Sig.
1	Physical and human risks.	0.73**	0.000
2	Environmental and natural risks	0.78**	0.000
3	Design risks	0.80**	0.000
4	Logistical risks	0.79**	0.000
5	Financial risks	0.60**	0.000
6	Legal risks	0.71**	0.000
7	Risks directly related to implementation	0.83**	0.000
8	Political risks	0.83**	0.000
9	Administrative risks	0.70**	0.000
10	before the implementation phase risk	0.80**	0.000
11	after the implementation risk	0.79**	0.000

* Significance of Correlation coefficient at 0.05, ** high significance of correlation coefficient at 0.01

4.2.3 Reliability

Table 4.6 shows the values of the reliability and validity coefficient of the study variables with their dimensions.

Table 4.6: Reliability and validity coefficient

Variable	Dimension	Number of items	Cronbach's alpha	Self- Validity Coefficient
Classification of risks	9	29	0.89	0.94
	Physical and human risks.	3	0.88	0.94
	Environmental and natural risks	3	0.84	0.92
	Design risks	4	0.86	0.93
	Logistical risks	3	0.89	0.94
Classification of risks	Logistical risks	3	0.89	0.94
	Financial risks	4	0.79	0.89
	Legal risks	2	0.81	0.90
	Risks directly related to implementation	4	0.77	0.88
	Political risks	2	0.79	0.89
	Administrative risks	4	0.88	0.94
means of remedying the effects of risks	2	12	0.83	0.91
	before the implementation phase risk	7	0.85	0.92
	after the implementation risk	5	0.80	0.89

As seen in Table 4.6, all Cronbach's Alpha coefficients are larger than (0.70) it is regarded as very acceptable in administrative and statistical terms, since the validity ratio reflects the precision of the measuring tool used in the study.

4.2.4 Normality test

The questionnaire referred to one of the most important tests for the normal distribution of data, which is the (Kolmogrove-Smirnov) test and the results as in Table 4.7 to test:

H_0: The data follow the normal distribution.

H_1: The data not follow the normal distribution.

Table 4.7: Tests of Normality

Kolmogorov-Smirnova			Shapiro-Wilk		
Statistic	d. f	S.g	Statistic	d. f	S.g
0.141	50	0.014	0.940	50	0.031

Table 4.7 shows that the value of Sig. for both tests (Kolmogorov-Smirnova) and (Shapiro-Wilk) is (0.014) and (0.031) respectively less than the level of significance (5%), therefore we reject the null hypothesis which states that the data follow a normal distribution, and we accept the alternative hypothesis, that meaning the data does not follow the normal distribution, so the nonparametric tests will be used for the data analysis questionnaire.

4.3 Descriptive analysis of study data

4.3.1 Descriptive analysis of personal data: The study sample included the following

Here the personal information of the firms involved in the questionnaire will be analyzed.

4.3.1.1 Qualification of the research sample

Table 4.8: Qualification of the research sample

		Frequency	Percent
Qualification	Bachelor's degree	22	44.0
	High diploma	5	10.0
	Master	11	22.0
	Ph.D.	12	24.0
	Total	50	100.0

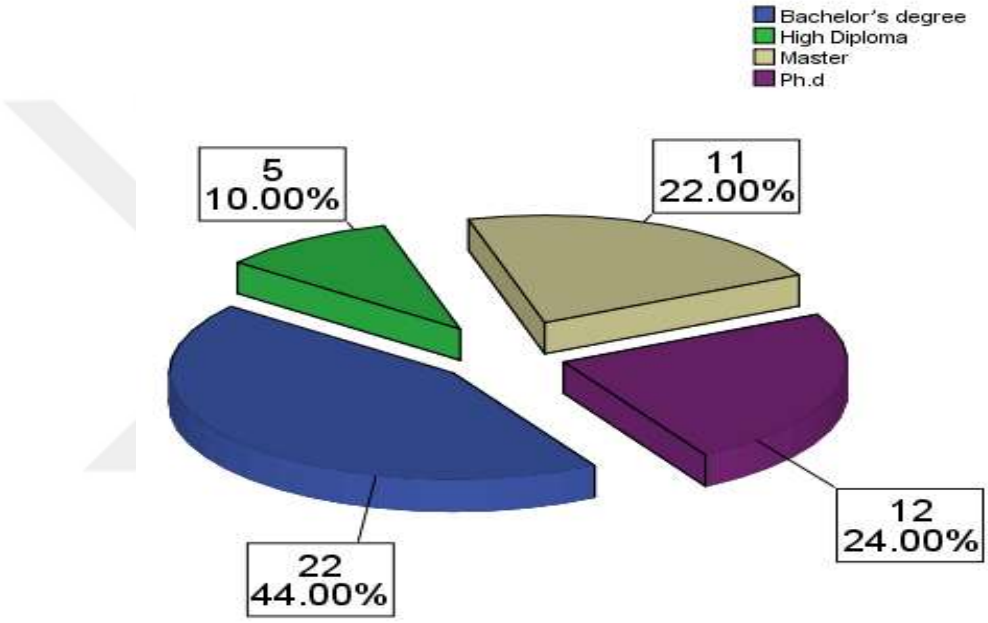

Figure 4.1: Pie chart of qualification of the research sample

Table 4.8 and Figure 4.1show that the research sample according to academic found qualification consisted of holders of a bachelor's degree by 44% and that the percentage of holders of a higher diploma was 10% the percentage of masters was 22% and the percentage of doctorate was 24%. We notice that there are a high percentage of master's and the doctoral degree holders in addition to holders of a bachelor's degree, which is a good indicator that the research sample individuals have academic qualifications that distinguish them from others in performing the tasks assigned to them.

4.3.1.2 The number of years of experience for the research sample

Table 4.9: The number of years of experience for the research sample

		Frequency	Percent
The number of years of experience	Less than 5	3	6.0
	5-10	3	6.0
	10-15	14	28.0
	More than 15	30	60.0
	Total	50	100.0

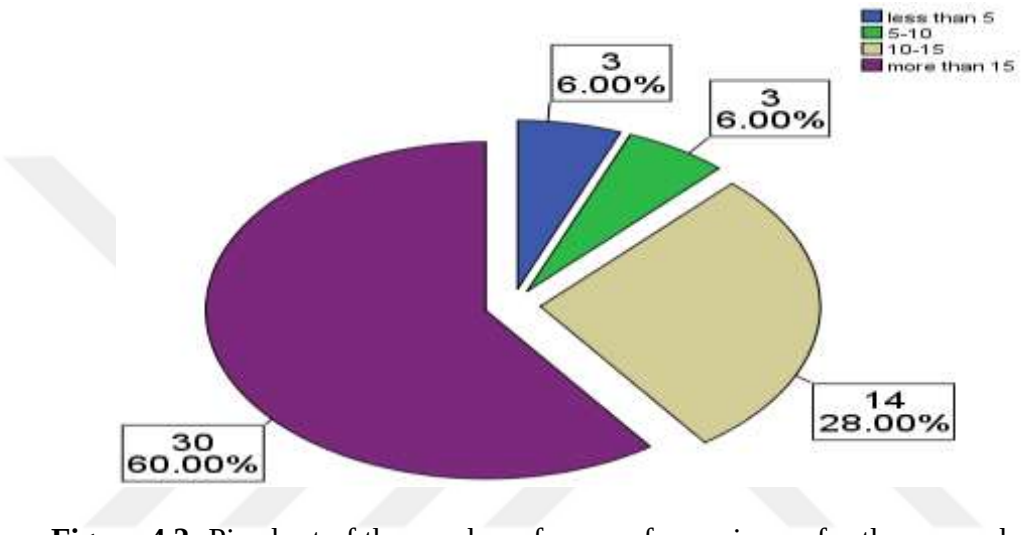

Figure 4.2: Pie chart of the number of years of experience for the research sample

Table 4.9 and Figure 4.2 show that the sample consisted of 6% according to the number of years of scientific experience for the age class less than 5 years and for the age class from 5 to 10 years, 28% for the age class 10-15 years and 60% for more than 60 years , also the number of years of scientific experience for the sample members is concentrated in the two age class 10-15 years and more than 15 years, and this indicates that the research sample members have long scientific experience in their fieldwork.

4.3.1.3 The nature of the work of the members of the research sample

Table 4.10: The nature of the work of the members of the research sample

	Frequency	Percent
Contactor	5	10.0
Advisor	23	46.0
Owner or owner representative	22	44.0
Total	50	100.0

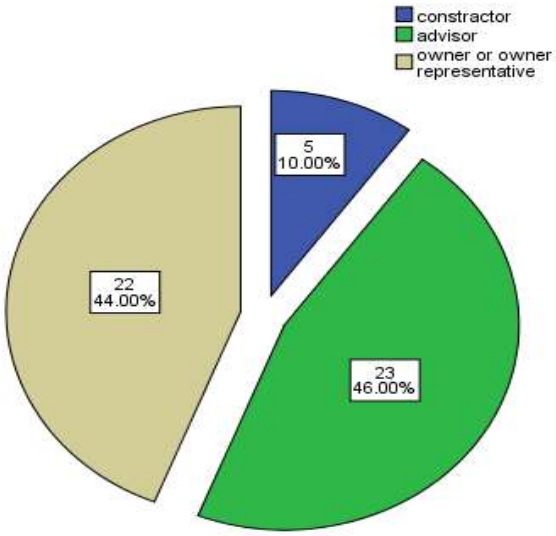

Figure 4.3: Pie Chart of The nature of the work of the members of the research sample

Table 4.10 and Figure 4.3 show that the sample was divided according to the nature of the work with 10% as a contractor, 46% as a consultant and 44% as the owner or representative of the owner and it is a good division to deal with the study problem we are dealing withit**.**

4.3.1.4 The type of sector of the members in the research sample

Table 4.11: The type of sector

	Frequency	Percent
Public	24	48.0
Special	11	22.0
Public & Special	15	30.0
Total	50	100.0

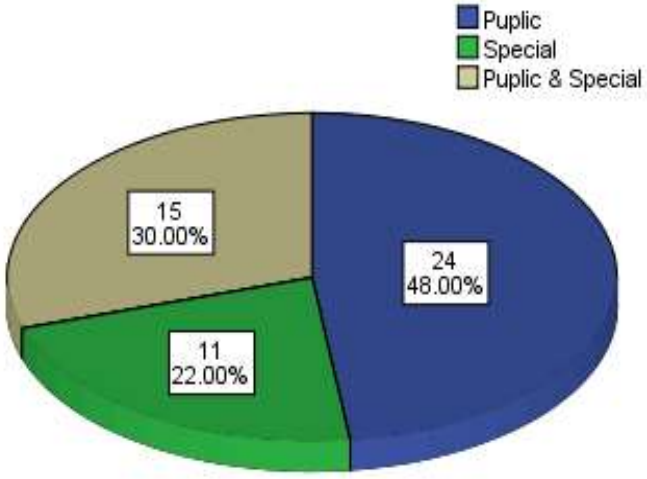

Figure 4.4: Pie chart of the type of sector

Table 4.11 and Figure 4.4 show that the research sample for the type of sector in which the sample members work was 48% in the public sector 22% in the private sector and 30% in the mixed sector (private and public), mean the highest percentages in the sectors operating in the construction industry.

4.3.1.5 The volume of the current workload of the research sample

Table 4.12: The volume of thhe current workload of the research sample

	Frequency	Percent
Small project	7	14.0
Medium project	14	28.0
Big project	29	58.0
Total	50	100.0

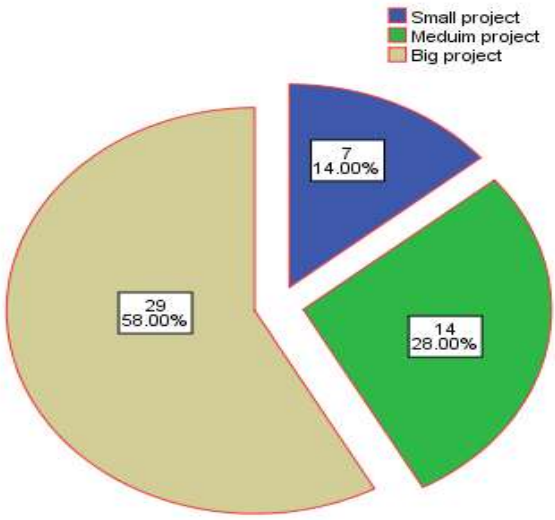

Figure 4.5: Pie chart of the volume of current workload of the research sample

From Table 4.12 and Figure 4.5 show that the current of the volume of job for the research sample is distributed as 14% for a small project, 28% for a medium project, and 58% for a large project, it can be seen here that the research sample included all types of established projects.

4.3.1.6 Qualification of the research sample according to the nature of the work of the members of the research sample

Table 4.13: Qualification of the research sample according to the natural of the work of the members of the research sample cross-tabulation.

		The nature of the work of the members of the research sample			Total
		Contactor	Advisor	Owner or owner represntative	
Qualification of the research sample	Bachelor's degree	0	8	14	22
	High diplom	1	1	3	5
	Master	1	8	2	11
	Ph.D.	3	6	3	12
Total		5	23	22	50

Table 4.14: Association coefficients for the qualification of the research sample according to the nature of the work of the members of the research sample.

		Value	Approximate significance
Normal by nominal	Phi	0.514	0.040
	Cramer's V	0.363	0.040
	Contingency coefficient	0.457	0.040
No. of valid cases		50	

Table 4.14 represents the two-way contingency table (cross table), the first way is the scientific qualification of the members of the research sample and the second is the nature of the work of the members of the research sample and show the significance of the coefficients' contingency, which are Phi coefficient, Cramer's V coefficient and contingency coefficient because the value of Sig. for each coefficient in was (0.040) which is less than the level of significance (5%), it indicates the significance of the relationship between the scientific qualification of the members of the research sample and the nature of their work.

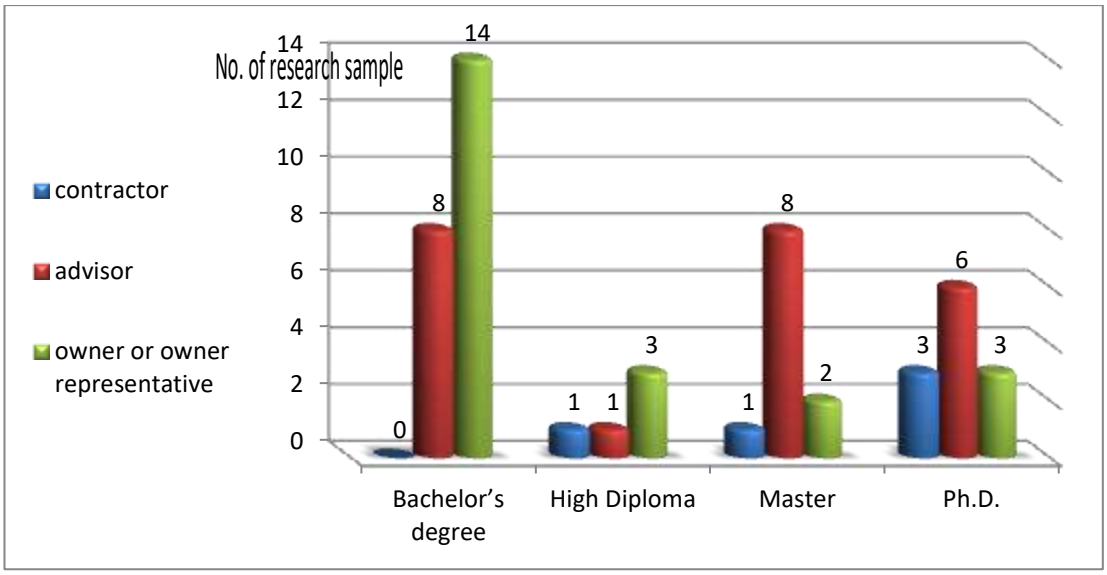

Figure 4.6: Qualification of the research sample according to the nature of the work of the members of the research sample

Figure 4.6 showsthat the highest number of the research sample was 14 individuals were those who were campaigners A Bachelor's degree, who by the nature of their work is the owner or representative of the owner followed by holders of a bachelor's and master's degree who are advisor with 8 and then an advisor who holds a doctorate with (6) which is a good indication that the research sample members have higher degrees according to the nature of their work.

4.3.1.7 The number of years of experience for the research sample according to the volume of the current workload of the research sample

Table 4.15: The number of years of experience for the research sample according to the volume of the current workload of the research sample cross tabulation

		The volume of current workload of the research sample			Total
		Small project	Medium project	Big project	
The number of years of experience for the research sample	Less than 5	3	0	0	3
	5-10	1	2	0	3
	10-15	0	4	10	14
	More than 15	3	8	19	30
Total		7	14	29	50

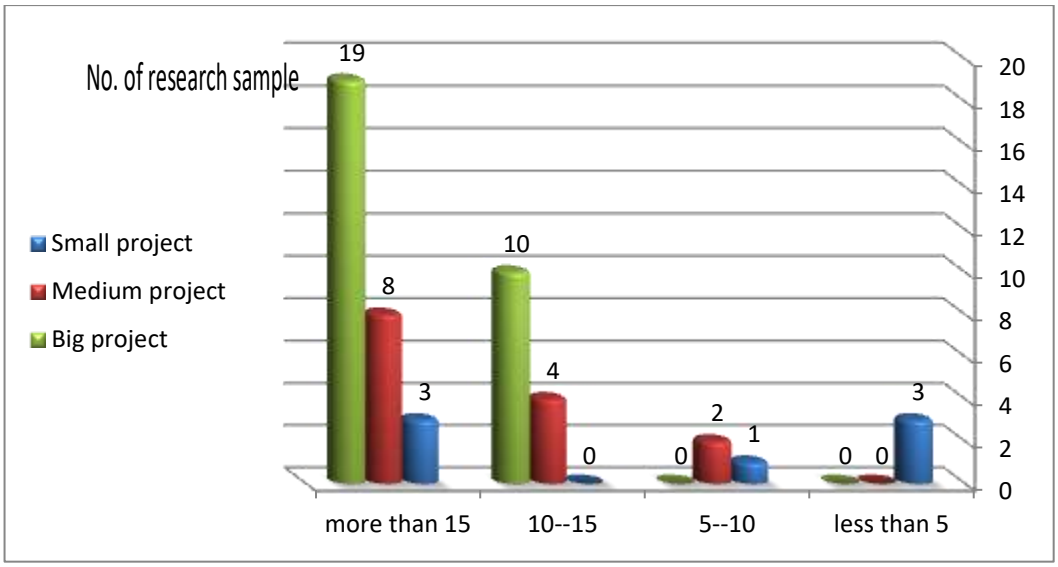

Figure 4.7: the number of years of the experience for the research sample according to the volume of the current workload of the research sample

Table 4.16: Association coefficients for the number of years of experience for the research sample and the volume of the current workload of the research sample

		Value	Approximate significance
Nominal by nominal	Phi	0.714	0.000
	Cramer's V	0.505	0.000
	Contingency coefficient	0.581	0.000
No. of valid cases		50	

Table 4.15 and Figure 4.7 show that the largest number of individuals was in the category of years of scientific experience over 15 years and in the category of workers in large projects amounted to 19 individuals followed by the category of years of scientific experience. The age group of experience is between 10-15 years and the category of work in the large projects amounted to 10 people followed by those who work in the medium projects and those who have scientific experience of more than 15 years, which amounted to 8 individuals, which are positive indicators on the subject of the current study as they have long scientific experience They work on a big projects.

Table 4.16 shows the significance of the coefficients' contingency, which are Phi coefficient, Cramer's V coefficient and contingency coefficient because the value of Sig. for each coefficient in was 0.000, which is less than the level of significance

(5%), therfor it indicates the significance of the relationship between the number of years of experience for the research sample and the volume of current worklod.

4.3.1.8 The qualification of the research sample according to the type of sector in which the members of the research sample work cross-tabulation

Table 4.17: The qualification of the research sample and the type of sector in which the members of the research sample work cross-tabulation

		The type of sector in which the members of the research sample work			Total
		Public	Special	Public & special	
Qualification of the research sample	Bachelor's degree	15	4	3	22
	High diploma	3	1	1	5
	Master	5	1	5	11
	Ph.D.	1	5	6	12
Total		24	11	15	50

Table 4.18: Association coefficients for the qualification of the research sample according to the type of sector in which the members of the research sample

		Value	Approximate significance
Nominal by nominal	Phi	0.523	0.034
	Cramer's	0.370	0.034
	Contingency coefficient	0.463	0.034
No. of valid cases		50	

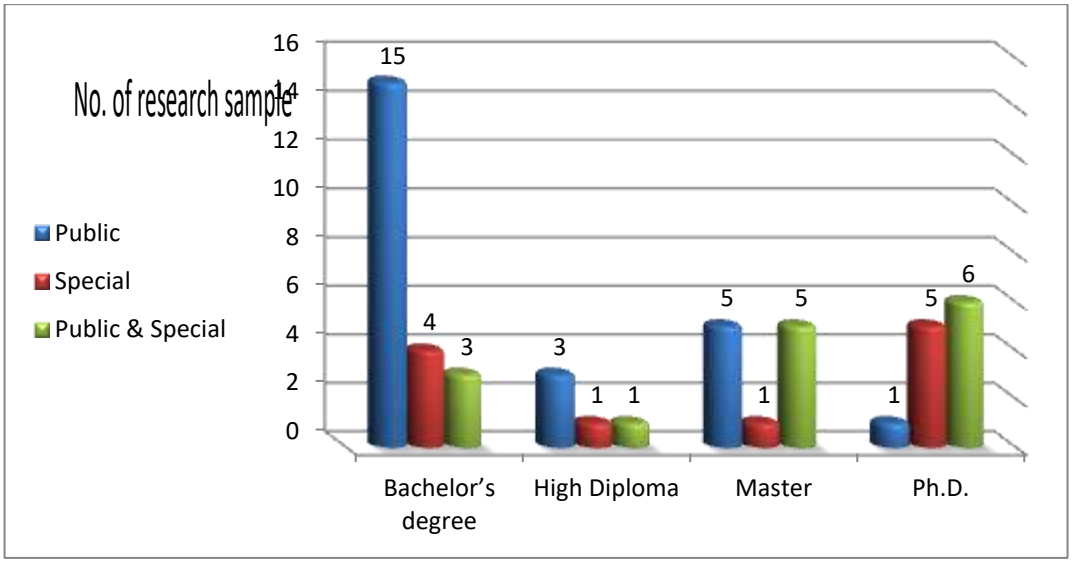

Figure 4.8: The qualification of the research sample according to the type of sector in which the members of the research sample work

Table 4.17 shows that the highest number 15 individuals who hold a bachelor's degree and work in the public sector, followed by 6 individuals who hold a doctorate and work in the public and private or mixed sectors. The other of the individuals were equal in their numbers in terms of academic qualification and sector type.

Table 4.18 and Figure 4.8 show that the contingency coefficients are of great importance, namely the Phi parameter and the Cramer V factor, as well as the contingency factor due to the value of Sig, as well as for each parameter it was 0.034 which is less than the level of significance 5% indicating the relationship between the qualification of the research sample and the type of sector Which members of the sample participating in the research work.

4.4 Presentation, analysis and interpretation of the study results

4.4.1 The risk classification variable

Table 4.19 shows the risk responsibility (contractor, owner, advisor, and other), weighted arithmetic means, standard deviation, chi-square statistic, and sig. for the variable of the risk classification variable.

1- **Weighted arithmetic means:** weighted arithmetic mean is similar to a normal arithmetic mean (the most common type of mean), except that instead of each of the existing data points contributing equally to the final average, some data points contribute more than others.

$$\bar{x} = \frac{\sum fixi}{\sum fi} \qquad (4.1)$$

xi: The Midpoint of the group.

fi: The frequency of a class interval is the number of numbers in the list.

2- **Standard deviation:** the standard deviation is the average amount of the variability in data set.

Through that, it is possible to know how far apart each degree is from the mean , a standard normal distribution has: a mean of 1 and a standard deviation of 1 mean of 0 and a standard deviation of 1, a mean larger than its standard deviation all scores within one standard deviation of the mean.

$$\sigma = \sqrt{\frac{\sum f\left(xi - \bar{x}\right)^2}{\sum fi}} \qquad 4.2)$$

3- **Chi-Square:** is a statistical procedure used by researchers to examine the differences between categorical variables in the same population, greater differences between expected and actual data produce a larger Chi-square value, and the larger the Chi-square value is the greater the probability that there is a significant difference.

$$\chi_c^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} \qquad (4.3)$$

4- **Degree of freedom D.F**.:The number of restrictions on the sample.

5- **P-value:** p-value, or probability value is a number describing how likely it is, that the data would have occurred under the null hypothesis of thestatistical test, the level of statistical significance Sig. is often expressed as a p-value between 0 and 1, the smaller the p-value, the stronger the evidence that you should reject the null hypothesis.

Table 4.19: The risk responsibility (contractor, owner, advisor, and other), weighted arithmetic means, standard deviation, chi-square statistic, and sig. for the variable of the risk classification variable.

Variable	Item	Risk Responsibility								weighted arithmetic means	standard deviation	chi-square	D.F.	Sig.
		contract-or		Owner		Advisor		Other						
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage					
The risk classification	Physical and human													
	1	45	90	4	8	1	2	0	0	1.22	0.68	72.52	2	0.000
	2	33	66	17	34	0	0	0	0	1.68	0.96	5.12	1	0.024
	3	41	82	3	6	6	13	0	0	1.30	0.68	53.56	2	0.000
	Environmental and natural													
	4	2	4	3	6	19	38	26	52	3.38	0.78	34.00	3	0.000
	5	8	16	2	4	12	24	28	56	3.20	1.11	29.68	3	0.000
	6	17	34	1	2	9	18	23	46	2.76	1.35	22.00	3	0.000

Table 4.19: Continue

Variable	Item	Risk Responsibility								weighted arithmetic means	standard deviation	chi-square	D.F.	Sig.
		contract-or		Owner		Advisor		Other						
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage					
The risk classification	Design													
	7	20	40	27	54	3	6	0	0	1.66	0.59	18.28	2	0.000
	8	9	18	36	72	4	8	1	2	1.94	0.59	61.52	3	0.000
	9	20	40	21	42	8	16	1	2	1.80	0.78	22.48	3	0.000
	10	10	20	18	36	22	44	0	0	2.24	0.77	42.48	2	0.016
	Logistic													
	11	25	50	18	36	7	14	0	0	1.64	0.72	9.88	2	0.007
	12	41	82	4	8	3	6	2	4	1.32	0.77	86.80	3	0.000
	13	45	90	2	4	1	2	2	4	1.20	0.67	112.72	3	0.000
	Financial													
	14	11	22	3	6	13	26	23	46	2.96	1.19	16.24	3	0.001
	15	11	22	1	2	7	14	31	62	3.16	1.23	40.56	3	0.000
	16	26	52	2	4	21	42	1	2	1.94	1.02	39.76	3	0.000
	17	13	26	5	10	31	62	1	2	2.40	0.90	42.48	3	0.000
	Legal													
	18	21	42	19	38	10	20	0	0	2.36	1.22	40.12	2	0.027
	19	21	42	22	44	7	14	0	0	2.30	1.16	8.44	2	0.015
	Have a direct relationship to implementation													
	20	10	20	32	64	6	12	2	4	2.00	0.70	43.12	3	0.000
	21	30	60	15	30	5	10	0	0	1.60	0.93	19.00	2	0.000
	22	41	82	8	16	1	2	0	0	1.20	0.45	54.76	2	0.000
	23	21	42	22	44	3	6	4	8	1.80	0.88	26.00	3	0.000
	Political													
	24	5	10	1	2	14	28	30	60	3.38	0.95	39.76	3	0.000
	25	5	10	1	2	9	18	35	70	3.48	0.95	56.56	3	0.000
	Administrative													
	26	12	24	26	52	3	6	9	18	2.18	1.00	22.80	3	0.000
	27	34	68	4	8	7	14	5	10	1.66	1.06	49.68	3	0.000
	28	22	44	6	12	19	38	3	6	2.06	1.04	21.20	3	0.000
	29	11	22	23	46	11	22	5	10	2.20	0.90	13.68	3	0.003

It is evident from Table 4.19 that all the 29 items of risk classification are divided between 9 dimensions that were statistically significant because the value of Sig. of the chi-square statistic at each degree of freedom for all the paragraphs was less than the level of significance (5%), this means that the research sample supported the study's hypotheses and evidence of their validity.

4.4.2 Dimensions of the risk rating variable

4.4.2.1 Physical & Humanities

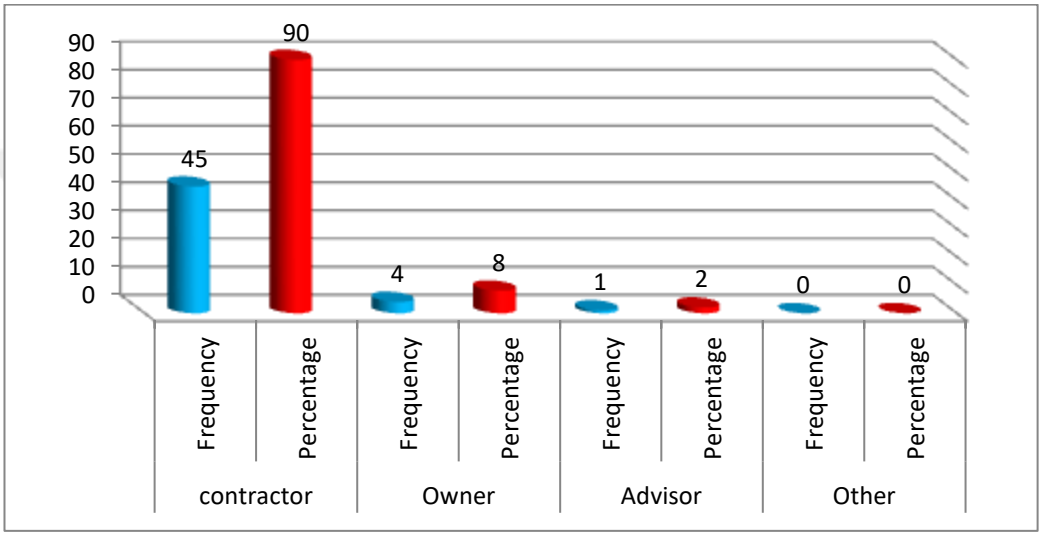

Figure 4.9: Low production capacity of workers / breakdown of machine

From Figure 4.9 it appears that 90% of the sample participating in the survey had their view that the contractor was responsible for the risks that occurred due to the low production capacity of workers / machine failure, 8% saw that the owner is responsible for this type of risk, and 2% saw that the advisor is responsible, 0% did not have a view that others would be responsible for the presence of low production capacity of workers / breakdown of machine**.**

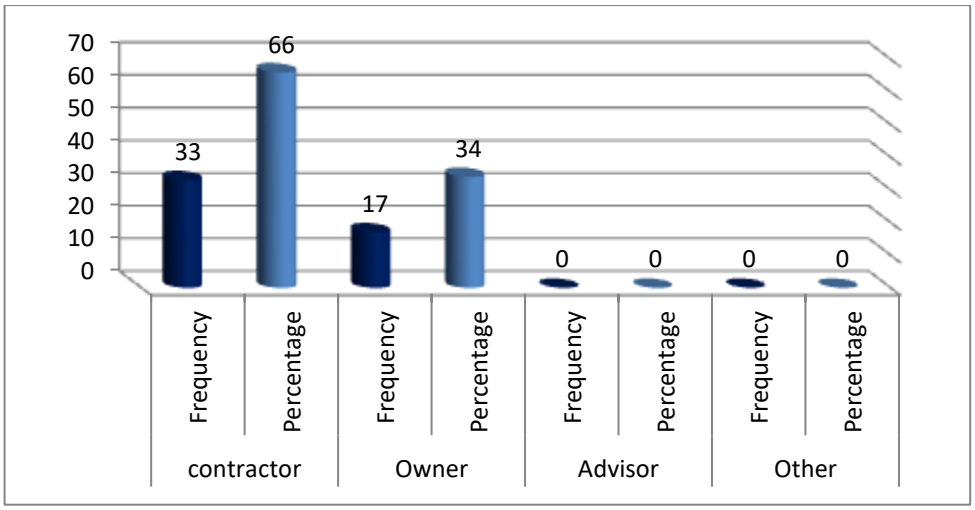

Figure 4.10: Supply of low-quality materials

From Figure 4.10 it becomes clear that 66% of the sample members had their view that the contractor is responsible for the supply of low-quality materials, and 34% were their point of view that the owner, and that the rate is 0% they had no opinion of this.

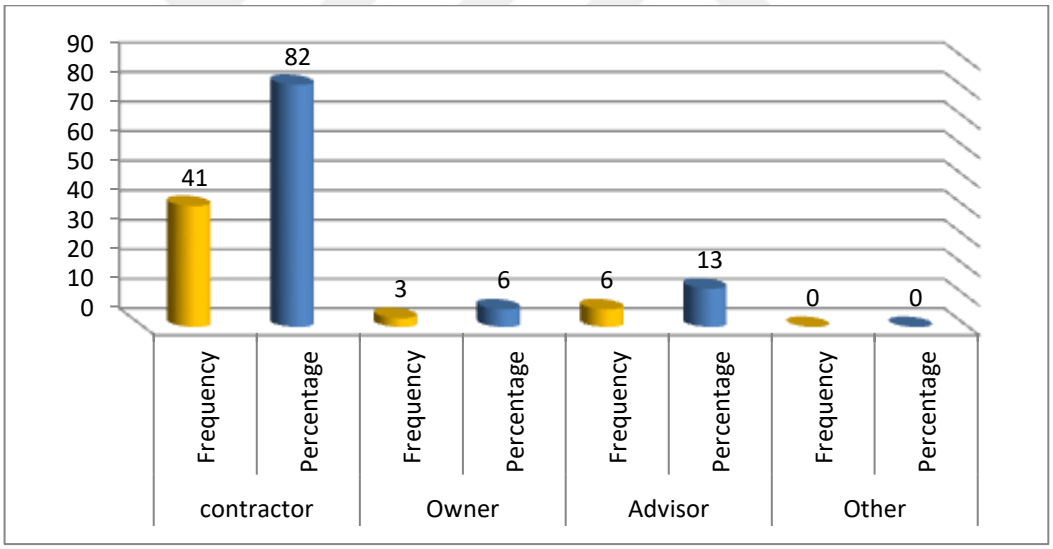

Figure 4.11: Accidents happen due to lack of safety precautions

It is evident from Figure 4.11 that 82% of the respondents saw that the contractor is responsible for the occurrence of accidents due to lack of safety precautions, 6% saw that the owner is responsible for the occurrence of accidents. For lack of safety precautions, 13% found the counselor responsible and 0% had no opinion.

4.4.2.2 Environmental and natural

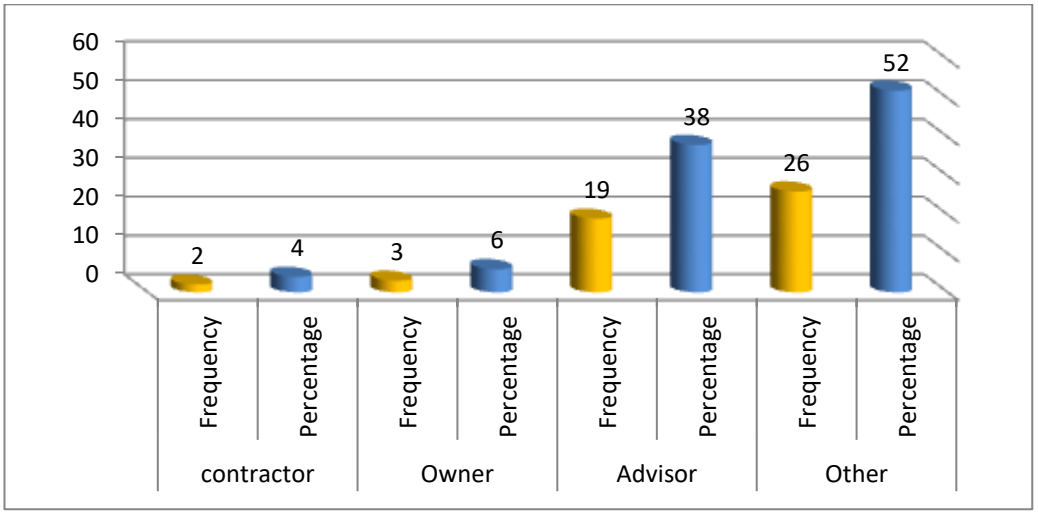

Figure 4.12: Natural disasters (floods)

Figure 4.12 shows that 4% of the research sample stated that the contractor was responsible for natural disasters (floods, earthquakes, etc.), 6% saw the owner is the responsible, 38% saw the consultant as a responsible and 52% believed others were responsible.

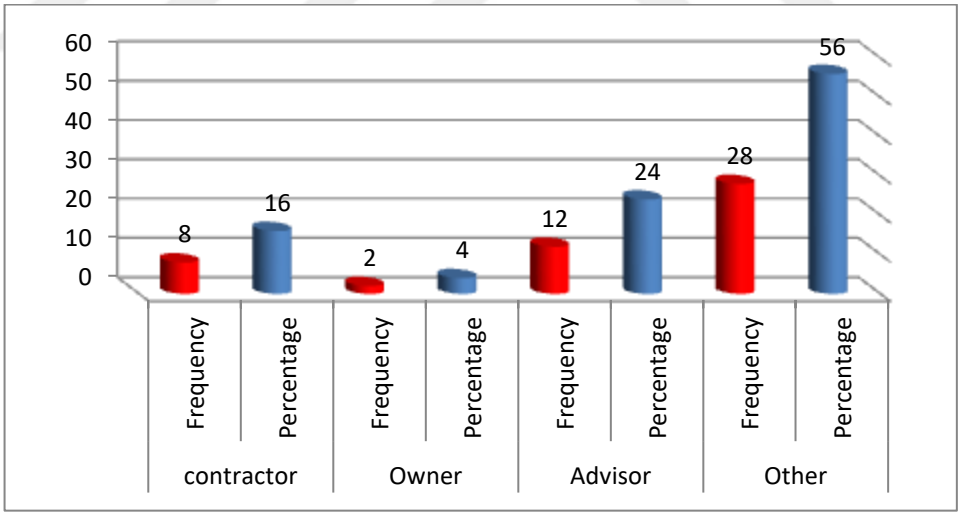

Figure 4.13: Inappropriate weather conditions

Figure 4.13 shows that 16% of the participating samples believe that the contractor is mainly responsible for unfavourable weather conditions due to lack of consideration, 4% believe the owner is responsible, 12% believe that the consultant is the responsible, and 28% believe that the owner is the responsible and who their opinion was that Others were responsible for this.

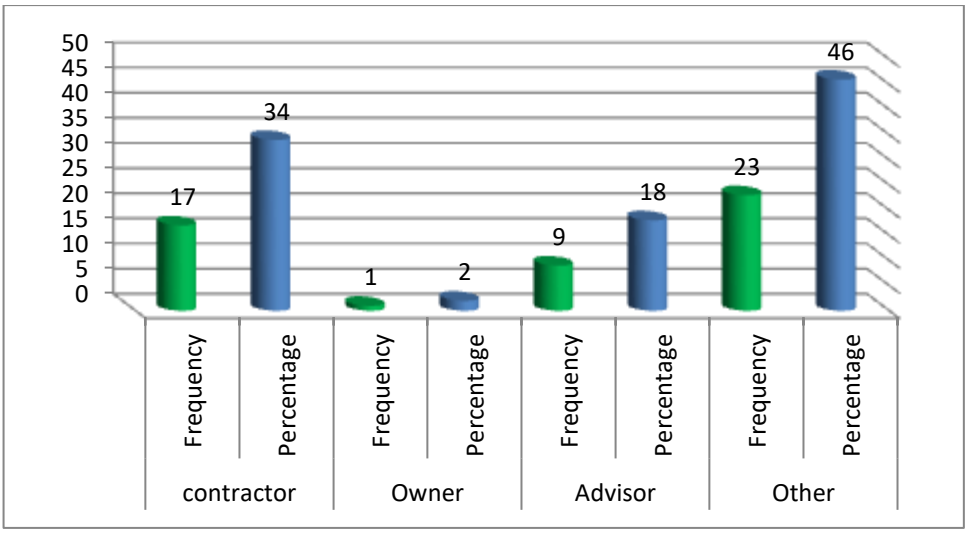

Figure 4.14: Difficulty accessing the site

Figure 4.14 shows that 34% of the respondents believe that the first person responsible for the difficulty of accessing the sites is the contractor, 2% believe that the official is the owner, and 18% believe that the consultant is responsible for this problem.

4.4.2.3 Design

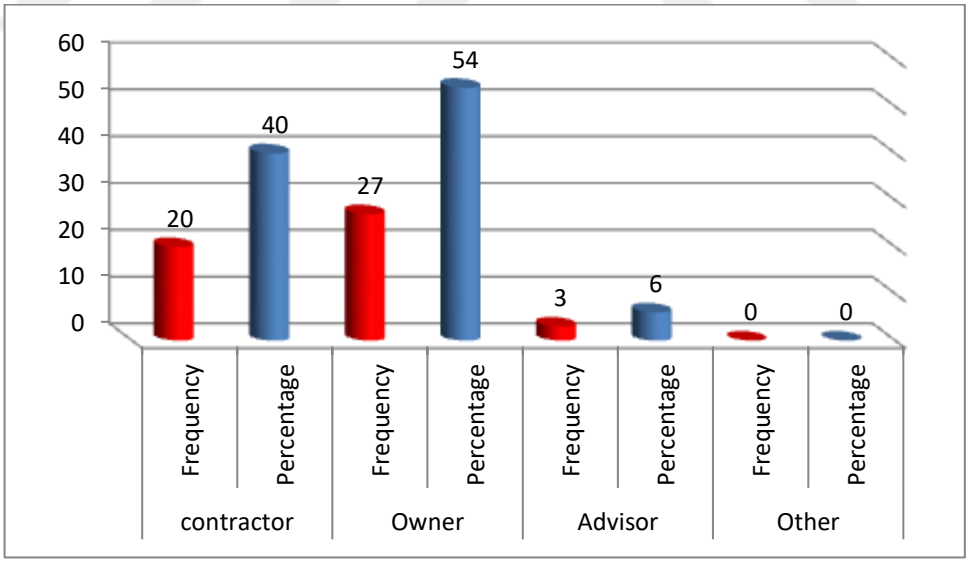

Figure 4.15: Mismatch between quantities, plans and specifications

Figure 4.15 shows that 40% of the research sample believes that the contractor is primarily responsible for the mismatch between quantities plans and specifications, 54% of the sample saw the owner as responsible for the nonconformity and 6% believe that the responsible is the consultant.

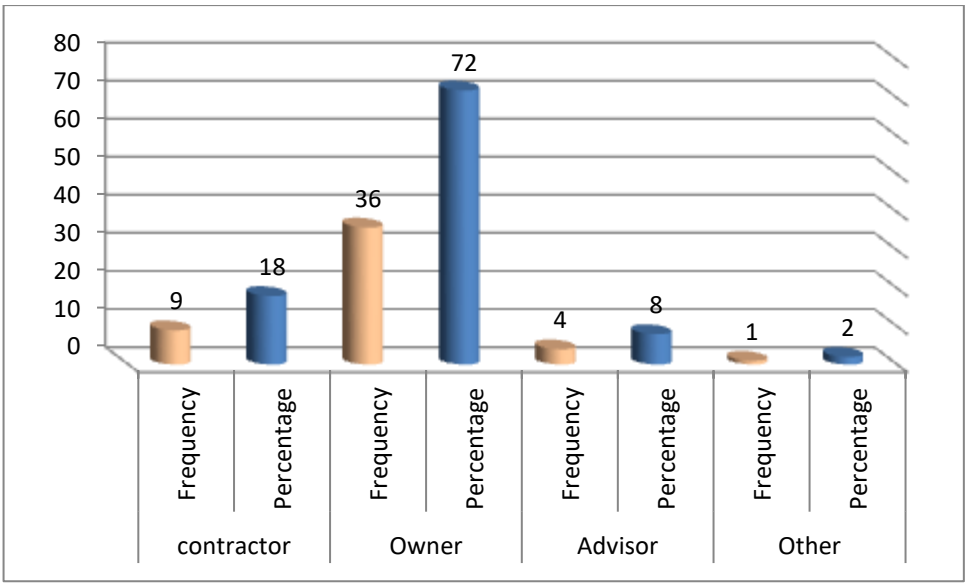

Figure 4.16: Mismatch between architectural and structural plans

Figure 4.16 shows that 18% of the research sample believes that the contractor is responsible for the mismatch between the architectural and construction plans, 72% believe that the owner is responsible, that 8% believe that the consultant is responsible and that 2% believe that other people are responsible about the mismatch between the architectural and construction plans.

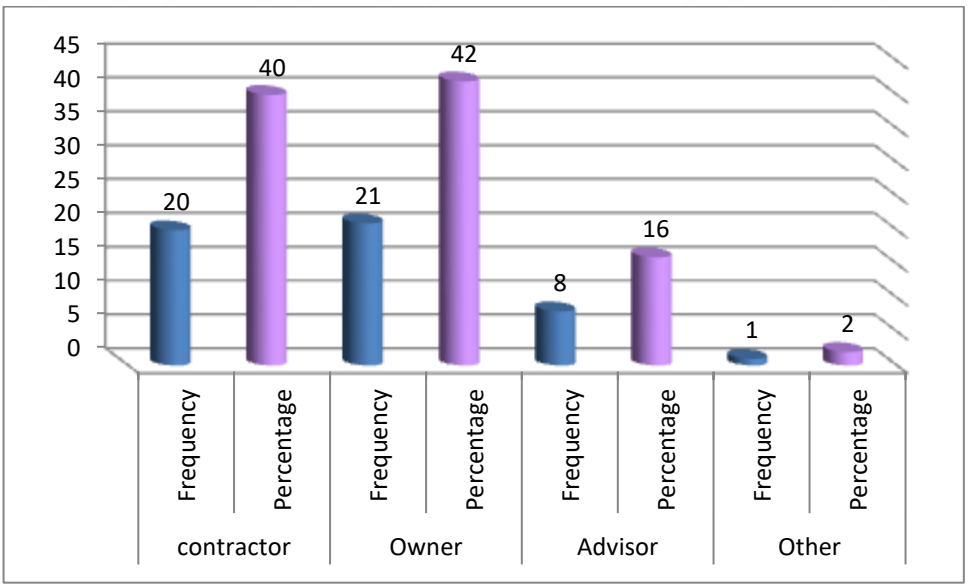

Figure 4.17: Accuracy in calculating quantities

It is evident from Figure 4.17 that 40% of the respondents believe that the contractor is responsible for the accuracy in calculating the quantities, 42% believe that the

owner is responsible, that the 16% believe that the consultant is responsible and 2% believe other people are responsible.

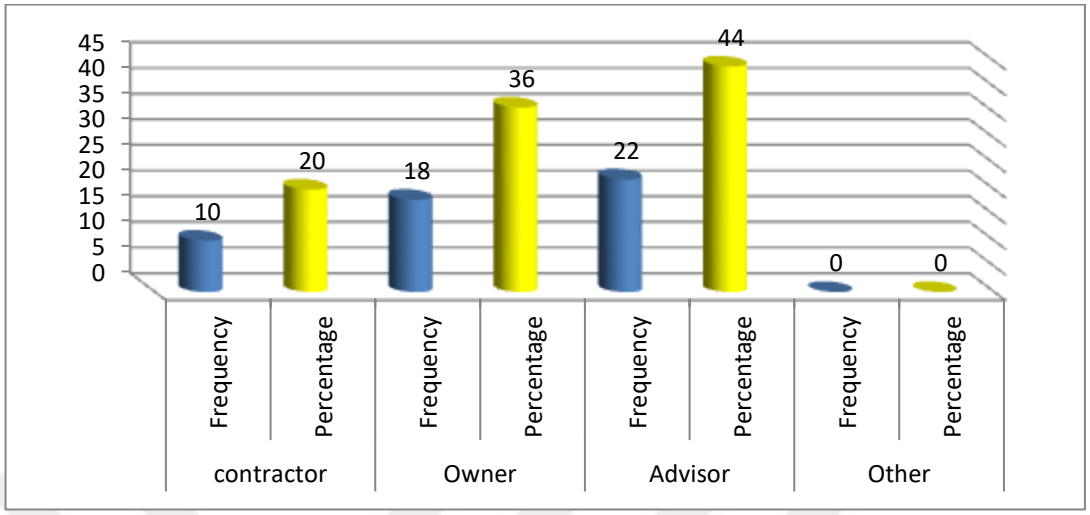

Figure 4.18: Commissioning to incompetent designers

From Figure 4.18 it becomes clear that 20% of the research sample individuals had their view that the contractor is responsible for commissioning to incompetent designers and 36% were their view that the owner is responsible and that 44% had their opinion that the consultant is the official and that 0% were their view that others are responsible.

4.4.2.4 Logistic

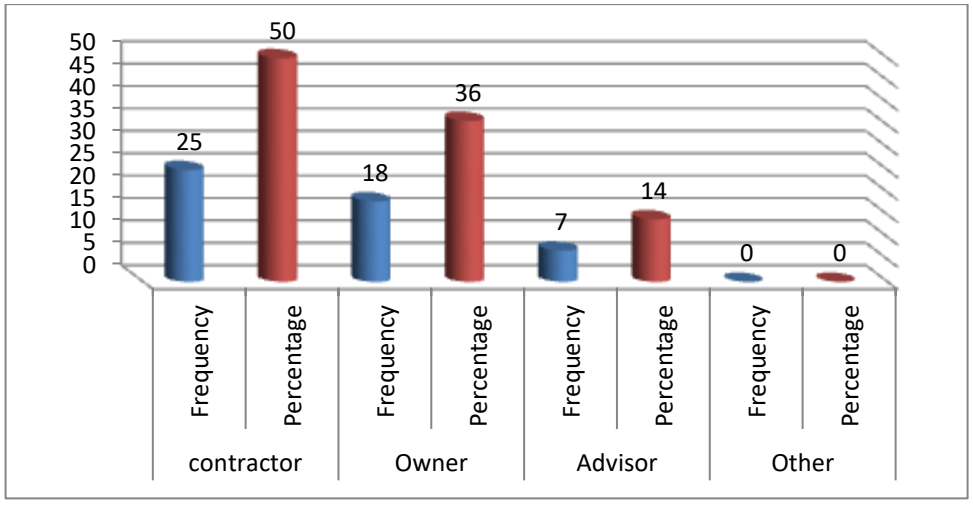

Figure 4.19: Inaccurate project scheduling

Figure 4.19 shows that 50% of the research sample has a view that the contractor is responsible for inaccurate project scheduling, 36% believe that the owner is responsible, and 14% have an opinion that the consultant is responsible.

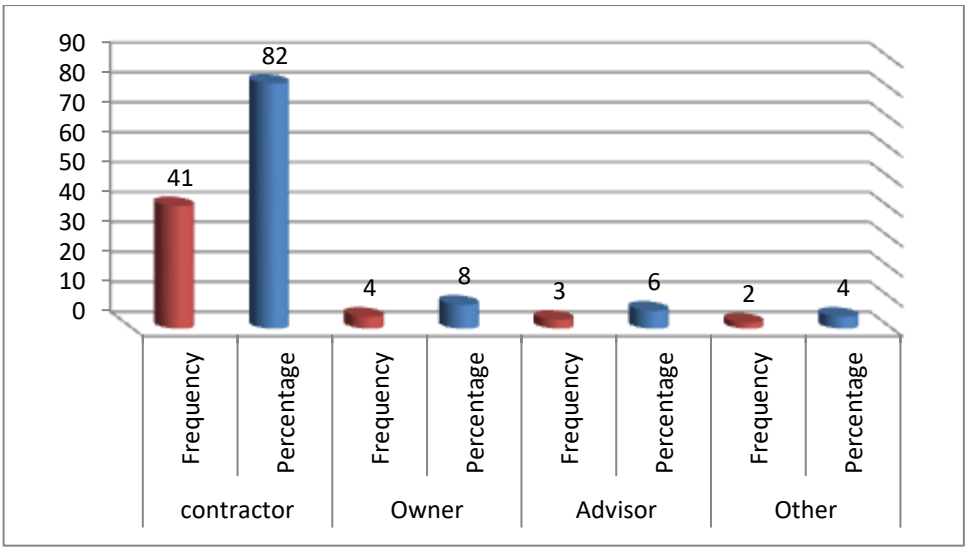

Figure 4.20: Poor communication within working range

It is evident from Figure 4.20 that 82% of the research sample had a view that the contractor was primarily responsible for poor communication in the scope of work, 8% saw that the owner is responsible for this weakness, and that 6% had an opinion that the consultant is responsible, and 4% saw that others are responsible for poor communication at work.

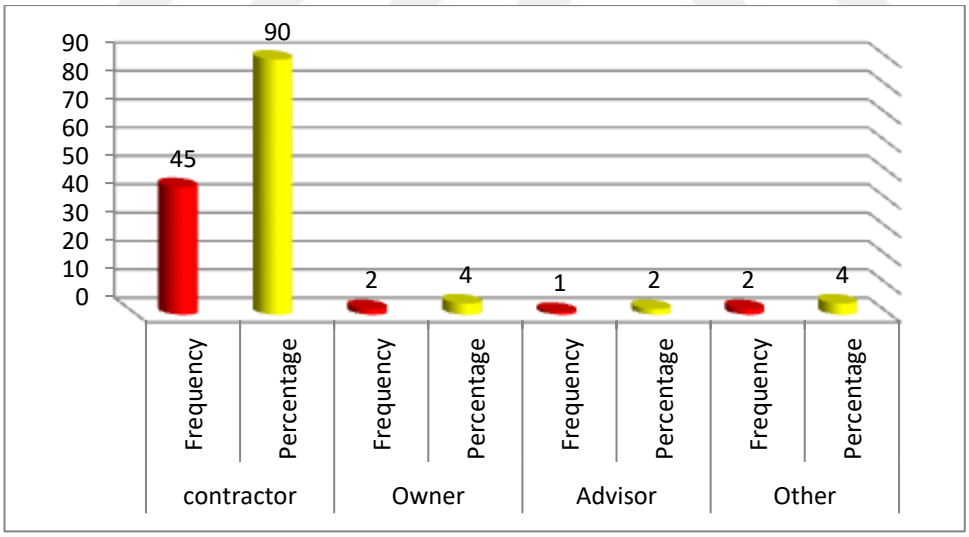

Figure 4.21: Shortage of labour, machinery and materials

From Figure 4.21 it becomes clear that 90% of the research sample individuals believe that the contractor is responsible for the shortage of labour, machinery and materials and 4% believe that the owner is responsible for this shortage, and that 2% of the respondents have their opinion that the consultant is responsible and 4% they saw the responsibility of others for this deficiency.

4.4.2.*5* Financial

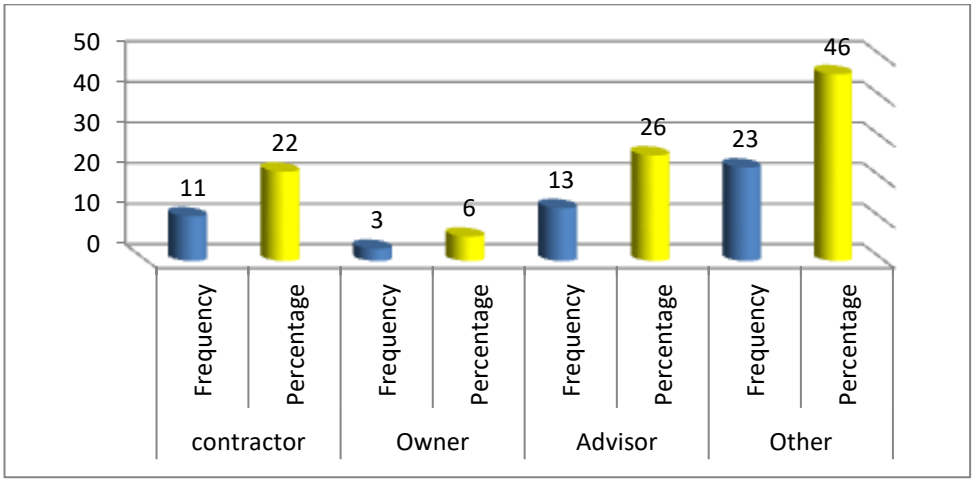

Figure 4.22: Inflation

From Figure 4.22 it becomes clear that 22% of the respondents found that the contractor is responsible for inflation because he did not plan for this issue before the start of the project, 6% believe that the owner is responsible for the same reason and 26% believe that the consultant is responsible for inflation due to some errors in the study he conducted for the project and that 46% believe that others are responsible for this inflation.

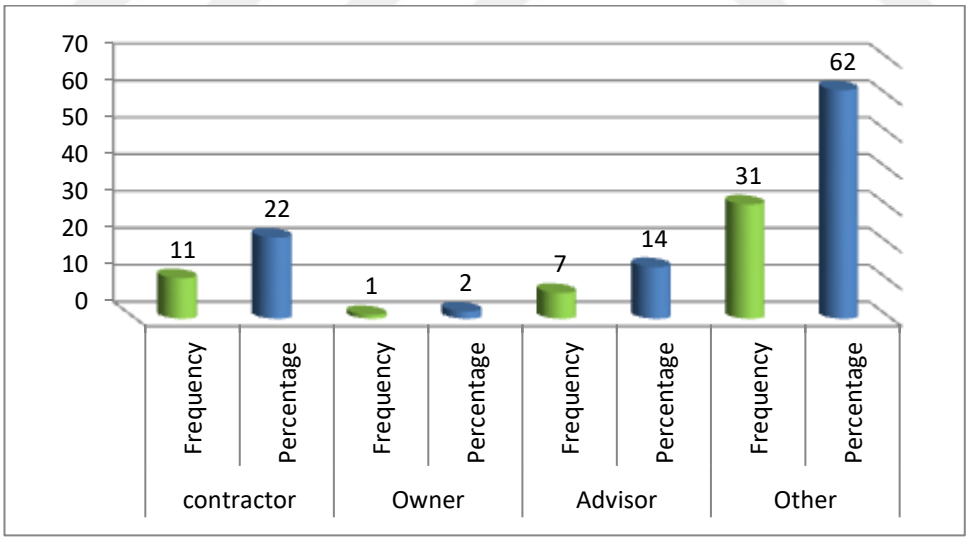

Figure 4.23: Exchange rate instability

It is evident from Figure 4.23 that 22% of the research sample had a point of view that the contractor is responsible for the lack of preparation and taking the necessary precautions in the event of the exchange rate instability, and that 2% saw that the owner is responsible, and 14% say that the consultant is responsible for this issue, and 62% saw that others are responsible.

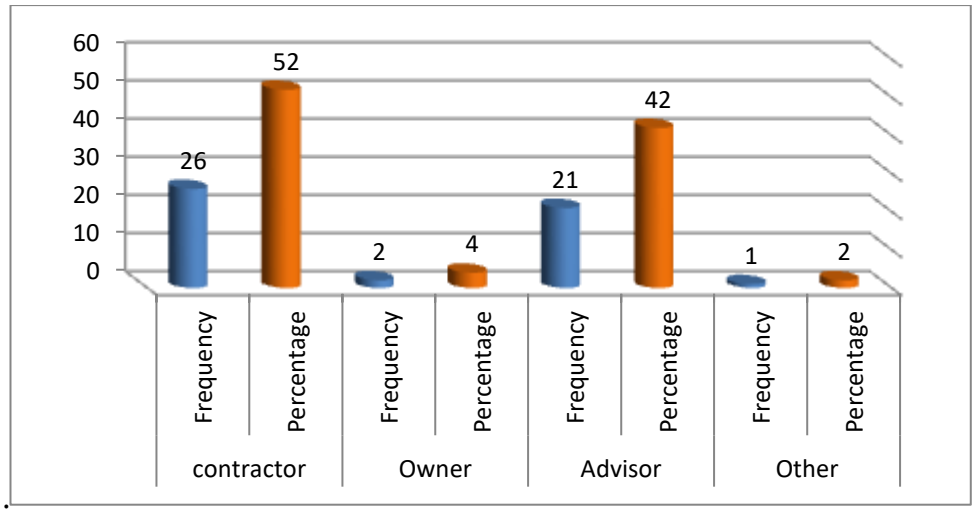

Figure 4.24: Delayed payments as per contract

Table 4.24, shows that 52% of the respondents expressed their opinion that the contractor is responsible for the delay in payment according to the contract, 4% believed that the owner was responsible, and 42% had their opinion that the advisor is responsible and 2% held the others responsible.

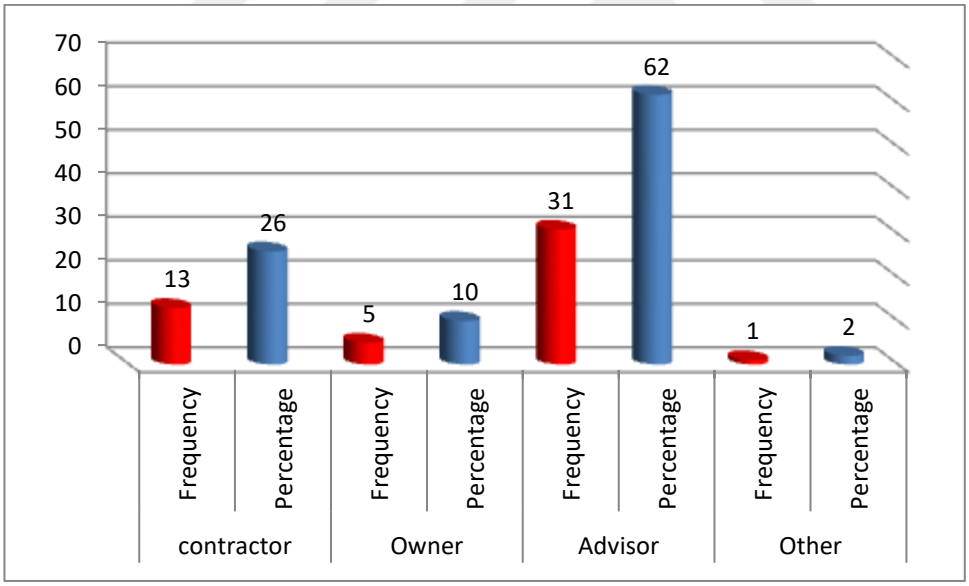

Figure 4.25: Poor management of the contractor's cash flow

Figure 4.25 shows that 26% of the respondents believe that the contractor is responsible for mismanaging the contractor's cash flow, 10% believe that the owner is responsible and 62% have an opinion that the consultant is responsible and 2% believe that others are responsible.

4.4.2.6 Legal

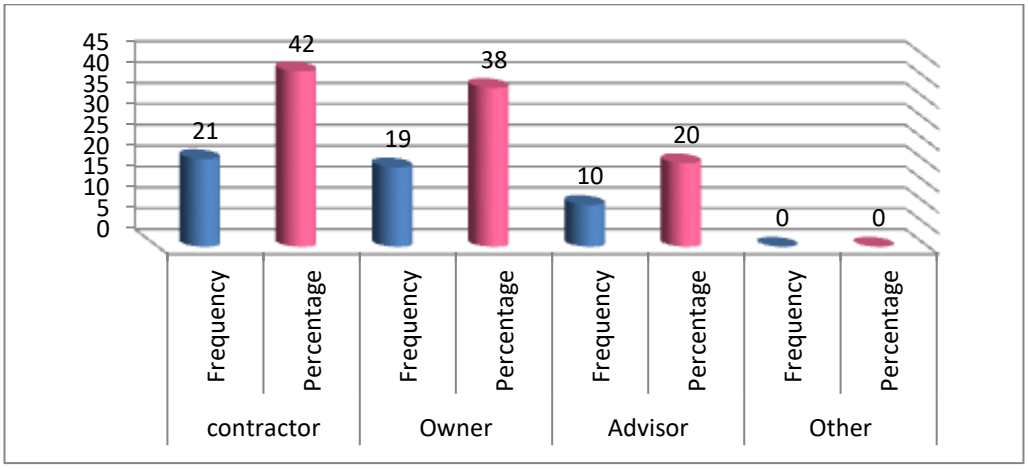

Figure 4.26: Difficulty obtaining the necessary permits to work.

From Figure 4.26, 42% of the research sample saw that the contractor was responsible for the difficulty in obtaining the necessary work permits, 38% saw the owner as a responsible, and 20% had an opinion that the consultant is responsible and 0% saw that other parties are responsible.

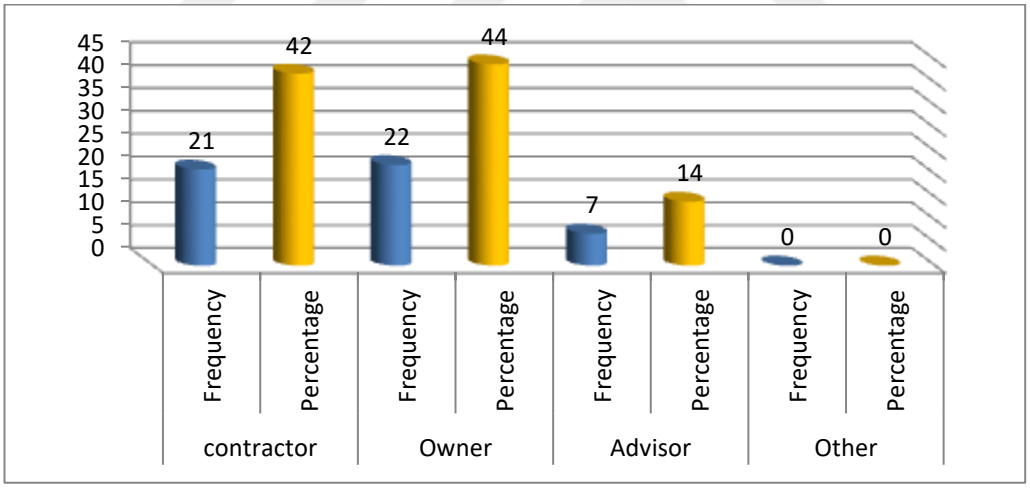

Figure 4.27: The emergence of legal disputes during the implementation phase between the project parties and the delay in resolving them.

From Figure 4.27, 42% of the sample respondents expressed their view that the contractor is primarily responsible for the the formation of legal issues between project participants during the implementation phase, as well as the delay in resolving them and that 44% saw that the owner is responsible for these disputes and that 14 % saw the counselor as a responsible and 0% saw others are responsible.

4.4.2.7 Risks directly related to implementation

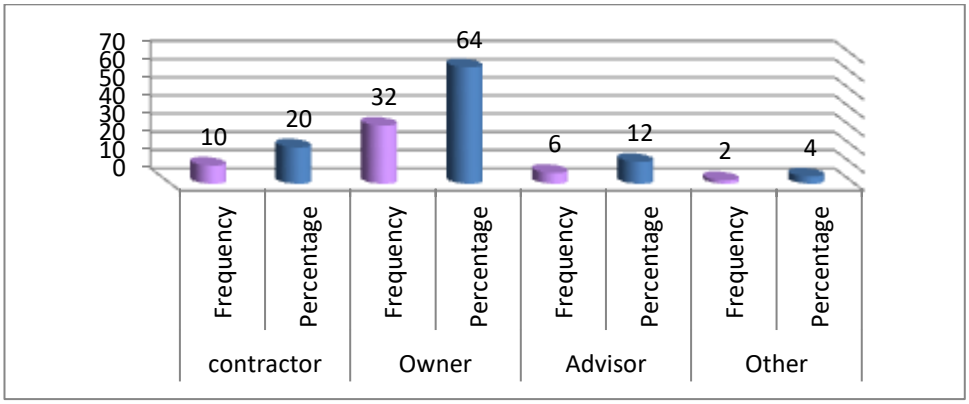

Figure 4.28: Design change

Figure 4.28 shows that 20% of the respondents believe that the contractor is the primary person responsible for changing the design, 32% believe that the owner is responsible for this change, 6% believe that the consultant is responsible and 2% have an opinion that other people are responsible.

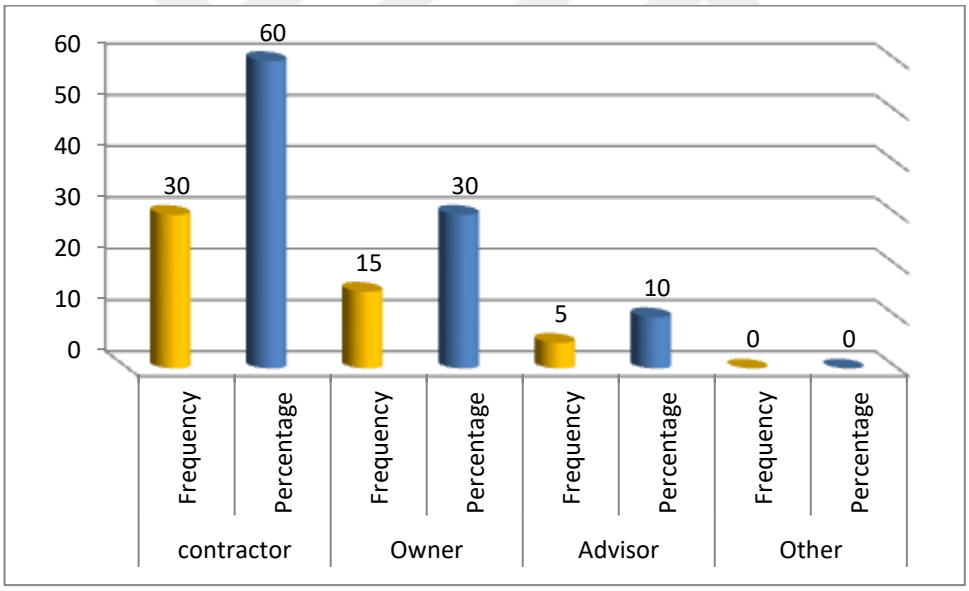

Figure 4.29: Low level of quality of the work due to time constraints of implementation.

Figure 4.29 shows that 60% of the respondents participating in the research believe that the contractor is responsible for the poor quality of the work due to lack of time for implementation, 30% believe that the owner is responsible, 10% believe that the consultant is responsible and 0% do not have an opinion.

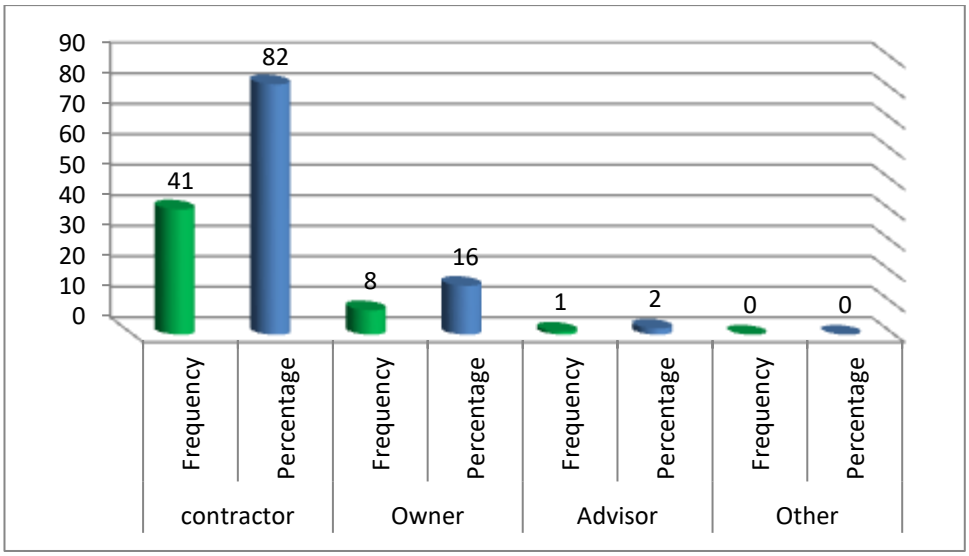

Figure 4.30: Implementation errors due to a misunderstanding of the plans, terms and specifications

Figure 4.30 shows that 82% of the samples expressed their opinion that the contractor was responsible for implementation errors as a result of misunderstanding the plans, terms and specifications, 16% of them believed that the owner was responsible, and 2% of them believed that the consultant was responsible.

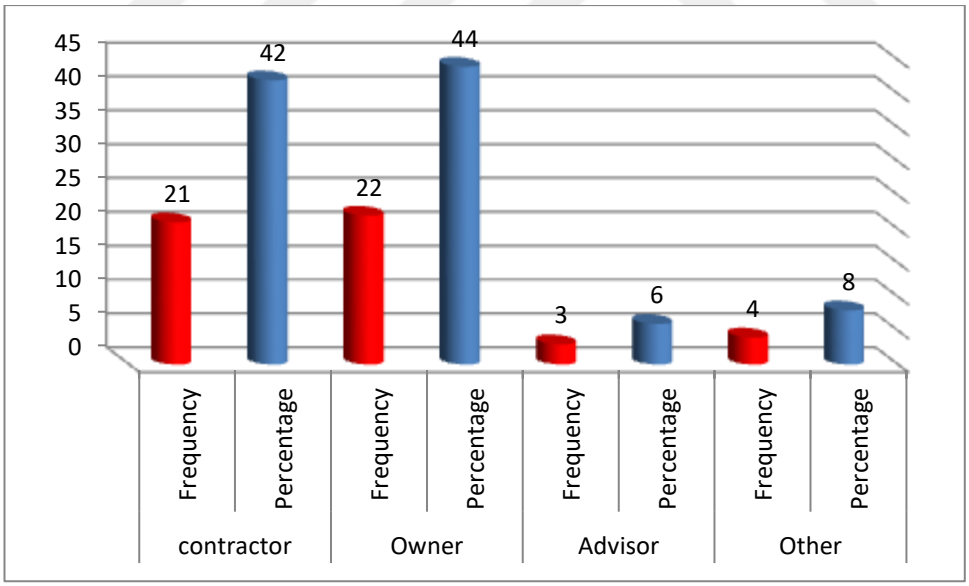

Figure 4.31: there is a difference between real and nodal quantities

It is evident from Figure 4.31 that 42% of the research sample saw that the contractor is responsible for the existence of a difference between the real and contractual quantities, terms and specifications, also 44% of this sample saw that the owner is responsible, 6% found that the consultant is responsible and the 8 % Saw that other people were responsible.

4.4.2.8 Political

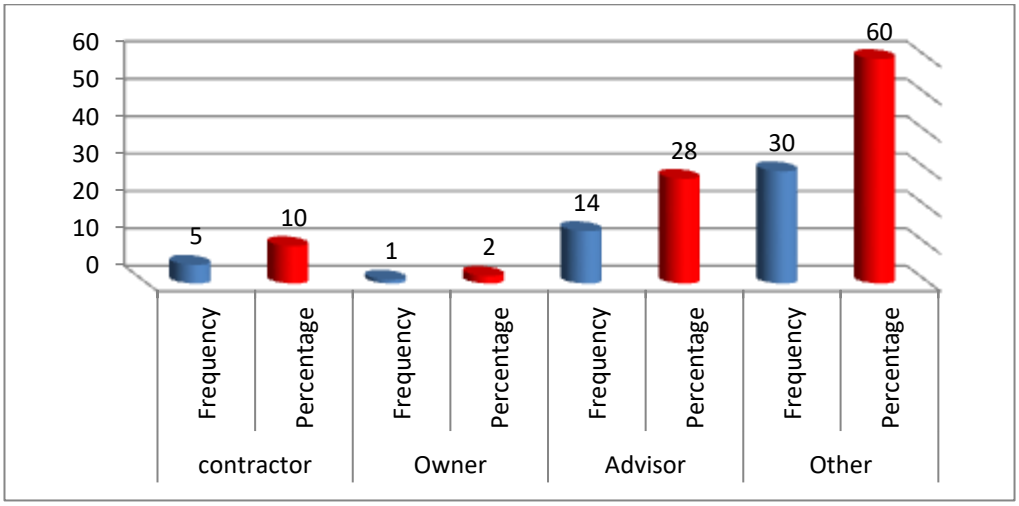

Figure 4.32: New government laws affecting work

Figure 4.32 shows that 10% of the research sample believes that the contractor is responsible for the new government laws that affected on the work, conditions and specifications and 2% believe that the owner is responsible, 28% believe that the consultant is responsible and 60% believe that there are others are responsible.

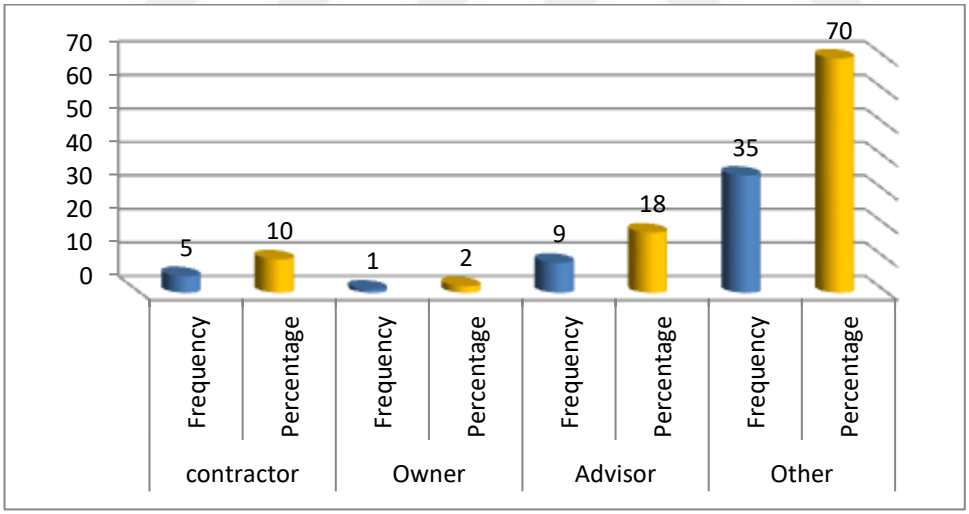

Figure 4.33: Security instability

Figure 4.33 shows that 10% of the sample believe that the contractor is responsible for the security instability, 2% believe that the owner is responsible, also 18% believe that the consultant is responsible and the 70% believe that others are responsible.

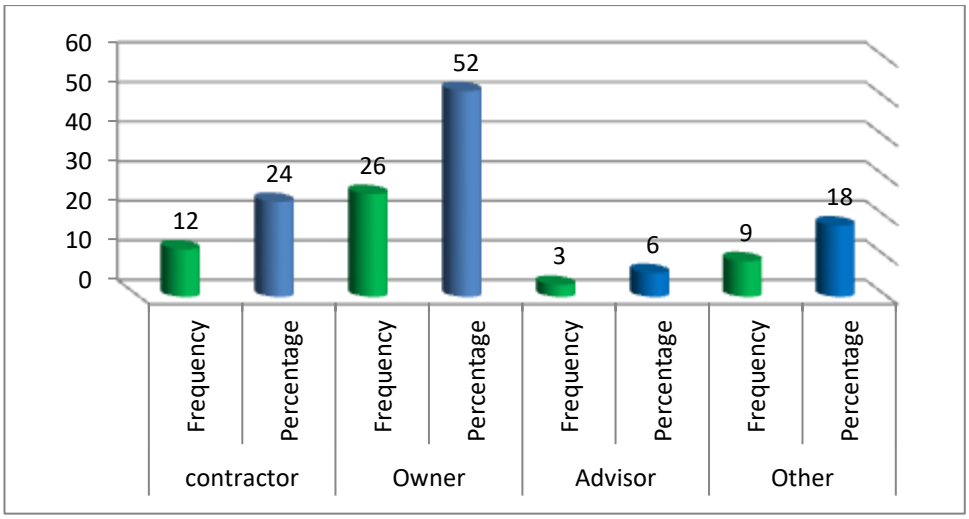

Figure 4.34: Unclear planning due to the project complexity

Figure 4.34 shows that 24% of the respondents who participated in the questionnaire believe that the contractor is responsible for the unclear planning due to the complexity of the project, while 52% of this sample believe that the owner is the responsible, also 6% of them saw the consultant as responsible and 18% believe that the parties are responsible. Others are responsible for the unclear planning that causes the complexity of the project.

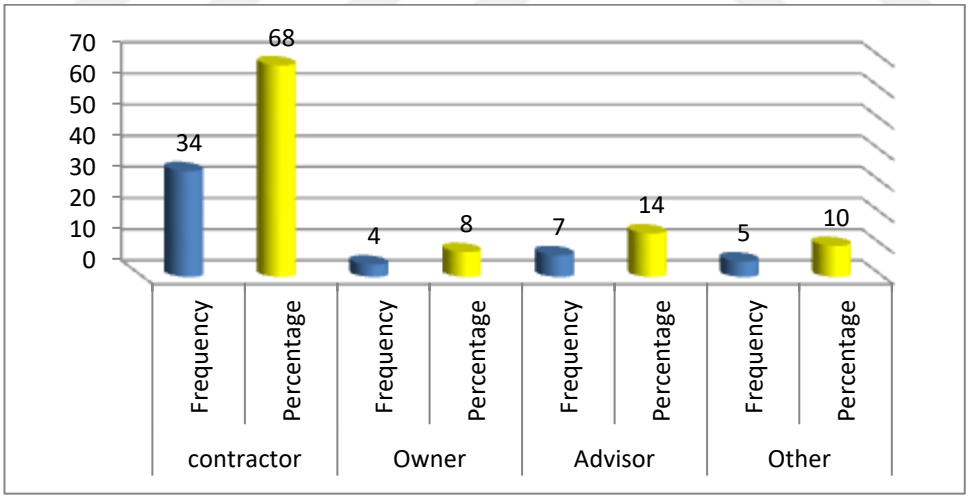

Figure 4.35: Poor communication between the project parties

From Figure 4.35, it was found that 68% of the respondents who participated in the questionnaire believe that the contractor is the main person responsible for poor communication between the project parties, while 8% believe that the owner is responsible for this weakness, and also found that 14% of them believe that the

consultant is responsible and 10 % believe that other external persons are responsible for poor communication between the project parties.

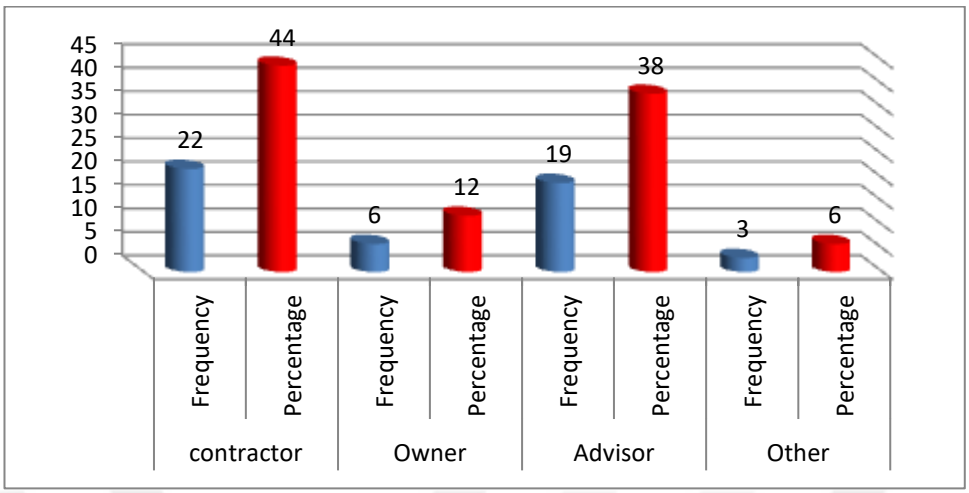

Figure 4.36: Poor management of Resources

Figure 4.36 shows that 44% of the sample is aware that the contractor is responsible for mismanagement of resources, 12% believe that the owner is responsible, while 38% have an opinion that the consultant is responsible and 6% believe that others are responsible.

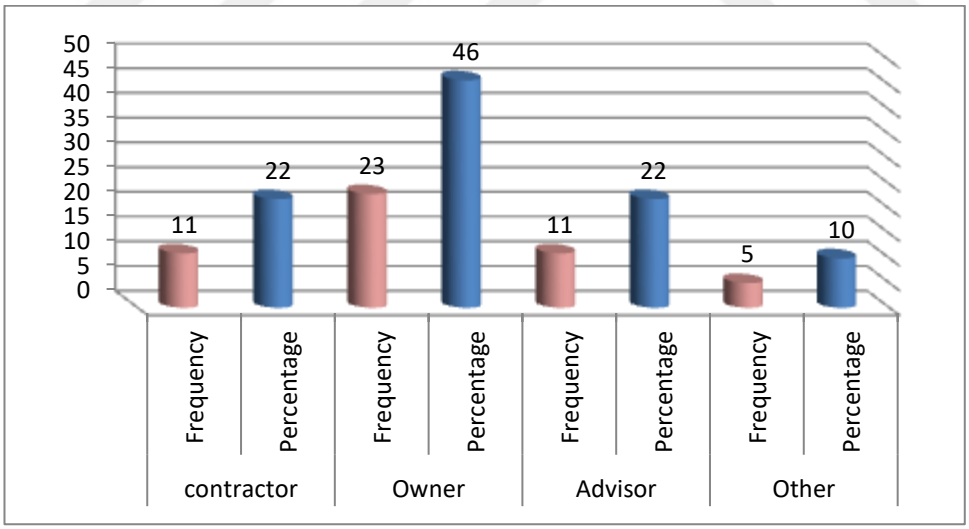

Figure 4.37: Lack of necessary information

From Figure 4.37 shows that 22% of the research sample individuals had an opinion that the contractor is responsible for Lack of necessary information, 46% say that the owner is responsible, while 22% had an opinion that the consultant is the official and the 10% say that others are responsible.

Finaly, from the analysis and interpretation of the study results by means of the arithmetic weighted mean, standard deviation, chi-square statistic, and sig. for a variable risk rating variable, the results were that all the 29 items of risk classification are divided between 9 dimensions that were statistically significant because the value of Sig. of the chi-square statistic at each degree of freedom for all the paragraphs was less than the level of significance (5%), this means that the research sample supported the study's hypotheses and evidence of their validity.

4.4.3 Means of remedying the effects of risks

Table 4.20: The risk responsibility (contractor, owner, advisor, and other), weighted arithmetic means, standard deviation, chi-square statistic, and sig. for the variable of the means of remedying the effects of risks variable

Variable	Item	Always	Percentage	Sometimes	Percentage	Not used	Percentage	Weighted arithmetic	Standard deviation	Chi-square	D.F.	Sig.
Remedying the effects of risks	Before the implementation risk											
	1	**21**	**42**	**27**	**54**	**2**	**4**	**1.62**	**0.57**	**20.440**	**2**	**0.00**
	2	**27**	**54**	**23**	**46**	**0**	**0**	**1.46**	**0.50**	**22.080**	**1**	**0.02**
	3	**32**	**64**	**16**	**32**	**2**	**4**	**1.40**	**0.57**	**27.040**	**2**	**0.00**
	4	**17**	**34**	**29**	**58**	**4**	**8**	**1.74**	**0.60**	**18.760**	**2**	**0.00**
	5	**23**	**46**	**13**	**26**	**14**	**28**	**1.82**	**0.85**	**10.641**	**2**	**0.03**
	6	**27**	**54**	**18**	**36**	**5**	**10**	**1.56**	**0.67**	**14.680**	**2**	**0.00**
	7	**33**	**66**	**12**	**24**	**5**	**10**	**1.44**	**0.67**	**25.480**	**2**	**0.00**
	After the implementation risk											
	1	**31**	**62**	**19**	**38**	**0**	**0**	**1.38**	**0.49**	**12.880**	**1**	**0.04**
	2	**26**	**52**	**24**	**48**	**0**	**0**	**1.48**	**0.50**	**22.080**	**1**	**0. 02**
	3	**20**	**40**	**29**	**58**	**1**	**2**	**1.62**	**0.53**	**24.520**	**2**	**0.00**
	4	**7**	**14**	**40**	**80**	**3**	**6**	**1.92**	**0.44**	**49.480**	**2**	**0.00**
	5	**32**	**49**	**26**	**52**	**1**	**2**	**1.56**	**0.54**	**22.360**	**2**	**0.00**

(N=50), Sig. Level =0.05

It is evident from Table 4.20 that all the (12) items of means of remedying the effects of risks are divided between (2) dimensions that were statistically significant because the value of Sig. of the chi-square statistic at each degree of freedom for all the

paragraphs was less than the level of significance (5%) and that means the research sample supported the study's hypotheses and evidence of their validity.

4.4.3.1 Before the implementation phase risk

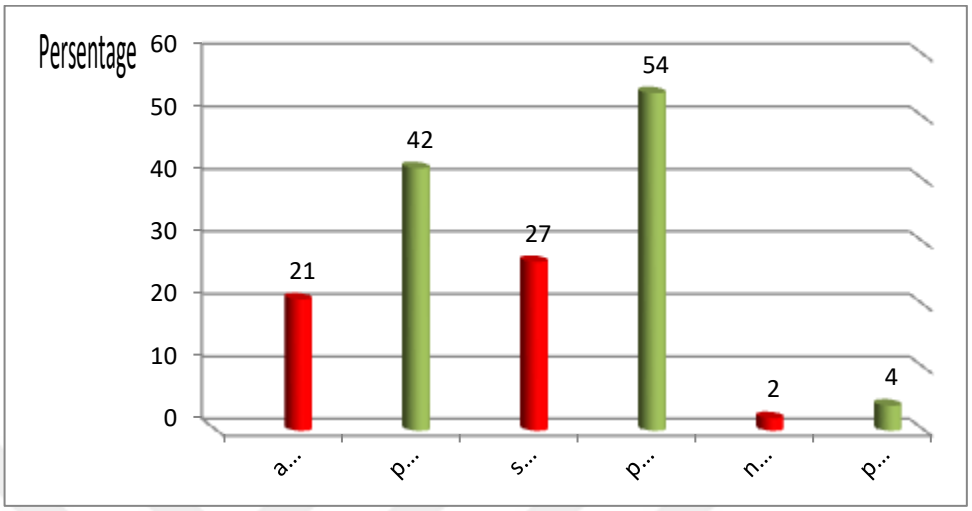

Figure 4.38: Methods to mitigate the effects of risk

Figure 4.38 shows that 42% of the sample members had their point of view methods to mitigate the effects of risks are always used, that 54% were used sometimes, and that 4% were not used.

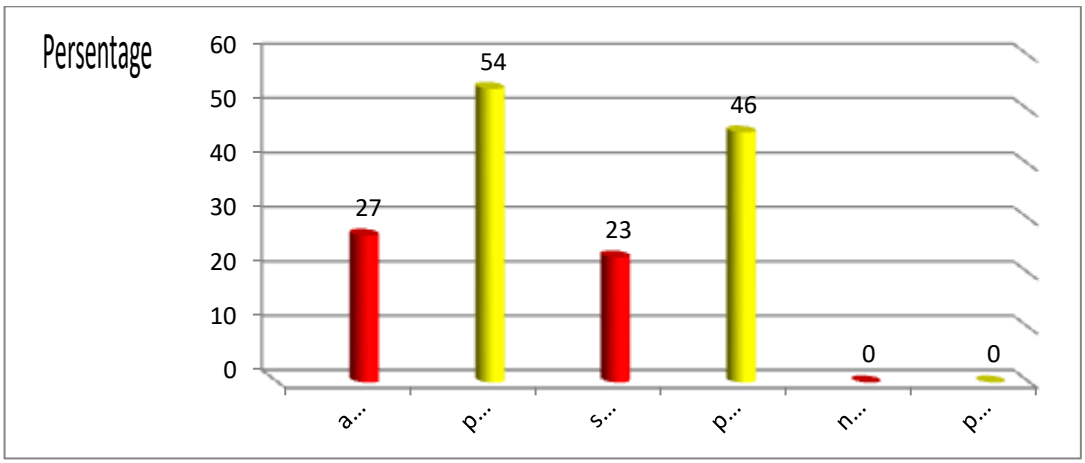

Figure 4.39: Use quantitative risk analysis methods to accurately predict time duration

From Figure 4.39, it becomes clear that 54% of the sample individuals participating in the questionnaire have their point of view that they use quantitative risk analysis methods to accurately predict the period of time always used, and that 46% of them were used sometimes but not always, and 0% were not used.

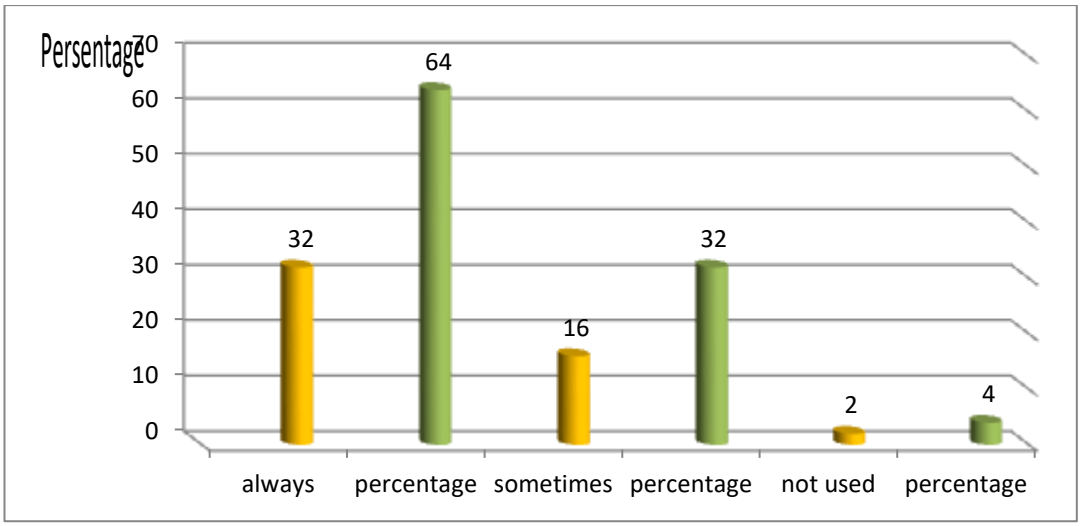

Figure 4.40: Reliance on practical experience in creating a work program before implementation

Figure 4.40 shows that 64% of the sample members believed that relying on practical experience in creating a work program before implementation is used is very important to avoid risks in the project, and that 32% of them believe that prior experience may have an impact on the risks that they may be exposed to Projects, while 4% of them rejected this idea.

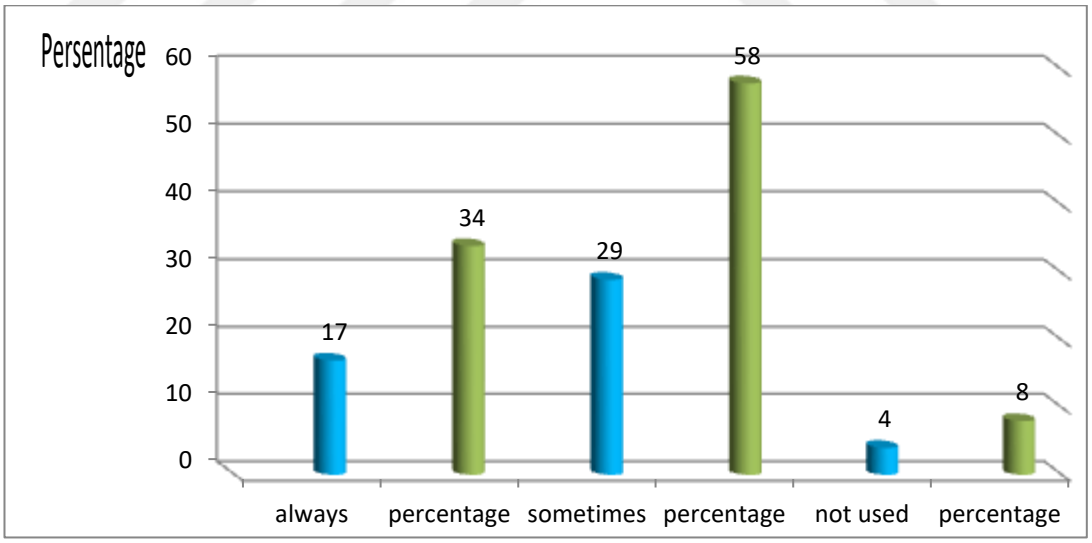

Figure 4.41: Reliance on practical experience in creating a work program before implementation

Figure 4.41 shows that 34% of the sample believe that relying on practical experience in creating a work program before implementation should be used for its permanent use, and that 58% of them support the idea of using it sometimes, and 8% have never used it.

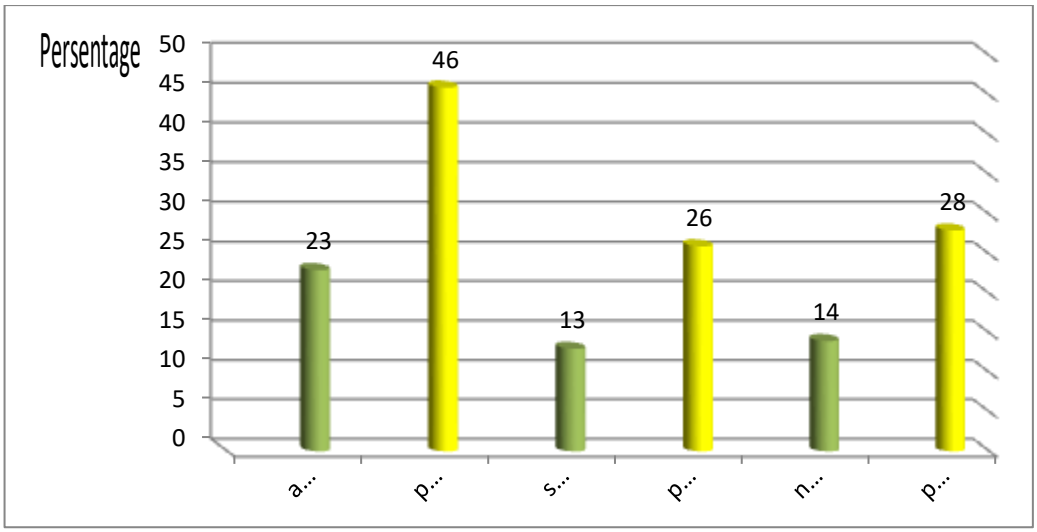

Figure 4.42: Transferring or dividing risks with the project parties

Figure 4.42 shows that 46% of respondents believe that diversion or risk allocation between project parties can always be used to reduce risks before implementation 26% of them believe that sometimes diversion or risk sharing is used with project parties, and 28% do not use division or diversion the risks.

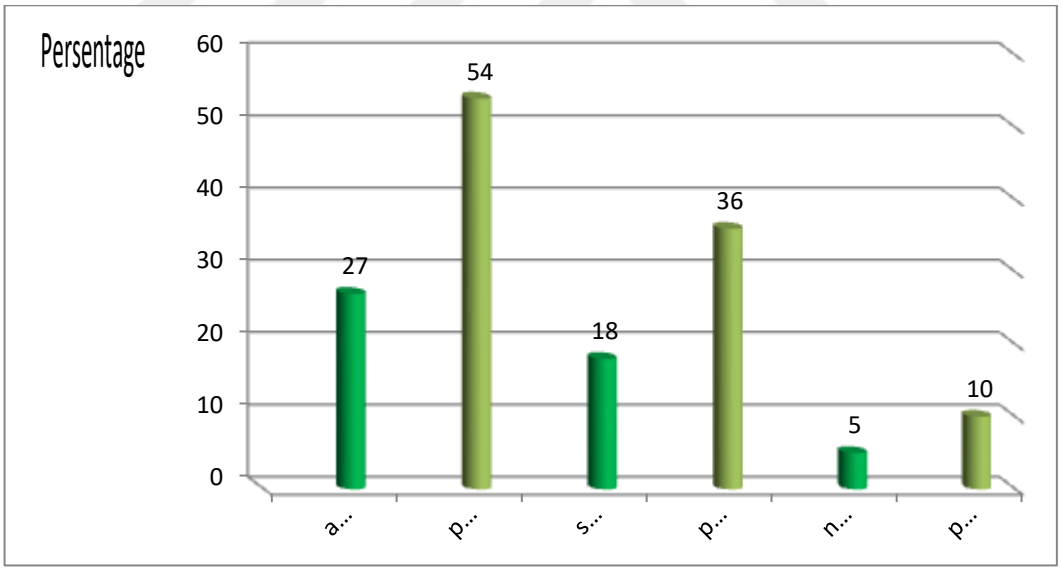

Figure 4.43: Refers to similar projects implemented or underway and obtaining information to produce an accurate work program

Figure 4.43 shows that 54% of the sample participating in the research believe that it is always possible to refer to similar projects that have been implemented or under implementation and to obtain information to produce an accurate work program that is used, while 36% find that it is sometimes possible to refer to similar projects, and 10% reject this idea.

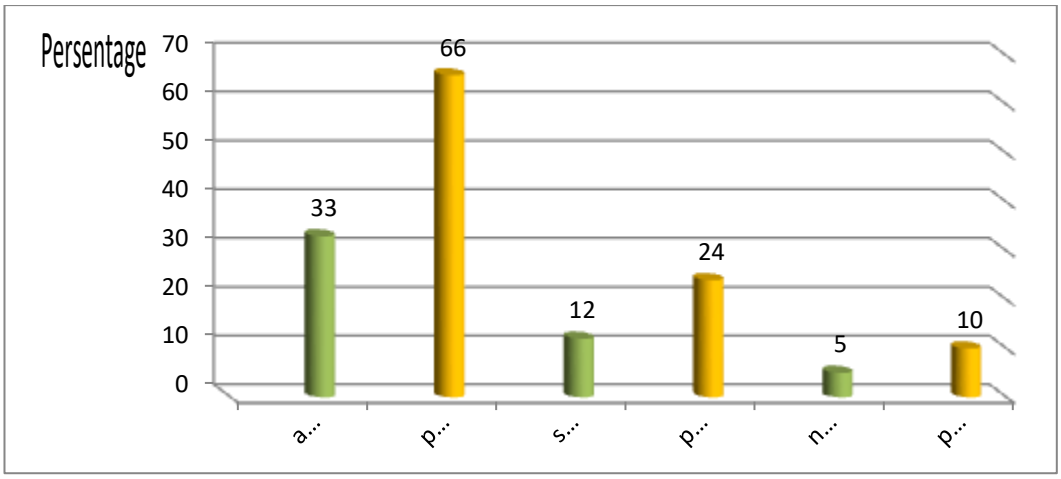

Figure 4.44: Use of modern systems (integrated computer programs)

Figure 4.44 shows that 66% of respondents see their use of modern systems (integrated computer programs) to be permanently and totally dependent on it, 24% use these devices only occasionally and when needed only, and 10% never use them.

4.4.3.2 After the implementation phase risk

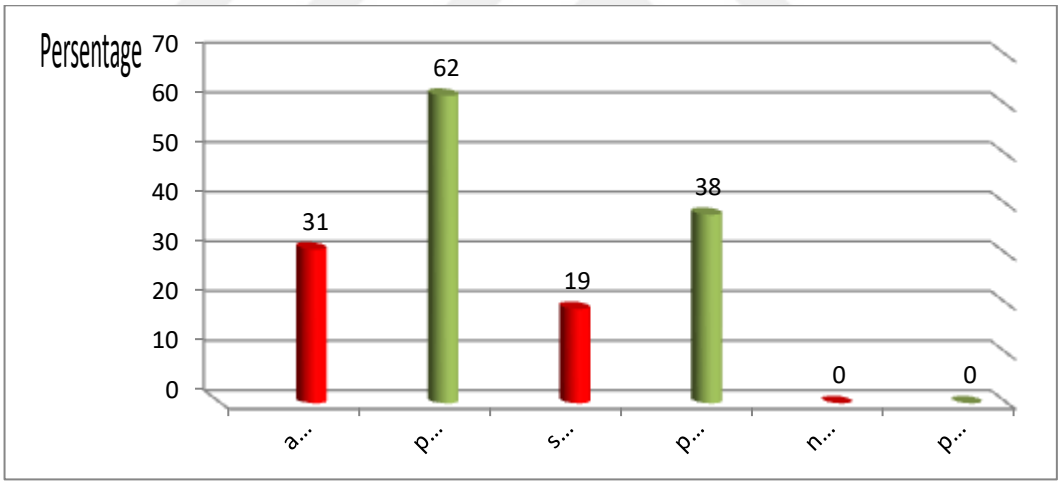

Figure 4.45: Increased labor and /or machinery

Figure 4.45 shows that 62% of the sample participating in the research always believed in increasing the number of employees and / or machines used that would reduce the expected risk, that 38% were sometimes but not always, and that 0% were not used.

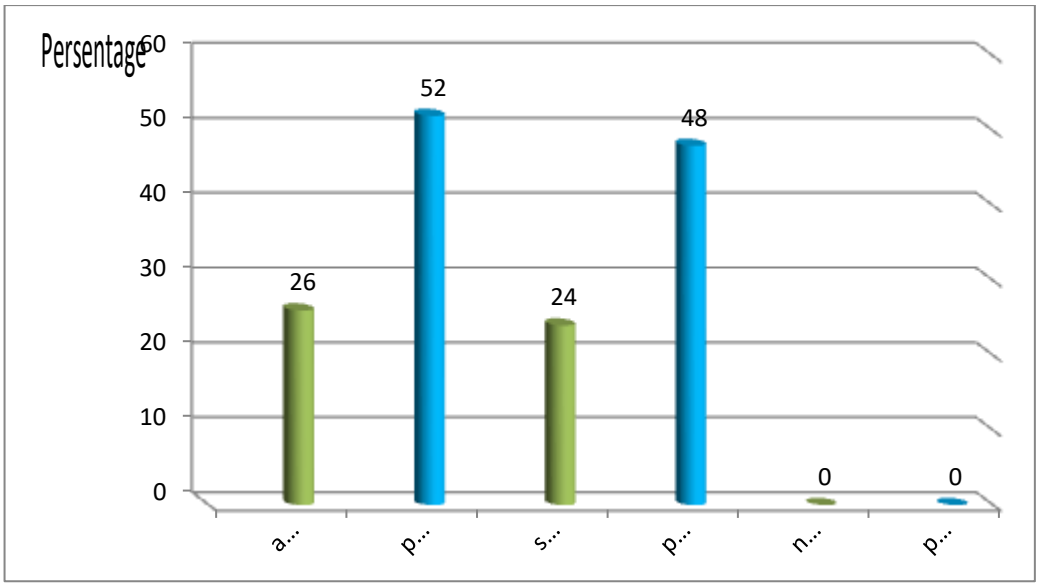

Figure 4.46: Increasing working hours

Figure 4.46 shows that 52% of respondents had a view of increasing the working hours that are being used to try to reduce the expected risks, that 48% of them were in favor of the idea of using it occasionally but not always, and that 0% did not support this idea at all.

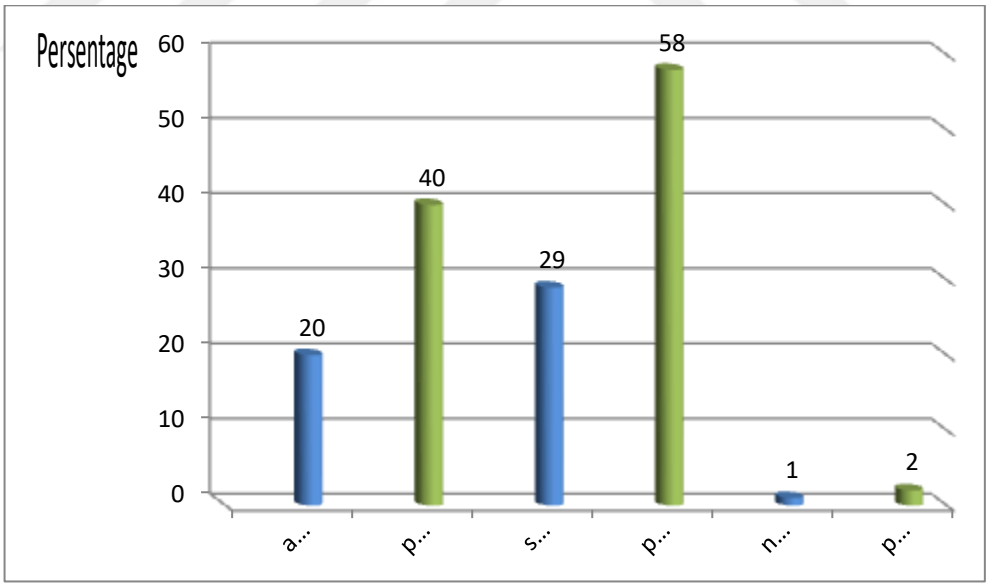

Figure 4.47: Change the sequence of implementation processes or overlap between them

Figure 4.47 shows that 40% of the sample members say that using the method of changing the sequence of implementation processes or overlapping between them leads to a reduction in risks during the implementation of the project always, and that 58% was used at times, while 2% support that this idea is never important.

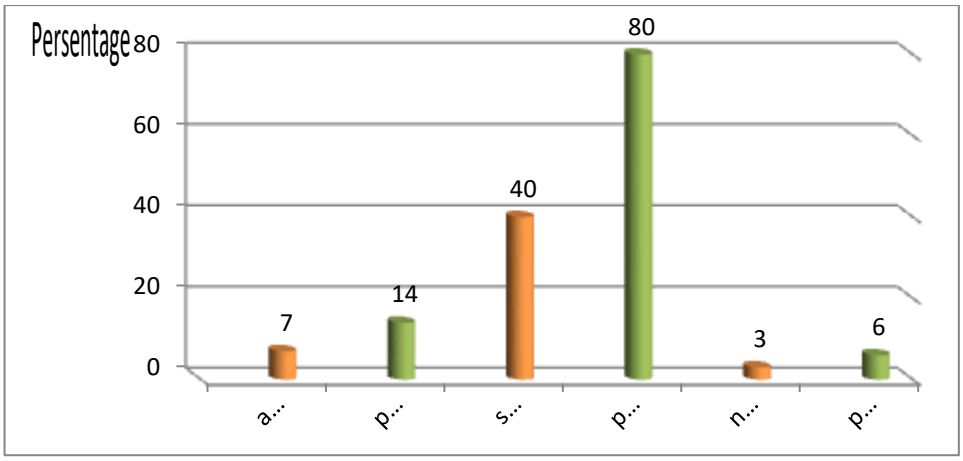

Figure 4.48: Full coordination with subcontractors.

Figure 4.48 shows that 14% of the sample members had their view on full coordination with subcontractors that could be used for the purpose of avoiding the occurrence of risks during the project period, while 80% of them supported this idea at times, and 6% did not support the use of this method.

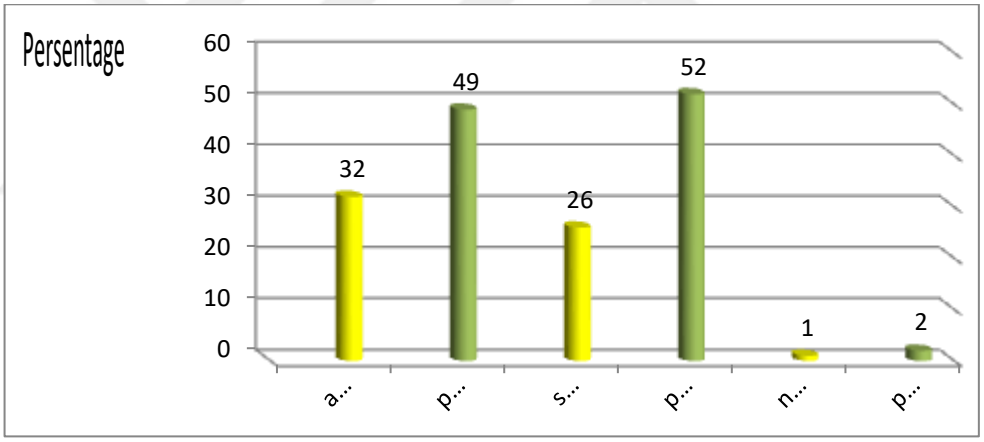

Figure 4.49: Close supervision of work to eliminate rejection of workers and re implementation

Figure 4.49 shows that 49% of the respondents of the sample always support their close supervision of the work to eliminate worker refusal and re-implementation, and that 52% sometimes, and that 2% are without supervision.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

In this thesis, which examines the risks to which construction projects are exposed in Iraq, and through a questionnaire that included 50 different samples between a contractor, a consultant, an owner and other parties, whose answers were taken for several questions related to the risks to which the projects are exposed and ways to avoid. Or reduce them, It was discovered that building projects are typically connected with risks and uncertainties since they are of a unique character, with one of their most essential elements being the lengthy implementation time that results in changes conditions, which makes it contain multiple risks, the conclusions obtained through the analysis based on the results of the questionnaire are:

1- There is a clear weakness and lack of knowledge of risks for companies and institutions that work on construction projects.

2- In most Iraqi construction businesses and organizations, there is no special department for risk management.

3- For most Iraqi companies there are no means to redress the risks before the construction phase.

4- Most of the risks are mitigated during the construction phases or when the danger occurs.

5- Most of the risks faced by construction projects in Iraq bear full responsibility for the contractor.

6- The most important risks facing construction projects in Iraq is the delay in financial matters (ie, the payment of financial dues) in a timely manner and without delay, and the main reason for it is the owner. Therefore, there must be good experience for subcontractors for the purpose of completing the project on time and with the specific quality and requirements mentioned In the contract and advance planning to avoid this type of risk.

7- Identify the causes of risks, identify and analyze them, and develop strategies to respond to them.

5.2 Recommendations

The research reached some recommendations, which are summarized in the following points:

1- The importance of spreading awareness of the necessity of applying the concept of risk management in construction projects.

Apply the fundamentals of risk management (identification, analysis, monitoring and control) to reduce or limit, the risks of the project are with construction companies and institutions.

2- That the most important risks in construction projects in Iraq are inflation and price fluctuations,

and the difference between the actual and contractual quantities and the delay in making payments according to the contract and discussing the unexpectedly high during bidding, design changes and funding cuts.

3- It has been proven that there is a correlation between the probability of occurrence of most risks, which indicates.

The existence of a relationship and correlation between risks, that is, the occurrence of some risks is a cause for the occurrence of other risks, and that the follow-up and control phase is of great importance to reduce the possibility of some potential risks.

4- The need to develop the managerial culture of project managers by taking advantage of modern technologies in all construction project facilities.

5- Develop engineering cadres in the field of risk analysis and management through the courses in which they have to participate, such as PMP and others education and qualification for engineers is very necessary for the purpose of applying them and benefiting from their experience in construction projects.

6- Working on developing contractual formulas between the employer and the contractor regarding analysis and management risks in a way that guarantees the rights of all parties during the establishment of a risk management program.

5.3 Recommendations for future studies

Recommendations for future studies help to avoid the potential risks:

1- A detailed study of the risk management of each type of risk.

2- According to the type of contract.

1- In light of the contractor's payment delays and their ramifications.

APPENDIX

Appendix-A: Description of the Questionnaire

Questionnaire title: Managing the construction phase risks of construction projects in Iraq.

Note: The data obtained for the purpose of scientific research will be strictly confidential.

Part one /Personal information

Academic qualification :

◯ Bachelor's degree ◯ Higher ◯ Diploma

◯ Master ◯ PhD

Years of Work Experience

◯ Less of 5 ◯ 5 – 10

◯ 10 -15 ◯ More than 15

Type of work

◯ Contractor ◯ Advisor

◯ Owner ◯ Other

Sector type

◯ Public ◯ Special

◯ Public and private

Current workload

◯ Small project ◯ Medium project

◯ Big project

Part two/ Risk rating: who bears the responsibility

Risk rating		Responsibility of risk			
		The contractor	**The owner**	**The Consultant**	**Another party**
1	**Physical and human risks.**				
	Low production capacity of workers / breakdown of machine				
	Supply of low quality materials				
	Accidents happen due to lack of safety precautions				
2	**Environmental and natural risks**				
	Natural disasters (floods)				
	Inappropriate weather conditions				
	Difficulty accessing the site				
3	**Design risks**				
	Mismatch between quantities, plans and specifications				
	Mismatch between architectural and structural plans				
	accuracy in calculating quantities				
	commissioning to incompetent designers				
4	**Logistical risks**				
	Inaccurate project scheduling				
	Poor communication within working range				
	Shortage of labor, machinery and materials				
5	**Financial risks**				
	Inflation				
	Exchange rate instability				
	Delayed payments as per contract				
	Poor management of the contractor's cash flow				
6	**Legal risks**				
	Difficulty obtaining the necessary permits to work				
	The emergence of legal disputes during the implementation phase between the project parties and the delay in resolving them				
7	**Risks directly related to**				

	implementation				
	Design change				
	Low level of quality of work due to time constraints of implementation				
	Implementation errors due to a misunderstanding of the plans, terms and specifications				
	There is a difference between real and nodal quantities				
8	**Political**				
	New government laws affecting work				
	Security instability				
9	**Administrative risks**				
	Unclear planning due to project complexity				
	Poor communication between the project parties				
	Poor management of resources				
	Lack of necessary information				

The third part / Means of remedying the effects of risks

A / risks Before the implementation stage : The table shown below contains some methods to mitigate the effects of the risks mentioned Implementation stage, please specify the percentage of use of these methods:		**Always**	**Sometimes**	**Not used**
1	Use quantitative risk analysis methods to accurately predict time duration			
2	Reliance on practical experience in creating a work program before implementation			
3	Add reserve and security for the period as a precaution for the schedule risk			
4	Transferring or dividing risks with the project parties			
5	Refer to similar projects implemented or underway and obtain information to produce an accurate work program			
6	Create an updated schedule by obtaining all updated information about the project			
7	Use of modern systems (integrated computer programs)			

B / During the implementation phase: This table contains some means to remedy the effects Risks during the implementation phase Please specify the percentage of use of these means:		Always	Sometimes	Not used
1	Increased labor and / or machinery			
2	Increasing working hours			
3	Change the sequence of implementation processes or overlap between them			
4	Full coordination with subcontractors			
5	Close supervision of works to eliminate rejection of workers and re-implementation			

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RESUME

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